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Networks Data Analytics Function Installation and Fault Recovery Guide

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Oracle Communications Networks Data Analytics Function Installation and Fault Recovery Guide, Release 23.2.0

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Acronyms

The following table provides information about the acronyms and the terminology used in the document.

Table Acronyms

Acronym	Description
3GPP	3rd Generation Partnership Project
5GC	5G Core Network
5GS	5G System
AF	Application Function
API	Application Programming Interface
AMF	Access and Mobility Management Function
CNC	Cloud Native Core
CNE	Oracle Communications Cloud Native Core, Cloud Native Environment
FQDN	Fully Qualified Domain Name
GUI	Graphical User Interface
HTTPS	Hypertext Transfer Protocol Secure
KPI	Key Performance Indicator
HA	High Availability
IMSI	International Mobile Subscriber Identity
K8s	Kubernetes
ME	Monitoring Events
Network Slice	A logical network that provides specific network capabilities and network characteristics.
NEF	Oracle Communications Cloud Native Core, Network Exposure Function
NF	Network Function
NRF	Oracle Communications Cloud Native Core, Network Repository Function
NSI	Network Slice Instance. A set of Network Function instances and the required resources (such as compute, storage and networking resources) which form a deployed Network Slice.
NSSF	Oracle Communications Cloud Native Core, Network Slice Selection Function
NWDAF	Network Data Analytics Function
OAM	Operations, Administration, and Maintenance
PLMN	Public Land Mobile Network
REST	Representational State Transfer
SBA	Service Based Architecture
SBI	Service Based Interface
SMF	Session Management Function
SNMP	Simple Network Management Protocol
SUPI	Subscription Permanent Identifier
UDM	Unified Data Management

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Table (Cont.) Acronyms

Acronym	Description
UE	User Equipment
URI	Uniform Resource Identifier

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What's New in This Guide

This section introduces the documentation updates for Release *23.2.x* in Oracle Communications Network Data Analytics Function (OCNWDAF) Installation and Fault Recovery Guide.

Release 23.2.0.0.1 - F80259-02, August 2023

There are no updates to this document in this release.

Release 23.2.0 - F80259-01, June 2023

- Added the following installation procedures:
  - Update OCNWDAF Preinstaller Files
  - Setup Encrypted Credentials
  - Configure Database Flag
  - Installing OCNWDAF Package
  - Configuring Service Mesh
  - Configuring Routing Rules in Ingress Gateway
  - Install Ingress and Egress Gateways
  - Ingress Gateway Parameters
- Updated the following sections:
  - Software Requirements
  - Installation Package Download
  - Pushing the Images to Customer Docker Registry
  - Verifying Installer
  - Uninstalling OCNWDAF
  - Verify Uninstallation
  - Global Parameters
  - NRF Client Parameters

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1 Introduction

This document provides information on how to install Oracle Communications Network Data Analytics Function (OCNWDAF) and its microservices. It also includes information on performing fault recovery for OCNWDAF.

1.1 Overview

Oracle Communications Networks Data Analytics Function (OCNWDAF) is a Network Function (NF) in the 5G core network.

OCNWDAF is a NF that assists in collecting and analyzing data in a 5G network. It enables the operator to collect and analyze the data in the network through an analytics function. The 5G technology requires prescriptive analytics to drive closed-loop automation and self-healing networks. In a 5G network, the consumers and producers of data are 5G Network Functions (NFs), Application Functions (AFs), and Operations, Administration, and Maintenance (OAM).

OCNWDAF broadly supports the following functions:

- OCNWDAF collects data from AMF, SMF, and NRF in the network. The data is collected directly from the NFs or through the Network Exposure Function (NEF).
- OCNWDAF is designed to provide analytics information to consumer NFs.

A 5G network contains a vast number of devices and sensors generating an enormous amount of data. OCNWDAF allows the Communications Service providers (CSPs) to efficiently monitor, manage, automate, and optimize their network operations after analyzing the data collected across the network. OCNWDAF also helps the CSPs in achieving operational efficiency and provides an enhanced service experience.

The analytics information provided by OCNWDAF is either statistical information on past events or predictive information which can be used to balance the resources on the network. Based on the collected analytics information, the CSPs can roll out new services or modify the existing services without waiting for a maintenance window in the network. This also ensures significantly fewer chances of network experiencing downtime.

A OCNWDAF consumer can avail analytics information for different analytic events. Alternatively, the consumers can subscribe or unsubscribe for specific analytics information as a one-time event or periodically get notified when a specifically defined event is detected.

Multiple instances of OCNWDAF may be deployed in the 5G network. NRF discovers OCNWDAF instances for the consumer network functions. The OCNWDAF information can also be locally configured on the consumer NFs. The OCNWDAF selection function in the consumer NF selects an OCNWDAF instance based on the available OCNWDAF instances by using the OCNWDAF discovery principles.

Different OCNWDAF instances present in the 5G network can be configured to provide a specific type of analytics information. This information about the OCNWDAF instance is described in the OCNWDAF profile stored in the NRF. The OCNWDAF instance provides the list of Analytics IDs that it supports when registering to the NRF, apart from other NRF registration elements required for registration on the NRF. The consumer NFs that need specific analytics types query the NRF and include the Analytics ID based on the required data.

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1.2 References

For more information about OCNWDAF, refer to the following documents:

- *Oracle Communications Networks Data Analytics Function User Guide*
- *Oracle Communications Networks Data Analytics Function Solutions Guide*
- *Oracle Communications Networks Data Analytics Function Troubleshooting Guide*
- *Oracle Communications Cloud Native Environment Installation and Fault Recovery Guide*
- *Oracle Communications Cloud Native Core cnDBTier Installation,Upgrade, and Fault Recovery Guide*
- *Oracle Communications Cloud Native Core cnDBTier User Guide*

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2
Prerequisites

Before you begin with the procedure for installing OCNWDAF, ensure that the following requirements are met:

- Software Requirements
- Environment Setup Requirements
- Resource Requirements

> **⚠ Caution**
>
> User, computer and applications, and character encoding settings may cause an issue when copy-pasting commands or any content from PDF. PDF reader version also affects the copy-pasting functionality. It is recommended to verify the pasted content especially when hyphens or any special characters are part of copied content.

2.1 Software Requirements

This section describes the software requirements for installing OCNWDAF:

Oracle Communications Cloud Native Environment Specification

Oracle Communications Network Data Analytics Function (OCNWDAF) 23.2.0 can be installed on Oracle Cloud Infrastructure (OCI), Oracle Communications Cloud Native Core, Cloud Native Environment (CNE) 1.9.x,1.10.x, and 22.1.x. releases.

Verify the CNE version with the following command:

```
echo $OCCNE_VERSION
```

> **ⓘ Note**
>
> From CNE 1.8.x and later, the container platform is Podman instead of docker. For more information about Podman installation, see *Oracle Communications Cloud Native Core, Cloud Native Environment (CNE) Installation, Upgrade, and Fault Recovery Guide*.

Mandatory Software

The following software items must be installed before starting the OCNWDAF installation:

Table 2-1 Mandatory Software

Software	Version
Kubernetes	1.20.7, 1.21.7, 1.22.5

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Table 2-1 (Cont.) Mandatory Software

Software	Version
HELM	3.1.2, 3.5.0, 3.6.3, 3.8.0
Podman	2.2.1, 3.2.3, 3.3.1
cnDBTier	22.4.1
CNC Console	23.1.0

To verify the current Helm and Kubernetes version installed on CNE, use the following commands:

- To check Kubernetes version, run the following command:

  ```
  kubectl version
  ```

- To check the Helm version, run the following command:

  ```
  helm3 version
  ```

Additional Software

Depending on your requirement, you may have to install additional software while deploying OCNWDAF. The list of additional software items, along with the supported versions and usage, is given in the following table:

Table 2-2 Additional Software

Software	App Version	Required For
elasticsearch	7.9.3	Logging
elastic-client	0.3.6	Metric Server
elastic-curator	5.5.4	Logging
elastic-exporter	1.1.0	Logging
elastic-master	7.9.3	Logging
logs	3.1.0	Logging
kibana	7.9.3	Logging
grafana	7.5.11	Metrics
prometheus	2.32.1	Metrics
prometheus-kube-state-metrics	1.9.7	Metrics
prometheus-node-exporter	1.0.1	Metrics
metalLb	0.12.1	External IP
metrics-server	0.3.6	Metrics
tracer	1.21.0	Tracing

To verify the installed software items, run the following command:

```
helm3 ls -A
```

If you need any services related to the above software items, and if the respective software is unavailable in CNE, then install that software before proceeding further.

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2.2 Environment Setup Requirements

This section provides information about environment setup requirements for installing OCNWDAF.

Network Access

The Kubernetes cluster hosts must have network access to the following repositories:

- **Local docker image repository**: It contains the OCNWDAF docker images. To check if the Kubernetes cluster hosts can access the local docker image repository, pull any image with an image-tag, using the following command:

  ```
  docker pull <docker-repo>/<image-name>:<image-tag>
  ```

  where:

  `docker-repo` is the IP address or host name of the docker image repository.

  `image-name` is the docker image name.

  `image-tag` is the tag assigned to the docker image used for the OCNWDAF pod.

- **Local helm repository** : It contains the OCNWDAF Helm charts. To check if the Kubernetes cluster hosts can access the local Helm repository, run the following command:

  ```
  helm repo update
  ```

Client Machine Requirements

This section describes the requirements for client machine, that is, the machine used by the user to run deployment commands.

The client machine must meet the following requirements:

- Network access to the helm repository and docker image repository.
- Helm repository configured on the client.
- Network access to the Kubernetes cluster.
- Required environment settings to run the `kubectl` and `docker` commands. The environment must have privileges to create a namespace in the Kubernetes cluster.
- Helm client installed so that the `helm install` command deploys the software in the Kubernetes cluster.

cnDBTier Requirements

OCNWDAF supports cnDBTier in a virtual CNE (vCNE) environment. cnDBTier must be up and active in case of containerized CNE. For more information about installation procedure, see the *Oracle Communications Cloud Native Core cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

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> **Note**
>
> If the environment has cnDBTier 23.2.0 installation, follow the instruction below:
>
> - If cnDBTier 23.2.0 release is installed, set the *ndb_allow_copying_alter_table* parameter to 'ON' in the cnDBTier custom values *dbtier_23.2.0_custom_values_23.2.0.yaml* file and perform cnDBTier upgrade before install, upgrade, or any fault recovery procedure is performed for OCNWDAF. Set the parameter to its default value, 'OFF' once the activity is completed and perform the cnDBTier upgrade to apply the parameter changes.
> - To perform cnDBTier upgrade, see *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

2.3 Resource Requirements

This section lists the resource requirements to install and run OCNWDAF.

OCNWDAF Services

The following table lists the resource requirement for OCNWDAF services:

Table 2-3 Core Microservices Resource Requirements

Microservice Name	POD Replica		CPU/POD		Memory/POD (in GB)		Ephemeral Storage	
	Min	Max	Min	Max	Min	Max	Min (Mi)	Max (GB)
ocn-nwdaf-analytics-info-service	1	2	1	2	1	2	78.1	1
nwdaf-ingress-gateway	1	2	1	2	1	2	78.1	1
nwdaf-cap4c-spring-cloud-config-server	1	1	2	2	1	1	78.1	1
nwdaf-egress-gateway	1	2	1	2	1	2	78.1	1
ocn-nwdaf-data-collection-service	2	4	2	4	2	4	78.1	1
ocn-nwdaf-subscription-service	1	2	1	2	1	2	78.1	1
ocn-nwdaf-mtlf-service	1	2	1	2	1	2	78.1	1
ocn-nwdaf-configuration-service	1	2	1	2	1	2	78.1	1
ocn-nwdaf-cap4c-model-controller	1	2	4	8	1	2	78.1	1
ocn-nwdaf-cap4c-model-executor	2	4	2	4	1	2	78.1	1

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Table 2-3 (Cont.) Core Microservices Resource Requirements

Microservice Name	POD Replica		CPU/POD		Memory/POD (in GB)		Ephemeral Storage	
ocn-nwdaf-cap4c-stream-analytics	2	4	4	8	1	2	78.1	1
ocn-nwdaf-cap4c-portal	1	2	2	4	1	2	78.1	1
ocn-nwdaf-cap4c-portal-service	1	2	2	4	1	2	78.1	1
ocn-nwdaf-cap4c-scheduler-service	1	2	1	2	1	2	78.1	1
ocn-nwdaf-cap4c-kafka-ingestor	2	4	1	2	1	2	78.1	1
ocn-nwdaf-cap4c-reporting-service	1	2	1	2	1	2	78.1	1
ocn-nwdaf-geo-redundacy-agent	1	1	1	1	1	2	78.1	1
Total	21	40	28	52	17	35		

Resource Requirements for Helm Test

This section provides the details on resource requirement to install and run OCNWDAF Helm Test.

Helm Test Job
This job runs on demand when Helm test command is executed. It runs the Helm test and stops after completion. These are short lived jobs, which gets terminated after the work is completed. Hence, they are not part of active deployment resource, but considered only during Helm test procedures.

Table 2-4 Helm Test Requirement

Container Type	CPU Request and Limit Per Container	Memory Request and Limit Per Container
Helm Test	Request- 1 CPU, Limit- 2 CPU	Request- 1 GB, Limit- 2 GB

Below is an example of the configurations that should be included under the global section of the *oc-nwdaf-custom-values.yaml* file.

```
global:
  testJobResources:
    limits:
      cpu: 2
      memory: 2Gi
      ephemeral-storage: 2Gi
    requests:
      cpu: 1
      memory: 1Gi
      ephemeral-storage: 200Mi
```


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3
Downloading Installation Package

This chapter describes how to download Oracle Communications Network Data Analytics Function (OCNWDAF) package.

- Installation Package Download
- Pushing the Images to Customer Docker Registry

3.1 Installation Package Download

This section provides information about how to download OCNWDAF package.

To download the OCNWDAF package from My Oracle Support:

1. Log in to My Oracle Support using the appropriate credentials.
2. Click **Patches & Updates** to locate the patch.
3. In the **Patch Search** console, select the **Product or Family (Advanced)** option.
4. Enter `Oracle Communications Cloud Native Core - 5G` in the **Product** field. Select the product from the **Product** drop-down
5. From the **Release** drop-down, select "**Oracle Communications Network Data Analytics Function <release_number>**" Where, `<release_number>` indicates the required release number of OCNWDAF.
6. Click **Search**.
   The Patch Advanced Search Results displays a list of releases.
7. Select the required patch from the list. The Patch Details window appears.
8. Click **Download**. The File Download window appears.
9. Click the **<p********_<release_number>_Tekelec>.zip** file.
10. Extract the release package zip file.
    Package is named as follows:

    nwdaf-pkg-<marketing-release-number>.zip

    For example: *nwdaf-pkg-23.2.0.0.zip*

To download the package from the edelivery portal, perform the following steps:

1. Login to the edelivery portal with your credentials. The following screen appears:

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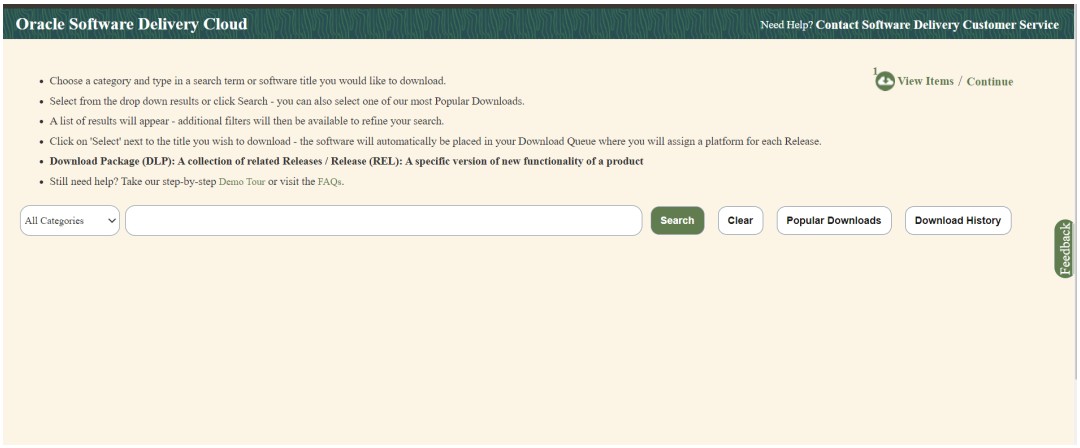
Figure 3-1 edelivery portal



2. Select the **Download Package** option, from **All Categories** drop down list.
3. Enter **Oracle Communications Network Data Analytics Data Function** in the search bar.
4. List of release packages available for download are displayed on the screen. Select the release package you want to download, the package automatically gets downloaded.

