Oracle® Communications

Network Repository Function (NRF) Cloud Native Installation and Upgrade Guide

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What's New in This Guide

This section introduces the documentation updates for Release 1.8.x in Oracle Communications Cloud Native Network Repository Function (NRF) Installation Guide.

Release 1.8.0

For Release 1.8.0, the following changes are performed in this document:

- Updated the common services versions in Prerequisites.
- OCNRF Configuration to support ASM is provided in Configuring OCNRF to support ASM section.
- HookJob parameters are updated under global section in OCNRF Configuration Parameters.

1
OCNRF Overview

This section includes information about the role of Oracle Communications Network Repository Function (OCNRF) in 5G Service Based Architecture.

The OCNRF is one of the main components of the 5G Service Based Architecture. The OCNRF maintains an updated repository of all the Network Functions (NFs) available in the operator's network along with the services provided by each of the NFs in the 5G core that are expected to be instantiated, scaled and terminated with minimal or no manual intervention.

The OCNRF supports discovery mechanisms that allow NFs to discover each other and get updated status of the desired NFs.

The OCNRF supports the following functions:

- Maintains the profiles of the available NF instances and their supported services in the 5G core network.
- Allows consumer NF instances to discover other provider's NF instances in the 5G core network.
- Allows NF instances to track the status of other NF instances.
- Provides Oauth2 based Access Token service for consumer NF authorization.
- Provides specific NF Type selection based on subscriber identity.
- Supports message forwarding from one NRF to another NRF.
- Supports geo-redundancy to ensure service availability.

The OCNRF interacts with every other Network Function in the 5G core network and it supports the above functions through the following services:

- Management Services
- Discovery Services
- AccessToken Service

References

- Cloud Native Environment 1.6 Installation Document
- Network Repository Function (NRF) User's Guide
- CNC Console User's Guide
- ATS User Manual

Acronyms

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

Table 1-1 Acronyms

Field	Description
5G System	3GPP system consisting of 5G Access Network (AN), 5G Core Network and UE
5G-AN	5G Access Network
5GC	5G Core Network
5G-NF	5G Network Function
AMF	Access and Mobility Management Function
API-Gateway	Application Program Interface Gateway
ASM	Aspen Service Mesh
CNE	Cloud Native Environment
FQDN	Fully Qualified Domain Name
K8s	Kubernetes
MMI	Machine Machine Interface
MPS	Messages Per Second
NDB	Network Database
NF	Network Function
Network Function	A functional building block within a network infrastructure, which has well defined external interfaces and well defined functional behavior. In practical terms, a network function is often a network node or physical appliance.
Network Slice	A logical network that provides specific network capabilities and network characteristics.
Network Slice instance	A set of Network Function instances and the required resources (e.g. compute, storage and networking resources) which form a deployed Network Slice.
NF Consumer	A generic way to refer to an NF which consumes services provided by another NF. Ex: An AMF is referred to as a Consumer when it consumes AMPolicy services provided by the PCF.
NF Instance	A specific instance of a network function type.
NF Producer or NF Provider	A generic way to refer to an NF which provides services that can be consumed by another NF. Ex: A PCF is a provider NF and provides AMPolicy Services
NRF	Network Repository Function
OCNRF	Oracle Communications Network Repository Function
OHC	Oracle Help Center
OSDC	Oracle Software Download Center
PLMN	Public Land Mobile Network
Resiliency	The ability of the NFV framework to limit disruption and return to normal or at a minimum acceptable service delivery level in the fame of a fault, failure, or an event that disrupts normal operation.
Scaling	Ability to dynamically extend/reduce resources granted to the Virtual Network Function (VNF) as needed. This includes scaling out/in or scaling up/down.
Scaling Out/In/ Horizontally	The ability to scale by add/remove resource instances (for example, VMs). Also called scaling Horizontally.
Scaling Up/Down/ Vertically	The ability to scale by changing allocated resources, for example, increase/decrease memory, CPU capacity or storage size.

Table 1-1 (Cont.) Acronyms

Field	Description
PCF	Policy Control Function
SEPP	Security Edge Protection Proxy
SCP	Service Communication Proxy
SLF	Subscriber Location Function
URI	Universal Resource Identifier

2
Installing OCNRF

This section describes the prerequisites and installation procedure for the OCNRF.

> **Note:**
>
> In case you want to configure OCNRF to support Aspen Service Mesh (ASM), refer to Configuring OCNRF to support ASM.

Prerequisites

Following are the prerequisites to install and configure OCNRF:

OCNRF Software

The OCNRF software includes:

- OCNRF Helm charts
- OCNRF docker images

The following software must be installed before installing OCNRF:

Table 2-1 Pre-installed Software

Software	Version
Kubernetes	v1.18.4
HELM	v2.14.3 and v3.2

Following are the common services that needs to be deployed as per the requirement:

Table 2-2 Common Services

Software	Chart Version	Required For
elasticsearch	7.6.1	Logging Area
elastic-curator	5.5.4	Logging Area
elastic-exporter	1.1.0	Logging Area
elastic-master	7.6.1	Logging Area
logs	3.0.0	Logging Area
kibana	7.6.1	Logging Area
grafana	7.0.4	Metrics Area
prometheus	2.16.0	Metrics Area
prometheus-kube-state-metrics	1.9.5	Metrics Area
prometheus-node-exporter	0.18.1	Metrics Area

Table 2-2 (Cont.) Common Services

Software	Chart Version	Required For
metallb	0.9.3	External IP
metrics-server	2.10.0	Metric Server
tracer	1.14.0	Tracing Area

> **Note:**
>
> Install the specified software items before proceeding, if any of the above services are needed and the respective software is not already installed in CNE.
> To check the installed software items, execute:
>
> ```
> helm ls
> ```
>
> Some of the systems may need to use helm command with `admin.conf` file, such as:
>
> ```
> helm --kubeconfig admin.conf
> ```

Network access

The Kubernetes cluster hosts must have network access to:

- Local docker image repository where the OCNRF images are available.
  To check if the Kubernetes cluster hosts has network access to the local docker image repository, try to pull any image with tag name to check connectivity by executing:

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

  > **Note:**
  >
  > Some of the systems may need to use helm command with `admin.conf` file, such as:
  >
  > ```
  > helm --kubeconfig admin.conf
  > ```

- Local helm repository where the OCNRF helm charts are available.
  To check if the Kubernetes cluster hosts has network access to the local helm repository, execute:

  ```
  helm repo update
  ```

> **Note:**
>
> Some of the systems may need to use helm command with `admin.conf` file, such as:
>
> ```
> helm --kubeconfig admin.conf
> ```

> **Note:**
>
> All the kubectl and helm related commands that are used in this document must be executed on a system depending on the infrastructure of the deployment. It could be a client machine such as a VM, server, local desktop, and so on.

Client machine requirement

Client machine needs to have the following minimum requirements:

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

Server or Space Requirements

For information on the server or space requirements, see the Oracle Communications Cloud Native Environment (OCCNE) Installation Guide.

Secret file requirement

For HTTPs and Access token, the following certs and pem files has to be created before creating secret files for Keys and MySql.

Note: The following files must be created before creating secret files.

1. ECDSA private Key and CA signed ECDSA Certificate (if initialAlgorithm: ES256)
2. RSA private key and CA signed RSA Certificate (if initialAlgorithm: RS256)
3. TrustStore password file
4. KeyStore password file

ServiceAccount requirement

Operator must create a service account, bind it with a Role for resource with permissions for atleast get, watch and list.

serviceAccountName is a mandatory parameter. Kubernetes Secret resource is used for providing the following:

- MYSQL DB Details to micro-services.
- NRF's Private Key, NRF's Certificate and CA Certificate Details to Ingress/Egress Gateway for TLS.
- NRF's Private and NRF's Public Keys to nfAccessToken micro-service for Digitally Signing AccessTokenClaims.
- Producer/Consumer NF's Service/Endpoint details for routing messages from/to Egress/Ingress Gateway.

The Secret(s) can be under same namespace where OCNRF is getting deployed (recommended) or # Operator can choose to use different namespaces for different secret(s). If all the Secret(s) are under same namespace as OCNRF, then Kubernetes Role can be binded with the given ServiceAccount. Otherwise ClusterRole needs to be binded with the given ServiceAccount. The Role/ClusterRole needs to be created with resources: (services, configmaps, pods, secrets, endpoints) and (verbs: get, watch, list). Refer to Creating Service Account, Role and Role bindings for more details.

DB Tier Requirement

DB Tier must be up and running. In case of geo-redundant deployments, replication between geo-redundant DB Tier must be configured. Refer to DB Tier section in OCCNE installation guide.

Installation Sequence

This section explains the tasks to be performed for installing OCNRF.

OCNRF pre-deployment configuration

Following are the pre-deployment configuration procedures:

1. Creating OCNRF namespace

> **Note:**
>
> This is a mandatory procedure, execute this before proceeding any further. The namespace created/verified in this procedure is an input for next procedures.

2. Creating Service Account, Role and Role bindings

> **Note:**
>
> This procedure is a sample. In case the **service account** with role and role-bindings is already configured or the user has any in-house procedure to create service account, skip this procedure. In case deployment is with ASM, then Configuring OCNRF with ASM for all details and skip this procedure.

3. Configuring MySql database and user
4. Configuring Kubernetes Secret for Accessing OCNRF Database

5. Configuring secrets for enabling HTTPS
6. Configuring Secret for Enabling AccessToken Service

Creating OCNRF namespace

This section explains how the user can verify if the required namespace is available in the system or not.

Procedure

1. Verify required namespace already exists in system:

   ```
   $ kubectl get namespaces
   ```

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

   > **Note:**
   >
   > This is an optional step. In case required namespace already exists, skip this procedure.

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

   For example:-

   ```
   $ kubectl create namespace ocnrf
   ```

Creating Service Account, Role and Role bindings

This section explains how user can create service account, required role and role bindings resources. The Secret(s) can be under same namespace where OCNRF is getting deployed (recommended) or operator can choose to use different namespaces for different secret(s). If all the Secret(s) are under same namespace as OCNRF, then Kubernetes Role can be binded with the given ServiceAccount. Otherwise ClusterRole needs to be binded with the given ServiceAccount.

Sample template for the resources is as follows and add sample template content to resource input yaml file.

Example file name: *ocnrf-resource-template.yaml*

Example command for creating the resources

```
kubectl -n <ocnrf-namespace> create -f ocnrf-resource-template.yaml
```

Sample template to create the resources

> **Note:**
>
> Update **<helm-release>** and **<namespace>** with respective OCNRF namespace and planned OCNRF helm release name in the place holders.

```
## Sample template start#
apiVersion: v1
kind: ServiceAccount
metadata:
  name: <helm-release>-ocnrf-serviceaccount
  namespace: <namespace>
---

apiVersion: rbac.authorization.k8s.io/v1
kind: Role
metadata:
  name: <helm-release>-ocnrf-role
  namespace: <namespace>
rules:
- apiGroups:
  - "" # "" indicates the core API group
  resources:
  - services
  - configmaps
  - pods
  - secrets
  - endpoints
  verbs:
  - get
  - watch
  - list
---

apiVersion: rbac.authorization.k8s.io/v1beta1
kind: RoleBinding
metadata:
  name: <helm-release>-ocnrf-rolebinding
  namespace: <namespace>
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: Role
  name: <helm-release>-ocnrf-role
subjects:
- kind: ServiceAccount
  name:  <helm-release>-ocnrf-serviceaccount
  namespace: <namespace>
## Sample template end#
```

Configuring MySql database and user

This section explains how database administrator can create the databases and users for OCNRF network function.

> **Note:**
>
> 1. Procedure can be different for geo-redundant OCNRF sites and standalone OCNRF site.
> 2. Before executing the below procedure for Geo-Redundant sites, ensure that the DB-Tier for Geo-Redundant sites are already up and replication channels are enabled.
> 3. While performing Fresh Installation, in case OCNRF release is already deployed, purge the deployment, remove databases, users used for previous deployment. Refer to Uninstalling OCNRF for uninstallation procedure.

Procedure for Geo-Redundant OCNRF sites

1. Login to the machine where ssh keys are stored and which has permission to access the SQL nodes of NDB cluster.
2. Connect to the SQL nodes.
3. Login to the MySQL prompt using root permission or user, which has permission to create users with conditions as mentioned below. For example: `mysql -h 127.0.0.1 -uroot -p`

   > **Note:**
   >
   > This command may vary from system to system, path for MySQL binary, root user and root password. After executing this command, user need to enter the password specific to the user mentioned in the command.

4. Check if the OCNRF database user already exists. If the user does not exists, create a database user.
   Below steps covers the creation of two types of OCNRF database users. Different users has different set of permissions.
   a. OCNRF privileged user: This user has complete set of permissions. This user can perform create, alter, drop operations on tables to perform install/upgrade/rollback or delete operations.
   b. OCNRF application user: This user has less set of permissions and will be used by OCNRF application during service operations handling. This user can insert, update, get, remove the records. This user cannot create, alter and drop the database as wells as tables

   ```
   $ SELECT User FROM mysql.user;
   ```

   In case, user already exists, move to next step. Else, create OCNRF user as follows:

   - Create new ocnrf privileged user:
     ```
     $ CREATE USER '<OCNRF Privileged-User Name>'@'%' IDENTIFIED BY
     '<OCNRF Privileged-User Password>';
     ```

Example:

```
$ CREATE USER 'nrfPrivilegedUsr'@'%' IDENTIFIED BY
'nrfPrivilegedPasswd'
```

- Create new ocnrf application user:

```
$ CREATE USER '<OCNRF APPLICATION User Name>'@'%' IDENTIFIED BY
'<OCNRF APPLICATION User Password>';
```

Example:

```
$ CREATE USER 'nrfApplicationUsr'@'%' IDENTIFIED BY
'nrfApplicationPasswd'
```

> **Note:**
>
> Both users must be created on all the SQL Nodes on all the sites.

5. Check if the OCNRF database already exists. If the database does not exists, create databases for OCNRF network function:
Execute the following command to check if database exists:

```
$ show databases;
```

In case database already exists, then move to next step. Else, perform the following steps.

For OCNRF application, two types of databases are required:

a. OCNRF application database: This database consists of tables used by application to perform functionality of NRF network function.

b. OCNRF network database: This database consists of tables used by OCNRF to store per the network details like system details and database backups.

a. Create database for OCNRF application:

```
$ CREATE DATABASE IF NOT EXISTS <OCNRF Application Database>
CHARACTER SET utf8;
```

Example:

```
$ CREATE DATABASE IF NOT EXISTS nrfApplicationDB CHARACTER SET
utf8;
```

b. Create database for OCNRF network database:

```
$ CREATE DATABASE IF NOT EXISTS <OCNRF network database>
CHARACTER SET utf8;
```

Example:

```
$ CREATE DATABASE IF NOT EXISTS nrfNetworkDB CHARACTER SET utf8;
```

> **Note:**
>
> OCNRF application and network database must be created on any one of SQL node on any one of the OCNRF site.

c. Grant permission to users on the OCNRF database created:

> **Note:**
>
> This step must be executed on all the SQL nodes on all the OCNRF Geo-Redundant sites.

```
$ GRANT SELECT, INSERT, CREATE, ALTER, DROP, LOCK TABLES, CREATE
TEMPORARY TABLES, DELETE, UPDATE, EXECUTE ON <OCNRF Application
Database>.* TO '<OCNRF Privileged-User Name>'@'%';
```

Example:

```
$ GRANT SELECT, INSERT, CREATE, ALTER, DROP, LOCK TABLES, CREATE
TEMPORARY TABLES, DELETE, UPDATE, EXECUTE ON nrfApplicationDB.*
TO 'nrfPrivilegedUsr'@'%';
```

d. Grant permission to OCNRF privileged user on OCNRF network database:

```
$ GRANT SELECT, INSERT, CREATE, ALTER, DROP, LOCK TABLES, CREATE
TEMPORARY TABLES, DELETE, UPDATE, EXECUTE ON <OCNRF network
database>.* TO '<OCNRF Privileged-User Name>'@'%';
```

Example:

```
$ GRANT SELECT, INSERT, CREATE, ALTER, DROP, LOCK TABLES, CREATE
TEMPORARY TABLES, DELETE, UPDATE, EXECUTE ON nrfNetworkDB.* TO
'nrfPrivilegedUsr'@'%';
```

e. Grant permission to OCNRF application user on OCNRF application database:

```
$ GRANT SELECT, INSERT, LOCK TABLES, DELETE, UPDATE, EXECUTE
ON <OCNRF Application Database>.* TO '<OCNRF APPLICATION User
Name>'@'%';
```

Example:

```
$ GRANT SELECT, INSERT, LOCK TABLES, DELETE, UPDATE, EXECUTE ON
nrfApplicationDB.* TO 'nrfApplicationUsr'@'%';
```

f. Grant read permission to OCNRF application user for replication_info:

```
$ GRANT SELECT ON replication_info.* TO '<OCNRF APPLICATION User
Name>'@'%';
```

Example:

```
$ GRANT SELECT ON replication_info.* TO 'nrfApplicationusr'@'%';
```

g. Apply the grants using following command:

```
FLUSH PRIVILEGES;
```

6. Execute the command, `show grants for <username>`, to confirm that users has all of the required permissions
7. Exit from database and logout from MYSQL nodes.