Untar the Package ZIP File

Run the following command to untar or unzip the OCNWDAF package zip file to the specific repository:

```
tar -xvf nwdaf-pkg-<marketing-release-number>.tgz
```

or

```
unzip  nwdaf-pkg-<marketing-release-number>.zip
```

After the package and its content is extracted, the following directory structure is displayed:

```
# Root
- images
  - tar of images
  - sha 256 of images
- troubleshooting/
    - nfDataCapture.sh
- ocn-nwdaf-helmChart/
    - helmChart
        - templates
        - charts
        - values.yaml
        - charts.yaml
        - nwdaf-pre-installer.tar.gz
    - simulator-helmChart
        - templates
        - charts
        - values.yaml
        - charts.yaml
 - nwdaf-ats/
```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```
- ocn-ats-nwdaf-tool
    -ngnix
    -templates
- ocnwdaf_tests
    -data
    -features
```

3.2 Pushing the Images to Customer Docker Registry

The OCNWDAF deployment package includes ready-to-use docker images (inside the images tar file) and Helm charts to help orchestrate containers in Kubernetes. The communication between service pods of OCNWDAF are preconfigured in the Helm charts.

Table 3-1 Docker Images for OCNWDAF

Service Name	Docker Image Name	Image Tag
NWDAF Analytics Info Service	ocn-nwdaf-analytics	23.2.0.0.0
NWDAF Configuration Service	ocn-nwdaf-configuration-service	23.2.0.0.0
NWDAF Data Collection Service	ocn-nwdaf-data-collection-service	23.2.0.0.0
NWDAF MTLF Service	ocn-nwdaf-mtlf-service	23.2.0.0.0
NWDAF Subscription Service	ocn-nwdaf-subscription-service	23.2.0.0.0
AMF NF Simulator Service	ocn-amf-simulator-service	23.2.0.0.0
SMF NF Simulator Service	ocn-smf-simulator-service	23.2.0.0.0
NRF NF Simulator Service	ocn-nrf-simulator-service	23.2.0.0.0
OAM Simulator Service	ocn-oam-simulator-service	23.2.0.0.0
Mesa Simulator Service (Data Generator)	mesa-simulator	23.2.0.0.0
cap4c ML model controller	cap4c-model-controller	23.2.0.0.0
cap4c ML model executor	cap4c-model-executor	23.2.0.0.0
cap4c stream analytics	cap4c-stream-analytics	23.2.0.0.0
kafka to mysql serializer	cap4c-kafka-ingestor	23.2.0.0.0
Reporting service	nwdaf-cap4c-reporting-service	23.2.0.0.0
kafka	nwdaf-cap4c-kafka	3.4.0
nwdaf-cap4c-scheduler	nwdaf-cap4c-scheduler-service	23.2.0.0.0
nwdaf-cap4c-spring-cloud-config-server	nwdaf-cap4c-spring-cloud-config-server	23.2.0.0.0
nwdaf-portal	nwdaf-portal	23.2.0.0.0
nwdaf-portal-service	nwdaf-portal-service	23.2.0.0.0
redis	nwdaf-cap4c-redis	7.0.4
zookeeper	nwdaf-cap4c-zookeper	3.8.0
nwdaf-cap4c-initial-setup-script	nwdaf-cap4c-initial-setup-script	23.2.0
ocats-nwdaf	ocats-nwdaf	23.2.0.0.0
ocats-nwdaf-notify	ocats-nwdaf-notify	23.2.0.0.0
Helm Test	nf-test	22.2.0
geo redundancy agent	ocn-nwdaf-geo-redundacy-agent	23.1.0.0.0
nwdaf-egress-gateway	ocingress_gateway	23.1.3
nwdaf-ingress-gateway	ocegress_gateway	23.1.3
nrf client configuration server	oc-config-server	22.4.0

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Table 3-1 (Cont.) Docker Images for OCNWDAF

Service Name	Docker Image Name	Image Tag
nrf client app info	oc-app-info	22.4.0
nrf client perf info	oc-perf-info	22.4.0
nrf client	nrf-client	22.4.0

To push the images to customer docker registry, perform the following steps:

1. Verify the package content, checksums of tarballs in the `Readme.txt` file.
2. If the images of the above services are already present in the artifact, then proceed with the Preinstallation tasks.
3. (Optional) If the images of the above services are not present in the artifact, then the user has to run the following commands to manually load, tag, and push the images. Run the following command:

   ```
   docker load --input <image_file_name.tar>
   ```

   Example:

   ```
   docker load --input images
   ```

4. Push the Docker images to the docker repository, run the following command:

   ```
   docker tag <image-name>:<image-tag> <docker-repo>/<image-name>:<image-tag>
   ```

   ```
   docker push <docker_repo>/<image_name>:<image-tag>
   ```

   > **Note**
   >
   > It is recommended to configure the docker certificate before running the push command to access customer registry through HTTPs, otherwise, docker push command may fail.

5. Verify if the image is loaded correctly by running the following command. Run the following command:

   ```
   docker images
   ```

6. (Optional) Push the Helm charts to the Helm repository. Run the following command:

   ```
   helm cm-push --force <chart name>.tgz <Helm repo>
   ```


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Untar the Preinstaller

To extract the *nwdaf-pre-installer.tar.gz* file outside the */helmchart* directory, run the following command:

```
tar xzC <path to extract> -f nwdaf-pre-installer.tar.gz
```

Verify the file structure of the extracted file:

```
- etc/
    - nwdaf-cap4c-spring-cloud-config-prod-properties/
    - kafka-topics.txt
- scripts/
    - util/
        - kubernetes-util.sh
        - helm-util.sh
        - generic-util.sh
    - prepare-dependencies.sh
```


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4 OCNWDAF Installation

This chapter describes how to install Oracle Communications Network Data Analytics Function (OCNWDAF) on Oracle Communications Cloud Native Core, Cloud Native Environment (CNE).

The steps are divided into two categories:

- Preinstallation
- Installation Tasks

You are recommended to follow the steps in the given sequence for preparing and installing OCNWDAF.

4.1 Preinstallation

To install OCNWDAF, perform the steps described in this section.

> **Note**
>
> The kubectl commands might vary based on the platform used for deploying CNC Policy. Users are recommended to replace `kubectl` with environment-specific command line tool to configure kubernetes resources through kube-api server. The instructions provided in this document are as per the CNE's version of kube-api server.

4.1.1 Creating Service Account, Role, and RoleBinding

This section describes the procedure to create service account, role, and rolebinding.

> **Important**
>
> The steps described in this section are optional and you can skip them in any of the following scenarios:
>
> - If service accounts are created automatically at the time of OCNWDAF deployment.
> - If the global service account with the associated role and rolebindings is already configured or if you are using any internal procedure to create service accounts. If a service account with necessary rolebinding is already available, then update the `ocnwdaf/values.yaml` with the account details before initiating the installation procedure. In case of incorrect service account details, the installation fails.

Create Service Account

To create the global service account:

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1. Create an OCNWDAF service account resource file:

   ```
   vi <ocnwdaf resource file>
   ```

   Example:

   ```
   vi ocnwdaf-sampleserviceaccount-template.yaml
   ```

2. Update the resource file with the release specific information:

   > **Note**
   >
   > Update <helm-release> and <namespace> with its respective OCNWDAF namespace and OCNWDAF Helm release name.

   ```
   apiVersion: v1
   kind: ServiceAccount
   metadata:
   name: <helm-release>-serviceaccount
   namespace: <namespace>
   ```

where, `<helm-release>` is the Helm deployment name.
`<namespace>` is the name of the Kubernetes namespace of OCNWDAF. All the microservices are deployed in this Kubernetes namespace.

Define Permissions using Role

To define permissions using roles:

1. Create an OCNWDAF roles resource file:

   ```
   vi <ocnwdaf sample role file>
   ```

   Example:

   ```
   vi ocnwdaf-samplerole-template.yaml
   ```

2. Update the resource file with the role specific information:

   ```
   apiVersion: rbac.authorization.k8s.io/v1
   kind: ClusterRole
   metadata:
     name: <helm-release>-role
   rules:
   - apiGroups: [""]
     resources:
     - pods
     - services
     - configmaps
     verbs: ["get", "list", "watch"]
   ```


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Create Rolebinding

To bind the roles with the service account:

1. Create an OCNWDAF rolebinding resource file:

   ```
   vi <ocnwdaf sample rolebinding file>
   ```

   Example:

   ```
   vi ocnwdaf-sample-rolebinding-template.yaml
   ```

2. Update the resource file with the role binding specific information:

   ```
   apiVersion: rbac.authorization.k8s.io/v1
   kind: RoleBinding
   metadata:
   name: <helm-release>-rolebinding
   namespace: <namespace>
   roleRef:
   apiGroup: rbac.authorization.k8s.io
   kind: Role
   name: <helm-release>-role
   subjects:
   - kind: ServiceAccount
   name: <helm-release>-serviceaccount
   namespace: <namespace>
   ```

Create Resources

Run the following commands to create resources:

```
kubectl -n <namespace> create -f <service account resource file>;
```

```
kubectl -n <namespace> create -f <roles resource file>;
```

```
kubectl -n <namespace> create -f <rolebinding resource file>
```

> **Note**
>
> Once the global service account is added, users must add `global.ServiceAccountName` in the `ocnwdaf/values.yaml` file; otherwise, installation may fail as a result of creating and deleting custom resource definitions (CRD).

4.1.2 Configuring Database, Creating Users, and Granting Permissions

This section explains how a database administrator can create the databases, users, and grant permissions to the users for OCNWDAF.

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Perform the following steps to create the OCNWDAF MySQL database and grant permissions to the OCNWDAF user for database operations:

1. Unzip the package *nwdaf-installer.zip*

   ```
   mkdir nwdaf-installer

   unzip nwdaf-installer.zip -d nwdaf-installer/
   ```

2. Log in to the server or machine with permission to access the SQL nodes of NDB cluster.
3. Connect to the SQL node of the NDB cluster or connect to the cnDBTier.
4. Run the following command to connect to the cnDBTier:

   ```
   kubectl -n <cndbtier_namespace> exec -it <cndbtier_sql_pod_name> -c
   <cndbtier_sql_container_name> -- bash
   ```

5. Run the following command to log in to the MySQL prompt as a user with root permissions:

   ```
   mysql -h 127.0.0.1 -uroot -p
   ```

6. Copy the file content from *nwdaf-release-package/installer/nwdaf-installer/sql/ocn-nwdaf-db-script-23.2.0.0.0.sql* and run it in the current MySQL instance.

4.1.3 Verifying and Creating OCNWDAF Namespace

This section explains how to verify or create a new namespace in the system.

To verify if the required namespace already exists in the system, run the following command:

```
$ kubectl get namespaces
```

In the output of the above command, check if the required namespace is available. If the namespace is not available, create the namespace using the following command:

```
$ kubectl create namespace <required namespace>
```

Example:

```
$ kubectl create namespace oc-nwdaf
```

Naming Convention for Namespaces

While choosing the name of the namespace where you wish to deploy OCNWDAF, make sure the namespace:

- starts and ends with an alphanumeric character
- contains 63 characters or less
- contains only alphanumeric characters or '-'

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> **Note**
>
> It is recommended to avoid using prefix `kube-` when creating namespace as this prefix is reserved for Kubernetes system namespaces.

4.1.4 Verifying Installer

A folder named *installer* is obtained on decompressing the release package, copy this folder to the Kubernetes bastion home. To verify if the *installer* has all the valid files, run the following commands:

```
[ -d "./nwdaf-release-package/helmChart" ] && echo "helmChart exist"
[ -d "./nwdaf-release-package/nwdaf-ats" ] && echo "nwdaf-ats exist"
[ -d "./nwdaf-release-package/nwdaf-pre-installer" ] && echo "nwdaf-pre-
installer exist"
[ -d "./nwdaf-release-package/nwdaf-pre-installer/scripts/prepare-
dependencies.sh" ] && echo "prepare-depencies.sh script exist"
[ -d "./nwdaf-release-package/nwdaf-pre-installer/etc/nwdaf-cap4c-spring-
cloud-config-prod-properties" ] && echo "nwdaf-cap4c-spring-cloud-config-prod-
properties exist"
[ -d "./nwdaf-release-package/nwdaf-pre-installer/etc/kafka-topics.txt" ] &&
echo "kafka-topics.txt exist"
```

Sample output:

```
helmChart exist
nwdaf-ats exist
nwdaf-pre-installer exist
prepare-depencies.sh script exist
nwdaf-cap4c-spring-cloud-config-prod-properties exist
kafka-topics.txt exist
```

4.2 Installation Tasks

This section describes the tasks that the user must follow for installing OCNWDAF.

4.2.1 Update OCNWDAF Preinstaller Files

> **Note**
>
> This is an optional procedure.

To update the preinstaller file, perform the following steps:

1. Make the required changes in *config* files present in the extracted *nwdaf-pre-installer* directory and create a fresh tar file by running the following command:

   ```
   tar -zcvf nwdaf-pre-installer.tar.gz nwdaf-pre-installer/
   ```

2. Replace the existing tar file in the */helmChart* directory with the new tar file.

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4.2.2 Setup Encrypted Credentials

To set up encrypted credentials, perform the following steps:

1. To update the secret values, replace the existing values with updated values after encoding the values using Base64 encoding method. Listed below are the secrets files:
   - *ocnwdaf-hooks-secret.yaml* under */helmchart/templates/* directory
   - *hook-secrets.yaml* under */helmchart/charts/nrf-client/templates/* directory
2. To read the secret values, decode the present values using Base64 decoding method.

4.2.3 Configure Database Flag

> **Note**
>
> This is an optional step. Perform this step based on customer requirement.

Update the *dbConfigStatus* flag in *values.yaml* file under */helmchart* with any of the following values (the default value is *alldb*):

- *alldb*: This is the default value of the flag. Set this flag to create a fresh database by removing the existing database. If this flag is present, proceed with the installation of the services.
- *nodb*: This flag disables the *dbCreation* hooks for the installation of the Helm chart. Set this flag to install the services if the database is present without deleting any data.
- *nwdafdb*: This flag is used to create or reinstall the database only for NWDAF services. Set this flag to run the *dbCreation* hook only for OCNWDAF services (standard installation is followed for the remaining services).
- *cap4cdb*: This flag is used to create or reinstall the database only for CAP4C services. Set this flag to run the *dbCreation* hook only for CAP4C services (standard installation is followed for the remaining services).

> **Note**
>
> If there is a requirement to install only OCNWDAF or only CAP4C services, set the *dbConfigStatus* flag to create the required DB and the charts that are not needed can be set to 'enabled: false' in the "*values. yaml*" under "`/helm chart`".
>
> For example, if a user wants to install CAP4C services only with its database, then set the *dbConfigStatus* flag to 'cap4cdb', and set the value of all the NWDAF FE services that are not required to 'enabled: false' and proceed with the installation procedure.

4.2.4 Configuring Service Mesh

> **Note**
>
> This configuration step is optional and only applies when a service mesh is available.

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OCNWDAF leverages the Platform Service Mesh (for example, Aspen Service Mesh (ASM)) for all the internal and external TLS communication by deploying a special sidecar proxy in each pod to intercept all the network communications. The service mesh integration provides inter-NF communication and allows API gateway to cowork with the service mesh. The service mesh integration supports the services by deploying a special sidecar proxy in each pod to intercept all the network communications between microservices. A service mesh provides the following services:

- Service discovery
- Routing and traffic configuration
- Encryption and authentication/authorization
- Metrics and monitoring

> **Note**
>
> To configure OCNWDAF to support a service mesh, the service mesh must be available in the cluster in which OCNWDAF is installed.

Enable or Disable Service Mesh

To enable or disable service mesh support, update the Istio sidecar section in the *values.yaml* file.

For example:

```
##########################

#ISTIO SIDECAR INJECTION #

##########################

istio:

   ## NOTE:  The label of the namespace will take precedence over the
injection field that is set here. If mesh is to be disabled, make sure the
namespace has no istio-injection label or set to disabled if present

   injection: false
   readinessCheck: &readinessCheck false
```

For more information, see Global Parameters.

Update the following NRF client parameters:

- `istioSidecarQuitUrl`
- `istioSidecarReadyUrl`
- `serviceMeshCheck`

For more information, see NRF Client Parameters.

Update the following Ingress Gateway Parameters in the *values.yaml* file:

- `serviceMeshCheck`

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Table 4-1 Ingress Gateway Parameter

Parameter	Description	Detail
serviceMeshCheck	This is a mandatory parameter. This flag must be set to `true` if a Service Mesh is present in the environment where OCNWDAF is deployed. If this parameter is set to `true` load balancing is handled by the Service Mesh.	**Range:** True or False **Default value:** False **Applicable to:** OCNWDAF

Update the following Egress Gateway parameters in the *values.yaml* file:

- `serviceMeshCheck`

Table 4-2 Egress Gateway Parameter

Parameter	Description	Detail
serviceMeshCheck	This is a mandatory parameter. This flag must be set to `true` if a Service Mesh is present in the environment where OCNWDAF is deployed. If this parameter is set to `true` load balancing is handled by the Service Mesh.	**Range:** True or False **Default value:** False **Applicable to:** OCNWDAF

After Service Mesh is enabled and deployed, the proxy containers run along with the OCNWDAF application pods.

> **Note**
>
> The gateways and other services inside the Service Mesh are not accessible from outside the Service Mesh. In order to use OCNWDAF with a Service Mesh, ensure that the dependencies (such as, cnDBTier or analytics consumers) are deployed within the Service Mesh.

4.2.5 Configuring Routing Rules in Ingress Gateway

The routing rules are configured in the Ingress Gateway *values.yaml* file. Once the routing rules are configured, the Ingress Gateway reroutes the incoming traffic to the microservices based on the configured routing rules.

Ingress Gateway *values.yaml* file:

```
- id: prodcon
    uri: http://10.123.158.150:31457
    path: /relinquishOwnerShip
    order: 1
    #Below field is used to provide an option to enable/disable route level
xfccHeaderValidation, it will override global configuration for
xfccHeaderValidation.enabled
    metadata:
```


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```
      # requestTimeout is used to set timeout at route level. Value should be
in milliseconds.
      requestTimeout: 4000
      requiredTime: 3000
      xfccHeaderValidation:
        validationEnabled: false
      oauthValidator:
        enabled: false
      svcName: "prodcon-1"
      configurableErrorCodes:
        enabled: false
        errorScenarios:
          - exceptionType: "NOT_FOUND_EXCEPTION"
            errorProfileName: "ERR_NOT_FOUND"
          - exceptionType: "UNKNOWN_HOST_EXCEPTION"
            errorProfileName: "ERR_UNKNOWN_HOST"
          - exceptionType: "CONNECT_EXCEPTION"
            errorProfileName: "ERR_400"
          - exceptionType: "XFCC_HEADER_NOT_PRESENT_OR_EMPTY"
            errorProfileName: "ERR_1300"
          - exceptionType: "GLOBAL_RATELIMIT"
            errorProfileName: "ERR_RATE_LIMIT"

      # Server header configuration if defined at Route level(irrespective of
being enabled/disabled) will take precedence over the Global conf. Uncomment
only if needed at Route level.
      #serverHeaderDetails:
      #  enabled: false
      #  errorCodeSeriesId: E2  # If not defined here, value at Global level
will be used as fallback. Value need to be one among "errorCodeSeriesList"
resource defined later.
    filters:
      controlledShutdownFilter:
        applicableShutdownStates:
          - "PARTIAL_SHUTDOWN"
          - "COMPLETE_SHUTDOWN"
        unsupportedOperations:
          - "GET"
          - "PUT"

      #Below are Request Custom Headers
      customReqHeaderEntryFilter:
        headers:
          - methods:
              - ALL
            headersList:
              - headerName: x-entry-headeReq-1
                defaultVal: script:shm-02,x-exit-new-req
                source: incomingReq
                sourceHeader: x-entry-current-user
              - headerName: x-entry-current-user
                defaultVal: 123
                source: incomingReq
                sourceHeader: test
      customReqHeaderExitFilter:
        headers:
```


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```
    - methods:
        - ALL
      headersList:
        - headerName: x-exit-headeReq-1
          defaultVal: abc
          source: incomingReq
          sourceHeader: x-exit-current-user
        - headerName: x-exit-current-user
          defaultVal: 123
          source: incomingReq
          sourceHeader: sbi-timer-feature
    - methods:
        - GET
        - POST
      headersList:
        - headerName: x-exit-headeReq-3
          defaultVal: abc
          source: incomingReq
          sourceHeader: x-exit-new-req
          override: false
        - headerName: x-exit-headeReq-4
          defaultVal: 123
          source: incomingReq
          sourceHeader: x-exit-headeReq-1
          override: false
    - methods:
        - DELETE
        - GET
      headersList:
        - headerName: x-exit-headerReq-5
          defaultVal: abc
          source: incomingReq
          sourceHeader: x-exit-headerReq-new
          override: false
        - headerName: x-exit-headerReq-6
          defaultVal: 123
          source: incomingReq
          sourceHeader: x-exit-headerReq-temp
          override: false
# Below are Response Custom Headers
customResHeaderEntryFilter:
  headers:
    - methods:
        - ALL
      headersList:
        - headerName: x-entry-headerRes-1
          defaultVal: abc
          source: incomingReq
          sourceHeader: x-entry-headeReq-1
          override: false
        - headerName: sbi-timer-feature-Res
          defaultVal: 123
          source: incomingReq
          sourceHeader: x-exit-new-req
customResHeaderExitFilter:
  headers:
```


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```
            - methods:
                - ALL
              headersList:
                - headerName: x-exit-headerRes-1
                  defaultVal: abc
                  source: incomingReq
                  sourceHeader: x-exit-headerReq-1
                  override: false
                - headerName: sbi-timer-feature
                  defaultVal: 123
                  source: incomingRes
                  sourceHeader: x-exit-headerRes-1
            - methods:
                - GET
                - PUT
              headersList:
                - headerName: x-exit-headeRes-3
                  defaultVal: abc
                  source: incomingRes
                  sourceHeader: x-exit-SourceRes-a
                  override: true
                - headerName: x-exit-headeRes-4
                  defaultVal: 123
                  source: incomingReq
                  sourceHeader: x-exit-SourceRes-b
                  override: false
            - methods:
                - DELETE
              headersList:
                - headerName: x-exit-headeRes-5
                  defaultVal: abc
                  source: incomingRes
                  sourceHeader: ""
                  override: false
                - headerName: x-exit-headeRes-6
                  defaultVal: 123
                  source: incomingRes
                  sourceHeader: ""
                  override: false
    #Below field is used for blacklisting(removing) a request header at route
level.
    removeRequestHeader:
      - name: myheader1
      - name: myheader3
    #Below field is used for blacklisting(removing) a response header at
route level.
    removeResponseHeader:
      - name: myresponseheader1
      - name: myresponseheader3
```

The following Ingress Gateway *routesConfig* parameters are updated:

- `id: prodcon`
- `uri: http://10.123.158.150:31457`
- `path: /relinquishOwnerShip`

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For more information on the customizable Ingress Gateway parameters, see Ingress Gateway Parameters.