Procedure for standalone OCNRF site

1. Login to the machine where ssh keys are stored and which has permission to access the SQL nodes of NDB cluster.
2. Connect to the SQL nodes.
3. Login to the MySQL prompt using root permission or user, which has permission to create users with conditions as mentioned below. For example: `mysql -h 127.0.0.1 -uroot -p`

> **Note:**
>
> This command may vary from system to system, path for mysql binary, root user and root password. After executing this command, user need to enter the password specific to the user mentioned in the command.

4. Check if OCNRF network function user already exists. If the user does not exists, create an OCNRF network function user.
   Below steps covers the creation of two types of OCNRF users. Different users has different set of permissions.
   a. OCNRF privileged user: This user has complete set of permissions. This user can perform create, alter, drop operations on tables to perform install/upgrade/ rollback or delete operations.
   b. OCNRF application user: This user has less set of permissions and will be used by OCNRF application during service operations handling. This user can insert, update, get, remove the records. This user can't create, alter and drop the database as wells as tables.

```
$ SELECT User FROM mysql.user;
```

In case, user already exists, move to next step. Else, create new following OCNRF user:

- Create new OCNRF application user:

  ```
  $ CREATE USER '<OCNRF APPLICATION User Name>'@'%' IDENTIFIED BY
  '<OCNRF APPLICATION Password>';
  ```

  Example:

  ```
  $ CREATE USER 'nrfApplicationUsr'@'%' IDENTIFIED BY
  'nrfApplicationPasswd'
  ```

- Create new OCNRF privileged user:

  ```
  $ CREATE USER '<OCNRF Privileged-User Name>'@'%' IDENTIFIED BY
  '<OCNRF Privileged-User Password>';
  ```

  Example:

  ```
  $ CREATE USER 'nrfPrivilegedUsr'@'%' IDENTIFIED BY
  'nrfPrivilegedPasswd'
  ```

> **Note:**
>
> Both users must be created on all the SQL Nodes for all the sites.

5. Check if OCNRF network function databases already exists. If not exists, create databases for OCNRF network function:
   Execute the following command to check if database exists:

   ```
   $ show databases;
   ```

   Check if required database is already in list. In case the database already exists, then move to next step. Else, perform the following steps.

   For OCNRF application, two types of databases are required:

   a. OCNRF application database: This database consists of tables used by application to perform functionality of NRF network function.
   b. OCNRF network database: This database consists of tables used by OCNRF to store per OCNRF network details like system details and database backups.

   a. Create database for OCNRF application:

      ```
      $ CREATE DATABASE IF NOT EXISTS <OCNRF Application Database>
      CHARACTER SET utf8;
      ```

      Example:

      ```
      $ CREATE DATABASE IF NOT EXISTS nrfApplicationDB CHARACTER SET
      utf8;
      ```

b. Create database for OCNRF network:

```
$ CREATE DATABASE IF NOT EXISTS <OCNRF network database>
CHARACTER SET utf8;
```

Example:

```
$ CREATE DATABASE IF NOT EXISTS nrfNetworkDB CHARACTER SET utf8;
```

6. Grant permissions to users on the databases:

> **Note:**
>
> This step must be executed on all the SQL nodes on each OCNRF standalone site.

a. Grant permission to OCNRF privileged user on OCNRF application database:

```
$ GRANT SELECT, INSERT, CREATE, ALTER, DROP, LOCK TABLES, CREATE
TEMPORARY TABLES, DELETE, UPDATE, EXECUTE ON <OCNRF Application
Database>.* TO '<OCNRF Privileged-User Name>'@'%';
```

Example:

```
$ GRANT SELECT, INSERT, CREATE, ALTER, DROP, LOCK TABLES, CREATE
TEMPORARY TABLES, DELETE, UPDATE, EXECUTE ON nrfApplicationDB.*
TO 'nrfPrivilegedUsr'@'%';
```

b. Grant permission to OCNRF privileged user on OCNRF network database:

```
$ GRANT SELECT, INSERT, CREATE, ALTER, DROP, LOCK TABLES, CREATE
TEMPORARY TABLES, DELETE, UPDATE, EXECUTE ON <OCNRF network
database>.* TO '<OCNRF Privileged-User Name>'@'%';
```

Example:

```
$ GRANT SELECT, INSERT, CREATE, ALTER, DROP, LOCK TABLES, CREATE
TEMPORARY TABLES, DELETE, UPDATE, EXECUTE ON nrfNetworkDB.* TO
'nrfPrivilegedUsr'@'%';
```

c. Grant permission to OCNRF application user on OCNRF application database:

```
$ GRANT SELECT, INSERT, LOCK TABLES, DELETE, UPDATE, EXECUTE
ON <OCNRF Application Database>.* TO '<OCNRF APPLICATION User
Name>'@'%';
```

Example:

```
$ GRANT SELECT, INSERT, LOCK TABLES, DELETE, UPDATE, EXECUTE ON
nrfApplicationDB.* TO 'nrfApplicationUsr'@'%';
```

d. Grant read permission to OCNRF application user for replication_info:

```
$ GRANT SELECT ON replication_info.* TO '<OCNRF APPLICATION User
Name>'@'%';
```

Example:

```
$ GRANT SELECT ON replication_info.* TO 'nrfApplicationusr'@'%';
```

7. Apply the grants using following command:

```
FLUSH PRIVILEGES;
```

8. Exit from MySQL prompt and SQL nodes.

Configuring Kubernetes Secret for Accessing OCNRF Database

This section explains the steps to configure kubernetes secrets for accessing the OCNRF database created in the above section. This procedure must be executed before deploying OCNRF.

Kubernetes Secret Creation for OCNRF Privileged Database User

This section explains the steps to create kubernetes secrets for accessing OCNRF database and privileged user details created by database administrator in above section. This section must be execute before deploying OCNRF.

Create kubernetes secret for privileged user as follows:

1. Create kubernetes secret for MySQL:

```
$ kubectl create secret generic <privileged user secret name> --
from-literal=dbUsername=<OCNRF Privileged Mysql database username>
--from-literal=dbPassword=<OCNRF Privileged Mysql User database
passsword> --from-literal=appDbName=<OCNRF Mysql database name>
--from-literal=networkScopedDbName=<OCNRF Mysql Network database
name> -n <Namespace of OCNRF deployment>
```

> **Note:**
>
> Note down the command used during the creation of kubernetes secret, this command is used for updates in future.

Example:

```
$ kubectl create secret generic
privilegeduser-secret --from-literal=dbUsername=nrfPrivilegedUsr
```

```
--from-literal=dbPassword=nrfPrivilegedPasswd --
from-literal=appDbName=nrfApplicationDb --from-
literal=networkScopedDbName=nrfNetworkDB -n ocnrf
```

2. Verify the secret created using above command:

```
$ kubectl describe secret <database secret name> -n <Namespace of
OCNRF deployment>
```

Example:

```
$ kubectl describe secret privilegeduser-secret -n ocnrf
```

Kubernetes Secret Update for OCNRF Privileged Database User

This section describes the steps to update the secrets. Update Kubernetes secret for privileged user as follows:

1. Copy the exact command used in Kubernetes Secret Creation for OCNRF Privileged Database User section during creation of secret:

```
$ kubectl create secret generic <privileged user secret
name> --from-literal=dbUsername=<OCNRF Privileged Mysql database
username> --from-literal=dbPassword=<OCNRF Privileged Mysql
database password> --from-literal=appDbName=<OCNRF Mysql database
name> --from-literal=networkScopedDbName=<OCNRF Mysql Network
database name> -n <Namespace of OCNRF deployment>
```

2. Update the same command with string "--dry-run -o yaml" and "kubectl replace -f - -n <Namespace of MYSQL secret>". After update, the command will be as follows:

```
$ kubectl create secret generic <privileged user secret
name> --from-literal=dbUsername=<OCNRF Privileged Mysql database
username> --from-literal=dbPassword=<OCNRF Privileged Mysql
database password> --from-literal=appDbName=<OCNRF Mysql database
name> --from-literal=networkScopedDbName=<OCNRF Mysql Network
database name> --dry-run -o yaml -n <Namespace of OCNRF deployment>
| kubectl replace -f - -n <Namespace of OCNRF deployment>
```

3. Execute the updated command. The following message is displayed:

```
secret/<database secret name> replaced
```

Kubernetes Secret Creation for OCNRF Application Database User

This section explains the steps to create secrets for accessing and configuring application database user created in above section. This section must be execute before deploying OCNRF.

Create kubernetes secret for OCNRF application database user for configuring records is as follows:

1. Create kubernetes secret for OCNRF application database user:

```
$ kubectl create secret generic <appuser-secret name> --
from-literal=dbUsername=<OCNRF APPLICATION User Name> --from-
literal=dbPassword=<Password for OCNRF APPLICATION User> --from-
literal=appDbName=<OCNRF Application Database> -n <Namespace of
OCNRF deployment>
```

> **Note:**
>
> Note down the command used during the creation of kubernetes secret, this command will be used for updates in future.

Example:

```
$ kubectl create secret generic
appuser-secret --from-literal=dbUsername=nrfApplicationUsr
--from-literal=dbPassword=nrfApplicationPasswd --from-
literal=appDbName=nrfApplicationDB -n ocnrf
```

2. Verify the secret creation:

```
$ kubectl describe secret <appuser-secret name> -n <Namespace of
OCNRF deployment>
```

Example:

```
$ kubectl describe secret appuser-secret -n ocnrf
```

Kubernetes Secret Update for OCNRF Application Database User

This section explains how to update the kubernetes secret.

1. Copy the exact command used in above section during creation of secret:

```
$ kubectl create secret generic <appuser-secret name> --
from-literal=dbUsername=<OCNRF APPLICATION User Name> --from-
literal=dbPassword=<Password for OCNRF APPLICATION User> --from-
literal=appDbName=<OCNRF Application Database> -n <Namespace of
OCNRF deployment>
```

2. Update the same command with string "--dry-run -o yaml" and "kubectl replace -f - -n <Namespace of MYSQL secret>". After update, the command will be as follows:

```
$ kubectl create secret generic <database secret name>
--from-literal=dbUsername=<OCNRF APPLICATION User Name> --from-
literal=dbPassword=<Password for OCNRF APPLICATION User> --from-
literal=appDbName=<OCNRF Application Database> --dry-run -o yaml
-n <Namespace of OCNRF deployment> | kubectl replace -f - -n
<Namespace of OCNRF deployment>
```

3. Execute the updated command. The following message is displayed:

```
secret/<database secret name> replaced
```

Configuring secrets for enabling HTTPS

Creation of secrets for enabling HTTPS in OCNRF Ingress gateway

This section explains the steps to configure secrets for enabling HTTPS in ingress and egress gateways. This section must be executed before enabling HTTPS in OCNRF Ingress/Egress gateway.

> **Note:**
>
> The passwords for TrustStore and KeyStore are stored in respective password files mentioned below.

To create kubernetes secret for HTTPS, following files are required:

- ECDSA private key and CA signed certificate of OCNRF (if initialAlgorithm is ES256)
- RSA private key and CA signed certificate of OCNRF (if initialAlgorithm is RS256)
- TrustStore password file
- KeyStore password file

> **Note:**
>
> Creation process for private keys, certificates and passwords is on discretion of user/operator.

1. Execute the following command to create secret:

```
$ kubectl create secret generic
<ocingress-secret-name> --from-file=<ssl_ecdsa_private_key.pem>
--from-file=<rsa_private_key_pkcs1.pem> --from-
file=<ssl_truststore.txt> --from-file=<ssl_keystore.txt> --from-
file=<caroot.cer> --from-file=<ssl_rsa_certificate.crt> --from-
file=<ssl_ecdsa_certificate.crt> -n <Namespace of OCNRF deployment>
```

> **Note:**
>
> Note down the command used during the creation of kubernetes secret, this command will be used for updates in future.

Example: The names used below are same as provided in custom_values.yaml in OCNRF deployment.

```
$ kubectl create secret generic
ocingress-secret --from-file=ssl_ecdsa_private_key.pem --from-
file=rsa_private_key_pkcs1.pem --from-file=ssl_truststore.txt
--from-file=ssl_keystore.txt --from-file=caroot.cer --from-
file=ssl_rsa_certificate.crt --from-file=ssl_ecdsa_certificate.crt -
n ocnrf
```

2. Verify the secret created using the following command:

```
$ kubectl describe secret <ocingress-secret-name> -n <Namespace of
OCNRF deployment>
```

Example:

```
$ kubectl describe secret ocingress-secret -n ocnrf
```

Update the secrets for enabling HTTPS in OCNRF Ingress gateway

This section explains how to update the secret with updated details.

1. Copy the exact command used in above section during creation of secret.
2. Update the same command with string "--dry-run -o yaml" and "kubectl replace -f - -n <Namespace of OCNRF deployment>".
3. Create secret command will look like:

```
$ kubectl create secret generic
<ocingress-secret-name> --from-file=<ssl_ecdsa_private_key.pem>
--from-file=<rsa_private_key_pkcs1.pem> --from-
file=<ssl_truststore.txt> --from-file=<ssl_keystore.txt> --from-
file=<caroot.cer> --from-file=<ssl_rsa_certificate.crt> --from-
file=<ssl_ecdsa_certificate.crt> --dry-run -o yaml -n <Namespace of
OCNRF deployment> | kubectl replace -f - -n <Namespace of OCNRF
deployment>
```

Example:-

The names used below are same as provided in custom_values.yaml in OCNRF deployment:

```
$ kubectl create secret generic
ocingress-secret --from-file=ssl_ecdsa_private_key.pem --from-
file=rsa_private_key_pkcs1.pem --from-file=ssl_truststore.txt
--from-file=ssl_keystore.txt --from-file=caroot.cer --from-
file=ssl_rsa_certificate.crt --from-file=ssl_ecdsa_certificate.crt
--dry-run -o yaml -n ocnrf | kubectl replace -f - -n ocnrf
```

4. Execute the updated command.

5. After successful secret update, the following message is displayed:

```
secret/<ocingress-secret> replaced
```

Creation of secrets for enabling HTTPS in OCNRF Egress gateway

This section explains the steps to create secret for HTTPS related details. This section must be executed before enabling HTTPS in OCNRF Egress gateway.

> **Note:**
>
> The passwords for TrustStore and KeyStore are stored in respective password files mentioned below.

To create kubernetes secret for HTTPS, following files are required:

- ECDSA private key and CA signed certificate of OCNRF (if initialAlgorithm is ES256)
- RSA private key and CA signed certificate of OCNRF (if initialAlgorithm is RS256)
- TrustStore password file
- KeyStore password file

> **Note:**
>
> Creation process for private keys, certificates and passwords is on discretion of user/operator.

1. Execute the following command to create secret.

```
$ kubectl create secret generic <ocegress-
secret-name> --from-file=<ssl_ecdsa_private_key.pem>  --from-
file=<ssl_rsa_private_key.pem> --from-file=<ssl_truststore.txt>
--from-file=<ssl_keystore.txt> --from-file=<ssl_cabundle.crt>
--from-file=<ssl_rsa_certificate.crt> --from-
file=<ssl_ecdsa_certificate.crt> -n <Namespace of OCNRF deployment>
```

> **Note:**
>
> Note down the command used during the creation of kubernetes secret, this command will be used for updates in future.

Example: The names used below are same as provided in custom_values.yaml in OCNRF deployment.

```
$ kubectl create secret generic ocegress-secret --from-
file=ssl_ecdsa_private_key.pem --from-file=ssl_rsa_private_key.pem
--from-file=ssl_truststore.txt --from-file=ssl_keystore.txt --from-
```

```
file=ssl_cabundle.crt --from-file=ssl_rsa_certificate.crt --from-
file=ssl_ecdsa_certificate.crt -n ocnrf
```

2. Command to verify secret created:

```
$ kubectl describe secret <ocegress-secret-name> -n <Namespace of
OCNRF deployment>
```

Example:

```
$ kubectl describe secret ocegress-secret -n ocnrf
```

Update the secrets for enabling HTTPS in OCNRF Egress gateway

This section explains how to update the secret with updated details.

1. Copy the exact command used in above section during creation of secret:
2. Update the same command with string "--dry-run -o yaml" and "kubectl replace -f - -n <Namespace of OCNRF deployment>".
3. Create secret command will look like:

```
kubectl create secret generic <ocegress-
secret-name> --from-file=<ssl_ecdsa_private_key.pem> --from-
file=<ssl_rsa_private_key.pem> --from-file=<ssl_truststore.txt>
--from-file=<ssl_keystore.txt> --from-file=<ssl_cabundle.crt>
--from-file=<ssl_rsa_certificate.crt> --from-
file=<ssl_ecdsa_certificate.crt> --dry-run -o yaml -n <Namespace of
OCNRF Egress Gateway secret> | kubectl replace -f - -n <Namespace
of OCNRF deployment>
```

Example:

The names used below are same as provided in custom_values.yaml in OCNRF deployment:

```
$ kubectl create secret generic
egress-secret --from-file=ssl_ecdsa_private_key.pem --from-
file=rsa_private_key_pkcs1.pem --from-file=ssl_truststore.txt
--from-file=ssl_keystore.txt --from-file=caroot.cer --from-
file=ssl_rsa_certificate.crt --from-file=ssl_ecdsa_certificate.crt
--dry-run -o yaml -n ocnrf | kubectl replace -f - -n ocnrf
```

4. Execute the updated command.
5. After successful secret update, the following message is displayed:

```
secret/<ocegress-secret> replaced
```

Configuring Secret for Enabling AccessToken Service

Access Token secret creation

This section explains the steps to create secret for AccessToken service of OCNRF. This section must be executed before enabling Access Token in OCNRF.

> **Note:**
>
> The password for KeyStore is stored in respective password file mentioned below.

To create kubernetes secret for AccessToken, following files are required:

- ECDSA private key and CA signed certificate of OCNRF (if initialAlgorithm is ES256)
- RSA private key and CA signed certificate of OCNRF (if initialAlgorithm is RS256)
- KeyStore password file: This file contains a password which is used to protect the PrivateKeys/Certificates that will get loaded into the application in-memory (KeyStore).
  For example:`echo qwerpoiu > keystore_password.txt`

  where `qwerpoiu` is the password and `keystore_password.txt` is the target file which is provided as input to the AccessToken secret.

> **Note:**
>
> Creation process for private keys, certificates and passwords is on discretion of user/operator.

1. Execute the following command to create secret. The names used below are same as provided in custom values.yaml in OCNRF deployment:

   ```
   kubectl create secret generic <ocnrfaccesstoken-secret> --from-
   file=<ecdsa_private_key.pem> --from-file=<rsa_private_key.pem> --
   from-file=<keystore_password.txt> --from-file=<rsa_certificate.crt>
   --from-file=<ecdsa_certificate.crt> -n <Namespace of OCNRF
   deployment>
   ```

   > **Note:**
   >
   > Note down the command used during the creation of kubernetes secret, this command will be used for updates in future.

Example:

```
$ kubectl create secret generic ocnrfaccesstoken-secret --from-
file=ecdsa_private_key.pem --from-file=rsa_private_key.pem --from-
file=keystore_password.txt --from-file=rsa_certificate.crt --from-
file=ecdsa_certificate.crt -n ocnrf
```

2. Execute the following command to verify secret created:

```
$ kubectl describe secret <ocnrfaccesstoken-secret-name> -n
<Namespace of OCNRF deployment>
```

Example:

```
 $ kubectl describe secret ocnrfaccesstoken-secret -n ocnrf
```

Access Token secret update

This section explains how to update the access token secret with updated details.

1. Copy the exact command used in above section during creation of secret.
2. Update the same command with string "--dry-run -o yaml" and "kubectl replace -f - -n <Namespace of OCNRF deployment>".
3. Create secret command will look like:

```
kubectl create secret generic <ocnrfaccesstoken-secret> --from-
file=<ecdsa_private_key.pem> --from-file=<rsa_private_key.pem> --
from-file=<keystore_password.txt> --from-file=<rsa_certificate.crt>
--from-file=<ecdsa_certificate.crt> --dry-run -o yaml -n <Namespace
of OCNRF deployment> | kubectl replace -f - -n <Namespace of OCNRF
deployment>
```

Example:-

The names used below are same as provided in custom_values.yaml in OCNRF deployment:

```
$ kubectl create secret generic ocnrfaccesstoken-secret --from-
file=ecdsa_private_key.pem --from-file=rsa_private_key.pem --from-
file=keystore_password.txt --from-file=rsa_certificate.crt --from-
file=ecdsa_certificate.crt --dry-run -o yaml -n ocnrf | kubectl
replace -f - -n ocnrf
```

4. Execute the updated command.
5. After successful secret update, the following message is displayed:

```
secret/<ocnrfaccesstoken-secret> replaced
```

OCNRF Access Token Service Usage Details

OCNRF implements Nnrf_AccessToken service (used for OAuth2 authorization), along with the "Client Credentials" authorization grant. It exposes a "Token Endpoint" where the Access Token Request service can be requested by NF Service Consumers.

The Nnrf_AccessToken service operation is defined as follows:

- Access Token Request (i.e. Nnrf_AccessToken_Get)

> **Note:**
>
> This procedure is specific to OCNRF Access Token service operation. OCNRF general configurations, database and database specific secret creation are not part of this procedure.

Procedure to use OCNRF Access Token Service Operation

This procedure provides step by step details which are needed to use 3GPP defined Access Token Service Operation supported by OCNRF.

1. **Create OCNRF private key and public certificate**
   This step explains need to create the OCNRF private keys and public certificates. Private key are used by OCNRF NF to sign the Access Token generated. It shall be available only with OCNRF. Public certificates are used by producer NFs to validate the access token generated by OCNRF. So, public certificates shall be available with producer network functions. Two types of signing algorithms are supported by OCNRF. For both types different keys and certificates required to be generated:
   - ES256: ECDSA digital signature with SHA-256 hash algorithm
   - RS256: RSA digital signature with SHA-256 hash algorithm

   Any one/both of algorithm files can be generated depending upon usage of hash algorithms. One algorithm depending upon configuration at OCNRF will decide which key will used to sign the Access Token.

   > **Note:**
   >
   > Creation process for private keys, certificates and passwords is on discretion of user/operator.

   Sample keys and certificates:
   After execution of this step, there will be private keys and public certificates of OCNRF (generated files depends upon algorithms chosen by operator/user).

   For example:

   ES256 based keys and certificates:
   - ecdsa_private_key.pem
   - ecdsa_certificate.crt

RS256 based keys and certificates:

- rsa_private_key.pem
- rsa_certificate.crt

2. **Password to keep safely the generated keys and certificate inside OCNRF container**
   This step explains the create password that is used to keep safely the generated keys and certificate inside OCNRF container.

   Sample step to create:

   ```
   echo qwerpoiu > keystore_password.txt
   ```

   where, `qwerpoiu` is the password and `keystore_password.txt` is the target password file

   > **Note:**
   >
   > This file is provided in Kubernetes secret.

   After execution of this step, file will be available with password.

   For example: `keystore_password.txt`

3. **Name space creation for Secrets**
   This step explains the need for creating kubernetes namespace in which kubernetes secrets will be created for OCNRF private keys, OCNRF public certificate and keystore password. Refer to Creating OCNRF Namespace section.

   > **Note:**
   >
   > - Different namespaces or same namespace can be used for OCNRF private keys, OCNRF public certificate and keystore password.
   > - Namespace(s) shall have RBAC resources defined with required privileges.
   > - It can be same namespace as for OCNRF.
   > - Namespace will be available in which required secrets can be created in next steps

4. **Secret creation for OCNRF private keys, OCNRF public certificate and keystore password**
   This step explain commands to create the kubernetes secret(s) in which OCNRF private keys, OCNRF public certificate and keystore password can be kept safely. Refer to Configuring Kubernetes Secret for Accessing OCNRF Database section.

> **Note:**
>
> Single secret can be created for OCNRF private keys, OCNRF public certificate and keystore password. Sample command is provided in steps to create single secret. In case, there is need to create separate secret for each entity, then same command can be used.

5. **Configure OCNRF custom_values.yaml with outcome details of Steps 1 to 4**
   This step explains customize the OCNRF custom_values.yaml to use the OCNRF private keys, OCNRF public certificate, keystore password file, secrets, and secret namespace. Refer to Configuring Secret for Enabling AccessToken Service section.

   Key Attributes in OCNRF custom_values.yaml:

   - nfaccesstoken.oauth.nrfInstanceId - OCNRF's NF Instance ID that will be used for signing AccessTokenClaim.
   - nfaccesstoken.oauth.initialAlgorithm - Signing algorithm which will be used by Access Token microservice. This is default value.
   - NF Access Token OCNRF Private Key Details
     a. k8SecretName - K8 Secret Name for OCNRF Access Token Private key
     b. k8NameSpace - Namespace for OCNRF Access Token Private key Secret
     c. rsa.filename - Key File name which is OCNRF Access Token Private Key for RSA algorithm
     d. ecdsa.filename - Key File name which is OCNRF Access Token Private Key for ECDSA algorithm
   - NF Access Token OCNRF Public Certificate Details
     a. k8SecretName - K8 Secret Name for OCNRF Access Token Public Certificate
     b. k8NameSpace - Namespace for OCNRF Access Token Public Certificate Secret
     c. rsa.filename - Key File name which is OCNRF Access Token Public Certificate for RSA algorithm
     d. ecdsa.filename - Key File name which is OCNRF Access Token Public Certificate for ECDSA algorithm
   - NF Access Token Key Store Password Details
     a. k8SecretName - K8 Secret Name for OCNRF Access Token Key Store Password
     b. k8NameSpace - Namespace for OCNRF Access Token Key Store password Secret
     c. filename - KeyStore password file

Installation Tasks

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

Download OCNRF package

Following is the procedure to download the release package from MOS:

1. Login to MOS using the appropriate login credentials.
2. Select **Product & Updates** tab.
3. In **Patch Search** console, select **Product or Family (Advanced)** tab.
4. Enter *Oracle Communications Cloud Native Core - 5G* in **Product** field and select the product from the Product drop-down.
5. Select *Oracle Communications Cloud Native Core Network Repository Function <release_number>* in **Release** field.
6. Click **Search**. The **Patch Advanced Search Results** list appears.
7. Select the required patch from the list. The Patch Details window appears.
8. Click on **Download**. File Download window appears.
9. Click on the **<p********_<release_number>_Tekelec>.zip** file.
10. Extract the release package zip file to download the network function patch to the system where network function must be installed.

Configuring OCNRF to support ASM

OCNRF leverages the Istio or Envoy service mesh (Aspen Service Mesh) for all internal and external communication. The service mesh integration provides inter-NF communication and allows API gateway co-working with service mesh. The service mesh integration supports the services by deploying a special sidecar proxy in the environment to intercept all network communication between microservices.

Supported ASM version: 1.5.7-am3

For ASM installation and configuration, refer to Official Aspen Service Mesh website for details.

Pre-deployment configurations

This sections explains the pre-deployment configuration procedure to install OCNRF with ASM support.

Follow the procedure as mentioned below:

1. **Steps for creating OCNRF namespace**
   a. Verify required namespace already exists in system:

      ```
      $ kubectl get namespaces
      ```

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

      ```
      $ kubectl create namespace <ocnrf namespace>
      ```

Example:

```
$ kubectl create namespace ocnrf
```

2. **Steps to set the connectivity to database (DB) service**
   a. **For VM based DB deployment**
      i. Create a Headless service for DB connectivity in OCNRF namespace:

```
$ kubectl apply -f db-connectivity.yaml
```

Sample *db-connectivity.yaml* file:

```
# db-connectivity.yaml
apiVersion: v1
kind: Endpoints
metadata:
  name: ocnrf-db-connectivity-service-headless
  namespace: <db-namespace>
subsets:
- addresses:
  - ip: <10.75.203.49> # IP Endpoint of DB service.
  ports:
  - port: 3306
    protocol: TCP
---
apiVersion: v1
kind: Service
metadata:
  name: ocnrf-db-connectivity-service-headless
  namespace: <db-namespace>
spec:
  clusterIP: None
  ports:
  - port: 3306
    protocol: TCP
    targetPort: 3306
  sessionAffinity: None
  type: ClusterIP
---
apiVersion: v1
kind: Service
metadata:
  name: ocnrf-db-connectivity-service
  namespace: <ocnrf-namespace>
spec:
  externalName: ocnrf-db-connectivity-service-headless.<db-
namespace>.svc.<domain>
  sessionAffinity: None
  type: ExternalName
```

ii. Create ServiceEntry and DestinationRule for DB connectivity service:

```
$ kubectl apply -f db-se-dr.yaml
```

Sample *db-se-dr.yaml* file:

```
apiVersion: networking.istio.io/v1alpha3
kind: ServiceEntry
metadata:
  name: ocnrf-db-external-se
  namespace: <ocnrf-namespace>
spec:
  exportTo:
  - "."
  hosts:
  - ocnrf-db-connectivity-service-headless.<db-
namespace>.svc.<domain>
  ports:
  - number: 3306
    name: mysql
    protocol: MySQL
  location: MESH_EXTERNAL
  resolution: NONE
---
apiVersion: networking.istio.io/v1alpha3
kind: DestinationRule
metadata:
  name: ocnrf-db-external-dr
  namespace: <ocnrf-namespace>
spec:
  exportTo:
  - "."
  host: ocnrf-db-connectivity-service-headless.<db-
namespace>.svc.<domain>
  trafficPolicy:
    tls:
      mode: DISABLE
```

b. **For KubeVirt based DB deployment**

i. DB connectivity headless service is not required for KubeVirt based deployment as DB service may be exposed as K8S service. OCNRF can use K8S service FQDN to connect to DB service.
Create a DestinationRule with DB FQDN to disable mTLS:

```
$ kubectl apply -f db-dr.yaml
```

Sample *db-dr.yaml* file:

```
apiVersion: networking.istio.io/v1alpha3
kind: DestinationRule
metadata:
  name: ocnrf-db-service-dr
  namespace: <ocnrf-namespace>
```

```
spec:
  exportTo:
  - "."
  host: <db-service-fqdn>.<db-namespace>.svc.<domain>
  trafficPolicy:
    tls:
      mode: DISABLE
```

3. **Configure access to Kubernetes API service**
   Create a service entry in pod networking so that pods can access kubernetes api-server:

   ```
   $ kubectl apply -f kube-api-se.yaml
   ```

   Sample *kube-api-se.yaml* file:

   ```
   # kube-api-se.yaml
   apiVersion: networking.istio.io/v1alpha3
   kind: ServiceEntry
   metadata:
     name: kube-api-server
     namespace: <ocnrf-namespace>
   spec:
     hosts:
     - kubernetes.default.svc.<domain>
     exportTo:
     - "."
     addresses:
     - <10.96.0.1> # cluster IP of kubernetes api server
     location: MESH_INTERNAL
     ports:
     - number: 443
       name: https
       protocol: HTTPS
     resolution: NONE
   ```

Deploying OCNRF with ASM

1. **Namespace label for auto sidecar injection**
   Create namespace label for auto sidecar injection to automatically add the sidecars in all of the pods spawned in OCNRF namespace:

   ```
   $ kubectl label ns <ocnrf-namespace> istio-injection=enabled
   ```

2. **Creating Service Account, Role and Role bindings**
   Create a Service Account for OCNRF and a role with appropriate security policies for sidecar proxies to work refer to sample *sa-role-rolebinding.yaml* file:

   ```
   $ kubectl apply -f sa-role-rolebinding.yaml
   ```

Sample *sa-role-rolebinding.yaml* file:

```
apiVersion: v1
kind: ServiceAccount
metadata:
  name: "ocnrf-service-account"
  namespace: "ocnrf"
  labels:
    app.kubernetes.io/component: internal
  annotations:
    sidecar.istio.io/inject: "false"
    "certificate.aspenmesh.io/customFields": '{ "SAN": { "DNS":
[ "ocnrf.3gpp.oracle.com" ] } }'
---

apiVersion: rbac.authorization.k8s.io/v1
kind: Role
metadata:
  name: "ocnrf-role"
  namespace: "ocnrf"
  labels:
    app.kubernetes.io/component: internal
  annotations:
    sidecar.istio.io/inject: "false"
rules:
- apiGroups:
  - "" # "" indicates the core API group
  resources:
  - services
  - configmaps
  - pods
  - secrets
  - endpoints
  verbs:
  - get
  - watch
  - list
---

apiVersion: rbac.authorization.k8s.io/v1
kind: RoleBinding
metadata:
  name: "ocnrf-rolebinding"
  namespace: "ocnrf"
  labels:
    app.kubernetes.io/component: internal
  annotations:
    sidecar.istio.io/inject: "false"
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: Role
  name: "ocnrf-role"
subjects:
- kind: ServiceAccount
```

```
name: "ocnrf-service-account"
namespace: "ocnrf"
```

3. **Update ocnrf-custom-values-1.8.0.yaml for the required annotations**
   Update custom values with following annotations:

   a. Update global section for following attributes:

   ```
   global:
     customExtension:
       allResources:
          labels: {}
          annotations: {}
       lbDeployments:
         annotations:
           oracle.com/cnc: "true"
       nonlbDeployments:
         annotations:
           oracle.com/cnc: "true"
   ```

   b. Update service account name with value configured OCNRF service account:

   ```
   serviceAccountName: <"ocnrf-release-1-8-0-ocnrf-serviceaccount">
   ```

   c. Update MySQL primary database host with value depending upon DB service configuration done in above section:

   ```
   mysql:
        primary:
          # Primary DB Connection Service IP or Hostname
          host: "ocnrf-db-connectivity-service"
   ```

   d. Update global ingress-gateway section for below attributes:
   In case of NF authentication using TLS certificate feature, update 'enabled' attribute to `true`.