> **Note**
>
> It is recommended to retain the default values of other *routesConfig* parameters.

4.2.6 Install Ingress and Egress Gateways

Run the following command to install the configured Helm charts of both the Ingress and Egress Gateways:

```
helm install <chart-name> <chart-path> -n <namespace>
```

After a successful installation, both the Ingress and Egress Gateway pods must be running in your namespace.

Sample output:

Figure 4-1 Sample Output

4.2.7 Installing OCNWDAF Package

To install the OCNWDAF package, perform the following steps:

1. Update the values in the `<replace here>` tag in the *values.yaml* file under the *<release directory>/ocn-nwdaf-helmChart/helmChart/* directory according to the setup.

```
...
    cluster:
        name: &clusterName '<replace here>'
        namespace: &nameSpace '<replace here>'
        dbConfig:
            MYSQL_HOST: &mySQLHost '<replace here>'
            MYSQL_PORT: &mySQLPort '<replace here>'
            MYSQL_ENGINE: &mySQLEngine '<replace here>'
            CNDBTIER_NAMESPACE: &cndbNameSpace '<replace here>'
            CNDBTIER_SQL_POD_NAME: &cndbSQLPodName '<replace here>'
...
```

2. Update the values in the `<replace here>` tag in the *values.yaml* file under the *<release directory>/ocn-nwdaf-helmChart/helmChart/charts/nrf-client* directory according to the setup.

```
...
 # Mysql Host
 envMysqlHost: &mySqlHostRef '<replace here>' # <enter here>
 envMysqlSecondaryHost: ''
```


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```
 # Mysql Port
 envMysqlPort: &mySqlPortRef '<replace here>' # <enter here>
 envMysqlSecondaryPort: ''
 dbEngine: &mySqlEngine '<replace here>' # <enter here>
...
```

3. Set the *Subcharts* flag in the centralized *values.yaml* file under the *<release directory>/ocn-nwdaf-helmChart/helmChart/* directory. The allowed values are true or false. The services with the flag set to "false" are not deployed.
4. Optionally, update any other parameter in centralized or subchart *values.yaml* files. For example, Prometheus monitoring details or hooks environment variables in the centralized *values.yaml* under the */helmchart* directory. Any microservice specific values like image name or tag, environment variables in microservices subchart *values.yaml* file.

   The following list is the default variables used to configure OCNWDAF, these variables are present in the centralized *values.yaml* files and in the secrets:

   - MYSQL_HOST
   - MYSQL_PORT
   - KAFKA_BROKERS
   - REDIS_HOST
   - REDIS_PORT
   - CAP4C_KAFKA_INGESTOR_DB
   - CAP4C_KAFKA_INGESTOR_DB_USER
   - CAP4C_KAFKA_INGESTOR_DB_PASSWORD
   - CAP4C_MODEL_CONTROLLER_DB
   - CAP4C_MODEL_CONTROLLER_DB_USER
   - CAP4C_MODEL_CONTROLLER_DB_PASSWORD
   - CAP4C_MODEL_EXECUTOR_DB_USER
   - CAP4C_MODEL_EXECUTOR_DB_PASSWORD
   - CAP4C_STREAM_ANALYTICS_DB
   - NWDAF_CAP4C_REPORTING_SERVICE_USER
   - NWDAF_CAP4C_REPORTING_SERVICE_PASSWORD
   - NWDAF_CAP4C_SCHEDULER_SERVICE_DB
   - NWDAF_CAP4C_SCHEDULER_SERVICE_DB_USER
   - NWDAF_CAP4C_SCHEDULER_SERVICE_DB_PASSWORD
   - NWDAF_CONFIGURATION_HOST
   - NWDAF_USER
   - NWDAF_DB_PASSWORD
5. Install OCNWDAF, run the following Helm installation command:

   ```
   helm install <installation name> <path to the chart directory> -
   n $K8_NAMESPACE --timeout <timeout>h
   ```


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For example:

```
helm install nwdaf helmChart/ -n ocnwdaf-ns --timeout 5h
```

> **Note**
>
> The parameter `--timeout` is optional. It is recommended to use this parameter to avoid any installation failure due to slow internet or CPU speeds. Use appropriate value for this parameter depending on the speed of image pull from the nodes of the Bastion host. The recommended timeout value is 30 minutes.

Mandatory Installation Instruction

> **Note**
>
> Some services are release name dependent, use "nwdaf" for <installation name> in the Helm install command.

Sample terminal screen once the installation starts:

```
[cloud-user@occne224-cluster-bastion-1 ]$ helm install nwdaf helmChart/ -n
nwdaf-test --timeout 30m
W0404 04:44:48.456730 3847781 warnings.go:70] autoscaling/v2beta2
HorizontalPodAutoscaler is deprecated in v1.23+, unavain v1.26+; use
autoscaling/v2 HorizontalPodAutoscaler
W0404 04:44:48.459573 3847781 warnings.go:70] autoscaling/v2beta2
HorizontalPodAutoscaler is deprecated in v1.23+, unavain v1.26+; use
autoscaling/v2 HorizontalPodAutoscaler
W0404 04:51:41.957767 3847781 warnings.go:70] autoscaling/v2beta2
HorizontalPodAutoscaler is deprecated in v1.23+, unavain v1.26+; use
autoscaling/v2 HorizontalPodAutoscaler
```

Sample output of resources in the namespace:

```
[cloud-user@occne224-cluster-bastion-1 ~]$ kubectl get all -n $K8_NAMESPACE
NAME                                    READY   STATUS
RESTARTS   AGE
pod/ocn-nwdaf-db-creation-hook-jj9mx   0/1     ContainerCreating
0          15s

NAME                                    COMPLETIONS   DURATION   AGE
job.batch/ocn-nwdaf-db-creation-hook   0/1           15s        15s
```

Sample output after installation is complete:

```
[cloud-user@occne224-cluster-bastion-1 ]$ helm install nwdaf helmChart/ -
n $K8_NAMESPACE --timeout 30m
W0404 04:44:48.456730 3847781 warnings.go:70] autoscaling/v2beta2
HorizontalPodAutoscaler is deprecated in v1.23+, unavain v1.26+; use
autoscaling/v2 HorizontalPodAutoscaler
W0404 04:44:48.459573 3847781 warnings.go:70] autoscaling/v2beta2
```


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```
HorizontalPodAutoscaler is deprecated in v1.23+, unavain v1.26+; use
autoscaling/v2 HorizontalPodAutoscaler
W0404 04:51:41.957767 3847781 warnings.go:70] autoscaling/v2beta2
HorizontalPodAutoscaler is deprecated in v1.23+, unavain v1.26+; use
autoscaling/v2 HorizontalPodAutoscaler
W0404 04:51:41.963127 3847781 warnings.go:70] autoscaling/v2beta2
HorizontalPodAutoscaler is deprecated in v1.23+, unavain v1.26+; use
autoscaling/v2 HorizontalPodAutoscaler
NAME: nwdaf
LAST DEPLOYED: Tue Apr  4 04:44:47 2023
NAMESPACE: nwdaf-test
STATUS: deployed
REVISION: 1
TEST SUITE: None
```

6. Run the following command to verify if all the dependencies are in **Running** state (if any pod is not in **Running** state wait for a maximum of five restarts):

```
kubectl get all -n $K8_NAMESPACE
```

Sample output:

Figure 4-2 Sample Output

```
NAME                                                              READY   STATUS    RESTARTS   AGE
pod/cap4c-kafka-ingestor-deploy-6c64cc996b-97z7p                  1/1     Running   0          56m
pod/cap4c-model-controller-deploy-7b78bf66f4-qvmpp                1/1     Running   0          56m
pod/cap4c-model-executor-sts-0                                    1/1     Running   0          56m
pod/cap4c-stream-analytics-deploy-79b8ccb6ff-65l6d                1/1     Running   0          56m
pod/kafka-sts-0                                                   1/1     Running   0          62m
pod/kafka-sts-1                                                   1/1     Running   0          62m
pod/kafka-sts-2                                                   1/1     Running   0          62m
pod/nrfclient-appinfo-6b594d4c95-txkrn                            1/1     Running   0          56m
pod/nrfclient-ocnf-nrf-client-nfdiscovery-5645fc669-7rhlx         1/1     Running   0          56m
pod/nrfclient-ocnf-nrf-client-nfdiscovery-5645fc669-8f6wg         1/1     Running   0          56m
pod/nrfclient-ocnf-nrf-client-nfmanagement-75795976-lnvxm         1/1     Running   0          56m
pod/nrfclient-ocpm-config-b8575dc7d-4hqvd                         1/1     Running   0          56m
pod/nwdaf-cap4c-kafka-ui-pod                                      1/1     Running   0          56m
pod/nwdaf-cap4c-reporting-service-deploy-7fb99d6856-2vhvg         1/1     Running   0          56m
pod/nwdaf-cap4c-scheduler-service-deploy-65f587d68b-cg8cx         1/1     Running   0          56m
pod/nwdaf-cap4c-scheduler-service-deploy-65f587d68b-n7p7t         1/1     Running   0          56m
pod/nwdaf-cap4c-spring-cloud-config-server-deploy-c4f865599-hnksh 1/1     Running   0          62m
pod/nwdaf-egress-gateway-5d7f4475b6-4966w                         1/1     Running   0          56m
pod/nwdaf-egress-gateway-5d7f4475b6-6p2bv                         1/1     Running   0          56m
pod/nwdaf-ingress-gateway-6d8df94bbf-84xkl                        1/1     Running   0          56m
pod/nwdaf-ingress-gateway-6d8df94bbf-q5vtv                        1/1     Running   0          56m
pod/nwdaf-portal-deploy-8d8b69c48-g6rkc                           1/1     Running   0          56m
pod/nwdaf-portal-service-deploy-84dfd7bc7-tp4wd                   1/1     Running   0          56m
pod/ocn-nrf-simulator-service-deploy-58ccf8ff66-7tp9g             1/1     Running   0          58m
pod/ocn-nwdaf-analytics-info-deploy-b8cb476d5-dshqm               1/1     Running   0          56m
pod/ocn-nwdaf-configuration-service-deploy-7f8b4b6656-wd549       1/1     Running   0          56m
pod/ocn-nwdaf-data-collection-service-deploy-b957f5589-nq6ts      1/1     Running   0          56m
pod/ocn-nwdaf-georedagent-7bcc778dbb-q8qxt                        1/1     Running   0          56m
pod/ocn-nwdaf-mtlf-service-deploy-6cb4c98bc-hq94g                 1/1     Running   0          56m
pod/ocn-nwdaf-subscription-service-deploy-67597ffd64-gptbx        1/1     Running   0          50m
pod/redis-master-pod                                              1/1     Running   0          56m
pod/redis-slave-sts-0                                             1/1     Running   0          56m
pod/redis-slave-sts-1                                             1/1     Running   0          56m
pod/zookeeper-sts-0                                               1/1     Running   0          62m
```


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OCNWDAF Microservices Port Mapping

Table 4-3 Port Mapping

Service	Port Type	IP Type	Network Type	Service Port	Container Port
ocn-nwdaf-analytics	Internal	ClusterIP	Internal / K8s	8080/TCP	8080/TCP
nwdaf-egress-gateway	Internal	ClusterIP	Internal / K8s	8080/TCP	8080/TCP
nwdaf-ingress-gateway	External	NodePort	External/ K8s	80/TCP	8081/TCP
ocn-nwdaf-configuration-service	Internal	ClusterIP	Internal / K8s	8080/TCP	8080/TCP
ocn-nwdaf-data-collection	Internal	ClusterIP	Internal / K8s	8080/TCP	8080/TCP
ocn-nwdaf-mtlf	Internal	ClusterIP	Internal / K8s	8080/TCP	8080/TCP
ocn-nwdaf-subscription	Internal	ClusterIP	Internal / K8s	8080/TCP	8080/TCP
ocn-nwdaf-analytics-info	Internal	ClusterIP	Internal / K8s	8080/TCP	8080/TCP
ocn-nwdaf-configuration	Internal	ClusterIP	Internal / K8s	8080/TCP	8080/TCP
ocn-nwdaf-georedagent	Internal	ClusterIP	Internal / K8s	9181/TCP	9181/TCP
cap4c-kafka-ingestor	Internal	ClusterIP	Internal / K8s	8080/TCP	8080/TCP
cap4c-model-controller	Internal	ClusterIP	Internal / K8s	8080/TCP	8080/TCP
cap4c-model-executor	Internal	ClusterIP	Internal / K8s	9092/TCP	9092/TCP
cap4c-stream-analytics	Internal	ClusterIP	Internal / K8s	8080/TCP	8080/TCP
nwdaf-cap4c-reporting-service	Internal	ClusterIP	Internal / K8s	8080/TCP	8080/TCP
nwdaf-cap4c-scheduler-service	Internal	ClusterIP	Internal / K8s	8080/TCP	8080/TCP
nwdaf-portal	External	NodePort	External / K8s	80/TCP	
nwdaf-portal-service	Internal	ClusterIP	Internal / K8s	8080/TCP	8080/TCP

> **Note**
>
> For NodePort services the Service Port will be allocated by the Kubernetes.

Installation of Simulator Chart

Follow the procedure below to install the simulator chart:

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1. Update the values in the `<replace here>` tag present in *values.yaml* under `/simulator-helmchart/` based on the setup:

```
...
    cluster:
        name: &clusterName '<replace here>'
        namespace: &nameSpace '<replace here>'
        dbConfig:
            MYSQL_HOST: &mySQLHost '<replace here>'
            MYSQL_PORT: &mySQLPort '<replace here>'
            MYSQL_ENGINE: &mySQLEngine '<replace here>'
            CNDBTIER_NAMESPACE: &cndbNameSpace '<replace here>'
            CNDBTIER_SQL_POD_NAME: &cndbSQLPodName '<replace here>'
...
```

2. Set the *Subcharts* flag in the centralized *values.yaml* file under the */simulator-helmchart* directory. The allowed values are true or false. The services with the flag set to false are not deployed.
3. Optionally, update any other parameter in centralized or subchart *values.yaml* files. For example, Prometheus monitoring details or hooks environment variables in the centralized *values.yaml* under the */simulator-helmchart* directory. Any microservice specific values like image name or tag, environment variables in microservices subchart *values.yaml* file.
4. Install simulators, run the following Helm installation command:

```
helm install <installation name> <path to the chart directory> -
n $K8_NAMESPACE --timeout <timeout>h
```

For example:

```
helm install simulators simulator-helmchart/ -n ocnwdaf-ns --timeout 30m
```

> **Note**
>
> The parameter `--timeout` is optional. It is recommended to use this parameter to avoid any installation failure due to slow internet or CPU speeds. Use appropriate value for this parameter depending on the speed of image pull from the nodes of the Bastion host. The recommended timeout value is 30 minutes.