   ```
     xfccHeaderValidation:
       extract:
         enabled: false
   ```

   e. Update ingress-gateway section for below attributes:
   Enable Service Mesh Flag in ingress-gateway:

   ```
   ingress-gateway:
     # Mandatory: This flag needs to set it "true" if Service Mesh
   would be present where OCNRF will be deployed
     serviceMeshCheck: true
   ```

   Change Ingress-Gateway Service Type to ClusterIP:

   ```
   global:
       # Service Type
       type: ClusterIP
   ```

f. Update NRF configuration microservice section for below attributes:

```
nrfconfiguration:
  service:
    # Service Type
    type: ClusterIP
```

g. Update NF access token microservice section for below attributes:

```
nfaccesstoken:
  deployment:
    customExtension:
      labels: {}
      annotations:
        traffic.sidecar.istio.io/excludeOutboundIPRanges:
<Kubernetes API Server IP Address in CIDR format>
```

4. **Install OCNRF using updated ocnrf-custom-values-1.8.0.yaml. Refer OCNRF installation section for details.**
   Sample output for pods:

```
NAME                                     READY   STATUS   RESTARTS
AGE
ocnrf-appinfo-69c54fff6c-59wsm            2/2   Running    0
2d13h
ocnrf-egressgateway-79448858b5-dqsbp      2/2   Running    0
2d13h
ocnrf-ingressgateway-5bb8784498-slvvd     2/2   Running    0
2d13h
ocnrf-nfaccesstoken-77bb954fc7-448t4      3/3   Running    0
2d13h
ocnrf-nfdiscovery-5df8755ff4-grtnn        2/2   Running    0
2d13h
ocnrf-nfregistration-7895d8799c-z6rpf     2/2   Running    0
2d13h
ocnrf-nfsubscription-69769fd586-dgjfp     2/2   Running    0
2d13h
ocnrf-nrfauditor-56487f956b-gqrrp         2/2   Running    0
2d13h
ocnrf-nrfconfiguration-6c6c9d466b-ptxqm   2/2   Running    0
2d13h
```

Post-deployment configuration

This section explains the post-deployment configurations to install OCNRF with support for ASM.

1. **Enable Inter-NF communication**
   For every new NF participating in call flows when OCNRF is client, DestinationRule and ServiceEntry needs to be created in OCNRF namespace to enable communication.

   Following are the inter-NF communication with OCNRF:

   - OCNRF to SLF/UDR communication

- OCNRF to other NRF communication (Forwarding)
- OCNRF to different NFs Notification Servers

```
$ kubectl apply -f new-nf-se-dr.yaml
```

Sample *new-nf-se-dr.yaml* file:

```
apiVersion: networking.istio.io/v1alpha3
kind: DestinationRule
metadata:
  name: <unique DR name for NR>
  namespace: <ocnrf-namespace>
spec:
  exportTo:
  - .
  host: <NF-public-FQDN>
  trafficPolicy:
    tls:
      mode: MUTUAL
      clientCertificate: /etc/certs/cert-chain.pem
      privateKey: /etc/certs/key.pem
      caCertificates: /etc/certs/root-cert.pem
---
apiVersion: networking.istio.io/v1alpha3
kind: ServiceEntry
metadata:
  name: <unique SE name for NR>
  namespace: <ocnrf-namespace>
spec:
  exportTo:
  - .
  hosts:
  - <NF-public-FQDN>
  ports:
  - number: <NF-public-port>
    name: http2
    protocol: HTTP2
  location: MESH_EXTERNAL
  resolution: NONE
```

Sample example resource is provided for UDR/SLF service below:

```
apiVersion: networking.istio.io/v1alpha3
kind: DestinationRule
metadata:
  name: udr1-dr
  namespace: <ocnrf-namespace>
spec:
  exportTo:
  - .
  host: s24e65f98-bay190-rack38-udr-11.oracle-ocudr.cnc.us-
east.oracle.com
  trafficPolicy:
```

```
    tls:
      mode: MUTUAL
      clientCertificate: /etc/certs/cert-chain.pem
      privateKey: /etc/certs/key.pem
      caCertificates: /etc/certs/root-cert.pem
---
apiVersion: networking.istio.io/v1alpha3
kind: ServiceEntry
metadata:
  name: udr-se
  namespace: <ocnrf-namespace>
spec:
  exportTo:
  - .
  hosts:
  - "s24e65f98-bay190-rack38-udr-11.oracle-ocudr.cnc.us-
east.oracle.com"
  ports:
  - number: 16016
    name: http2
    protocol: HTTP2
  location: MESH_EXTERNAL
  resolution: NONE
```

> **Note:**
>
> Above procedure need to be executed for all of forwarding NRFs and SLF/UDR.

For each Network Function Notification URI(s) which NFs sends to OCNRF during subscription creation which are not part of Service Mesh Registry, DestinationRule and ServiceEntry needs to be created in OCNRF namespace to enable communication.

```
$ kubectl apply -f notification-uri-se-dr.yaml
```

Example:

```
apiVersion: networking.istio.io/v1alpha3
kind: DestinationRule
metadata:
  name: ocpcf-callback-dr
  namespace: <ocnrf-namespace>
spec:
  exportTo:
  - .
  host: ocpcf-notifications-processor-03.oracle-ocpcf.cnc.us-
east.oracle.com
  trafficPolicy:
    tls:
      mode: MUTUAL
      clientCertificate: /etc/certs/cert-chain.pem
```

```
      privateKey: /etc/certs/key.pem
      caCertificates: /etc/certs/root-cert.pem
---
apiVersion: networking.istio.io/v1alpha3
kind: ServiceEntry
metadata:
  name: ocpcf-callback-se
  namespace: <ocnrf-namespace>
spec:
  exportTo:
  - .
  hosts:
  - "ocpcf-notifications-processor-03.oracle-ocpcf.cnc.us-
east.oracle.com"
  ports:
  - number: 16016
    name: http2
    protocol: HTTP2
  location: MESH_EXTERNAL
  resolution: NONE
```

2. **OSO deployment**
   No additional steps are required. Refer to *OSO Installation Guide* for more information.

> **Note:**
>
> If OSO is deployed in same namesapce as OCNRF, make sure all deployments of OSO has the following annotations to skip sidecar injection as OSO currently does not support ASM sidecar proxy.
>
> ```
> sidecar.istio.io/inject: "\"false\""
> ```

OCNRF Installation

This section describes how to install OCNRF on the cloud native environment.

1. Unzip the release package file to the system where you want to install the network function. You can find the OCNRF package as follows:
   `ReleaseName-pkg-Releasenumber.tgz`

   where:
   ReleaseName is a name which is used to track this installation instance.

   Releasenumber is the release number.

   For example, ocnrf-pkg-1.8.0.0.0.tgz
2. Untar the OCNRF package file to get OCNRF docker image tar file:

   ```
   tar -xvzf ReleaseName-pkg-Releasenumber.tgz
   ```

3. Load the *ocnrf-images-<release_number>.tar* file into the Docker system:

   ```
   docker load --input /IMAGE_PATH/ocnrf-images-<release_number>.tar
   ```

4. Verify that the image is loaded correctly by entering this command:

   ```
   docker images
   ```

5. Execute the following commands to push the docker images to docker registry:

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


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

6. Untar the helm files:

   ```
   tar -xvzf ocnrf-<release_number>.tgz
   ```

7. Create the customize ocnrf-custom-values-1.8.0.yaml file with the required input parameters. To customize the file, refer to Customizing OCNRF chapter.
8. Go to the extracted OCNRF package as explained in:

   ```
   cd ocnrf-<release_number>
   ```

9. Install OCNRF by executing the following command:
   a. In case of helm2, execute the following command:

      ```
      helm install ocnrf/ --name <helm-release> --namespace <k8s
      namespace> -f <ocnrf_customized_values.yaml>
      ```

      Example: `helm install ocnrf/ --name ocnrf --namespace ocnrf -f ocnrf-custom-values-1.8.0.yaml`

   b. In case of helm3, execute the following command:

      ```
      helm3 install -name <helm-release-name> <charts> --namespace
      <namespace-name> -f <custom-values.yaml-filename>
      ```

> **Caution:**
>
> This command will appear hung for a while. Because from OCNRF 1.8.0 release onwards, Kubernetes jobs will get execute by Install/Upgrade/ Rollback helm hooks. Helm Deployment will be shown as DONE after all the applicable hooks are executed.
> timeout duration (optional): If not specified, default value will be 300 (300 seconds) in Helm2 and 5m (5 minutes) in Helm3. Specifies the time to wait for any individual kubernetes operation (like Jobs for hooks). Default value is 5m0s. If the helm install command fails at any point to create a kubernetes object, it will internally call the purge to delete after timeout value (default: 300s). Here timeout value is not for overall install, but it is for automatic purge on installation failure.

To verify the deployment status, open a new terminal and execute the following command:

Command: `$ watch kubectl get pods -n <k8s namespace>`

The pod status gets updated on a regular interval. When helm install command exits with the status, you may stop watching the status of kubernetes pods.

> **Note:**
>
> In case helm purge do not clean the deployment and kubernetes objects completely then follow Cleaning OCNRF deployment section.

10. Execute the following command to check the status:
    a. For helm2:
       `helm status <helm-release>`

       For example: `helm status ocnrf`
    b. For helm3:

       ```
       helm3 status <helm-release>  -n <helm-release>
       ```

       Example: `helm3 status ocnrf -n ocnrf`
11. Execute the following command to check status of the services:
    `kubectl -n <k8s namespace> get services`

    For example:
    `kubectl -n ocnrf get services`

    Note: If `external load balancer` is used, `EXTERNAL-IP` is assigned to `<helm release name>-ingressgateway.ocnrf` is the release name. `ocnrf` is the helm release name.

```
NAME                    TYPE          CLUSTER-IP     EXTERNAL-IP
PORT(S)            AGE
ocnrf-egressgateway    ClusterIP     10.233.1.61    <none>
8080/TCP,5701/TCP  30h
```

```
ocnrf-ingressgateway   LoadBalancer  10.233.52.194  <pending>
80:31776/TCP       30h
ocnrf-nfaccesstoken    ClusterIP     10.233.53.115  <none>
8080/TCP           30h
ocnrf-nfdiscovery      ClusterIP     10.233.21.28   <none>
8080/TCP           30h
ocnrf-nfregistration   ClusterIP     10.233.4.140   <none>
8080/TCP           30h
ocnrf-nfsubscription   ClusterIP     10.233.44.98   <none>
8080/TCP           30h
ocnrf-nrfauditor       ClusterIP     10.233.1.71    <none>
8080/TCP           30h
ocnrf-nrfconfiguration LoadBalancer  10.233.40.230  <pending>
8080:30076/TCP     30h
ocnrf-ocnrf-app-info   ClusterIP     10.104.113.86  <none>
5906/TCP           30h
```

12. Execute the following command to check status of the pods:
    `kubectl get pods -n <k8s namespace>`

    Status column of all the pods should be 'Running'.

    Ready column of all the pods should be n/n, where n is number of containers in the pod.

    For example:

    ```
    kubectl get pods -n ocnrf
    ```

    ```
    NAME                                      READY   STATUS    RESTARTS
    AGE
    ocnrf-egressgateway-d6567bbdb-9jrsx       2/2     Running   0
    30h
    ocnrf-egressgateway-d6567bbdb-ntn2v       2/2     Running   0
    30h
    ocnrf-ingressgateway-754d645984-h9vzq     2/2     Running   0
    30h
    ocnrf-ingressgateway-754d645984-njz4w     2/2     Running   0
    30h
    ocnrf-nfaccesstoken-59fb96494c-k8w9p      2/2     Running   0
    30h
    ocnrf-nfaccesstoken-49fb96494c-k8w9q      2/2     Running   0
    30h
    ocnrf-nfdiscovery-84965d4fb9-rjxg2        1/1     Running   0
    30h
    ocnrf-nfdiscovery-94965d4fb9-rjxg3        1/1     Running   0
    30h
    ocnrf-nfregistration-64f4d8f5d5-6q92j     1/1     Running   0
    30h
    ocnrf-nfregistration-44f4d8f5d5-6q92i     1/1     Running   0
    30h
    ocnrf-nfsubscription-5b6db965b9-gcvpf     1/1     Running   0
    30h
    ocnrf-nfsubscription-4b6db965b9-gcvpe     1/1     Running   0
    30h
    ocnrf-nrfauditor-67b676dd87-xktbm         1/1     Running   0
    30h
    ```

```
ocnrf-nrfconfiguration-678fddc5f5-c5htj  1/1    Running  0
30h
ocnrf-appinfo-8b7879cdb-jds4r            1/1    Running  0
30h
```

3
Customizing OCNRF

This section includes information about OCNRF customization.

- OCNRF Configuration
- OCNRF Configurable Parameters

OCNRF Configuration

This section describes about the OCNRF customization.

The OCNRF deployment is customized by overriding the default values of various configurable parameters.

Follow the below steps to customize the `ocnrf-custom-values-1.8.0.yaml` file as per the required parameters:

1. Go to the Oracle Help Center (OHC) Web site.
2. Navigate to **Industries->Communications->Cloud Native Core->Release 2.3.0**.
3. Click the **NRF Custom Template** link to download the zip file.
4. Unzip the file to get ocnrf-custom-configTemplates-1.8.0.0.0 file that contains the ocnrf-custom-configTemplates-1.8.0.0.0. This file is used during installation.
   - `ocnrf-custom-values-1.8.0.yaml`: This file is used during installation.
   - `NrfDashboard-1.8.0.json`: This file is used by `grafana`.
   - `NrfAlertrules-1.8.0.yaml`: This file is used for `prometheus`.
   - `OCNRF-MIB-TC-1.8.0.mib`: This is considered as OCNRF top level mib file, where the Objects and their data types are defined.
   - `OCNRF-MIB-1.8.0.mib`: This file fetches the Objects from the top level mib file and based on the Alert notification, these objects can be selected for display.
   - `OCNRF-Configuration-OpenAPI-1.8.0.yaml`: This file is OPEN API specification for OCNRF configuration.
5. Customize the ocnrf-custom-values-1.8.0.yaml file.
6. Save the updated ocnrf-custom-values-1.8.0.yaml file in the helm chart directory.

> **Note:**
>
> Refer section OCNRF Configuration Parameters to know more about the configurable parameters.

OCNRF Images

Following are the OCNRF images:

Table 3-1 OCNRF Images

Services	Image	Tag
<helm-release-name>-nfregistration	ocnrf-nfregistration	1.8.0
<helm-release-name>-nfsubscription	ocnrf-nfsubscription	1.8.0
<helm-release-name>-nfdiscovery	ocnrf-nfdiscovery	1.8.0
<helm-release-name>-nrfauditor	ocnrf-nrfauditor	1.8.0
<helm-release-name>-nrfconfiguration	ocnrf-nrfconfiguration	1.8.0
<helm-release-name>-appinfo	ocnrf-appinfo	1.8.0
<helm-release-name>-nfaccesstoken	configurationinit	1.4.0
	configurationupdate	1.4.0
	ocnrf-nfaccesstoken	1.8.0
<helm-release-name>-egressgateway	configurationinit	1.4.0
	configurationupdate	1.4.0
	ocegress_gateway	1.8.1
<helm-release-name>-ingressgateway	configurationinit	1.4.0
	configurationupdate	1.4.0
	ocingress_gateway	1.8.1

Note:

IngressGateway, EgressGateway and NFAccessToken uses same configurationinit and configurationupdate docker images.

OCNRF Configuration Parameters

This section includes information about the configuration parameters of OCNRF.

OCNRF allows customization of parameters for the following services and related settings.

Mandatory Configurations

Following is the mandatory parameter, which must be configured before installing OCNRF:

- `nrfInstanceId`: NFInstanceID of OCNRF.

Global Parameters

Table 3-2 Global Parameters

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`mysql.primary.host`	Primary DB Connection Service IP or Hostname	mysql-connectivity-service.occne-infra	M	Primary DB Connection Service HostName or IP	OCNRF connects to Primary DB Connection Service if not available then it connects to Secondary DB Connection Service. For NDB Cluster, use Host/IP of the DB Connection Service.
`mysql.primary.port`	Primary DB Connection Service	3306	M	Primary DB Connection Service Port	Port that is used while connecting to Primary DB Connection Service.
`mysql.secondary.host`	Secondary DB Connection Service IP or Hostname		O	Secondary DB Connection Service HostName or IP	OCNRF connects to Secondary DB Connection Service only if the Primary DB Connection Service is unavailable. It again switch pack to Primary DB Connection Service one it is available. For NDB Cluster, use Host/IP of the Remote DB Connection Service (if available).
`mysql.secondary.port`	Secondary DB Connection Service Port		O	Secondary DB Connection Service Port	Port that is used while connecting to Secondary DB Connection Service.
`nrfInstanceId`	OCNRF's NF Instance ID		M		This is the NfInstanceId of OCNRF that will get deployed. Format of NfInstanceId: Universally Unique Identifier (UUID) version 4, as described in IETF RFC 4122 e.g.: 6faf1bbc-6e4a-4454-a507-a14ef8e1bc5c This ID is used to uniquely identify this OCNRF instance in a Geo-Redundant Deployment. Hence it is very important that the Instance ID MUST be unique across all OCNRF deployments.

Table 3-2 (Cont.) Global Parameters

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`dockerRegistry`	Registry for docker		M		Docker Registry's FQDN/ Port where OCNRF's docker images are available.
`database.nameSpace`	Namespace for database connection	ocnrf	M		The Namespace where the Kubernetes Secret is created which contains MYSQL details. **Note**: See database.name configuration for more details.
`database.name`	Secret name for OCNRF Application user used for APP-INFO	appuser-secret	M		The Kubernetes Secret which contains the Database name, Database User name and the Password for OCNRF Application user. **Note**: Refer OCNRF Pre-requisites section for the file format.
`database.appUserSecretName`	Secret name for OCNRF Application user	appuser-secret	M		The Kubernetes Secret which contains the Database name, Database User name and the Password for OCNRF Application user. **Note**: Refer OCNRF Pre-requisites section for the file format.
`database.privilegedUserSecretName`	Secret name for OCNRF Privileged user	privilegeduser-secret	M		The Kubernetes Secret which contains the Database name, Database User name and the Password for OCNRF Privileged user. **Note**: Refer OCNRF Pre-requisites section for the file format.
`hookJobResources.limits.cpu`	Maximum amount of CPU that **K8s** will allow the hook job resource to use	2	O		It is the maximum CPU resource allocated to hook job.

Table 3-2 (Cont.) Global Parameters

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`hookJobResources.limits.memory`	Maximum memory that **K8s** will allow the hook job resource to use	2Gi	O		It is the maximum Memory allocated to hook job.
`hookJobResources.requests.cpu`	The amount of CPU that the system will guarantee for the hook job resource, **and K8s** will use this value to decide on which node to place the pod	1	O		It is the maximum CPU resource for requests allocated to hook job.
`hookJobResources.requests.memory`	The memory that the system will guarantee for the hook job resource, **and K8s** will use this value to decide on which node to place the pod	1Gi	O		It is the maximum memory for requests allocated to hook job.
`serviceAccountName`	ServiceAccount which is having permission for get, watch and list operation for following kubernetes resources; services, configmaps, pods, secrets and endpoints		M		This SeviceAccount is used for: • fetching MYSQL DB Details from configured kubernetes secret • fetching OCNRF's Private Key, OCNRF's Certificate and CA Certificate from configured kubernetes secret • fetching OCNRF's Private and OCNRF's Public Keys for Digitally Signing AccessTokenClaims. • fetching Producer/ Consumer NF's Service/Endpoint details for routing messages from/to Egress/Ingress Gateways. Refer to prerequisites for command details.

Table 3-2 (Cont.) Global Parameters

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`customExtension.allResources.labels`	Custom Labels that needs to be added to all the OCNRF k8s resources		O		This can be used to add custom label(s) to all k8s resources that will be created by OCNRF helm chart.
`customExtension.allResources.annotations`	Custom Annotations that needs to be added to all the OCNRF k8s resources		O		This can be used to add custom annotation(s) to all k8s resources that will be created by OCNRF helm chart.
`customExtension.lbServices.labels`	Custom Labels that needs to be added to OCNRF Services that are considered as Load Balancer type		O		This can be used to add custom label(s) to all Load Balancer Type Services that will be created by OCNRF helm chart.
`customExtension.lbServices.annotations`	Custom Annotations that needs to be added to OCNRF Services that are considered as Load Balancer type		O		This can be used to add custom annotation(s) to all Load Balancer Type Services that will be created by OCNRF helm chart.
`customExtension.lbDeployments.labels`	Custom Labels that needs to be added to OCNRF Deployments that are associated to a Service which is of Load Balancer type		O		This can be used to add custom label(s) to all Deployments that will be created by OCNRF helm chart which are associated to a Service which if of Load Balancer Type.
`customExtension.lbDeployments.annotations`	Custom Annotations that needs to be added to OCNRF Deployments that are associated to a Service which is of Load Balancer type		O		This can be used to add custom annotation(s) to all Deployments that will be created by OCNRF helm chart which are associated to a Service which if of Load Balancer Type.

Table 3-2 (Cont.) Global Parameters

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`customExtension.nonlbServices.labels`	Custom Labels that needs to be added to OCNRF Services that are considered as not Load Balancer type		O		This can be used to add custom label(s) to all non-Load Balancer Type Services that will be created by OCNRF helm chart.
`customExtension.nonlbServices.annotations`	Custom Annotations that needs to be added to OCNRF Services that are considered as not Load Balancer type		O		This can be used to add custom annotation(s) to all non-Load Balancer Type Services that will be created by OCNRF helm chart.
`customExtension.nonlbDeployments.labels`	Custom Labels that needs to be added to OCNRF Deployments that are associated to a Service which is not of Load Balancer type		O		This can be used to add custom label(s) to all Deployments that will be created by OCNRF helm chart which are associated to a Service which if not of Load Balancer Type.
`customExtension.nonlbDeployments.annotations`	Custom Annotations that needs to be added to OCNRF Deployments that are associated to a Service which is not of Load Balancer type		O		This can be used to add custom annotation(s) to all Deployments that will be created by OCNRF helm chart which are associated to a Service which if not of Load Balancer Type.
`k8sResource.container.prefix`	Value that will be prefixed to all the container names of OCNRF.		O		This value will be used to prefix to all the container names of OCNRF.
`k8sResource.container.suffix`	Value that will be suffixed to all the container names of OCNRF.		O		This value will be used to suffix to all the container names of OCNRF.

Table 3-2 (Cont.) Global Parameters

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`xfccHeaderValidation.extract.enabled`	Attribute to enable/disable the XFCC Header validation at OCNRF Ingress Gateway level	false	C	true/false	This value will enable/ disable the XFCC header validation feature at OCNRF Ingress Gateway level. For more details about feature see OCNRF User's guide. Helm Upgrade will be required to enable the feature at existing OCNRF deployment.
`dayZeroConfiguration.hplmnList`	Value of PLMN supported by OCNRF. This value can be configured via Rest based too. But providing option in helm to configure mandatory attributes during installation itself.		M		Value of PLMN supported by OCNRF
`dayZeroConfiguration.hplmnList`	Value of PLMN supported by OCNRF. This value can be configured via Rest based too. But providing option in helm to configure mandatory attributes during installation itself.		M		Value of PLMN supported by OCNRF

Table 3-2 (Cont.) Global Parameters

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`dayZeroConfiguration.endpoint`	Value of OCNRF endpoint. This value can be configured via Rest based too. But providing option in helm to configure mandatory attributes during installation itself.	ocnrf-ingress gateway.ocnrf.svc.cluster.local	M	Service Name for OCNRF ingress gateway	# OCNRF END Point Name and Port. This value is used in UriList of NfListRetrival Service Operation response. # The endpoint needs to be OCNRF's External Routable FQDN (e.g. ocnrf.oracle.com) # OR External Routable IpAddress (e.g. 10.75.212.60) # OR for routing with in the same K8 cluster use full NRF API-Gateway's Service FQDN as below format # <helm-release-name>-endpoint.<namespace>.svc.<cluster-domain-name> # e.g ocnrf-endpoint.nrf-1.svc.cluster.local # where # "ocnrf": is the helm release name (deployment name that will be used during "helm install") # "nrf-1": is the namespace in which NRF will be deployed # "cluster.local": is the K8's dnsDomain name # (dnsDomain can be found using "kubectl -n kube-system get configmap kubeadm-config -o yaml | grep -i dnsDomain")
`dayZeroConfiguration.endpointPort`	Value of OCNRF endpoint Port. This value can be configured via Rest based too. But providing option in helm to configure mandatory attributes during installation itself.	80	M	Port for OCNRF ingress gateway	This parameter will be used as OCNRF end point port.

Table 3-2 (Cont.) Global Parameters

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`dayZeroConfiguration.oauthTokenAlgorithm`	Initial Algorithm for Access Token key certificate infrastucture. This value can be configured via Rest based too. But providing option in helm to configure mandatory attributes during installation itself.	ES256	M	ES256, RS256	Initial Algorithm for Access Token key certificate infrastucture.

Ingress Gateway Global Parameters

Table 3-3 Ingress Gateway Global Parameters

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`staticIpAddressEnabled`	Static load balancer IP enabled flag	false	O	true/false	
`staticIpAddress`	Static IP address assigned to the Load Balancer from the metalLB IP pool.	<ipaddress>	M, when `staticIpAddressEnabledis` true		If Static load balancer IP needs to be set, then set staticIpAddressEnabled flag to true and provide value for staticIpAddress. Else random IP will be assigned by the metalLB from its IP Pool.
`staticNodePortEnabled`	Static Node Port enabled flag	false	O	true/false	If Static node port needs to be set, then set staticNodePortEnabled flag to true and provide value for staticHttpNodePort or staticHttpsNodePort. Else random node port will be assigned by K8.

Table 3-3 (Cont.) Ingress Gateway Global Parameters

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
staticHttpNodePort	HTTP node port	30080	M, when staticNodePortEnabled is true and ingress-gateway.enableIncomingHttp is true		
staticHttpsNodePort	HTTPs node port	30443	M, when staticNodePortEnabled is true and ingress-gateway.enableIncomingHttps is true		
publicHttpSignalingPort	Service Port on which OCNRF's Ingress Gateway is exposed	80	O		If enableIncomingHttp is true, publicHttpSignalingPort will be used as HTTP/2.0 Port (unsecured)
publicHttpsSignallingPort	Service Port on which OCNRF's Ingress Gateway is exposed	443	O		If enableIncomingHttps is true, publicHttpsSignallingPort Port will be used as HTTPS/2.0 Port (secured TLS)

Ingress Gateway

Table 3-4 Ingress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
ingress-gateway.enableIncomingHttp	This flag is for enabling/ disabling HTTP/2.0 (insecure) in Ingress Gateway.	true	O	true/false	If the value is set to false, OCNRF will not accept any HTTP/2.0 (unsecured) Traffic. If the value is set to true, OCNRF will accept HTTP/2.0 (unsecured) Traffic
ingress-gateway.enableIncomingHttps	This flag is for enabling/ disabling HTTPS/2.0 (secure) in Ingress Gateway.	false	O	true/false	If the value is set to false, OCNRF will not accept any HTTPS/2.0 (unsecured) Traffic. If the value is set to true, OCNRF will accept HTTPS/2.0 (unsecured) Traffic
ingress-gateway.serviceMeshCheck	This flag needs to be set to "true" if Service Mesh exists where OCNRF is deployed.	false	O	true/false	If the value is set to false, OCNRF's ingress-gateway will try to create connection directly with the backend micro-services's PODs. If the value is set to true, OCNRF's ingress-gateway will try to create connection using Service FQDN of the backend micro-services.
ingress-gateway.image.name	Ingress Gateway image name.	ocingress_gateway	O		
ingress-gateway.image.tag	Tag name of Ingress Gateway image	OCNRF images	O		
ingress-gateway.image.pullPolicy	This setting will tell if image need to be pulled or not	IfNotPresent	O	Always, IfNotPresent, Never	
ingress-gateway.initContainersImage.name	Image Name for Ingress Gateway init container	configurationinit	O		
ingress-gateway.initContainersImage.tag	Tag name of Ingress Gateway init container	OCNRF images	O		

Table 3-4 (Cont.) Ingress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`ingress-gateway.initContainersImage.pullPolicy`	This setting will tell if image need to be pulled or not	IfNotPresent	O	Always, IfNotPresent, Never	
`ingress-gateway.updateContainersImage.name`	Image Name for Ingress Gateway update container	configurationupdate	O		
`ingress-gateway.updateContainersImage.tag`	Tag name of Ingress Gateway update container	OCNRF images	O		
`ingress-gateway.updateContainersImage.pullPolicy`	This setting will tell if image need to be pulled or not	IfNotPresent	O	Always, IfNotPresent, Never	
`ingress-gateway.jaegerTracingEnabled`	Flag to enable or disable the Jaeger Tracing at ingress-gateway	false	O	true / false	While making this flag as true, update the below attributes with correct values.
`ingress-gateway.opentracing.jaeger.udpsender.host`	Host name of Jaeger Agent Service	jaeger-agent.cne-infra	M, if `ingress-gateway.jaegerTracingEnabled` is true		
`ingress-gateway.opentracing.jaeger.udpsender.port`	Port of Jaeger Agent Service	6831	M, if `ingress-gateway.jaegerTracingEnabled` is true		

Table 3-4 (Cont.) Ingress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`ingress-gateway.opentracing.jaeger.probabilisticSampler`	Jaeger message sampler	0.5	O	0 to 1	# Jaeger message sampler. Value range: 0 to 1 # e.g. Value 0: No Trace will be sent to Jaeger collector # e.g. Value 0.3: 30% of message will be sampled and will be sent to Jaeger collector # e.g. Value 1: 100% of message (i.e. all the messages) will be sampled and will be sent to Jaeger collector
`ingress-gateway.cipherSuites`	Allowed CipherSuites for TLS1.2		M, if `ingress-gateway.enableIncomingHttps` is true	- TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384 - TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384 - TLS_ECDHE_RSA_WITH_CHACHA20_POLY1305_SHA256 - TLS_DHE_RSA_WITH_AES_256_GCM_SHA384 - TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 - TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256	

Table 3-4 (Cont.) Ingress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`ingress-gateway.service.ssl.privateKey.k8SecretName`	Secret name that contains OCNRF Ingress gateway Private Key	ocingress-secret	M, if `ingress-gateway.enableIncomingHttps` is true		
`ingress-gateway.service.ssl.privateKey.k8NameSpace`	Namespace in which k8SecretName is present	ocnrf	M, if `ingress-gateway.enableIncomingHttps` is true		
`ingress-gateway.service.ssl.privateKey.rsa.filename`	OCNRF's Private Key (RSA type) file name	rsa_private_key_pkcs1.pem	M, if `ingress-gateway.enableIncomingHttps` is true and `ingress-gateway.service.ssl.initialAlgorithm` is RS256		If initialAlgorithm is configured as RSA, then rsa file name must be configured. Otherwise OCNRF's ingress gateway will not comeup.

Table 3-4 (Cont.) Ingress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`ingress-gateway.service.ssl.privateKey.ecdsa.filename`	OCNRF's Private Key (ECDSA type) file name	ssl_ecdsa_private_key.pem	M, if `ingress-gateway.enableIncomingHttps` is true and `ingress-gateway.service.ssl.initialAlgorithm` is ES256		If initialAlgorithm is configured as ECDSA, then rsa file name must be configured. Otherwise OCNRF's ingress gateway will not comeup.
`ingress-gateway.service.ssl.certificate.k8SecretName`	Secret name that contains OCNRF's Certificate for HTTPS	ocingress-secret	M, if `ingress-gateway.enableIncomingHttps` is true		This is a Secret object for OCNRFcertificate details for HTTPS.
`ingress-gateway.service.ssl.certificate.k8NameSpace`	Namespace in which OCNRF's Certificate is present	ocnrf	M, if `ingress-gateway.enableIncomingHttps` is true		

Table 3-4 (Cont.) Ingress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`ingress-gateway.service.ssl.certificate.rsa.filename`	OCNRF's Certificate (RSA type) file name	ssl_rsa_certificate.crt	M, if `ingress-gateway.enableIncomingHttps` is true and `ingress-gateway.service.ssl.initialAlgorithm` is RS256		If initialAlgorithm is configured as RSA, then rsa file name must be configured. Otherwise OCNRF's ingress gateway will not comeup.
`ingress-gateway.service.ssl.certificate.ecdsa.filename`	OCNRF's Certificate (ECDSA type) file name	ssl_ecdsa_certificate.crt	M, if `ingress-gateway.enableIncomingHttps` is true and `ingress-gateway.service.ssl.initialAlgorithm` is ES256		If initialAlgorithm is configured as ECDSA, then rsa file name must be configured. Otherwise OCNRF's ingress gateway will not comeup.

Table 3-4 (Cont.) Ingress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`ingress-gateway.service.ssl.caBundle.k8SecretName`	Secret name that contains OCNRF's CA details for HTTPS	ocingress-secret	M, if `ingress-gateway.enableIncomingHttps` is true		
`ingress-gateway.service.ssl.caBundle.k8NameSpace`	Namespace in which OCNRF's CA details is present	ocnrf	M, if `ingress-gateway.enableIncomingHttps` is true		
`ingress-gateway.service.ssl.caBundle.filename`	OCNRF's CA bundle filename	caroot.cer	M, if `ingress-gateway.enableIncomingHttps` is true		
`ingress-gateway.service.ssl.keyStorePassword.k8SecretName`	Secret name that contains keyStorePassword	ocingress-secret	M, if `ingress-gateway.enableIncomingHttps` is true		
`ingress-gateway.service.ssl.keyStorePassword.k8NameSpace`	Namespace in which OCNRF's keystore password is present	ocnrf	M, if `ingress-gateway.enableIncomingHttps` is true		

Table 3-4 (Cont.) Ingress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`ingress-gateway.service.ssl.keyStorePassword.fileName`	OCNRF's Key Store password Filename	ssl_keystore.txt	M, if `ingress-gateway.enableIncomingHttps` is true		
`ingress-gateway.service.ssl.trustStorePassword.k8SecretName`	Secret name that contains trustStorePassword	ocingress-secret	M, if `ingress-gateway.enableIncomingHttps` is true		
`ingress-gateway.service.ssl.trustStorePassword.k8NameSpace`	Namespace in which trustStorePassword is present	ocnrf	M, if `ingress-gateway.enableIncomingHttps` is true		
`ingress-gateway.service.ssl.trustStorePassword.fileName`	OCNRF's trustStorePassword Filename	ssl_truststore.txt	M, if `ingress-gateway.enableIncomingHttps` is true		
`ingress-gateway.service.ssl.initialAlgorithm`	Initial Algorithm for HTTPS	RS256	O	ES256, RS256	Algorithm that will be used in TLS handshake
`ingress-gateway.service.log.level.root`	setting logging level	WARN	O	OFF, FATAL, ERROR, WARN, INFO, DEBUG, TRACE, ALL	

Table 3-4 (Cont.) Ingress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
ingress-gateway.service.log.level.ingress	setting logging level	WARN	O	OFF, FATAL, ERROR, WARN, INFO, DEBUG, TRACE, ALL	
ingress-gateway.service.log.level.oauth	setting logging level	WARN	O	OFF, FATAL, ERROR, WARN, INFO, DEBUG, TRACE, ALL	
ingress-gateway.service.customExtension.labels	Custom Labels that needs to be added to ingress-gateway specific Service.		O		This can be used to add custom label(s) to ingress-gateway Service.
ingress-gateway.service.customExtension.annotations	Custom Annotations that needs to be added to ingress-gateway specific Services.		O		This can be used to add custom annotation(s) to ingress-gateway Service.
ingress-gateway.global.type	Kind of Service that will be used for this deployment	LoadBalancer	O	ClusterIP, NodePort, LoadBalancer and ExternalName	It is not recommended to change the Service Type.
ingress-gateway.deployment.customExtension.labels	Custom Labels that needs to be added to ingress-gateway specific Deployment.		O		This can be used to add custom label(s) to ingress-gateway Deployment.
ingress-gateway.deployment.customExtension.annotations	Custom Annotations that needs to be added to ingress-gateway specific Deployment.		O		This can be used to add custom annotation(s) to ingress-gateway Deployment.
ingress-gateway.resources.limits.cpu	Maximum amount of CPU that **K8s** will allow the ingress-gateway service container to use	4	O		It is the maximum CPU resource allocated to ingress-gateway.