Sample terminal screen once the installation starts:

```
[cloud-user@occne224-cluster-bastion-2 ocn-nwdaf-helmChart]$ helm install
simulators simulator-helmChart/ -n ttest --timeout 30m
W0511 10:38:19.670067 2848359 warnings.go:70]
spec.template.spec.containers[0].env[61].name: duplicate name
"SPRING_KAFKA_CONSUMER_PROPERTIES_MAX_POLL_INTERVAL_MS"
NAME: simulators
LAST DEPLOYED: Thu May 11 10:38:12 2023
NAMESPACE: ttest
STATUS: deployed
```


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```
REVISION: 1
TEST SUITE: None
```

5. Run the following command to verify if all the dependencies are in **Running** state (if any pod is not in **Running** state wait for a maximum of five restarts):

   ```
   kubectl get all -n $K8_NAMESPACE
   ```

   Sample output:

Figure 4-3 Sample Output

```
NAME                                                              READY   STATUS    RESTARTS
pod/cap4c-kafka-ingestor-deploy-6c64cc996b-jwfhz                  1/1     Running   0
pod/cap4c-model-controller-deploy-7b78bf66f4-zmcdj                1/1     Running   0
pod/cap4c-model-executor-sts-0                                    1/1     Running   0
pod/cap4c-stream-analytics-deploy-79b8ccb6ff-85fbz                1/1     Running   0
pod/kafka-sts-0                                                   1/1     Running   0
pod/kafka-sts-1                                                   1/1     Running   0
pod/kafka-sts-2                                                   1/1     Running   0
pod/mesa-simulator-deploy-54d6d5b4bc-dqsrv                        1/1     Running   0
pod/nrfclient-appinfo-6b594d4c95-kd4pr                            1/1     Running   0
pod/nrfclient-ocnf-nrf-client-nfdiscovery-5645fc669-5dsfz         1/1     Running   0
pod/nrfclient-ocnf-nrf-client-nfdiscovery-5645fc669-pvkpd         1/1     Running   0
pod/nrfclient-ocnf-nrf-client-nfmanagement-75795976-52prh         1/1     Running   0
pod/nrfclient-ocpm-config-b8575dc7d-9jksl                         1/1     Running   0
pod/nwdaf-cap4c-kafka-ui-pod                                      1/1     Running   0
pod/nwdaf-cap4c-reporting-service-deploy-7fb99d6856-kstfv         1/1     Running   0
pod/nwdaf-cap4c-scheduler-service-deploy-65f587d68b-d2d5f         1/1     Running   0
pod/nwdaf-cap4c-spring-cloud-config-server-deploy-c4f865599-qtv8q  1/1     Running   0
pod/nwdaf-egress-gateway-5d7f4475b6-d7x62                         1/1     Running   0
pod/nwdaf-egress-gateway-5d7f4475b6-vs578                         1/1     Running   0
pod/nwdaf-ingress-gateway-6d8df94bbf-kjr5x                        1/1     Running   0
pod/nwdaf-ingress-gateway-6d8df94bbf-kqv2v                        1/1     Running   0
pod/nwdaf-portal-deploy-8d8b69c48-hz2hk                           1/1     Running   0
pod/nwdaf-portal-service-deploy-84dfd7bc7-4sxg9                   1/1     Running   0
pod/ocn-amf-simulator-service-deploy-5569998698-zp2bp             1/1     Running   0
pod/ocn-nrf-simulator-service-deploy-58ccf8ff66-mzls9             1/1     Running   0
pod/ocn-nwdaf-analytics-info-deploy-b8cb476d5-bpkk7               1/1     Running   0
pod/ocn-nwdaf-configuration-service-deploy-7f8b4b6656-m7pjz       1/1     Running   0
pod/ocn-nwdaf-data-collection-service-deploy-b957f5589-k6fn5      1/1     Running   0
pod/ocn-nwdaf-georedagent-7bcc778dbb-5b25w                        1/1     Running   0
pod/ocn-nwdaf-mtlf-service-deploy-6cb4c98bc-bmmz4                 1/1     Running   0
pod/ocn-nwdaf-subscription-service-deploy-67597ffd64-jvglb        1/1     Running   0
pod/ocn-oam-simulator-76c64fbcdc-h9js8                            1/1     Running   0
pod/ocn-smf-simulator-service-deploy-747d9ffb4-ckgxg              1/1     Running   0
pod/redis-master-pod                                              1/1     Running   0
pod/redis-slave-sts-0                                             1/1     Running   0
pod/redis-slave-sts-1                                             1/1     Running   0
pod/zookeeper-sts-0                                               1/1     Running   0
```

6. The following services with port mapping are deployed:

Table 4-4 Port Mapping

Service	Port Type	IP Type	Network Type	Service Port	Container Port
ocn-nrf-simulator	Internal	ClusterIP	Internal / K8s	8080/TCP	8080/TCP
ocn-amf-simulator	Internal	ClusterIP	Internal / K8s	8080/TCP	8080/TCP
mesa-simulator	Internal	ClusterIP	Internal / K8s	8080/TCP	8080/TCP
ocn-smf-simulator	Internal	ClusterIP	Internal / K8s	8080/TCP	8080/TCP

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Table 4-4 (Cont.) Port Mapping

Service	Port Type	IP Type	Network Type	Service Port	Container Port
ocn-oam-simulator	Internal	ClusterIP	Internal / K8s	8080/TCP	8080/TCP

Configure Service Parameters

In the *values.yaml* under `/helmchart/` select the services to deploy, the Helm chart parameters are listed below:

```
nrfclient.enabled: true
ocn-nrf-simulator.enabled: true
nwdaf-cap4c-zookeeper.enabled: true
nwdaf-cap4c-kafka.enabled: true
nwdaf-cap4c-kafka-ui.enabled: true
nwdaf-cap4c-keycloak.enabled: false
nwdaf-cap4c-redis.enabled: true
nwdaf-cap4c-spring-cloud-config-server.enabled: true
nwdaf-cap4c-scheduler-service.enabled: true
nwdaf-cap4c-reporting-service.enabled: true
nwdaf-cap4c-stream-analytics.enabled: true
nwdaf-cap4c-model-executor.enabled: true
nwdaf-cap4c-model-controller.enabled: true
nwdaf-cap4c-kafka-ingestor.enabled: true
ocn-nwdaf-configuration-service.enabled: true
ocn-nwdaf-subscription.enabled: true
ocn-nwdaf-data-collection.enabled: true
ocn-nwdaf-mtlf.enabled: true
ocn-nwdaf-analytics.enabled: true
ocnNwdafGeoredagent.enabled: false
nwdaf-portal-service.enabled: true
nwdaf-portal.enabled: tru
common-services-gateways.enabled: true
cap4cDeployTemp.enabled: false
```

In the *values.yaml* under `/simulator-helmChart/` select the simulators to deploy, the simulator Helm chart parameters are listed below:

```
ocn-smf-simulator.enabled: true
ocn-mesa-simulator.enabled: true
ocn-amf-simulator.enabled: true
ocn-oam-simulator.enabled: true
```

4.3 Postinstallation Tasks

This section explains the postinstallation tasks for OCNWDAF.

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4.3.1 Performing Helm Test

Helm Test is a feature that validates the successful installation of OCNWDAF and determines if the NF is ready to take traffic. The pods are tested based on the namespace and label selector configured for the helm test configurations.

> **Note**
>
> Helm Test can be performed only on helm3.

Prerequisite: To perform the helm test, you must have the helm test configurations completed under the "Global Parameters" section of the `custom_values.yaml` file. For more information on parameters, see Global Parameters.

Run the following command to perform the helm test:

```
helm3 test <helm-release_name> -n <namespace>
```

where:

`helm-release-name` is the release name.

`namespace` is the deployment namespace where OCNWDAF is installed.

Example:

```
helm3 test ocnwdaf -n ocnwdaf
```

Sample output:

```
NAME: ocnwdaf
LAST DEPLOYED: Mon Nov 14 11:01:24 2022
NAMESPACE: ocnwdaf
STATUS: deployed
 REVISION: 1
TEST SUITE: ocnwdaf-test
Last Started: Mon Nov 14 11:01:45 2022
Last Completed: Mon Nov 14 11:01:53 2022
Phase: Succeeded
NOTES:
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```

4.3.2 Configuring OCNWDAF GUI

This section describes how to configure Oracle Communications Networks Data Analytics Function (OCNWDAF) GUI using the following steps:

Configure OCNWDAF GUI in CNC Console

Prerequisite: To configure OCNWDAF GUI in CNC Console, you must have CNC Console installed. For information on how to install CNC Console, refer to *Oracle Communications Cloud Native Configuration Console Installation, Upgrade, and Fault Recovery Guide.*

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Before installing CNC Console, ensure that the instances parameters are updated in the *occncc_custom_values.yaml* file.

If CNC Console is already installed, ensure all the parameters are updated in the *occncc_custom_values.yaml* file. For information refer to *Oracle Communications Cloud Native Configuration Console Installation, Upgrade, and Fault Recovery Guide.*

Access OCNWDAF GUI

To access OCNWDAF GUI, follow the procedure mentioned in the "Accessing CNC Console" section of *Oracle Communications Cloud Native Configuration Console Installation, Upgrade, and Fault Recovery Guide*.

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5 OCNWDAF Customization

Customizing OCNWDAF

This section describes how to customize OCNWDAF.

The OCNWDAF deployment is customized by overriding the default values of various configurable parameters in the `values.yaml` file.

To customize the values yaml file, perform the following steps:

1. Extract the *Custom_Templates* file available in the extracted documentation release package to get the following files that are used to customize the deployment parameters during installation:
   a. `values.yaml`: This file is used to customize the OCNWDAF deployment with ATS.
   b. `nwdafAlertrules.yaml`: This file is used for Prometheus.

   For more information about how to download the package from My Oracle Support, see the Installation Package Download section.
2. Customize the `ocn-nwdaf-helmChart/helmChart/values.yaml` file.
3. Save the updated `ocn-nwdaf-helmChart/helmChart/values.yaml` file in the Helm chart directory.

> **Note**
>
> - All parameters mentioned as mandatory must be present in ocn-nwdaf-helmChart/helmChart/values.yaml file and configured before the deployment.
> - All fixed value parameters listed must be present in the ocn-nwdaf-helmChart/helmChart/values.yaml file with the exact values as specified in this section.
> - The properties in the *values.yaml* of all the sub charts are configurable, but it is not advisable to update the properties. Update the properties of the sub charts only when there is a specific customer requirement.

5.1 Configurable Parameters

This section lists all the OCNWDAF configurable parameters.

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5.1.1 Global Parameters

Table 5-1 Global Paramaters

Parameter	Description	Details
`global.test.nfName`	This is a mandatory parameter. The value of *nfName* is specified as *ocnwdaf*. The *nfName* is used as a prefix in the test container name.	**Default value:** ocnwdaf
`global.test.image.name`	This is a mandatory parameter. Name of the test image.	**Default value:** nf_test
`global.test.image.tag`	This is a mandatory parameter. Name of the test image tag.	**Default value:** 23.2.0
`global.test.config.logLevel`	This is an optional parameter. Helm test hook-related configurations. It indicates the logging level of the test container.	**Range:** INFO, DEBUG, FATAL, ERROR, WARN **Default value**: INFO
`global.test.config.timeout`	This is an optional parameter. Helm test hook-related configurations. Beyond this duration, helm test is considered as a failure.	**Default value**: 240
`global.test.complianceEnable`	This is an optional parameter. Helm test hook-related configurations. Sets the test container as compliant.	**Range:** true, false **Default value:** true
`global.test.resources`	This is a mandatory parameter. It specifies the resources to which the test pod needs access.	**Default value:** - deployments/v1 - configmaps/v1 - serviceaccounts/v1 -poddisruptionbudgets/v1 - roles/v1 - statefulsets/v1 - services/v1 - rolebindings/v1

Example of the configurations that should be included under the global section of the *ocnwdaf-custom-values.yaml* file.

```
global:
  test:
    nfName: ocnwdaf
    image:
      name: nf_test
      tag: 23.2.0
    config:
      logLevel: INFO
      timeout: 240
    complianceEnable: true
    resources:
      - deployments/v1
```


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```
- configmaps/v1
- serviceaccounts/v1
- poddisruptionbudgets/v1
- roles/v1
- statefulsets/v1
- services/v1
- rolebindings/v1
```

Istio Sidecar Injection Parameters

These parameters are used to enable Service Mesh support:

> **Note**
>
> The label of the namespace takes precedence over the configured `injection` parameter. If Service Mesh has to be disabled, ensure the `injection` parameter is not configured in the namespace or it is disabled.

Table 5-2 Istio Sidecar Paramaters

Parameter	Description	Details
`injection`	This parameter is used to enable Service Mesh support.	**Range:** true, false **Default value:** False
`readinessCheck`	Flag to enable or disable the feature. If disabled then there is no need to configure.	**Range:** true, false **Default value:** False

5.1.2 Microservice Parameters

For each microservice, there is an option to specify the following parameters in its own *values.yaml* file to perform the *readinessProbe*.

Table 5-3 Microservice Parameter

Parameter	Description	Details
`readinessProbe.initialDelaySeconds`	This is an optional parameter. Specifies the configurable wait time before performing the first readiness probe by Kubelet.	**Default value**: *20*
`readinessProbe.timeoutSeconds`	This is an optional parameter. Number of seconds after which the probe times out.	**Default value**: 3
`readinessProbe.periodSeconds`	This is an optional parameter. Specifies the time interval for every readiness probe check performed by Kubelet.	**Default value**: 10
`readinessProbe.successThreshold`	This is an optional parameter. Minimum consecutive successes for the probe to be considered successful after having failed.	**Default value**: 1

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Table 5-3 (Cont.) Microservice Parameter

Parameter	Description	Details
`readinessProbe.failureThreshold`	This is an optional parameter. When a Pod starts and the probe fails, Kubernetes will try *failureThreshold* times before giving up.	**Default value**: 3

Following is an example of the configurations that should be included in the *values.yaml* file of each microservice.