Table 3-4 (Cont.) Ingress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`ingress-gateway.resources.limits.initServiceCpu`	Maximum amount of CPU that **K8s** will allow the ingress-gateway init container to use	1	O		It is the CPU resource allocated to ingress-gateway init container.
`ingress-gateway.resources.limits.updateServiceCpu`	Maximum amount of CPU that **K8s** will allow the ingress-gateway update container to use	1	O		It is the CPU resource allocated to ingress-gateway update container.
`ingress-gateway.resources.limits.memory`	Maximum memory that **K8s** will allow the ingress-gateway service container to use	4Gi	O		It is the maximum Memory allocated to ingress-gateway.
`ingress-gateway.resources.limits.initServiceMemory`	Memory Limit for ingress-gateway init container	1Gi	O		It is the memory allocated to ingress-gateway init container.
`ingress-gateway.resources.limits.updateServiceMemory`	Memory Limit for ingress-gateway update container	1Gi	O		It is the memory allocated to ingress-gateway update container.
`ingress-gateway.resources.requests.cpu`	The amount of CPU that the system will guarantee for the ingress-gateway service container, **and K8s** will use this value to decide on which node to place the pod	4	O		It is the maximum CPU resource allocated to ingress-gateway.

Table 3-4 (Cont.) Ingress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`ingress-gateway.resources.requests.initServiceCpu`	The amount of CPU that the system will guarantee for the ingress-gateway init container, **and K8s** will use this value to decide on which node to place the pod	1	O		It is the CPU resource allocated to ingress-gateway init container.
`ingress-gateway.resources.requests.updateServiceCpu`	The amount of CPU that the system will guarantee for the ingress-gateway update container, **and K8s** will use this value to decide on which node to place the pod	1	O		It is the CPU resource allocated to ingress-gateway update container.
`ingress-gateway.resources.requests.memory`	The memory that the system will guarantee for the ingress-gateway service container, **and K8s** will use this value to decide on which node to place the pod	4Gi	O		It is the maximum memory for requests allocated to ingress-gateway.
`ingress-gateway.resources.requests.initServiceMemory`	Memory Limit for ingress-gateway init container	1Gi	O		It is the memory allocated to ingress-gateway init container.
`ingress-gateway.resources.requests.updateServiceMemory`	Memory Limit for ingress-gateway update container	1Gi	O		It is the memory allocated to ingress-gateway update container.
`ingress-gateway.resources.target.averageCpuUtil`	Target CPU utilization after which Horizontal Pod Autoscaler will be triggered.	80	O		

Table 3-4 (Cont.) Ingress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`ingress-gateway.minReplicas`	Minimum number of pod that will be deployed	2	O		
`ingress-gateway.maxReplicas`	Maximum number of pod that will be scaled up	5	O		

Egress Gateway

Table 3-5 Egress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`egress-gateway.enableOutgoingHttps`	This flag is for enabling/ disabling HTTPS/2.0 (secured TLS) in Egress Gateway.	false	O	true/false	If the value is set to false, OCNRF will not accept any HTTPS/2.0 (unsecured) Traffic. If the value is set to true, OCNRF will accept HTTPS/2.0 (unsecured) Traffic
`egress-gateway.deploymentegressgateway.image`	Egress Gateway image name	ocegress_gateway	O		
`egress-gateway.deploymentegressgateway.imageTag`	tag name of image	OCNRF images	O		
`egress-gateway.deploymentegressgateway.pullPolicy`	This setting will tell if image need to be pulled or not	IfNotPresent	O	Always, IfNotPresent, Never	
`egress-gateway.initContainersImage.name`	Image Name for Egress Gateway init container	configurationinit	O		

Table 3-5 (Cont.) Egress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`egress-gateway.initContainersImage.tag`	Tag name of Egress Gateway init container	OCNRF images	O		
`egress-gateway.initContainersImage.pullPolicy`	This setting will tell if image need to be pulled or not	IfNotPresent	O	Always, IfNotPresent, Never	
`egress-gateway.updateContainersImage.name`	Image Name for Egress Gateway update container	configurationupdate	O		
`egress-gateway.updateContainersImage.tag`	Tag name of Egress Gateway update container	OCNRF images	O		
`egress-gateway.updateContainersImage.pullPolicy`	This setting will tell if image need to be pulled or not	IfNotPresent	O	Always, IfNotPresent, Never	
`egress-gateway.jaegerTracingEnabled`	Flag to enable or disable the Jaeger Tracing at egress gateway	false	O	true / false	While making this flag as true, update the below attributes with correct values.
`egress-gateway.opentracing.jaeger.udpsender.host`	Host name of Jaeger Agent Service	jaeger-agent.cne-infra	M, if `egress-gateway.jaegerTracingEnabled` is enabled		

Table 3-5 (Cont.) Egress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`egress-gateway.opentracing.jaeger.udpsender.port`	Port of Jaeger Agent Service	6831	M, if `egress-gateway.jaegerTracingEnabled` is enabled		
`egress-gateway.opentracing.jaeger.probabilisticSampler`	Jaeger message sampler	0.5	O	0 to 1	# Jaeger message sampler. Value range: 0 to 1 # e.g. Value 0: No Trace will be sent to Jaeger collector # e.g. Value 0.3: 30% of message will be sampled and will be sent to Jaeger collector # e.g. Value 1: 100% of message (i.e. all the messages) will be sampled and will be sent to Jaeger collector
`egress-gateway.scpIntegrationEnabled`	Using SCP as an Proxy in Egress Gateway	false	O	true/false	If it is configured as false, SCP will not be used as an proxy. Messages will be directly sent to the Producers/HTTP Servers. If it is configured as true, SCP will be used as an Proxy for delivering messages to the Producers/HTTP Servers.
`egress-gateway.scpHttpHost`	SCP Configuration For Egress Gateway	localhost	M, if `egress-gateway.scpIntegrationEnabled` is true		All the SCP related configuration will be used only if scpIntegrationEnabled is set to true. SCP's HTTP Host/IP and Port Combination. This will be while sending HTTP/2.0 (unsecured) traffic.

Table 3-5 (Cont.) Egress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`egress-gateway.scpHttpPort`	SCP's HTTP Port	80	M, if `egress-gateway.scpIntegrationEnabled` is true		
`egress-gateway.scpHttpsHost`	SCP Configuration For Egress Gateway	localhost	M, if `egress-gateway.scpIntegrationEnabled` is true		All the SCP related configuration will be used only if scpIntegrationEnabled is set to true. SCP's HTTP Host/IP and Port Combination. This will be while sending HTTP/2.0 (unsecured) traffic.
`egress-gateway.scpHttpsPort`	SCP's HTTPS Port	443	M, if `egress-gateway.scpIntegrationEnabled` is true		This will be while sending HTTPS/2.0 (unsecured) traffic.
`egress-gateway.scpApiPrefix`	SCP's API Prefix. (Applicable only for SCP with TLS enabled)	/	O		This will be used for constructing the Egress messgage's APIROOT while proxying message to SCP. Change this value to SCP's apiprefix. "/" is not expected to be provided along.
`egress-gateway.scpDefaultScheme`	SCP's default scheme when 3gpp-sbi-target-apiroot header is missing	https	O		

Table 3-5 (Cont.) Egress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`egress-gateway.cipherSuites`	Allowed CipherSuites for TLS1.2		M, if `egress-gateway.enableOutgoingHttps` is true	- TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384 - TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384 - TLS_ECDHE_RSA_WITH_CHACHA20_POLY1305_SHA256 - TLS_DHE_RSA_WITH_AES_256_GCM_SHA384 - TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 - TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256	
`egress-gateway.service.ssl.privateKey.k8SecretName`	Secret name that contains OCNRF Egress gateway Private Key	ocegress-secret	M, if `egress-gateway.enableOutgoingHttps` is true		

Table 3-5 (Cont.) Egress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`egress-gateway.service.ssl.privateKey.k8NameSpace`	Namespace in which k8SecretName is present	ocnrf	M, if `egress-gateway.enableOutgoingHttps` is true		
`egress-gateway.service.ssl.privateKey.rsa.filename`	OCNRF's Private Key (RSA type) file name	ssl_rsa_private_key.pem	M, if `egress-gateway.enableOutgoingHttps` is true and `egress-gateway.service.ssl.initialAlgorithm` is RS256		If initialAlgorithm is configured as RSA, then rsa file name must be configured. Otherwise OCNRF's egress gateway will not comeup.
`egress-gateway.service.ssl.privateKey.ecdsa.filename`	OCNRF's Private Key (ECDSA type) file name	ssl_ecdsa_private_key.pem	M, if `egress-gateway.enableOutgoingHttps` is true and `egress-gateway.service.ssl.initialAlgorithm` is ES256		If initialAlgorithm is configured as ECDSA, then rsa file name must be configured. Otherwise OCNRF's egress gateway will not comeup.

Table 3-5 (Cont.) Egress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`egress-gateway.service.ssl.certificate.k8SecretName`	Secret name that contains OCNRF's Certificate for HTTPS	ocegress-secret	M, if `egress-gateway.enableOutgoingHttps` is true		This is a Secret object for OCNRFcertificate details for HTTPS.
`egress-gateway.service.ssl.certificate.k8NameSpace`	Namespace in which OCNRF's Certificate is present	ocnrf	M, if `egress-gateway.enableOutgoingHttps` is true		
`egress-gateway.service.ssl.certificate.rsa.filename`	OCNRF's Certificate (RSA type) file name	ssl_rsa_certificate.crt	M, if `egress-gateway.enableOutgoingHttps` is true and `egress-gateway.service.ssl.initialAlgorithm` is RS256		If initialAlgorithm is configured as RSA, then rsa file name must be configured. Otherwise OCNRF's egress gateway will not comeup.

Table 3-5 (Cont.) Egress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`egress-gateway.service.ssl.certificate.ecdsa.filename`	OCNRF's Certificate (ECDSA type) file name	ssl_ecdsa_certificate.crt	M, if `egress-gateway.enableOutgoingHttps` is true and `egress-gateway.service.ssl.initialAlgorithm` is ES256		If initialAlgorithm is configured as ECDSA, then rsa file name must be configured. Otherwise OCNRF's egress gateway will not comeup.
`egress-gateway.service.ssl.caBundle.k8SecretName`	Secret name that contains OCNRF's CA details for HTTPS	ocegress-secret	M, if `egress-gateway.enableOutgoingHttps` is true		
`egress-gateway.service.ssl.caBundle.k8NameSpace`	Namespace in which OCNRF's CA details is present	ocnrf	M, if `egress-gateway.enableOutgoingHttps` is true		
`egress-gateway.service.ssl.caBundle.filename`	OCNRF's CA bundle filename	ssl_cabundle.crt	M, if `egress-gateway.enableOutgoingHttps` is true		

Table 3-5 (Cont.) Egress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`egress-gateway.service.ssl.keyStorePassword.k8SecretName`	Secret name that contains keyStorePassword	ocegress-secret	M, if `egress-gateway.enableOutgoingHttps` is true		
`egress-gateway.service.ssl.keyStorePassword.k8NameSpace`	Namespace in which OCNRF's keystore password is present	ocnrf	M, if `egress-gateway.enableOutgoingHttps` is true		
`egress-gateway.service.ssl.keyStorePassword.fileName`	OCNRF's Key Store password Filename	ssl_keystore.txt	M, if `egress-gateway.enableOutgoingHttps` is true		
`egress-gateway.service.ssl.trustStorePassword.k8SecretName`	Secret name that contains trustStorePassword	ocegress-secret	M, if `egress-gateway.enableOutgoingHttps` is true		
`egress-gateway.service.ssl.trustStorePassword.k8NameSpace`	Namespace in which trustStorePassword is present	ocnrf	M, if `egress-gateway.enableOutgoingHttps` is true		

Table 3-5 (Cont.) Egress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
egress-gateway.service.ssl.trustStorePassword.fileName	OCNRF's trustStorePassword Filename	ssl_truststore.txt	M, if egress-gateway.enableOutgoingHttps is true		
egress-gateway.service.ssl.initialAlgorithm	Initial Algorithm for HTTPS	RS256	O	ES256, RS256	Algorithm that will be used in TLS handshake
egress-gateway.service.log.level.root	setting logging level	WARN	O	OFF, FATAL, ERROR, WARN, INFO, DEBUG, TRACE, ALL	
egress-gateway.service.log.level.egress	setting logging level	WARN	O	OFF, FATAL, ERROR, WARN, INFO, DEBUG, TRACE, ALL	
egress-gateway.service.log.level.oauth	setting logging level	WARN	O	OFF, FATAL, ERROR, WARN, INFO, DEBUG, TRACE, ALL	
egress-gateway.service.customExtension.labels	Custom Labels that needs to be added to egress-gateway specific Service		O		This can be used to add custom label(s) to egress-gateway Service
egress-gateway.service.customExtension.annotations	Custom Annotations that needs to be added to egress-gateway specific Services		O		This can be used to add custom annotation(s) to egress-gateway Service

Table 3-5 (Cont.) Egress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`egress-gateway.service.type`	Kind of Service that will be used for this Deployment	LoadBalancer	O	ClusterIP, NodePort, LoadBalancer and ExternalName	It is not recommended to change the Service Type.
`egress-gateway.deployment.customExtension.labels`	Custom Labels that needs to be added to egress-gateway specific Deployment		O		This can be used to add custom label(s) to egress-gateway Deployment.
`egress-gateway.deployment.customExtension.annotations`	Custom Annotations that needs to be added to egress-gateway specific Deployment		O		This can be used to add custom annotation(s) to egress-gateway Deployment.
`egress-gateway.resources.limits.cpu`	Maximum amount of CPU that **K8s** will allow the egress-gateway service container to use	4	O		It is the maximum CPU resource allocated to egress-gateway.
`egress-gateway.resources.limits.initServiceCpu`	Maximum amount of CPU that **K8s** will allow the egress-gateway init container to use	1	O		It is the CPU resource allocated to egress-gateway init container.
`egress-gateway.resources.limits.updateServiceCpu`	Maximum amount of CPU that **K8s** will allow the egress-gateway update container to use	1	O		It is the CPU resource allocated to egress-gateway update container.
`egress-gateway.resources.limits.memory`	Maximum memory that **K8s** will allow the egress-gateway update container to use	4Gi	O		It is the maximum Memory allocated to egress-gateway.
`egress-gateway.resources.limits.initServiceMemory`	Memory Limit for egress-gateway init container	1Gi	O		It is the memory allocated to egress-gateway init container.

Table 3-5 (Cont.) Egress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`egress-gateway.resources.limits.updateServiceMemory`	Memory Limit for egress-gateway update container	1Gi	O		It is the memory allocated to egress-gateway update container.
`egress-gateway.resources.requests.cpu`	The amount of CPU that the system will guarantee for the egress-gateway service container, **and K8s** will use this value to decide on which node to place the pod	4	O		It is the maximum CPU resource allocated to egress-gateway.
`egress-gateway.resources.requests.initServiceCpu`	The amount of CPU that the system will guarantee for the egress-gateway init container, **and K8s** will use this value to decide on which node to place the pod	1	O		It is the CPU resource allocated to egress-gateway init container.
`egress-gateway.resources.requests.updateServiceCpu`	The amount of CPU that the system will guarantee for the egress-gateway update container, **and K8s** will use this value to decide on which node to place the pod	1	O		It is the CPU resource allocated to egress-gateway update container.
`egress-gateway.resources.requests.memory`	The memory that the system will guarantee for the egress-gateway service container, **and K8s** will use this value to decide on which node to place the pod	4Gi	O		It is the maximum memory for requests allocated to egress-gateway.