```
readinessProbe:
  initialDelaySeconds: 20
  timeoutSeconds: 3
  periodSeconds: 10
  successThreshold: 1
  failureThreshold: 3
```

5.1.3 Georedundancy Parameters

Configure the following parameters to enable and configure georedundancy in the values.yaml file for OCNWDAF:

Table 5-4 REDUNDANCY AGENT CONFIGURATION

Parameter	Description	Default Value
ocnwdaf.cluster.namespace	Name space of the deployment **Note:** Change this to the name space of OCNWDAF deployments.	ocn-nwdaf
ocnnwdaf.geored.hooks.database	Database information for the hook	nwdaf_subscription
ocnnwdaf.geored.hooks.table	Table information for the hook	nwdaf_subscription
ocnnwdaf.geored.hooks.column1	Column1 information for the hook	record_owner
ocnnwdaf.geored.hooks.column2	Column2 information for the hook	current_owner
ocnnwdaf.geored.hooks.image	Image information for the hook	ocnwdaf-docker.dockerhub-phx.oci.oraclecorp.com/nwdaf-cap4c/nwdaf-cap4c-mysql:8.0.30
ocnnwdaf.geored.agent.name	Name of the deployment	ocn-nwdaf_georedagent
ocnnwdaf.geored.agent.replicas	Number of Replicas	1
ocnnwdaf.geored.agent.image.source	Image for GRD Agent **Note:**Modify this value if the image is in a different repository.	occne-repo-host:5000/occne/redagent-ms-dev:1.0.31
ocnnwdaf.geored.agent.image.pullPolicy	Image Pull Policy	IfNotPresent
ocnnwdaf.geored.agent.resources.limits.cpu	CPU Limit	1

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Table 5-4 (Cont.) REDUNDANCY AGENT CONFIGURATION

Parameter	Description	Default Value
ocnnwdaf.geored.agent.resources.limits.memory	Memory Limit	1Gi
ocnnwdaf.geored.agent.resources.request.cpu	CPU Request	1
ocnnwdaf.geored.agent.resources.request.memory	Memory Request	1Gi
ocnnwdaf.geored.agent.service.type	Service Type of the Deployment	ClusterIP
ocnnwdaf.geored.agent.service.port.containerPort	Container Port of the Deployment	9181
ocnnwdaf.geored.agent.service.port.targetPort	Target Port of the Deployment	9181
ocnnwdaf.geored.agent.service.port.name	Name of the Service Port	ocnwdafgeoredagentport
ocnnwdaf.geored.agent.service.prometheusport.containerPort	Container Port of the Prometheus	9000
ocnnwdaf.geored.agent.service.prometheusport.targetPort	Target Port of the Prometheus	9000
ocnnwdaf.geored.agent.service.prometheusport.name	Name of the Prometheus **Note:** Modify the port name based on the Prometheus on the deployed setup.	http-cnc-metrics
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_SERVER_HTTP2_ENABLED	Enable/Disable HTTP2	TRUE
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_HEARTBEAT_INTERVAL_MS	Time Interval To check HeartBeat in "ms"	10000
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_HEARTBEAT_THRESHOLD	Number of Time Times to check Heart Beat	5
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_CORE_COMP_THRESHOLD	Number of Time Times to check Heart Beat toward Core Components provides	5
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_SITE_NUMBER	Current Site Number	1
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_SITE_ID	Current Site ID	OCNWDAF-XX-1
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_NUMBER_OF_MATED_SITE	Number of Mated Sites. It is updated based on GRD Sites in sync.	1
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_SELF_ADDRESS	Current Agent Address. The resolvable URL of the OCNWDAF Gateway service. This address should be reachable outside the cluster .	
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_MICROSERVICE_LIVELINESS_MS	Check Interval for OCNWDAF Microservice in "ms".	10000

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Table 5-4 (Cont.) REDUNDANCY AGENT CONFIGURATION

Parameter	Description	Default Value
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_OCNWDAF_CORE_COMPONENT_LIST	List of OCNWDAF microservices that needs to be verified.	ocn-nwdaf-subscription
ocnnwdaf.geored.agent.env.GEO_RED_SITE_SUBSCRIPTION_OWNERSHIP_TRANSFER_URL	Subscription API for Ownership Transfer	http://ocn-nwdaf-subscription-service-internal:8087/nnwdaf-eventssubscription/v1/subscriptions/updateServingOwner
ocnnwdaf.geored.agent.env.GEO_RED_SITE_DATA_COLLECTION_URL	Data Collection API for Ownership Check	http://ocn-nwdaf-data-collection-service-internal:8081/ra/notify
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_DBTIER_REPLICATION_STATUS_URL	cnDBTier Monitor Service URL for Replication	Use the Reachable Monitor Service from Deployed CNDB namespace. For example: http://mysql-cluster-db-monitor-svc.{cndbnamspace}.svc.{domainname}:8080/db-tier/status/replication
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_DBTIER_STATUS_URL	cnDBTier Monitor Service URL for Local	Use the Reachable Monitor Service from Deployed CNDB namespace. For example: http://mysql-cluster-db-monitor-svc.{cndbnamspace}.svc.{domainname}:8080/db-tier/status/local
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_SITE_SECONDARY_SITEID	Secondary Site ID	OCNWDAF-XX-2
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_SITE_SECONDARY_ADDRESS	Secondary Site Address	The Resolvable URL of the OCNWDAF Gateway of Secondary Site. This address should be reachable outside the cluster
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_SITE_TERTIARY_SITEID	Tertiary Site ID	OCNWDAF-XX-3
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_SITE_TERTIARY_ADDRESS	Tertiary Site Address	The Resolvable URL of the OCNWDAF Gateway of Tertiary Site. This address should be reachable outside the cluster
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_DB_URL	IP of the Site cnDBTier	The Cluster IP/External IP of the CNDB
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_USERNAME	Name of the DB User with privileges to GRD DB and Subscription DB. The user should have access to both GRD and Subscription Databases	occneuser

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Table 5-4 (Cont.) REDUNDANCY AGENT CONFIGURATION

Parameter	Description	Default Value
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_PASSWORD	Password for the DB User	password
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_ENABLE	Enable/disable GRD	false
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_DB_PORT	Port of the database	3306
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_DB_NAME	Name of the GRD database	georedagent
ocnnwdaf.geored.agent.env.GEO_RED_AGENT_CONFIG_SERVER	Config Server URL for the Site's OCNWDAF	http://nwdaf-cap4c-spring-cloud-config-server:8888

5.1.4 NRF Client Parameters

To configure NRF client parameters, you should configure the following parameters in the values.yaml file. The following table provides details about the NRF client customization parameters in the `values.yaml` file:

Table 5-5 Configurable Parameters - NRF Client Configuration

Parameter	Description	Details
global.deploymentNrfClientService.envNfNamespace	This is a mandatory parameter. Contains the namespace of the services to be monitored by performance service.	Default value: No services are monitored, leave blank. **Note:** If no services are to be monitored, envNfNamespace can be left blank.
nrf-client.configmapApplicationConfig.profile	This is a mandatory parameter. Contains configuration parameters that goes into nrf-client's config map. **Note:** See config-map table for configurable parameters.	Default Value: Valid profile. Please refer to the ocnwdaf-<*version*>custom-values.yaml example below.
appinfo.infraServices	This is a conditional parameter. Set this parameter to an empty array if any one of the following conditions are met: • Deploying on occne 1.4 or lesser version • Not deploying on OCCNE • Do not wish to monitor infra services such as db-monitor service	NA
perf-info.configmapPerformance.prometheus	This is a conditional parameter. Specifies Prometheus server URL. **Note:** If no value is specified, OCNWDAF reports "0" load to NRF.	Default Value: http://prometheus-server.prometheus:5802

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Table 5-5 (Cont.) Configurable Parameters - NRF Client Configuration

Parameter	Description	Details
global.leaderPodDbName	Contains the name for Leader Pod Database in the global parameters. This database is unique per site.	Range: Valid database name.
nrf-client-nfmanagement.dbConfig.leaderPodDbName	Contains the name for Leader Pod Database in the nrf-client-nfmanagement.dbConfig.	Range: Valid database name.
global.networkDbName	Contains the network database name in the global parameters.	Default Value: Valid Release Database name. For Example: nwdafReleaseDB
nrf-client-nfmanagement.dbConfig.networkDbName	Contains the network database name in the nrf-client-nfmanagement.dbConfig parameters.	Default Value: networkDbNameRef
nrf-client-nfmanagement.enablePDBSupport	Set this to true to enable PDB Support. **Note:** If this parameter is set to true, helm test will fail. It is an expected behavior, as the mode is active and on standby, leader pod (nrf-client-management) will be in a ready state and follower will not be in ready state, which will lead to failure in the helm test.	Range: true or false Default Value: true
nrf-client-nfmanagement.replicas	Contains number of NRF-Client replicas.	Default Value: 2

Table 5-6 Configurable parameters of NRF Client Configuration in Config-map

Parameter	Description	Details
primaryNrfApiRoot	Primary NRF hostname and port Hostname/IP:Port.	Range: Valid API root Applicable to: OCNWDAF Added, Deprecated, or Updated: Added in Release 1.6.x
SecondaryNrfApiRoot	secondary NRF hostname and port Hostname/IP:Port For example: nrf2-api-gateway.svc:80	Range: Valid API root Applicable to: OCNWDAF Added, Deprecated, or Updated: Added in Release 1.6.x
retryAfterTime	When primary NRF is down, this will be the wait Time (in ISO 8601 duration format) after which request to primary NRF will be retried to detect primary NRF's availability. For example: PT120S	Range: Valid ISO 8601 duration format Applicable to: OCNWDAF Added, Deprecated, or Updated: Added in Release 1.6.x
nrfClientType	The NfType of the NF registering. This should be set to OCNWDAF.	Default Value: OCNWDAF Applicable to: OCNWDAF Added, Deprecated, or Updated: Added in Release 1.6.x

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Table 5-6 (Cont.) Configurable parameters of NRF Client Configuration in Config-map

Parameter	Description	Details
nrfClientSubscribeTypes	NF Type(s) for which the NF wants to discover and subscribe to the NRF. **Note:** Leave blank if OCNWDAF does not require this option.	Range: AMF, NRF, UDM, SMF, AUSF, NEF, PCF, SMSF, NSSF, UDR, LMF, GMLC, 5G_EIR, SEPP, UPF, N3IWF, AF, UDSF, BSF, CHF, NWDAF Applicable to: OCNWDAF Added, Deprecated, or Updated: Added in Release 1.6.x
appProfiles	NfProfile of OCNWDAF to be registered with NRF.	Range: Valid NF Profile Applicable to: OCNWDAF Added, Deprecated, or Updated: Added in Release 1.6.x
enableF3	Support for 29.510 Release 15.3.	Range: true or false Default Value: true Applicable to: OCNWDAF Added, Deprecated, or Updated: Added in Release 1.6.x
enableF5	Support for 29.510 Release 15.5.	Range: true or false Default Value: true Applicable to: OCNWDAF Added, Deprecated, or Updated: Added in Release 1.6.x
renewalTimeBeforeExpiry	Time(seconds) before the subscription validity expires. For example: 3600 (1hr)	Range: Time in seconds Default Value: 3600 Applicable to: OCNWDAF Added, Deprecated, or Updated: Added in Release 1.6.x
validityTime	The default validity time (days) for subscriptions. For example: 30 (30 days)	Range: Time in days Default Value: 30 Applicable to: OCNWDAF Added, Deprecated, or Updated: Added in Release 1.6.x
enableSubscriptionAutoRenewal	Enable renewal of subscriptions automatically.	Range: true or false Default Value: true Applicable to: OCNWDAF Added, Deprecated, or Updated: Added in Release 1.6.x
acceptAdditionalAttributes	Enable additionalAttributes as part of 29.510 Release 15.5.	Range: true or false Default Value: false Applicable to: OCNWDAF
enableVirtualNrfResolution	Enable virtual NRF session retry by alternate routing service.	Range: true or false Applicable to: OCNWDAF Added, Deprecated, or Updated: Added in Release 1.9.0
virtualNrfFqdn	Virtual NRF FQDN used to query static list of route.	Default Value: nrf.oracle.com Applicable to: OCNWDAF Added, Deprecated, or Updated: Added in Release 1.9.0

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Table 5-6 (Cont.) Configurable parameters of NRF Client Configuration in Config-map

Parameter	Description	Details
virtualNrfScheme	Scheme to be used with the virtual FQDN.	Range: http or https Applicable to: OCNWDAF Added, Deprecated, or Updated: Added in Release 1.9.0
requestTimeoutGracePeriod	An additional grace period where no response is received from the NRF. This additional period shall be added to the requestTimeout value. This will ensure that the egress-gateway shall first timeout, and send an error response to the NRF-client.	Range: Integer value Applicable to: OCNWDAF Added, Deprecated, or Updated: Added in Release 1.9.0
nrfRetryConfig	Configurations required for the NRF Retry mechanism.	Default Value: Valid configuration. Please refer to the ocnwdaf-<version>custom-values.yaml example below. Applicable to: OCNWDAF Added, Deprecated, or Updated: Added in Release 1.9.0
healthCheckConfig	Configurations required for the Health check of NRFs.	Default Value: Valid configuration. Please refer to the ocnwdaf-<*version*>custom-values.yaml example below. Applicable to: OCNWDAF Added, Deprecated, or Updated: Added in Release 1.9.0
supportedDataSetId	The data-set value to be used in queryParams for NFs autonomous or on-demand discovery.	Range: SUBSCRIPTION, POLICY, EXPOSURE, APPLICATION. Applicable to: OCNWDAF Added, Deprecated, or Updated: Added in Release 1.7.1

Table 5-7 NRF Client Parameters

Parameter	Description	Detail
nrfclient.nrf-client.configmapApplicationConfig.profile	This is a mandatory parameter. It contains configuration parameters that goes into nrf-client's config map. **Note:** See configmap table for configurable parameters	Applicable to: OCNWDAF
nrfclient.nrf-client	This is a mandatory parameter. Microservice level control if specific microservice need to be disabled.	Applicable to: OCNWDAF
config-server	This is a mandatory parameter. Details of Config-server microservice.	Applicable to: OCNWDAF
config-server.enabled	This is a mandatory parameter. Engineering-parameter	Applicable to: OCNWDAF

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Table 5-7 (Cont.) NRF Client Parameters

Parameter	Description	Detail
config-server.envMysqlDatabase	This is a mandatory parameter. It specifies MySQL Config Server Database Name.	Default Value: Provisional DB name Applicable to: OCNWDAF
config-server.dbConfig.dbEngine	This is a mandatory parameter. Database hook Configuration	Default Value: Database Engine name Applicable to: OCNWDAF
appinfo.enabled	This is a mandatory parameter. Use to enable or disable appinfo microservices.	Range: true or false Default Value: true Applicable to: OCNWDAF
appinfo.debug	This is a mandatory parameter. Represent appinfo image name. Note: Registry is taken from global section: • image: oc-app-info • appinfo image tag • imageTag: 23.2.0 • Set Log Level to DEBUG. • If false, Log Level shall be INFO	Range: true or false Default Value: false Applicable to: OCNWDAF
serviceMeshCheck	This is a mandatory parameter. This flag needs to be set to `true` if a Service Mesh is present in the environment where OCNWDAF is deployed.	**Range:** True or False. **Default value:** False Applicable to: OCNWDAF
istioSidecarQuitUrl	This is a mandatory parameter. It needs to be set with correct URL format http://127.0.0.1:<istio management port>/quitquitquit" if Service Mesh is present in the environment where OCNWDAF is deployed.	**Default value**: http://127.0.0.1:15000/quitquitquit" Applicable to: OCNWDAF
istioSidecarReadyUrl	This is a mandatory parameter. It needs to be set with correct URL format http://127.0.0.1:<istio management port>/ready" if Service Mesh is present in the environment where OCNWDAF is deployed.	**Default value**: http://127.0.0.1:<istio management port>/ready" Applicable to: OCNWDAF

Table 5-8 NRF Client NF Discovery Parameters

Parameter	Description	Details
nrf-client.nrf-client-nfdiscovery	This is a mandatory parameter. Contains deployment specific configuration for Nrf-Client Discovery Microservice	Applicable to: OCNWDAF
configmapApplicationConfig	This is a mandatory parameter.	Applicable to: OCNWDAF
cpuRequest	This is a mandatory parameter.	Default Value: 2 Applicable to: OCNWDAF
cpuLimit	This is a mandatory parameter.	Default Value: 2 Applicable to: OCNWDAF

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Table 5-8 (Cont.) NRF Client NF Discovery Parameters

Parameter	Description	Details
memoryRequest	This is a mandatory parameter.	Default Value: 1Gi Applicable to: OCNWDAF
memoryLimit	This is a mandatory parameter.	Default Value: 1Gi Applicable to: OCNWDAF
minReplicas	This is a mandatory parameter.	Default Value: 1 Applicable to: OCNWDAF
maxReplicas	This is a mandatory parameter.	Default Value: 5 Applicable to: OCNWDAF
averageCpuUtil	This is a mandatory parameter.	Default Value: 80 Applicable to: OCNWDAF
commonCfgServer.configServerSvcName	This is a mandatory parameter.	Default Value: nsconfig Applicable to: OCNWDAF
commonCfgServer.port	This is a mandatory parameter.	Default Value: 8080 Applicable to: OCNWDAF
commonCfgClient.enabled	This is a mandatory parameter.	Default Value: *cfgClientEnabled Applicable to: OCNWDAF
nrf-client.nrf-client-nfdiscovery.dbConfig	This is a mandatory parameter. Contains database credentials of Nrf-Client Discovery parameters.	Default Value: Valid database host (Example: ocnwdaf-nsdb.db) Applicable to: OCNWDAF
dbConfig.dbHost	This is a mandatory parameter. DB credential of nrf-client-nfdiscovery parameters.	Applicable to: OCNWDAF
dbConfig.dbPort	This is a mandatory parameter. Databse credential of nrf-client-nfdiscovery parameters.	Default Value: 3306 Applicable to: OCNWDAF
dbConfig.secretName	This is a mandatory parameter.Contains name of the secret.	Default Value: Provisional DB secret Applicable to: OCNWDAF
dbConfig.dbName	This is a mandatory parameter. Contains name of the database.	Default Value: Provisional DB name Applicable to: OCNWDAF
dbConfig.dbUNameLiteral	This is a mandatory parameter. Contains the name of the Key configured for "DB Username" in Secret with following name: "<dbConfig.secretName>".	Applicable to: OCNWDAF
dbConfig.dbPwdLiteral	This is a mandatory parameter. Contains the name of the Key configured for "DB Password" in Secret with following name: "<dbConfig.secretName>".	Applicable to: OCNWDAF
dbConfig.dbEngine	This is a mandatory parameter. Database engine name.	Default Value: NDBCLUSTER Applicable to: OCNWDAF
serviceMeshCheck	This is a mandatory parameter. This flag needs to be set to `true` if a Service Mesh is present in the environment where OCNWDAF is deployed.	**Range:** True or False. **Default value:** False Applicable to: OCNWDAF

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Table 5-8 (Cont.) NRF Client NF Discovery Parameters

Parameter	Description	Details
istioSidecarQuitUrl	This is a mandatory parameter. It needs to be set with correct URL format http:// 127.0.0.1:<istio management port>/quitquitquit" if Service Mesh is present in the environment where OCNWDAF is deployed.	**Default value**: http:// 127.0.0.1:15000/ quitquitquit" Applicable to: OCNWDAF
istioSidecarReadyUrl	This is a mandatory parameter. It needs to be set with correct URL format http:// 127.0.0.1:<istio management port>/ready" if Service Mesh is present in the environment where OCNWDAF is deployed.	**Default value**: http:// 127.0.0.1:<istio management port>/ready" Applicable to: OCNWDAF

Table 5-9 NRF Client NF Management Parameters

Parameter	Description	Details
nrf-client-nfmanagement	This is a mandatory parameter. Contains deployment specific configuration for nrf-client-nfmanagement microservice	Applicable to: OCNWDAF
configmapApplicationConfig	This is a mandatory parameter.	Applicable to: OCNWDAF
replicas	This is a mandatory parameter.	Default Value: 1 Applicable to: OCNWDAF
cpuRequest	This is a mandatory parameter.	Default Value: 1 Applicable to: OCNWDAF
cpuLimit	This is a mandatory parameter.	Default Value: 1 Applicable to: OCNWDAF
memoryRequest	This is a mandatory parameter.	Default Value: 1Gi Applicable to: OCNWDAF
memoryLimit	This is a mandatory parameter.	Default Value: 1Gi Applicable to: OCNWDAF
commonCfgServer.configServerSvcName	This is a mandatory parameter.	Default Value: nsconfig Applicable to: OCNWDAF
commonCfgServer.port	This is a mandatory parameter.	Default Value: 8080 Applicable to: OCNWDAF
commonCfgClient.enabled	This is a mandatory parameter.	Default Value: *cfgClientEnabled Applicable to: OCNWDAF
dbConfig	This is a mandatory parameter. Contains database credentials of Nrf-Client Discovery parameters,	Default Value: Valid dbConfig set of properties. Please refer to the ocnwdaf-<version>custom-values.yaml example. Applicable to: OCNWDAF
dbConfig.dbHost	This is a mandatory parameter. DB credential of nrf-client-nfdiscovery parameters.	Default Value: Valid database host (Example: ocnwdaf-nsdb.db) Applicable to: OCNWDAF

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Table 5-9 (Cont.) NRF Client NF Management Parameters

Parameter	Description	Details
dbConfig.dbPort	This is a mandatory parameter. Database credential of nrf-client-nfdiscovery parameters.	Default Value: 3306 Applicable to: OCNWDAF
dbConfig.secretName	This is a mandatory parameter. Contains name of the secret.	Default Value: Provisional DB secret Applicable to: OCNWDAF
dbConfig.dbName	This is a mandatory parameter. Contains name of the database.	Default Value: Provisional DB name Applicable to: OCNWDAF
dbConfig.dbUNameLiteral	This is a mandatory parameter. Contains the name of the Key configured for "DB Username" in Secret with following name: "<dbConfig.secretName>".	Applicable to: OCNWDAF
dbConfig.dbPwdLiteral	This is a mandatory parameter. Contains the name of the Key configured for "DB Password" in Secret with following name: "<dbConfig.secretName>".	Applicable to: OCNWDAF
bConfig.dbEngine	This is a mandatory parameter. Database engine name.	Default Value: NDBCLUSTER Applicable to: OCNWDAF
serviceMeshCheck	This is a mandatory parameter. This flag needs to be set to `true` if a Service Mesh is present in the environment where OCNWDAF is deployed.	**Range:** True or False. **Default value:** False Applicable to: OCNWDAF
istioSidecarQuitUrl	This is a mandatory parameter. It needs to be set with correct URL format http:// 127.0.0.1:<istio management port>/quitquitquit" if Service Mesh is present in the environment where OCNWDAF is deployed.	**Default value**: http:// 127.0.0.1:15000/ quitquitquit" Applicable to: OCNWDAF
istioSidecarReadyUrl	This is a mandatory parameter. It needs to be set with correct URL format http:// 127.0.0.1:<istio management port>/ready" if Service Mesh is present in the environment where OCNWDAF is deployed.	**Default value**: http:// 127.0.0.1:<istio management port>/ready" Applicable to: OCNWDAF

Here is a sample configuration for NRF client in ocnwdaf-<*version*>custom-values.yaml file:

```
# Please add below in global section of custom values.yaml of NF deployment.
global:
  # The value of nfName is specified as ocnf which is stands of Oracle NF.
  # nfName is used as a prefix in serivce names of nrf client's service and
other services it connects to for eg appinfo, config server etc.
  nfName: ocnf
  # Global control to enable/disable deployment of NF Discovery service,
enable it if on demand discovery of NF is required.
  nrfClientNfDiscoveryEnable: true
```


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```
  # Global control to enable/disable deployment of NF Management service.
  nrfClientNfManagementEnable: true
  # Global Parameter to enable/disable DEBUG Container tool
  extraContainers: "DISABLED"
  extraContainersTpl: |
    - command:
        - /bin/sleep
        - infinity
      image: {{ printf "%s/%s:%s" (include "getdockerregistry.name" .)
"ocdebugtool/ocdebug-tools" "22.3.1" }}
      imagePullPolicy: Always
      name: {{ printf "%s-tools-%s" (include "getprefix" .) (include
"getsuffix" .) | trunc 63 | trimPrefix "-" | trimSuffix "-"  }}
      resources:
        requests:
          ephemeral-storage: "2Gi"
          cpu: "0.5"
          memory: "1Gi"
        limits:
          ephemeral-storage: "4Gi"
          cpu: "1"
          memory: "2Gi"
      securityContext:
        allowPrivilegeEscalation: true
        capabilities:
          drop:
          - ALL
          add:
          - NET_RAW
          - NET_ADMIN
        readOnlyRootFilesystem: false
        runAsUser: 7000
  # Global parameter to mention if alternate-route service is
available(deployed) or not.
  alternateRouteServiceEnable: false
  altServiceHTTP2Enabled: true
  altServiceReqTimeout: 3000
  altServiceLookupInterval: 3000
  # Metrics name for OSO
  cncMetricsName: cnc-metrics
  # Jaeger tracing host
  envJaegerAgentHost: ''
  # Jaeger tracing port
  envJaegerAgentPort: 6831
  # Provide value for NodePort
  nrfClientNodePort: 0
  # Docker registry from which config-server images, nrf-client images will
be pulled
  #dockerRegistry: ocnrf-registry.us.oracle.com:5000
  dockerRegistry: cgbu-cnc-comsvc-release-docker.dockerhub-
phx.oci.oraclecorp.com
  # Readiness-Detector image details with tag
  #Vendor name
  vendor: "Oracle"
  # application name
  applicationName: "nrf-client"
```