Table 3-5 (Cont.) Egress Gateway

Parameter	Description	Default value	Mandatory (M)/ Optional (O)	Range or Possible Values (If applicable)	Notes
`egress-gateway.resources.requests.initServiceMemory`	Memory Limit for egress-gateway init container	1Gi	O		It is the memory allocated to egress-gateway init container.
`egress-gateway.resources.requests.updateServiceMemory`	Memory Limit for egress-gateway update container	1Gi	O		It is the memory allocated to egress-gateway update container.
`egress-gateway.resources.target.averageCpuUtil`	Target CPU utilization after which Horizontal Pod Autoscaler will be triggered.	80	O		
`egress-gateway.minReplicas`	Minimum number of pod that will be deployed	2	O		
`egress-gateway.maxReplicas`	Maximum number of pod that will be scaled up	5	O		

NF Registration Micro service (`nfregistration`)

Table 3-6 NF Registration

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`nfregistration.image.name`	Full Image Path	ocnrf-nfregistration	O	Full image path of image	
`nfregistration.image.tag`	Tag of Image	OCNRF images	O	Tag of image in docker repository	
`nfregistration.image.pullPolicy`	This setting will tell if image need to be pulled or not	IfNotPresent	O	Always, IfNotPresent, Never	

Table 3-6 (Cont.) NF Registration

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
nfregistration.service.customExtension.labels	Custom Labels that needs to be added to nfregistration specific Service		O		This can be used to add custom label(s) to nfregistration Service
nfregistration.service.customExtension.annotations	Custom Annotations that needs to be added to nfregistration specific Services		O		This can be used to add custom annotation(s) to nfregistration Service
nfregistration.service.type	Service that will be used for this Deployment	ClusterIP	O	ClusterIP, NodePort, LoadBalancer and ExternalName	It is not recommended to change the Service Type.
nfregistration.deployment.customExtension.labels	Custom Labels that needs to be added to nfregistration specific Deployment		O		This can be used to add custom label(s) to nfregistration Deployment
nfregistration.deployment.customExtension.annotations	Custom Annotations that needs to be added to nfregistration specific Deployment		O		This can be used to add custom annotation(s) to nfregistration Deployment

Table 3-6 (Cont.) NF Registration

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`nfregistration.resources.limits.cpu`	Maximum amount of CPU that **K8s** will allow the nfregistration service container to use	4	O		It is the maximum CPU resource allocated to nfregistration Deployment.
`nfregistration.resources.limits.memory`	Maximum memory that **K8s** will allow the nfregistration service container to use	2Gi	O		It is the maximum Memory allocated to nfregistration Deployment.
`nfregistration.resources.requests.cpu`	The amount of CPU that the system will guarantee for the nfregistration service container, **and K8s** will use this value to decide on which node to place the pod	4	O		It is the maximum CPU resource allocated to nfregistration Deployment.
`nfregistration.resources.requests.memory`	The memory that the system will guarantee for the nfregistration, **and K8s** will use this value to decide on which node to place the pod	2Gi	O		It is the maximum memory for requests allocated to nfregistration Deployment.
`nfregistration.resources.target.averageCpuUtil`	Target CPU utilization after which Horizontal Pod Autoscaler will be triggered.	80	O		

Table 3-6 (Cont.) NF Registration

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
nfregistration.minReplicas	Minimum number of pod that will be deployed	2	O		
nfregistration.maxReplicas	Maximum number of pod that will be scaled up	7	O		
nfregistration.responseCompressionGzip	Attribute to enable/disable gzip compression on responses from OCNRF for management services as applicable. OCNRF will do compression when consumer network function indicates it supports GZIP compression.	true	O	true/false	OCNRF supports GZIP compression in response of service operations i.e. NFListRetrieval, NFProfileRetrieva, NFRegister, NFUpdate. OCNRF will do compression when consumer network function indicates it supports GZIP compression.

NF Subscription Micro service (`nfsubscription`)

Table 3-7 NF Subscription

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`nfsubscription.image.name`	Full Image Path	ocnrf-nfsubscription	O	Full image path of image	
`nfsubscription.image.tag`	Tag of Image	OCNRF images	O	Tag of image in docker repository	
`nfsubscription.image.pullPolicy`	This setting will tell if image need to be pulled or not	IfNotPresent	O	Always, IfNotPresent, Never	
`nfsubscription.service.customExtension.labels`	Custom Labels that needs to be added to nfsubscription specific Service		O		This can be used to add custom label(s) to nfsubscription Service
`nfsubscription.service.customExtension.annotations`	Custom Annotations that needs to be added to nfsubscription specific Services		O		This can be used to add custom annotation(s) to nfsubscription Service
`nfsubscription.service.type`	Kind of Service that will be used for this Deployment	ClusterIP	O	ClusterIP, NodePort, LoadBalancer and ExternalName	It is not recommended to change the Service Type.

Table 3-7 (Cont.) NF Subscription

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`nfsubscription.deployment.customExtension.labels`	Custom Labels that needs to be added to nfsubscription specific Deployment		O		This can be used to add custom label(s) to nfsubscription Deployment.
`nfsubscription.deployment.customExtension.annotations`	Custom Annotations that needs to be added to nfsubscription specific Deployment		O		This can be used to add custom annotation(s) to nfsubscription Deployment.
`nfsubscription.resources.limits.cpu`	Maximum amount of CPU that **K8s** will allow the nfsubscription service container to use	2	O		It is the maximum CPU resource allocated to nfsubscription Deployment.
`nfsubscription.resources.limits.memory`	Maximum memory that **K8s** will allow the nfsubscription service container to use	2Gi	O		It is the maximum Memory allocated to nfsubscription Deployment.

Table 3-7 (Cont.) NF Subscription

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`nfsubscription.resources.requests.cpu`	The amount of CPU that the system will guarantee for the nfsubscription service container, **and K8s** will use this value to decide on which node to place the pod	2	O		It is the maximum CPU resource allocated to nfsubscription Deployment.
`nfsubscription.resources.requests.memory`	The memory that the system will guarantee for the nfsubscription, **and K8s** will use this value to decide on which node to place the pod	2Gi	O		It is the maximum memory for requests allocated to nfsubscription Deployment.
`nfsubscription.resources.target.averageCpuUtil`	Target CPU utilization after which Horizontal Pod Autoscaler will be triggered.	80	O		
`nfsubscription.minReplicas`	Minimum number of pod that will be deployed	2	O		
`nfsubscription.maxReplicas`	Maximum number of pod that will be scaled up	7	O		

OCNRF Auditor Micro service (`nrfauditor`)

Table 3-8 OCNRF Auditor

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`nrfauditor.image.name`	Full Image Path	ocnrf-nrfauditor	O	Full image path of image	

Table 3-8 (Cont.) OCNRF Auditor

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`nrfauditor.image.tag`	Tag of Image	OCNRF images	O	Tag of image in docker repository	
`nrfauditor.image.pullPolicy`	This setting indicates if the image needs to be pulled or not	IfNotPresent	O	Always, IfNotPresent, Never	
`nrfauditor.service.customExtension.labels`	Custom Labels that needs to be added to nrfauditor specific Service		O		This can be used to add custom label(s) to nrfauditor Service
`nrfauditor.service.customExtension.annotations`	Custom Annotations that needs to be added to nrfauditor specific Services		O		This can be used to add custom annotation(s) to nrfauditor Service
`nrfauditor.service.type`	Kind of Service that will be used for this Deployment	ClusterIP	O	ClusterIP, NodePort, LoadBalancer and ExternalName	It is not recommended to change the Service Type
`nrfauditor.deployment.customExtension.labels`	Custom Labels that needs to be added to nrfauditor specific Deployment		O		This can be used to add custom label(s) to nrfauditor Deployment

Table 3-8 (Cont.) OCNRF Auditor

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`nrfauditor.deployment.customExtension.annotations`	Custom Annotations that needs to be added to nrfauditor specific Deployment		O		This can be used to add custom annotation(s) to nrfauditor Deployment
`nrfauditor.resources.limits.cpu`	Maximum amount of CPU that **K8s** will allow the nrfauditor service container to use	6	O		It is the maximum CPU resource allocated to nrfauditor Deployment.
`nrfauditor.resources.limits.memory`	Maximum memory that **K8s** will allow the nrfauditor service container to use	3Gi	O		It is the maximum Memory allocated to nrfauditor Deployment.
`nrfauditor.resources.requests.cpu`	The amount of CPU that the system will guarantee for the nrfauditor service container, **and K8s** will use this value to decide on which node to place the pod	6	O		It is the maximum CPU resource allocated to nrfauditor Deployment.

Table 3-8 (Cont.) OCNRF Auditor

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`nrfauditor.resources.requests.memory`	The memory that the system will guarantee for the nrfauditor, **and K8s** will use this value to decide on which node to place the pod	3Gi	O		It is the maximum memory for requests allocated to nrfauditor Deployment.

NF Discovery Micro service (`nfdiscovery`)

Table 3-9 NF Discovery

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`nfdiscovery.image.name`	Full Image Path	ocnrf-nfdiscovery	O	Full image path of image	
`nfdiscovery.image.tag`	Tag of Image	OCNRF images	O	Tag of image in docker repository	
`nfdiscovery.image.pullPolicy`	This setting determines if image needs to be pulled or not	IfNotPresent	O	Always, IfNotPresent, Never	
`nfdiscovery.service.customExtension.labels`	Custom Labels that needs to be added to nfdiscovery specific Service		O		This can be used to add custom label(s) to nfdiscovery Service

Table 3-9 (Cont.) NF Discovery

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`nfdiscovery.service.customExtension.annotations`	Custom Annotations that needs to be added to nfdiscovery specific Services		O		This can be used to add custom annotation(s) to nfdiscovery Service
`nfdiscovery.service.type`	Kind of Service that will be used for this Deployment	ClusterIP	O	ClusterIP, NodePort, LoadBalancer and ExternalName	
`nfdiscovery.deployment.customExtension.labels`	Custom Labels that needs to be added to nfdiscovery specific Deployment		O		This can be used to add custom label(s) to nfdiscovery Deployment
`nfdiscovery.deployment.customExtension.annotations`	Custom Annotations that needs to be added to nfdiscovery specific Deployment		O		This can be used to add custom annotation(s) to nfdiscovery Deployment
`nfdiscovery.resources.limits.cpu`	Maximum amount of CPU that **K8s** will allow the nfdiscovery service container to use	4	O		It is the maximum CPU resource allocated to nfdiscovery Deployment.

Table 3-9 (Cont.) NF Discovery

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`nfdiscovery.resources.limits.memory`	Maximum memory that **K8s** will allow the nfdiscovery service container to use	2Gi	O		It is the maximum Memory allocated to nfdiscovery Deployment.
`nfdiscovery.resources.requests.cpu`	The amount of CPU that the system will guarantee for the nfdiscovery service container, **and K8s** will use this value to decide on which node to place the pod	4	O		It is the maximum CPU resource allocated to nfdiscovery Deployment.
`nfdiscovery.resources.requests.memory`	The memory that the system will guarantee for the nfdiscovery, **and K8s** will use this value to decide on which node to place the pod	2Gi	O		It is the maximum memory for requests allocated to nfdiscovery Deployment.
`nfdiscovery.resources.target.averageCpuUtil`	Target CPU utilization after which Horizontal Pod Autoscaler will be triggered.	80	O		
`nfdiscovery.minReplicas`	Minimum number of pod that will be deployed	2	O		
`nfdiscovery.maxReplicas`	Maximum number of pod that will be scaled up	7	O		

OCNRF Configuration

Table 3-10 OCNRF Configuration

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`image.name`	Full Image Path	nrfconfiguration	O	Full image path of image	
`image.tag`	Tag of Image	OCNRF images	O	Tag of image in docker repository	
`image.pullPolicy`	This setting determines if image needs to be pulled or not	IfNotPresent	O	Always, IfNotPresent, Never	
`service.staticIpAddressEnabled`	Static load balancer IP enabled flag	false	O		If Static load balancer IP needs to be set, then set staticIpAddressEnabled flag to true and provide value for staticIpAddress. Else random IP will be assigned by the metalLB from its IP Pool
`service.staticIpAddress`	Static load balancer IP	<ipaddress>	M, if `nrfconfiguration.service.metalLbIpAllocationEnabled` is true		Static IP address assigned to the Load Balancer from the metalLB IP pool.
`service.staticNodePortEnabled`	Static Node Port enabled flag	false	O		If Static node port needs to be set, then set staticNodePortEnabled flag to true and provide value for staticNodePort, else random node port will be assigned by K8

Table 3-10 (Cont.) OCNRF Configuration

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
service.staticNodePort	Static Node Port	30076	M, if nrfconfiguration.service.staticIpAddressEnabled is enabled.		If Static node port needs to be set, then set staticNodePortEnabled flag to true and provide value for staticNodePort Else random node port will be assigned by K8
nrfconfiguration.service.customExtension.labels	Custom Labels that needs to be added to nrfconfiguration specific Service		O		This can be used to add custom label(s) to nrfconfiguration Service
nrfconfiguration.service.customExtension.annotations	Custom Annotations that needs to be added to nrfconfiguration specific Services		O		This can be used to add custom annotation(s) to nrfconfiguration Service
nrfconfiguration.service.type	Kind of Service that will be used for this Deployment	LoadBalancer	O	ClusterIP, NodePort, LoadBalancer and ExternalName	It is not recommended to change the Service Type.
nrfconfiguration.deployment.customExtension.labels	Custom Labels that needs to be added to nrfconfiguration specific Deployment		O		This can be used to add custom label(s) to nrfconfiguration Deployment
nrfconfiguration.deployment.customExtension.annotations	Custom Annotations that needs to be added to nrfconfiguration specific Deployment		O		This can be used to add custom annotation(s) to nrfconfiguration Deployment.

Table 3-10 (Cont.) OCNRF Configuration

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`nrfconfiguration.resources.limits.cpu`	Maximum amount of CPU that **K8s** will allow the nrfconfiguration service container to use	2	O		It is the maximum CPU resource allocated to nrfconfiguration Deployment.
`nrfconfiguration.resources.limits.memory`	Maximum memory that **K8s** will allow the nrfconfiguration service container to use	2Gi	O		It is the maximum Memory allocated to nrfconfiguration Deployment.
`nrfconfiguration.resources.requests.cpu`	The amount of CPU that the system will guarantee for the nrfconfiguration service container, **and K8s** will use this value to decide on which node to place the pod	2	O		It is the maximum CPU resource allocated to nrfconfiguration Deployment.
`nrfconfiguration.resources.requests.memory`	The memory that the system will guarantee for the nrfconfiguration, **and K8s** will use this value to decide on which node to place the pod	2Gi	O		It is the maximum memory for requests allocated to nrfconfiguration Deployment.
`nrfconfiguration.resources.target.averageCpuUtil`	Target CPU utilization after which Horizontal Pod Autoscaler will be triggered.	80	O		

NF Access Token (nfaccesstoken)

Table 3-11 NF Access Token

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
nfaccesstoken.enabled	Flag to disable Oauth functionality	true	O	true / false	If AccessToken service is not required, operator can choose to set it as false so that nfAccessToken micro-service will not be deployed.
nfaccesstoken.image.name	Full Image Path for access token service container	ocnrf-nfaccesstoken	O	Full image path of image	
nfaccesstoken.image.tag	Tag of Image	OCNRF images	O	Tag of image in docker repository	
nfaccesstoken.image.pullPolicy	This setting will tell if image need to be pulled or not	IfNotPresent	O	Always IfNotPresent Never	
nfaccesstoken.initContainersImage.name	Full Image Path for init container	configurationinit	O	Image Name for Access token Key certificate infrastructure	This image is used by OCNRF gateway for Key/ Certificate infrastructure.
nfaccesstoken.initContainersImage.tag	Tag of Image	OCNRF images	O	Tag of image in docker repository	
nfaccesstoken.initContainersImage.pullPolicy	This setting will tell if image need to be pulled or not	IfNotPresent	O	Always IfNotPresent Never	
nfaccesstoken.updateContainersImage.name	Full Image Path for update container	configurationupdate	O	Image Name for Access token Key certificate infrastructure	
nfaccesstoken.updateContainersImage.tag	Tag of Image	OCNRF images	O	Tag of image in docker repository	

Table 3-11 (Cont.) NF Access Token

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`nfaccesstoken.updateContainersImage.pullPolicy`	This setting will tell if image need to be pulled or not	IfNotPresent	O	Always IfNotPresent Never	
`nfaccesstoken.oauth.nrfInstanceId`	OCNRF's NF Instance ID that is used for signing AccessTokenClaim	6faf1bbc-6e4a-4454-a507-a14ef8e1bc5c	M		This is NRF Instance ID that will be used for signing AccessTokenClaim (is IE of AccessTokenClaim). If NRF needs to issue AccessTokenClaim using its own NF instance ID then the nrfInstanceId configured in the global section (global.nrfInstanceId) needs to configured here again. If NRF needs to issue AccessTokenClaim using a common/virtual then a common/virtual NF instance ID needs to be configured here (along with the common/virtual PrivateKey and Certificate Pair). The same NF instance id and PrivateKey and Certificate Pair needs to be configured in all other NRFs as well so that tokens issues by all the NRF can be validated using a Single NfInstanceId and KeyPair.
`nfaccesstoken.oauth.privateKey.k8SecretName`	Secret name that contains OCNRF Private key	ocnrfaccesstoken-secret	M, if `nfaccesstoken.enabled` is true		This is a Secret object for OCNRFPrivate Key.
`nfaccesstoken.oauth.privateKey.k8NameSpace`	Namespace in which OCNRF Private key is present	ocnrf	M, if `nfaccesstoken.enabled` is true		