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```
  # prefix for Metrics
  metricPrefix: &metricPrefix ""
  # suffix for Metrics
  metricSuffix: &metricSuffix ""
  # Common service port
  nrfClientCommonServicePort: '9090'
  # Prometheus configuration
  prometheusScrapingConfig:
    enabled: false
    path: "/actuator/prometheus"
  nfInstanceId: 'fe7d992b-0541-4c7d-ab84-c6d70b1b01b1'
  configServerEnable: true
  # Config-Server Service. Shall be used as {{ ReleaseName }}-
configServerFullNameOverride
  configServerFullNameOverride: ocpm-config
  # Mysql Host
  envMysqlHost: &mySqlHostRef 10.233.5.39 # Changed
  envMysqlSecondaryHost: ''
  # Mysql Port
  envMysqlPort: &mySqlPortRef '3306'
  envMysqlSecondaryPort: ''
  # Mysql Secret Name
  dbCredSecretName: &dbCredSecretNameRef 'ocnf-db-pass'
  # Mysql Config Server Databse Name
  # Global Control to disable appinfo service
  appinfoServiceEnable: true
  # Global Control to disable performance info service
  performanceServiceEnable: true
  egressGatewayHost: ocn-nrf-simulator-service.ocnwdaf-ns # Changed
  # Deployment Specific configuration
  deploymentNrfClientService:
    # Services to be monitored by performance service
    # If no services are to be monitored,
envNfNamespace,envNfType,envConsumeSvcName can be left blank
    envNfNamespace: ''
    envNfType: ''
    envConsumeSvcName: ''
    # Egress gateway Host. Shall be used as {{ ReleaseName }}-
envEgressGatewayFullnameOverride
    envEgressGatewayFullnameOverride: egressgateway
    # Egress gateway Port
    envEgressGatewayPort: "8080" # Changed
    # Callback URI to receive Notifications from NRF
    nfApiRoot: http://ocnrf-ingressgateway.ocnrf:80
    nodeSelectorEnabled: false
    nodeSelectorKey: zone
    nodeSelectorValue: app
  # K8s Secret containing Database/user/password for DB Hooks for creating
tables
  privilegedDbCredSecretName: &privDbCredSecretNameRef 'ocnf-privileged-db-
pass'
  releaseDbName: &dbNameRef 'ocnf_config_server'
  networkDbName: &networkDbNameRef 'nrfNetworkDB'
  # Database Name for LeaderPod
  # Every NF has to configure a different LeaderPod for each site
  # so that when the sites are geo-redundant, the entries in the table do not
```


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```
crash.
  leaderPodDbName: &leaderPodDbRef 'leaderPodDb'

  # Service Account Name
  serviceAccountName: ""

  # Application name that is added in logs as labels
  app_name: "nrfclient"
  supportedVersions:
    - autoscaling/v2
    - autoscaling/v2beta2
    - autoscaling/v2beta1
    - autoscaling/v1
    - policy/v1
    - policy/v1beta1
  #Resource Values for Hook Jobs
  hookJobResources:
    limits:
      cpu: 2
      memory: 2Gi
    requests:
      cpu: 1
      memory: 1Gi


# Details of perf-info microservices
perf-info:
   image: occnp/oc-perf-info
   imageTag: 22.4.1 # Changed from 22.3.2
   # Service namespace for perf-info
   service_namespace: ocnrf
   # Replicas for perf Info
   replicas: 2
   # Pull Policy - Possible Values are:- Always, IfNotPresent, Never
   imagepullPolicy: IfNotPresent
   service:
     type: ClusterIP
     port: 5905
   resources: {}
     # We usually recommend not to specify default resources and to leave
this as a conscious
     # choice for the user. This also increases chances charts run on
environments with little
     # resources, such as Minikube. If you do want to specify resources,
uncomment the following
     # lines, adjust them as necessary, and remove the curly braces after
'resources:'.
     # limits:
     #  cpu: 100m
     #  memory: 128Mi
     # requests:
     #  cpu: 100m
     #  memory: 128Mi
   nodeSelector: {}
   tolerations: []
   affinity: {}
```


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```
   commonCfgClient:
     enabled: false
   commonCfgServer:
   # Do not comment this line in case you want to deploy both config-server
and APIGW in same namespace simultaneously
   # Otherwise comment this line and use 'host'
     configServerSvcName: 'common-config-server'
     host: 'common-config-server'
     port: '80'
     pollingInterval: 5000
   dbConfig:
     dbHost: *mySqlHostRef
     dbPort: *mySqlPortRef
     secretName: *dbCredSecretNameRef
     dbName: *dbNameRef
     # Name of the Key configured for "DB Username" in Secret with following
name: "<dbConfig.secretName>"
     dbUNameLiteral: mysql-username
     # Name of the Key configured for "DB Password" in Secret with following
name: "<dbConfig.secretName>"
     dbPwdLiteral: mysql-password
   ingress:
      enabled: false
   configmapPerformance:
     prometheus: http://prometheus-server.prometheus:5802

# Microservice level control if specific microservice need to be disabled
nrf-client:
   # This config map is for providing inputs to NRF-Client
   configmapApplicationConfig:
      &configRef
      # Config-map to provide inputs to Nrf-Client
      # primaryNrfApiRoot - Primary NRF Hostname and Port
      # SecondaryNrfApiRoot - Secondary NRF Hostname and Port
      # nrfRouteList - Can be used to specify routes with priority instead of
primary and secondary NRF API root
      # useNrfRouteList - Can be used to specify whether nrfRouteList should
be used instead of primary and secondary NRF API root
      # nrfScheme - Scheme of primary and secondary NRF http or https
      # retryAfterTime - Default downtime(in Duration) of an NRF detected to
be unavailable.
      # nrfClientType - The NfType of the NF registering
      # nrfClientSubscribeTypes - the NFType for which the NF wants to
subscribe to the NRF.
      # appProfiles - The NfProfile of the NF to be registered with NRF.
      # enableF3 - Support for 29.510 Release 15.3
      # enableF5 - Support for 29.510 Release 15.5
      # registrationRetryInterval - Retry Interval after a failed autonomous
registration request
      # subscriptionRetryInterval - Retry Interval after a failed autonomous
subscription request
      # discoveryRetryInterval - Retry Interval after a failed autonomous
discovery request
      # discoveryRefreshInterval - The default interval after which
autonomous discovery requests will be resent
      # discoveryDurationBeforeExpiry - This value specifies the rate at
```


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```
which the NF shall resend discovery requests to NRF. The value shall be
configured in terms of percentage(1-100). if the discovery ValidityPeriod is
60s, then the discovery requests shall be sent at
discoveryDurationBeforeExpiry * 60/100
      # renewalTimeBeforeExpiry - Time Period(seconds) before the
Subscription Validity time expires.
      # validityTime - The default validity time(days) for subscriptions.
      # enableSubscriptionAutoRenewal - Enable Renewal of Subscriptions
automatically.
      # nfHeartbeatRate - This value specifies the rate at which the NF shall
heartbeat with the NRF. The value shall be configured in terms of
percentage(1-100). if the heartbeatTimer is 60s, then the NF shall heartbeat
at nfHeartBeatRate * 60/100
      # acceptAdditionalAttributes - Enable additionalAttributes as part of
29.510 Release 15.5
      # retryForCongestion - The duration(seconds) after which nrf-client
should retry to a NRF server found to be congested.
      # supportedDataSetId - The data-set value to be used in queryParams for
NFs autonomous/on-demand discovery. e.g. data-set=POLICY
      # enableVirtualNrfResolution- enable virtual NRF session retry by
Alternate routing service
      # virtualNrfFqdn - virtual NRF FQDN used to query static list of route
      # virtualNrfScheme - http or https
      # useAlternateScpOnAlternateRouting - enable use SCP on alternate
routing service
      # subscriberNotificationRetry - number of health status notification
retries to a subscriber
      # requestTimeoutGracePeriod - grace period(seconds) for timeout period
until no response is received from NRF
      # nrfRetryConfig - configurations required for the NRF Retry mechanism
      #serviceRequestType - type of service operation for which configuration
is applicable
      #primaryNRFRetryCount - number of retries for primary instance
      #nonPrimaryNRFRetryCount - number of retries for non-primary instance
      #alternateNRFRetriesCount - number of retry attempts
      #errorReasonsForFailure - httpStatusCode or error conditions for which
retry shall be attempted
      #requestTimeout - timeout period(seconds) where no response is received
from NRF
      #gatewayErrorCodes - httpStatusCode sent by gateway for which retry
shall be attempted
      # healthCheckConfig - configurations required for the Health check of
NRFs
      #healthCheckCount - consecutive success/failure operation count
(default -1 means disabled)
      #healthCheckInterval - interval duration in seconds to perform health
check
      #requestTimeout - timeout period(seconds) where no response is received
from NRF
      #errorReasonsForFailure - httpStatusCode or error conditions for which
the NRF is considered as unhealthy
      #gatewayErrorCodes - httpStatusCode sent by gateway for the NRF shall
be considered unhealthy
      #enableDiscoveryRefresh - Feature flag to enable Automatic Discovery
Refresh
      #enableRediscoveryIfNoProdNFs - Feature flag to enable rediscovery when
```


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```
No Producer NFs are available
      #offStatesForRediscoveryIfNoProdNFs - Comma separated value for states
to consider Producer NFs as not available

      #appProfiles=[{"nfInstanceId":"fe7d992b-0541-4c7d-ab84-
c6d70b1b01b1","nfType":"NWDAF","nfStatus":"REGISTERED","plmnList":null,"nsiLis
t":null,"fqdn":"pcf.oracle.com","interPlmnFqdn":null,"ipv4Addresses":null,"ipv
6Addresses":null,"priority":null,"capacity":null,"load":null,"locality":null,"
udrInfo":null,"udmInfo":null,"ausfInfo":null,"amfInfo":null,"smfInfo":null,"up
fInfo":null,"pcfInfo":null,"bsfInfo":null,"customInfo":null,"recoveryTime":nul
l,"nfServices":[{"serviceInstanceId":"03063893-
cf9e-4f7a-9827-067f6fa9dd01","serviceName":"nnrf-nfmanagement","versions":
[{"apiVersionInUri":"v1","apiFullVersion":"1.2.2","expiry":"2019-08-03T18:55:0
8.871+0000"}],"scheme":"http","nfServiceStatus":"REGISTERED","fqdn":"nrf.oracl
e.com","interPlmnFqdn":null,"apiPrefix":"bsf-
service","defaultNotificationSubscriptions":null,"allowedPlmns":null,"allowedN
fTypes":["PCF","NEF",
"NWDAF"],"allowedNfDomains":null,"allowedNssais":null,"priority":null,"capacit
y":null,"load":null,"recoveryTime":null,"supportedFeatures":null}],"sNssais":n
ull}]

      profile: |-
         [appcfg]
         primaryNrfApiRoot=ocn-nrf-simulator-service.ocnwdaf-ns:8080
         secondaryNrfApiRoot=
         nrfRouteList=[{"nrfApi":"nrfDeployName-
nrf-1:8080","scheme":"http","weight":100,"priority":1}]
         useNrfRouteList=false
         nrfScheme=http
         retryAfterTime=PT120S
         nrfClientType=NRF
         nrfClientSubscribeTypes=PCF
         appProfiles=[{"nfInstanceId":"fe7d992b-0541-4c7d-ab84-
c6d70b1b01b1","nfType":"NWDAF","nfStatus":"REGISTERED","plmnList":null,"nsiLis
t":null,"fqdn":"ocn-nwdaf-
communication","interPlmnFqdn":null,"ipv4Addresses":null,"ipv6Addresses":null,
"priority":null,"capacity":null,"load":null,"locality":null,"udrInfo":null,"ud
mInfo":null,"ausfInfo":null,"amfInfo":null,"smfInfo":null,"upfInfo":null,"pcfI
nfo":null,"bsfInfo":null,"customInfo":null,"recoveryTime":null,"nfServices":
[{"serviceInstanceId":"03063893-
cf9e-4f7a-9827-067f6fa9dd01","serviceName":"nnrf-nfmanagement","versions":
[{"apiVersionInUri":"v1","apiFullVersion":"1.2.2","expiry":"2019-08-03T18:55:0
8.871+0000"}],"scheme":"http","nfServiceStatus":"REGISTERED","fqdn":"nrf.oracl
e.com","interPlmnFqdn":null,"apiPrefix":"bsf-
service","defaultNotificationSubscriptions":null,"allowedPlmns":null,"allowedN
fTypes":["PCF","NEF",
"NWDAF"],"allowedNfDomains":null,"allowedNssais":null,"priority":null,"capacit
y":null,"load":null,"recoveryTime":null,"supportedFeatures":null}],"sNssais":n
ull}]
         enableF3=true
         enableF5=true
         registrationRetryInterval=5000
         subscriptionRetryInterval=5000
         enableDiscoveryRefresh=false
         discoveryRetryInterval=5000
         discoveryRefreshInterval=10
```


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```
          discoveryDurationBeforeExpiry=90
          renewalTimeBeforeExpiry=3600
          enableRediscoveryIfNoProdNFs=false

offStatesForRediscoveryIfNoProdNFs=SUSPENDED,UNDISCOVERABLE,DEREGISTERED
          validityTime=30
          enableSubscriptionAutoRenewal=true
          nfHeartbeatRate=80
          acceptAdditionalAttributes=true
          retryForCongestion=5
          supportedDataSetId=
          enableVirtualNrfResolution=false
          virtualNrfFqdn=nrf.oracle.com
          virtualNrfScheme=http
          useAlternateScpOnAlternateRouting=
          subscriberNotificationRetry=2
          requestTimeoutGracePeriod=2
          enableDiscoveryRefresh=false

nrfRetryConfig=[{"serviceRequestType":"ALL_REQUESTS","primaryNRFRetryCount":1,
"nonPrimaryNRFRetryCount":1,"alternateNRFRetryCount":-1,"errorReasonsForFailur
e":
["503","504","500","SocketTimeoutException","JsonProcessingException","Unknown
HostException","NoRouteToHostException","IOException"],"gatewayErrorCodes":
["503"],"requestTimeout":10},
{"serviceRequestType":"AUTONOMOUS_NFREGISTER","primaryNRFRetryCount":1,"nonPri
maryNRFRetryCount":1,"alternateNRFRetryCount":-1,"errorReasonsForFailure":
["503","504","500","SocketTimeoutException","JsonProcessingException","Unknown
HostException","NoRouteToHostException","IOException"],"gatewayErrorCodes":
["503"],"requestTimeout":10}]

healthCheckConfig={"healthCheckCount":-1,"healthCheckInterval":5,"requestTimeo
ut":10,"errorReasonsForFailure":
["503","504","500","SocketTimeoutException","IOException"],"gatewayErrorCodes"
:["503", "504", "500"]}

   # Deployment specific configuration for Nrf-Client Discovery Microservice
   nrf-client-nfdiscovery:
      global:
          #ephemeralStorage value in MB. Value 0 means ephemeral-storage will
not be set during deployment.
          logStorage: 0 #default calculated value 70
          crictlStorage: 0 #default calculated value 1
          ephemeralStorageLimit: 0 #default calculated value 1024
          maxUnavailable: "25%"
      configmapApplicationConfig: *configRef
      # NRF Client Microservice image name
      image: nrf-client
      # NRF Client Microservice image tag
      imageTag: '22.3.3'
      envJaegerSamplerParam: '1'
      envJaegerSamplerType: ratelimiting
      envJaegerServiceName: nrf-client-nfdiscovery
      # Resource Details
      cpuRequest: 2
      cpuLimit: 2
```


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```
      memoryRequest: 1Gi
      memoryLimit: 1Gi
      # Min replicas to scale to maintain an average CPU utilization
      minReplicas: 1
      # Max replicas to scale to maintain an average CPU utilization
      maxReplicas: 2
      averageCpuUtil: 80
      type: ClusterIP
      # Set to true if the discovery results should be cached.
      cacheDiscoveryResults: false
      # Discovery Service Port
      envDiscoveryServicePort: 5910
      # Management Service Port
      envManagementServicePort: 5910
      #Restart Policy for hooks
      hookRestartPolicy: Never
      # prefix for Metrics
      metricPrefix: *metricPrefix
      # suffix for Metrics
      metricSuffix: *metricSuffix
      #The sidecar (istio url) when deployed in serviceMesh
      # Default value: http://127.0.0.1:15000/quitquitquit
      istioSidecarQuitUrl: ""
      # Default value: http://127.0.0.1:15000/ready
      istioSidecarReadyUrl: ""
      # Flag to enable service Mesh
      serviceMeshCheck: false
      # Flag to switch between "HELM" based or "REST" based nfProfile
configuration
      nfProfileConfigMode: "HELM"
      # Flag to enable/ disable the feature
      # Allowed Values: DISABLED, ENABLED, USE_GLOBAL_VALUE
      extraContainers: USE_GLOBAL_VALUE
      commonCfgClient:
         enabled: false
      commonCfgServer:
        # Do not comment this line in case you want to deploy both config-
server and APIGW in same namespace simultaneously
        # Otherwise comment this line and use 'host'
        configServerSvcName: 'common-config-server'
        host: 'common-config-server'
        port: '80'
        pollingInterval: 5000
        nfProfileUri: 'nf/nf-common-component/v1/nrf-client-nfmanagement/
nfProfileList'
      dbConfig:
        dbHost: *mySqlHostRef
        dbPort: *mySqlPortRef
        secretName: *privDbCredSecretNameRef
        dbName: *dbNameRef
        # Name of the Key configured for "DB Username" in Secret with
following name: "<dbConfig.secretName>"
        dbUNameLiteral: mysql-username
        # Name of the Key configured for "DB Password" in Secret with
following name: "<dbConfig.secretName>"
        dbPwdLiteral: mysql-password
```


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```
   # Deployment specific configuration for Nrf-Client Management Microservice
   nrf-client-nfmanagement:
      global:
         #ephemeralStorage value in MB. Value 0 means ephemeral-storage will
not be set during deployment.
         logStorage: 0 #default calculated value 70
         crictlStorage: 0 #default calculated value 1
         ephemeralStorageLimit: 0 #default calculated value 1024
         minAvailable: 1
      configmapApplicationConfig: *configRef
      # NRF Client Microservice image name
      image: nrf-client
      # NRF Client Microservice image tag
      imageTag: '22.3.3'
      envJaegerSamplerParam: '1'
      envJaegerSamplerType: ratelimiting
      envJaegerServiceName: nrf-client-nfmanagement
      enablePDBSupport: false
      # Resource Details
      replicas: 1
      cpuRequest: 1
      cpuLimit: 1
      memoryRequest: 1Gi
      memoryLimit: 1Gi
      type: ClusterIP
      #Restart Policy for hooks
      hookRestartPolicy: Never
      # prefix for Metrics
      metricPrefix: *metricPrefix
      # suffix for Metrics
      metricSuffix: *metricSuffix
      #The sidecar (istio url) when deployed in serviceMesh
      # Default value: http://127.0.0.1:15000/quitquitquit
      istioSidecarQuitUrl: ""
      # Default value: http://127.0.0.1:15000/ready
      istioSidecarReadyUrl: ""
      # Flag to enable service Mesh
      serviceMeshCheck: false
      # Flag to switch between "HELM" based or "REST" based nfProfile
configuration
      nfProfileConfigMode: "HELM"
      # Flag to switch between "HELM" based or "REST" based nrfRoute
configuration
      nrfRouteConfigMode: "HELM"
      # Flag to enable/ disable the feature
      # Allowed Values: DISABLED, ENABLED, USE_GLOBAL_VALUE
      extraContainers: USE_GLOBAL_VALUE
      commonCfgClient:
         enabled: false
      commonCfgServer:
        # Do not comment this line in case you want to deploy both config-
server and APIGW in same namespace simultaneously
        # Otherwise comment this line and use 'host'
        configServerSvcName: 'common-config-server'
        host: 'common-config-server'
```


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```
        port: '80'
        pollingInterval: 5000
      dbConfig:
        dbHost: *mySqlHostRef
        dbPort: *mySqlPortRef
        secretName: *privDbCredSecretNameRef
        dbName: *dbNameRef
        networkDbName: *networkDbNameRef
        # Database for leaderPod selection
        leaderPodDbName: *leaderPodDbRef
        # Name of the Key configured for "DB Username" in Secret with
following name: "<dbConfig.secretName>"
        dbUNameLiteral: mysql-username
        # Name of the Key configured for "DB Password" in Secret with
following name: "<dbConfig.secretName>"
        dbPwdLiteral: mysql-password

# Details of Config-server microservice
config-server:
   enabled: true
   image: occnp/oc-config-server
   imageTag: 22.3.2
   fullNameOverride: "config-server"
   envJaegerServiceName: pcf-config
   # This is the NfInstanceId of NF that will get deployed. This shall be
used in the profile being registered.
   nfInstanceId: 'fe7d992b-0541-4c7d-ab84-c6d70b1b01b1'
   # Mysql Config Server Databse Name
   envMysqlDatabase: ocnf_config_server
   # Replicas for Config server - This is exact value without scaling
   replicas: 1
   nodeSelectorEnabled: false
   nodeSelectorKey: zone
   nodeSelectorValue: app
   # Resource details
   resources:
    limits:
      cpu: 1
      memory: 1Gi
    requests:
      cpu: 0.5
      memory: 1Gi
   servicePcfConfig:
       type: NodePort

# Details of appinfo microservices
appinfo:
   enabled: true
   image: occnp/oc-app-info
   imageTag: 22.3.2
   pullPolicy: IfNotPresent
    # Replicas for Appinfo - This is exact value without scaling
   replicas: 1
   # Set Log Level to DEBUG. If false, Log Level shall be INFO
   debug: true
   serviceAccountName: ''
```


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```
   commonCfgClient:
     enabled: false
   commonCfgServer:
   # Do not comment this line in case you want to deploy both config-server
and APIGW in same namespace simultaneously
   # Otherwise comment this line and use 'host'
     configServerSvcName: 'common-config-server'
     host: 'common-config-server'
     port: '80'
     pollingInterval: 5000
   dbConfig:
     dbHost: *mySqlHostRef
     dbPort: *mySqlPortRef
     secretName: *dbCredSecretNameRef
     dbName: *dbNameRef
     # Name of the Key configured for "DB Username" in Secret with following
name: "<dbConfig.secretName>"
     dbUNameLiteral: mysql-username
     # Name of the Key configured for "DB Password" in Secret with following
name: "<dbConfig.secretName>"
     dbPwdLiteral: mysql-password
   # Service to be monitored by appinfo
   # nFType in core_services must consist of nfType used in nrfclient profile.
   #Examples-1 NRF with all services listed
   #core_services:
   #  nrf:
   #  - "ocnrf-nfRegistration"
   #  - "ocnrf-nfSubscription"
   #Example-2 NRF without listing any services
   core_services: {}
   # Infrastructure services
   # If using occne 1.4 or if you don't want to monitor infra services such
as db-monitor service then the below mentioned
   # attribute 'infraServices' should be uncommented and empty array should
be passed as already mentioned.
   # If infraServices is not set, by default appinfo shall monitor status of
db-monitor-svc and db-replication-svc.
   #infraServices: []
```

5.1.5 Ingress Gateway Parameters

Listed below are the customizable Ingress Gateway parameters:

Table 5-10 Routes Config Customizable Parameters

Parameter	Description	Details
`globalRemoveRequestHeader[0].name`	This field is used for blacklisting (removing) a request header at global level. Hence, it will be applied to all routes configured. Additional header can be configured by adding a new element in the next line and so on.	**Default Value:** Value to be updated accordingly

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Table 5-10 (Cont.) Routes Config Customizable Parameters

Parameter	Description	Details
`globalRemoveResponseHeader[0].name`	This field is used for blacklisting(removing) a response header at global level. Hence, it will be applied to all routes configured. Additional header can be configured by adding a new element in the next line and so on.	**Default Value:** Value to be updated accordingly
`routesConfig[0].id`	This is a mandatory parameter. Id of the route.	**Default Value:** Value to be updated accordingly
`routesConfig[0].uri`	This is a mandatory parameter. Service name of the internal microservice of this NF.	**Default Value:** Value to be updated accordingly
`routesConfig[0].path`	This is a mandatory parameter. Provide the path to be matched.	**Default Value:** Value to be updated accordingly
`routesConfig[0].order`	This is a mandatory parameter. Provide the order of the execution of this route.	**Default Value:** Value to be updated accordingly
`routesConfig[0].metadata.requestTimeout`	requestTimeout is used to set timeout at route level. Value should be in milliseconds. If present then it will override global request timeout	**Default Value:**0
`routesConfig[0].metadata.xfccHeaderValidation.validationEnabled`	This is used to provide an option to enable or disable route level xfccHeaderValidation, it will override global configuration for xfccHeaderValidation.enabled	**Default Value:**False
`routesConfig[0].metadata.oauthValidator.enabled`		**Default Value:** Value to be updated accordingly
`routesConfig[0].metadata.ccaHeaderValidation.enabled`	This is used to provide an option to enable or disable route level ccaHeaderValidation, it will override global configuration for ccaHeaderValidation.enabled	**Default Value:**False
`routesConfig[0].filters.invalidRouteFilter.errorCodeOnInvalidRoute`	This is a mandatory parameter. If invalidRouteFilter filter is configured, then keep the 'order' value highest compared to other routesComment the parameters related to invalidRouteFilter if configurable error code is not required for invalid route. Configurable error code for invalid route.	**Default Value:** Value to be updated accordingly
`routesConfig[0].filters.invalidRouteFilter.errorCauseOnInvalidRoute`	This is a mandatory parameter. Error cause for invalid route.	**Default Value:** Value to be updated accordingly
`routesConfig[0].filters.invalidRouteFilter.errorTitleOnInvalidRoute`	This is a mandatory parameter. Error title for invalid route.	**Default Value:** Value to be updated accordingly

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Table 5-10 (Cont.) Routes Config Customizable Parameters

Parameter	Description	Details
routesConfig[0].filters.invalidRouteFilter.errorDescriptionOnInvalidRoute	This is a mandatory parameter. Error description for invalid route.	**Default Value:** Value to be updated accordingly
routesConfig[0].filters.removeRequestHeader[0].name	This field is used for blacklisting(removing) a request header at route level. Additional header can be configured by adding a new element in the next line and so on.	The value of "name" attribute denotes the name of the request header which is to be blacklisted/removed at route level. Add a new entry in next line for every header to be removed.
routesConfig[0].filters.removeResponseHeader[0].name	Below field is used for blacklisting(removing) a response header at route level. Additional header can be configured by adding a new element in the next line and so on.	The value of "name" attribute denotes the name of the response header which is to be blacklisted/removed at route level. Add a new entry in next line for every header to be removed.
routesConfig[0].metadata.svcName	The following parameter configurable per route in route-metadata is used to track Overload Control data. If this parameter is not configured in route metadata then svc name from routesConfig[0].uri field is used as the required key to track Overload Control data.	The value of "svcName" attribute denotes the back-end service tag to be used as the required key (configurable per route) to track Overload Control data instead of using back-end service name from routesConfig[0].uri as the required key
routesConfig[0].metadata.serverHeaderDetails.enabled	Server header configuration if defined at Route level (irrespective of being enabled/disabled) will take precedence over the Global conf.	**Default Value:** Value to be updated accordingly
routesConfig[0].metadata.serverHeaderDetails.errorCodeSeriesId	If not defined here, value at Global level will be used as fallback. Value need to be one among "errorCodeSeriesList" resource defined.	**Default Value:** Value to be updated accordingly
routesConfig[0].metadata.requiredTime	If isSbiTimerEnabled is true then this is the minimum time required to process an incoming request. If the timeout falls below this then request will be rejected.	**Default Value:** Value to be updated accordingly

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6
Uninstalling OCNWDAF

To perform an automated uninstall, run the following command:

```
helm uninstall <installation name> -n $K8_NAMESPACE
```

This command removes all the resources including the PVCs.

Sample Output:

```
[cloud-user@occne224-cluster-bastion-1 ]$ helm uninstall nwdaf -
n $K8_NAMESPACE
W0404 05:04:57.056877 3860334 warnings.go:70] autoscaling/v2beta2
HorizontalPodAutoscaler is deprecated in v1.23+, unavailable     in v1.26+;
use autoscaling/v2 HorizontalPodAutoscaler
W0404 05:04:57.065008 3860334 warnings.go:70] autoscaling/v2beta2
HorizontalPodAutoscaler is deprecated in v1.23+, unavailable     in v1.26+;
use autoscaling/v2 HorizontalPodAutoscaler
release "nwdaf" uninstalled
```

To perform a manual uninstall, run the following commands:

```
helm uninstall <installation name> -n <namespace> --no-hooks
```

```
kubectl delete all --all -n $K8_NAMESPACE && kubectl delete secret --all -
n $K8_NAMESPACE
```

> ⚠ **Caution**
>
> The `kubectl delete` command deletes all the Kubernetes objects of the specified namespace.

For troubleshooting procedures, see, *Oracle Communications Networks Data Analytics Function Troubleshooting Guide*.

6.1 Verify Uninstallation

To verify the OCNWDAF uninstallation, run the following command:

```
$ kubectl get all -n <release-namespace>
```

In case of successful uninstallation, no OCNWDAF resource is displayed in the command output.

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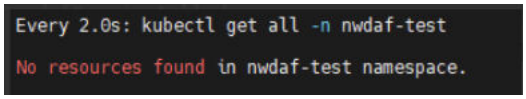
Sample Output

Figure 6-1 Sample Output



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7
Fault Recovery

This chapter explains how to perform fault recovery for OCNWDAF deployment.

7.1 Introduction

This section describes the procedures to perform disaster recovery for Oracle Communications Networks Data Analytics Function (OCNWDAF) deployment. The OCNWDAF operators can take database backup and restore it either on the same or a different cluster. The OCNWDAF stores data in the following storages:

- MySQL NDB Cluster
- Apache Kafka

> **Note**
>
> This section describes the recovery procedures to restore OCNWDAF databases only. To restore all the databases that are part of DBTier, see Oracle Communications Cloud Native Core cnDBTier Installation, Upgrade, and Fault Recovery Guide.

> **Note**
>
> You must take database backup and restore it either on the same or a different cluster. It uses the OCNWDAF database to run any command or follow instructions.

7.2 Fault Recovery Impact

This section provides an overview of Fault recovery scenarios and the impacted areas.

The following table provides information about the impacted areas during Oracle Communications Network data Analytics Function Fault recovery:

Table 7-1 Fault Recovery Impacted Area

Scenario	Requires Fault Recovery or re-install of Kafka?	Requires Fault Recovery or re-install of MySQL?	Other
Deployment Failure	No	No	Uninstall and re-install Helm.
cnDBTier Corruption	Yes	Yes	Restore MySQL from backup and ensure it is not re-installed.
When DBTier failed in a Single Site	No	Yes	Restore MySQL from backup and ensure it is not re-installed.

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Table 7-1 (Cont.) Fault Recovery Impacted Area

Scenario	Requires Fault Recovery or re-install of Kafka?	Requires Fault Recovery or re-install of MySQL?	Other
Configuration Database Corruption	No	Yes	Backup and restore of configuration database is required.
Site Failure	No	No	Uninstall and re-install Helm.

7.3 Prerequisites

Ensure that the following prerequisites are met before performing the disaster recovery procedures:

- Ensure that cnDBTier is in a healthy state and available. Run the following command to check the status of cnDBTier service:

  ```
  kubectl -n <namespace> exec <management node pod> -- ndb_mgm -e show
  ```

- Enable the automatic backup on DBTier by scheduling regular backups. The regular backups help in disaster recovery with the following tasks:
  - Restore stable version of the network function databases
  - Minimize significant loss of data due to upgrades or roll back failures
  - Minimize loss of data due to system failure
  - Minimize loss of data due to data corruption or deletion due to external input
  - Migrate network function database information from one site to another
  - Docker images used during the previous installation or upgrade must be retained in the external data source

7.4 Fault Recovery Scenarios

This chapter describes the fault recovery procedures for various scenarios.

7.4.1 Deployment Failure

This scenario describes how to recover OCNWDAF when the deployment corrupts.

To recover OCNWDAF:

1. Run the following command to uninstall OCNWDAF:

   ```
   helm uninstall <release_name> --namespace <namespace>

   Example:
   helm uninstall oc-nwdaf --namespace oc-nwdaf
   ```


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For more information about uninstalling OCNWDAF, see the **Uninstalling OCNWDAF** chapter in *Oracle Communication Networks Data Analytics Function Installation Guide.*

2. Install OCNWDAF as described in the **Installing OCNWDAF** chapter in *Oracle Communication Networks Data Analytics Function Installation Guide.* Use the back up of custom values file to reinstall the OCNWDAF.

Restore OCNWDAF, cnDBTier, and OCNWDAF database (DB) as described in Restoring OCNWDAF and cnDBTier.

7.4.2 cnDBTier Corruption

This section describes how to recover database when the data replication is broken due to database corruption and cnDBTier has failed in single site.

When the database corrupts, the database on all the other sites may also corrupt due to data replication. It depends on the replication status after the corruption has occurred. If the data replication is broken due to database corruption, then DBTier fails in either single or multiple sites (not all sites). And if the data replication is successful, then database corruption replicates to all the DBTier sites and DBTier fails in all sites.

If corrupted database replicated to mated sites, refer to the procedure When DBTier failed in a Single Site.

7.4.3 When DBTier failed in a Single Site

This section describes how to recover database when the data replication is broken due to database corruption and DBTier has failed in a single site.

To recover database:

1. Uninstall OCNWDAF helm chart. For information about uninstalling OCNWDAF, see the **Uninstalling OCNWDAF** chapter in the *Oracle Communications Networks Data Analytics Function Installation Guide*.
2. For DBTier disaster recovery:
   a. Create on-demand backup from mated site that has health replication with failed site. For more information about DBTier backup, see the **Create On-demand Database Backup** chapter in the *Oracle Communications Cloud Native Core DBTier Disaster Recovery Guide.*
   b. Use the backup data from mate site for restore. For more information about DBTier restore, see the **Restore Georeplication Failure** chapter in *Oracle Communications Cloud Native Core DBTier Disaster Recovery Guide.*
3. Install OCNWDAF helm chart. For more information about installing OCNWDAF, see the **Installing OCNWDAF** chapter in the *Oracle Communication Networks Data Analytics Function Installation Guide.*

7.4.4 Configuration Database Corruption

This scenario describes how to recover OCNWDAF when its configuration database corrupts.

The configuration database is stored in a site exclusive database along with its tables. Thus, corruption of configuration database impacts only a particular site.

To recover OCNWDAF configuration database, user has to restore the DB backup.

1. Transfer the *<backup_ filename >.sql.gz* file to the SQL node where user want to restore it.

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2. Log into MySQL NDB Cluster's SQL node on the new DB cluster and create a new database where the database needs to be restored.
3. For details on creating database, user and adding permissions, see **Configuring Database, Creating Users, and Granting Permissions** section in the **Preinstallation** Chapter in *Oracle Communications Networks Data Analytics Function Installation Guide*.

> **Note**
>
> The database name created in the above step should be same as the database name created in the following step.

4. To restore the database to the new database created use the following command:

```
gunzip < <backup_filename>.sql.gz | mysql -h127.0.0.1 –u <username> -p
<backup-database-name>
```

Enter the password when prompted.

Example:

```
gunzip < OCNWDAFdbBackup.sql.gz | mysql -h127.0.0.1 -u dbuser -p OCNWDAFdb
```

7.4.5 Site Failure

This section describes how to perform disaster recovery when the site has a software failure.

It is assumed that the user has DBTier and OCNWDAFinstalled on multiple sites with automatic data replication and backup enabled.

To recover the failed sites:

1. Run the Cloud Native Environment (CNE) installation procedure to install a new cluster. For more information, see *Oracle Communications Cloud Native Environment (OCCNE) Installation Guide*.
2. For DBTier disaster recovery:
   a. Take on-demand backup from the mate site that has health replication with the failed site or sites. For more information about on-demand backup, see the **Create On-demand Database** Backup chapter in the *Oracle Communications Cloud Native Core DBTier Disaster Recovery Guide.*
   b. Use the backup data from the mate site to restore the database. For more information about database restore, see the **Restore Georeplication Failure chapter** in the *Oracle Communications Cloud Native Core DBTier Disaster Recovery Guide.*
3. Install OCNWDAF helm chart. For more information about installing OCNWDAF, see the **Installing OCNWDAF**chapter in the *Oracle Communication Networks Data Analytics Function Installation Guide.*

7.4.6 Kafka Issues

Kafka related issues (and solution) are described in the following sections.

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Scenario 1

OCNWDAFmicroservices need to consume Kafka messages again from the beginning. This scenario can occur if any of the OCNWDAF microservices stopped consuming messages or failed to process them correctly. For example, when a DB downtime occurs, none of the messages consumed by the microservices will be processed correctly and we need to "retry" them.

Current Kafka configuration in OCNWDAFis based on transactions. Restart the microservice that needs to consume such messages and the messages from the last offset in Kafka are consumed. After restarting the service, the messages backlog is not consumed, change the microservice configuration stored in the Spring Cloud Configuration.

Solution

1. Ensure the microservice consumer configuration is `auto-offset-reset: earliest`. This will process the topic partition at the earliest offset (current setup value).
2. Redeploy the microservice.

Scenario 2

OCNWDAFmicroservices must ignore all messages in Kafka. This scenario can occur when the data sources like AMF, SMF, UDM, and so on are generating wrong data and overloading OCNWDAF.

Solution 1

Delete all messages in the topic, follow the steps below:

- Delete and recreate the topic.

OR

- Update the retention Kafka retention policy
  1. Stop the consumer microservice.
  2. Check the current retention policy, run the command:

     ```
     kafka-configs --zookeeper <zkhost>:2181 --describe --entity-type topics
     --entity-name <topic name>
     ```

  3. Update the retention policy in Kafka to a very low value (for example,1 min per instance):

     ```
     kafka-configs.sh --zookeeper <zkhost>:2181 --entity-type topics --alter
     --entity-name <topic name> --add-config retention.ms=60000
     ```

  4. Wait for Kafka service to delete the messages.
  5. Set the retention policy value.
  6. Redeploy the microservice.

Solution 2

Follow the procedure below, to retain the wrong messages and allow the Kafka service to delete the messages according to the retention policy.

1. Change Kafka consumer configuration to `auto-offset-reset: latest`. This will process the messages from the latest partition offset.

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2. Redeploy the microservice.

7.4.7 Microservice Deployment Issue

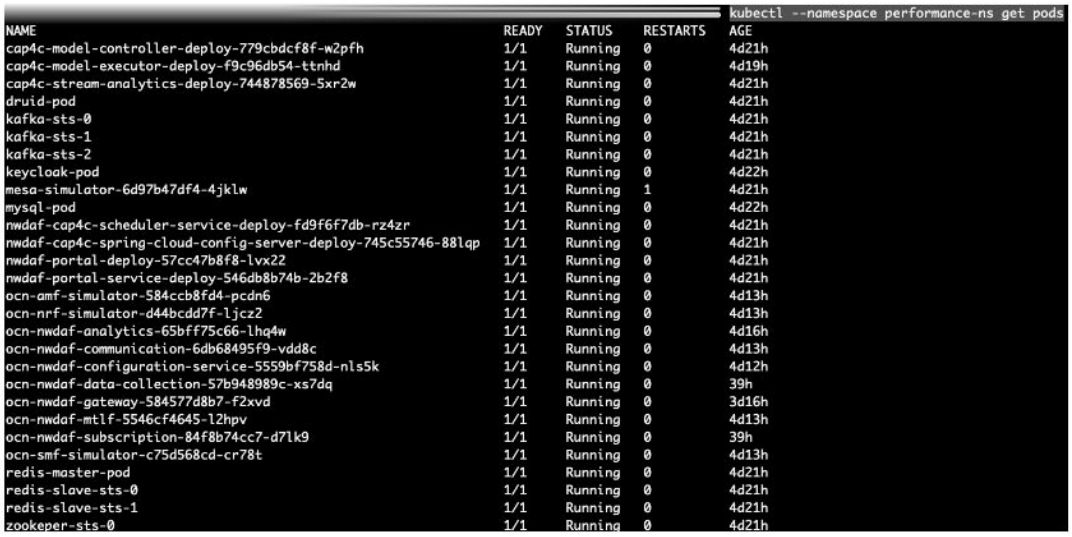
Follow the procedure below to resolve microservice deployment issue:

1. Run the following command to obtain information on the pods deployed and their status:

   ```
   kubectl --namespace [namespace name] get pods --sort-
   by='.status.containerStatuses[0].restartCount'
   ```

   Sample Output:

   Figure 7-1 Sample Output



```
kubectl --namespace performance-ns get pods
NAME                                                  READY   STATUS    RESTARTS   AGE
cap4c-model-controller-deploy-779cbdcf8f-w2pfh        1/1     Running   0          4d21h
cap4c-model-executor-deploy-f9c96db54-ttnhd           1/1     Running   0          4d19h
cap4c-stream-analytics-deploy-744878569-5xr2w         1/1     Running   0          4d21h
druid-pod                                             1/1     Running   0          4d21h
kafka-sts-0                                           1/1     Running   0          4d21h
kafka-sts-1                                           1/1     Running   0          4d21h
kafka-sts-2                                           1/1     Running   0          4d21h
keycloak-pod                                          1/1     Running   0          4d22h
mesa-simulator-6d97b47df4-4jklw                       1/1     Running   1          4d21h
mysql-pod                                             1/1     Running   0          4d22h
nwdaf-cap4c-scheduler-service-deploy-fd9f6f7db-rz4zr  1/1     Running   0          4d21h
nwdaf-cap4c-spring-cloud-config-server-deploy-745c55746-88lqp  1/1  Running  0      4d21h
nwdaf-portal-deploy-57cc47b8f8-lvx22                  1/1     Running   0          4d21h
nwdaf-portal-service-deploy-546db8b74b-2b2f8          1/1     Running   0          4d21h
ocn-amf-simulator-584ccb8fd4-pcdn6                    1/1     Running   0          4d13h
ocn-nrf-simulator-d44bcdd7f-ljcz2                     1/1     Running   0          4d13h
ocn-nwdaf-analytics-65bff75c66-lhq4w                  1/1     Running   0          4d16h
ocn-nwdaf-communication-6db68495f9-vdd8c              1/1     Running   0          4d13h
ocn-nwdaf-configuration-service-5559bf758d-nls5k      1/1     Running   0          4d12h
ocn-nwdaf-data-collection-57b948989c-xs7dq            1/1     Running   0          39h
ocn-nwdaf-gateway-584577d8b7-f2xvd                    1/1     Running   0          3d16h
ocn-nwdaf-mtlf-5546cf4645-l2hpv                       1/1     Running   0          4d13h
ocn-nwdaf-subscription-84f8b74cc7-d7lk9               1/1     Running   0          39h
ocn-smf-simulator-c75d568cd-cr78t                     1/1     Running   0          4d13h
redis-master-pod                                      1/1     Running   0          4d21h
redis-slave-sts-0                                     1/1     Running   0          4d21h
redis-slave-sts-1                                     1/1     Running   0          4d21h
zookeper-sts-0                                        1/1     Running   0          4d21h
```

2. Observe the **Restarts** column, the ideal value is "0", indicating the pods have not re-started. If the column **Status** is not **Running** and the value of the **Restarts** is constantly increasing implies an underlying problem with the microservice or any dependency.
3. Refer to the *Oracle Communications Networks Data Analytics Function Troubleshooting Guide* to resolve the issue.
4. If required, re-deploy the microservice.

In a Kubernetes setup, at least one pod of each microservice must be deployed so, if the problem root cause is due to a dependency, re-deploying the microservice is not required. It is sufficient to fix the dependency and wait for Kubernetes to retry the deployment.

If there are any changes in the Spring Cloud Config properties of the microservice, refreshing the property through its actuator with a POST request to `http://{host}:{port}/actuator/refresh`. If the issue is not resolved (not all properties support online refresh), redeploy the microservice.

7.5 Backup and Restore

This chapter describes the Backup and Restore procedures.

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7.5.1 OCNWDAF Database Backup and Restore

Introduction

Perform this procedure to take a backup of the OCNWDAF database (DB) and restore the database on a different cluster. This procedure is for on-demand backup and restore of OCNWDAF DB. The commands used for these procedures are provided by the MYSQL Network Database(NDB) cluster.

Prerequisite

Ensure that the MYSQL NDB cluster is in a healthy state, and each of its database node is in running state. Run the following command to check the status of cnDBTier service:

```
kubectl -n <namespace> exec <management node pod> -- ndb_mgm -e show
```

Where,

- `<namespace>` is the namespace where cnDBTier is deployed
- `<management node pod>` is the management node pod of cnDBTier

Example:

```
[cloud-user@vcne2-bastion-1 ~]$ kubectl -n nwdafsvc exec ndbmgmd-0 -- ndb_mgm
-e show
Connected to Management Server at: localhost:1186
Cluster Configuration
---------------------
[ndbd(NDB)]     2 node(s)
id=1    @10.233.86.202  (mysql-8.0.22 ndb-8.0.22, Nodegroup: 0, *)
id=2    @10.233.81.144  (mysql-8.0.22 ndb-8.0.22, Nodegroup: 0)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.81.154  (mysql-8.0.22 ndb-8.0.22)
id=50   @10.233.86.2  (mysql-8.0.22 ndb-8.0.22)

[mysqld(API)]   2 node(s)
id=56   @10.233.81.164  (mysql-8.0.22 ndb-8.0.22)
id=57   @10.233.96.39  (mysql-8.0.22 ndb-8.0.22)

[cloud-user@vcne2-bastion-1 ~]$
```

OCNWDAF DB Backup

If the OCNWDAF database backup is required, do the following:

1. Log in to any of the SQL node or API node, and then run the following command to take dump of the database:

   ```
   kubectl exec -it <sql node> -n <namespace> bash
   mysqldump --quick -h127.0.0.1 –u <username> -p  <databasename>| gzip >
   <backup_filename>.sql.gz
   ```

   Where,

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- <sql node> is the SQL node of cnDBTier
- <namespace> is the namespace where cnDBTier is deployed
- <username> is the database username
- <databasename> is the name of the database that has to be backed up
- <backup_filename> is the name of the backup dump file

2. Enter the OCNWDAF database name and password in the command when prompted. Example:

```
kubectl exec -it ndbmysqld-0 -n nwdaf bash
mysqldump --quick -h127.0.0.1 -u dbuser -p nwdafdb | gzip >
NWDAFdbBackup.sql.gz
```

> **Note**
>
> Ensure that there is enough space on the directory to save the backup file.

OCNWDAF RESTORE

If OCNWDAF database restore is required, do the following:

1. Transfer the <backup_ filename>.sql.gz file to the SQL node where you want to restore it.
2. Log in to the SQL node of the MYSQL NDB cluster on the new DB cluster and create a new database where the database needs to be restored
3. Create database, database user, and grant permissions as described in Configuring Database, Creating Users, and Granting Permissions.

> **Note**
>
> The database name created in this step should be the same as the database name created in the next sub step. Also, the Kubernetes secret should be the same as in the values.yaml file used for installing OCNWDAF.

4. To restore the database to the new database created, run the following command:

```
gunzip < <backup_filename>.sql.gz | mysql -h127.0.0.1 –u <username> -p
<databaseName >
```

Example:

```
gunzip < nwdafdbBackup.sql.gz | mysql -h127.0.0.1 -u dbuser -p newnwdafdb
```

5. Enter the password when prompted.

7.5.2 Restoring OCNWDAF and cnDBTier

Perform this procedure to restore OCNWDAF, cnDBTier, and OCNWDAF database (DB).

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Prerequisites:

- Take a backup of the `custom_values.yaml` file that was used for installing OCNWDAF.
- Take a backup of the OCNWDAFdatabase and restore the database as described in Restoring OCNWDAF and cnDBTier Perform this task once every evening.

If OCNWDAFdeployment is corrupted, do the following:

1. Run the following command to uninstall the corrupted OCNWDAFdeployment:

   ```
   helm uninstall <release_name> --namespace <namespace>
   ```

   Where,

   - `<release_name>` is a name used to track this installation instance.
   - `<namespace>` is the release number.

   Example:

   ```
   helm uninstall ocnwdaf --namespace nwdafsvc
   ```

2. Install OCNWDAFusing the backed up copy of the `custom_values.yaml` file. For information about installing OCNWDAF using Helm, see Installation Tasks

   .

If cnDBTier and NF deployment is corrupted, do the following:

1. Install cnDBTier as described in *Oracle Communication Cloud Native Core cnDBTier Installation, Upgrade, and Fault Recovery Guide*.
2. Restore OCNWDAFDB as described in Restoring OCNWDAF and cnDBTier
3. Install OCNWDAFusing the backed up copy of the `custom_values.yaml` file. For information about installing OCNWDAF, see Installation Tasks

If DB Secret or cnDBTier mysql FQDN or IP or PORT is changed, do the following:

1. In the backed up copy of the `custom_values.yaml` file, update these values: `dbHost/dbPort/dbAppUserSecretName/dbPrivilegedUserSecretName`.

   ```
   # DB Connection Service IP Or Hostname with secret name.
     database:
       dbHost: "mysql-connectivity-service.nwdafsvc"
       dbPort: "3306"
       # K8s Secret containing Database/user/password for all services of
   OCNWDAF interacting with DB.
       dbAppUserSecretName: "seppuser-secret"
       # K8s Secret containing Database/user/password for DB Hooks for
   creating tables
       dbPrivilegedUserSecretName: "nwdafprivilegeduser-secret"
   ```

2. Run the following Helm upgrade command to update the secrets for OCNWDAF control plane microservices, such as configuration, subscription, audit, and notification, to connect to the DB with changed DB Secret or DB FQDN, IP, or Port:

   ```
   helm upgrade <release name> -f <custom_values.yaml> --namespace
   <namespace> <helm-repo>/chart_name --version <helm_version>
   ```


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Example:

```
helm upgrade ocnwdaf -f /home/cloud-user/1.12/values.yaml /home/cloud-user/
1.11.0/ocnwdaf --namespace nwdafsvc
```

7.5.3 Kafka Backup and Restore

Follow the backup procedures described below:

- Backup Zookeeper State Data
- Backup Kafka Topics and Messages

Once the backup procedures are completed, follow the restore procedures:

- Restore Zookeeper State Data
- Restore Kafka Data and Messages

Finally, follow the procedure to Verify the Restoration.

Backup Zookeeper State Data

The Zookeeper stores its data in the directory specified by the `dataDir` field in the `~/kafka/config/zookeeper.properties` configuration file. Read the value of this field to determine the directory to backup. By default, `dataDir` points to the `/tmp/zookeeper` directory.

> **Note**
>
> If the `dataDir` points to some other directory in your installation, use that value instead of `/tmp/zookeeper` in the following commands.

1. Run the command `~/kafka/config/zookeeper.properties`.

   Sample output:

   ```
   # the directory where the snapshot is stored.
   dataDir=/tmp/zookeeper
   # the port at which the clients will connect
   clientPort=2181
   # disable the per-ip limit on the number of connections since this is a
   non-production config
   maxClientCnxns=0
   ```

2. Create a compressed archive file of the contents in the directory. Run the command:

   ```
   tar -czf /home/kafka/zookeeper-backup.tar.gz /tmp/zookeeper/*
   ```

3. Run the command `ls`, to verify if the `tar` file is created. The output will display the compressed file `zookeeper-backup.tar.gz`.
4. A backup of the Zookeeper State Data is successfully created.

Backup Kafka Topics and Messages

Kafka stores topics, messages, and internal files in the directory that the `log.dirs` field specifies in the `~/kafka/config/server.properties` configuration file. Read the value of this

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field to determine the directory to backup. By default, `log.dirs` points to the `/tmp/kafka-logs` directory.

> **Note**
>
> If the `log.dirs` points to some other directory in your installation, use that value instead of `/tmp/kafka-logs` in the following commands.

1. Run the command `~/kafka/config/server.properties`.

   Sample output:

   ```
   ############################# Log Basics #############################

   # A comma separated list of directories under which to store log files
   log.dirs=/tmp/kafka-logs

   # The default number of log partitions per topic. More partitions allow
   greater
   # parallelism for consumption, but this will also result in more files
   across
   # the brokers.
   num.partitions=1

   # The number of threads per data directory to be used for log recovery at
   startup and flushing at shutdown.
   # This value is recommended to be increased for installations with data
   dirs located in RAID array.
   num.recovery.threads.per.data.dir=1
   ```

2. Stop the Kafka service so that the data in the `log.dirs` is in a consistent state. Run `exit` to become a non-root user, then run the command:

   ```
   sudo systemctl stop kafka
   ```

3. Once the Kafka service is stopped, login as Kafka root user. Run the command:

   ```
   sudo -iu kafka
   ```

   > **Note**
   >
   > Always stop or start the Kafka and Zoo Keeper services as non-root sudo user, as in the Apache Kafka installation prerequisite the **kafka** user is restricted as a security precaution. This prerequisite disables sudo access for the **kafka** user, hence commands fail to execute.

4. Create a compressed archive file of the contents in the directory. Run the command:

   ```
   tar -czf /home/kafka/kafka-backup.tar.gz /tmp/kafka-logs/*
   ```

5. Run the command `ls`, to verify if the `tar` file is created. The output will display the compressed file `kafka-backup.tar.gz`.

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6. Start the Kafka service, run `exit` to become a non-root user, then run the command:

   ```
   sudo systemctl start kafka
   ```

7. Once the Kafka service is started, login as Kafka root user. Run the command:

   ```
   sudo -iu kafka
   ```

8. A backup of the Kafka Data is successfully created.

Restore Zookeeper State Data

1. To prevent data directories from receiving invalid data during the restoration period, stop both Zookeeper and Kafka. Run the following commands:
   - Run `exit` to become a non-root user, then run the command:

     ```
     sudo systemctl stop kafka
     ```

   - Stop the Zookeeper service:

     ```
     sudo systemctl stop zookeeper
     ```

2. Login as Kafka root user. Run the command:

   ```
   sudo -iu kafka
   ```

3. Delete the existing cluster data directory, run the command:

   ```
   rm -r /tmp/zookeeper/*
   ```

4. Restore the backedup data, run the command:

   ```
   tar -C /tmp/zookeeper -xzf /home/kafka/zookeeper-backup.tar.gz --strip-components 2
   ```

   > **Note**
   >
   > The `-C` flag specifies the `tar` to change to the directory `/tmp/zookeeper` before extracting the data. Specifying `--strip 2` flag in the command ensures `tar` extracts the archive's contents in the directory `/tmp/zookeeper/` and not in any another directory (such as `/tmp/zookeeper/tmp/zookeeper/`) inside it.

5. Cluster state data is successfully restored.

Restore Kafka Data and Messages

1. Delete the existing Kafka directory, run the command:

   ```
   rm -r /tmp/kafka-logs/*
   ```


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2. After directory deletion, the Kafka installation is similar to a fresh installation with no topics or messages present in it. Restore the backed up data, extract the files:

   ```
   tar -C /tmp/kafka-logs -xzf /home/kafka/kafka-backup.tar.gz --strip-components 2
   ```

   The `-C` flag specifies `tar` to change to the directory `/tmp/kafka-logs` before extracting the data. Specifying `--strip 2` flag ensures that the archive's contents are extracted in `/tmp/kafka-logs/` and not in another directory (such as `/tmp/kafka-logs/kafka-logs/`) inside it.

3. Run `exit` to become a non-root user, then run the command:

   ```
   sudo systemctl start kafka
   ```

   Start the Zookeeper service

   ```
   sudo systemctl start zookeeper
   ```

4. Login as Kafka root user. Run the command:

   ```
   sudo -iu kafka
   ```

5. Kafka data is successfully restored.

Verify the Restoration

1. Once Kafka is successfully running, run the following command to read the messages:

   ```
   ~/kafka/bin/kafka-console-consumer.sh --bootstrap-server localhost:9092 --topic <TopicName> --from-beginning
   ```

   > **Note**
   >
   > If Kafka has not started up properly, you might encounter the following warning:
   >
   > ```
   > Output
   > [2018-09-13 15:52:45,234] WARN [Consumer clientId=consumer-1, groupId=console-consumer-87747] Connection to node -1 could not be established. Broker may not be available. (org.apache.kafka.clients.NetworkClient)
   > ```

   Always wait for Kafka to start fully before performing this step.

2. Retry the previous step if you encountered a warning, or run the following command (as non-root sudo user) to restart Kafka:

   ```
   sudo systemctl restart kafka
   ```


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3. The following message is displayed if restoration is successful:

```
Output
<Topic Message>
```

> **Note**
>
> If you do not see this message, check if you missed out procedure steps in the previous section and run them.

A successful verification implies, data has been backed up and restored correctly in a single Kafka installation.

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