Table 3-11 (Cont.) NF Access Token

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`nfaccesstoken.oauth.privateKey.rsa.filename`	OCNRF's Private Key (RSA type) file name	rsa_private_key.pem	M, if `nfaccesstoken.enabled` is true and `nfaccesstoken.oauth.initialAlgorithm` is RS256		If initialAlgorithm is configured as RSA, then rsa file name must be configured. Otherwise OCNRF gateway will not comeup.
`nfaccesstoken.oauth.privateKey.ecdsa.filename`	ECDSA key file names	ecdsa_private_key.pem	M, if `nfaccesstoken.enabled` is true and `nfaccesstoken.oauth.initialAlgorithm` is ES256		If initialAlgorithm is configured as ECDSA, then rsa file name must be configured. Otherwise OCNRF's NFAccessToken microservice will not comeup.
`nfaccesstoken.oauth.certificate.k8SecretName`	Secret name that contains OCNRF's certificate	ocnrfaccesstoken-secret	M, if `nfaccesstoken.enabled` is true		This is a Secret object for OCNRFcertificate details for HTTPS.
`nfaccesstoken.oauth.certificate.k8NameSpace`	Namespace in which k8SecretName is present	ocnrf	M, if `nfaccesstoken.enabled` is true		

Table 3-11 (Cont.) NF Access Token

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`nfaccesstoken.oauth.certificate.rsa.filename`	OCNRF's certificate (RSA type) file name	rsa_certificate.crt	M, if `nfaccesstoken.enabled` is true and `nfaccesstoken.oauth.initialAlgorithm` is RS256		If initialAlgorithm is configured as RSA, then rsa file name must be configured. Otherwise OCNRF's NFAccessToken microservice will not comeup.
`nfaccesstoken.oauth.certificate.ecdsa.filename`	OCNRF's certificate (ECDSA type) file name	ecdsa_certificate.crt	M, if `nfaccesstoken.enabled` is true and `nfaccesstoken.oauth.initialAlgorithm` is ES256		If initialAlgorithm is configured as ECDSA, then rsa file name must be configured. Otherwise OCNRF's NFAccessToken microservice will not comeup.
`nfaccesstoken.oauth.keyStorePassword.k8SecretName`	Secret name that contains OCNRF's keystore password	ocnrfaccesstoken-secret	M, if `nfaccesstoken.enabled` is true		
`nfaccesstoken.oauth.keyStorePassword.k8NameSpace`	Namespace in which OCNRF's keystore password is present	ocnrf	M, if `nfaccesstoken.enabled` is true		Password that is used for creating in-memory Java Key Store (JKS)
`nfaccesstoken.oauth.keyStorePassword.filename`	KeyStore password file	keystore_password.txt	M, if `nfaccesstoken.enabled` is true		

Table 3-11 (Cont.) NF Access Token

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
nfaccesstoken.oauth.initialAlgorithm	Initial Algorithm for Access Token key certificate infrastructure	ES256	O	ES256, RS256	
nfaccesstoken.service.customExtension.labels	Custom Labels that needs to be added to nfaccesstoken specific Service		O		This can be used to add custom label(s) to nfaccesstoken Service
nfaccesstoken.service.customExtension.annotations	Custom Annotations that needs to be added to nfaccesstoken specific Services		O		This can be used to add custom annotation(s) to nfaccesstoken Service
nfaccesstoken.service.type	Kind of Service that will be used for this Deployment	ClusterIP	O	ClusterIP, NodePort, LoadBalancer and ExternalName	It is not recommended to change the Service Type.
nfaccesstoken.deployment.customExtension.labels	Custom Labels that needs to be added to nfaccesstoken specific Deployment		O		This can be used to add custom label(s) to nfaccesstoken Deployment
nfaccesstoken.deployment.customExtension.annotations	Custom Annotations that needs to be added to nfaccesstoken specific Deployment		O		This can be used to add custom annotation(s) to nfaccesstoken Deployment
nfaccesstoken.resources.limits.cpu	Maximum amount of CPU that **K8s** will allow the nfaccesstoken service container to use	4	O		It is the maximum CPU resource allocated to nfaccesstoken.
nfaccesstoken.resources.limits.initServiceCpu	Maximum amount of CPU that **K8s** will allow the nfaccesstoken initi container to use	1	O		It is the CPU resource allocated to nfaccesstoken init container.

Table 3-11 (Cont.) NF Access Token

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`nfaccesstoken.resources.limits.updateServiceCpu`	Maximum amount of CPU that **K8s** will allow the nfaccesstoken update container to use	1	O		It is the CPU resource allocated to nfaccesstoken update container.
`nfaccesstoken.resources.limits.memory`	Maximum memory that **K8s** will allow the nfaccesstoken service container to use	2Gi	O		It is the maximum Memory allocated to nfaccesstoken.
`nfaccesstoken.resources.limits.initServiceMemory`	Memory Limit for nfaccesstoken init container	1Gi	O		It is the memory allocated to nfaccesstoken init container.
`nfaccesstoken.resources.limits.updateServiceMemory`	Memory Limit for nfaccesstoken update container	1Gi	O		It is the memory allocated to nfaccesstoken update container.
`nfaccesstoken.resources.requests.cpu`	The amount of CPU that the system will guarantee for the nfaccesstoken service container, **and K8s** will use this value to decide on which node to place the pod	4	O		It is the maximum CPU resource allocated to nfaccesstoken.
`nfaccesstoken.resources.requests.initServiceCpu`	The amount of CPU that the system will guarantee for the nfaccesstoken initicontainer, **and K8s** will use this value to decide on which node to place the pod	1	O		It is the CPU resource allocated to nfaccesstoken init container.

Table 3-11 (Cont.) NF Access Token

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`nfaccesstoken.resources.requests.updateServiceCpu`	The amount of CPU that the system will guarantee for the nfaccesstoken update container, **and K8s** will use this value to decide on which node to place the pod	1	O		It is the CPU resource allocated to nfaccesstoken update container.
`nfaccesstoken.resources.requests.memory`	The memory that the system will guarantee for the nfaccesstoken, **and K8s** will use this value to decide on which node to place the pod	2Gi	O		It is the maximum memory for requests allocated to nfaccesstoken.
`nfaccesstoken.resources.requests.initServiceMemory`	Memory Limit for nfaccesstoken init container	1Gi	O		It is the memory allocated to nfaccesstoken init container.
`nfaccesstoken.resources.requests.updateServiceMemory`	Memory Limit for nfaccesstoken update container	1Gi	O		It is the memory allocated to nfaccesstoken update container.
`nfaccesstoken.resources.target.averageCpuUtil`	Target CPU utilization after which Horizontal Pod Autoscaler will be triggered.	80	O		
`nfaccesstoken.minReplicas`	Minimum number of pod that will be deployed	2	O		
`nfaccesstoken.maxReplicas`	Maximum number of pod that will be scaled up	7	O		

Application Info

Table 3-12 Application Info (`appinfo`)

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`appinfo.image.name`	Full Image Path	app_info	O	Full image path of image	
`appinfo.image.tag`	Tag of Image	OCNRF images	O	Tag of image in docker repository	
`appinfo.pullPolicy`	This setting will tell if image need to be pulled or not	IfNotPresent	O	Always IfNotPresent Never	
`appinfo.resources.limits.cpu`	Maximum amount of CPU that **K8s** will allow the appinfo service container to use	200m	O		It is the maximum CPU resource allocated to appinfo Deployment.
`appinfo.resources.limits.memory`	Maximum memory that **K8s** will allow the appinfo service container to use	1Gi	O		It is the maximum Memory allocated to appinfo Deployment.
`appinfo.resources.requests.cpu`	The amount of CPU that the system will guarantee for the appinfo service container, **and K8s** will use this value to decide on which node to place the pod	200m	O		It is the maximum CPU resource allocated to appinfo Deployment.

Table 3-12 (Cont.) Application Info (`appinfo`)

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`appinfo.resources.requests.memory`	The memory that the system will guarantee for the appinfo serv, **and K8s** will use this value to decide on which node to place the pod	1Gi	O		It is the maximum memory for requests allocated to appinfo Deployment.
`appinfo.service.type`	Kind of Service that will be used for this Deployment	ClusterIP	O	ClusterIP, NodePort, LoadBalancer and ExternalName	It is not recommended to change the Service Type
`appinfo.service.customExtension.labels`	Custom Labels that needs to be added to appinfo specific Service		O		This can be used to add custom label(s) to nfaccestoken Service
`appinfo.service.customExtension.annotations`	Custom Annotations that needs to be added to appinfo specific Services		O		This can be used to add custom annotation(s) to nfaccestoken Service

Table 3-12 (Cont.) Application Info (`appinfo`)

Parameter	Description	Default value	Mandatory (M) / Optional (O)	Range or Possible Values (If applicable)	Notes
`appinfo.deployment.customExtension.labels`	Custom Labels that needs to be added to appinfo specific Deployment		O		This can be used to add custom label(s) to nfaccesstoken Deployment
`appinfo.deployment.customExtension.annotations`	Custom Annotations that needs to be added to appinfo specific Deployment		O		This can be used to add custom annotation(s) to nfaccesstoken Deployment

4
Upgrading OCNRF

This section includes information about upgrading an existing OCNRF deployment.

> **Note:**
>
> OCNRF upgrade is supported only within the same release for updating helm configuration.

When you attempt to upgrade an existing OCNRF deployment, the running set of containers and pods are replaced with the new set of containers and pods. However, If there is no change in the pod configuration, the running set of containers and pods are not replaced.

If you need to change any configuration then change the `ocnrf-custom-values-1.8.0.yaml` file with new values.

> **Note:**
>
> It is advisable to create a backup of the file before changing any configuration.

To configure the parameters, see section OCNRF Configuration.

> **Caution:**
>
> OCNRF 1.8.0 upgrade supports changing HELM configurable parameters only.

Execute the following command to upgrade an existing OCNRF deployment:

1. For helm 2, execute the following command:

   ```
   $ helm upgrade <release> <helm chart> [--version <OCNRF version>]
   -f <ocnrf_customized_values.yaml>
   ```

   For example:

   ```
   $ helm upgrade <release> <helm chart> [--version <OCNRF version>] -f
   ocnrf-custom-values-1.8.0.yaml
   ```

2. For helm 3, execute the following command:

```
$ helm3 upgrade <release> <helm chart> [--version <OCNRF version>]
-f <ocnrf_customized_values.yaml> --namespace <namespace-name>
```

To check the status of the upgrade, execute:

```
helm status <helm-release>
```

For example: `helm status ocnrf`

Table 4-1 Parameters and Definitions during OCNRF Upgrade

Parameters	Definitions
`<helm chart>`	It is the name of the chart that is of the form `<repository/ocnrf>`. For example: `reg-1/ocnrf or cne-repo/ocnrf`
`<release>`	It can be found in the output of `helm list` command

In case of backout:

1. Check the history of helm deployment:
   `helm history <helm_release>`
2. Rollback to the required revision:
   `helm rollback <release name> <revision number>`

5
Uninstalling OCNRF

This section explains uninstallation procedure of OCNRF and its details in MySQL.

Deleting the OCNRF deployment

This procedure explains how to delete the OCNRF deployment:

Execute the following command to completely delete or remove the OCNRF deployment:

1. For helm2:

   ```
   $ helm del --purge <helm-release>
   ```

   Example:

   ```
   $ helm del --purge ocnrf
   ```

2. For helm3:

   ```
   helm3 uninstall <helm-release> -n <namespace>
   ```

   Example:

   ```
   helm3 uninstall ocnrf -n ocnrf
   ```

> **Note:**
>
> In case helm purge do not clean the deployment and kubernetes objects completely then follow Cleaning OCNRF deployment section.

To check if helm purge has not deleted all of the kubernetes objects, execute the following command:

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

This will give a detailed overview of the current objects of <release-namespace> which were not cleaned during helm purge.

> **Caution:**
>
> rbac and service account details may have been created by user itself prior to helm install in same namespace and not using helm install. In case same service account and rbac resource are needed, then don't delete them.

Cleaning OCNRF deployment

This procedure explains how to cleanup the OCNRF deployment.

1. Remove failed helm release:
   Run command to get all of the helm release.

   ```
   $ helm ls --all
   ```

   If OCNRF helm release is in a failed state, please purge the namespace using the command:

   a. For helm 2:

      ```
      $ helm delete --purge <release-namespace>
      ```

   b. For helm 3:

      ```
      helm3 uninstall <release-name> -n <release-namespace>
      ```

   > **Note:**
   >
   > If this is taking more time as it will run the delete hook jobs. In this case, run below script parallel in another session to clear all the delete jobs.

   Cleanup hook-jobs

   ```
   $ while true; do kubectl delete jobs --all -n <release-namespace>;
   sleep 5;done
   ```

   Monitor the "helm delete --purge <release-namespace>" command. Once that is succeeded, press "ctrl+c" to stop the above command execution.

2. Cleanup all of the kubernetes objects.

   ```
   $ kubectl get all -n <release-namespace>
   This will give a detailed overview of the current objects of
   <release-namespace>. Delete all those objects.
   ```

> **Caution:**
>
> Be sure before executing the following commands as it deletes all objects of kubernetes in the specified namespace. In case user has created rbac and service account details prior to helm install in same namespace and is required, then do not delete them. In case, custom service account was not provided by the user and safe to remove it, then execute below commands to delete the resources or objects which are not required:
>
> ```
> Deleting all the kubernetes objects: "kubectl delete all
> --all -n <release-namespace>"
> Deleting all the current configmaps: "kubectl delete cm --
> all -n <release-namespace>"
> ```

3. Cleanup of pending resources in namespace:
   Sometimes it is seen that some resources are not deleted while purging the deployment. This step explains how to check the pending resources and clean them.

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

   This will give a detailed overview of the current objects of <release-namespace>.
   Delete pending resources in the namespace:

   ```
   $ kubectl delete <resource-type> <resource-name> -n <release-
   namespace>
   ```

4. Execute the following command to delete kubernetes namespace:

   > **Caution:**
   >
   > Be sure before removing the namespace. It will delete all resources or objects created in the namespace.

   ```
   $ kubectl delete namespace <ocnrf kubernetes namespace>
   ```

   Example:

   ```
   $ kubectl delete namespace ocnrf
   ```

Deleting the OCNRF MySQL details

This procedure explains how to delete the OCNRF MySQL database after deletion of OCNRF deployment.

> **Note:**
>
> Procedure can be different for Geo-Redundant OCNRF sites and standalone OCNRF site.

Procedure for Geo-Redundant OCNRF sites

1. Login to the machine which has permission to access the SQL nodes of NDB cluster.
2. Connect to the SQL node of NDB cluster successively. MySQL commands must be run on all the SQL nodes.
3. Login to the MySQL prompt using root permission or user, which has permission to delete the table records. For example: `mysql -h 127.0.0.1 -uroot -p`

   > **Note:**
   >
   > This command may vary from system to system, path for mysql binary, root user and root password. After executing this command, user need to enter the password specific to the user mentioned in the command.

4. Execute the following command to delete data specific to purged site:

```
$ DELETE FROM NfScreening WHERE nrfInstanceId = '<OCNRF's NF
Instance ID of Site under deletion>';
$ DELETE FROM NrfSystemOptions WHERE nrfInstanceId = '<OCNRF's NF
Instance ID of Site under deletion>';
$ DELETE FROM NfInstances WHERE nrfInstanceId = '<OCNRF's NF
Instance ID of Site under deletion>';
$ DELETE FROM NfStatusMonitor WHERE nrfInstanceId = '<OCNRF's NF
Instance ID of Site under deletion>';
$ DELETE FROM NfSubscriptions WHERE nrfInstanceId = '<OCNRF's NF
Instance ID of Site under deletion>';
$ DELETE FROM NrfEventTransactions WHERE currentOwner = '<OCNRF's
NF Instance ID of Site under deletion>';
```

   > **Caution:**
   >
   > Since these tables are shared by each geo-redundant site, tables shall not be deleted.

5. Exit from MySQL prompt and SQL nodes:

   > **Note:**
   >
   > Execute the commands on any one SQL node on one geo-redundant site. Other Geo-redundant sites will get the data records removed automatically.

Procedure for standalone OCNRF site

1. Login to the machine which has permission to access the SQL nodes of NDB cluster
2. Connect to the SQL node of NDB cluster successively. MySQL commands must be run on all the SQL nodes.
3. Login to the MySQL prompt using root permission or user, which has permission to drop the tables. For example: `mysql -h 127.0.0.1 -uroot -p`

> **Note:**
>
> This command may vary from system to system, path for mysql binary, root user and root password. After executing this command, user need to enter the password specific to the user mentioned in the command.

4. Execute the following commands to drop the tables:

```
$ DROP TABLE IF EXISTS 'NfInstances';
$ DROP TABLE IF EXISTS 'NfStatusMonitor';
$ DROP TABLE IF EXISTS 'NfSubscriptions';
$ DROP TABLE IF EXISTS 'NfScreening';
$ DROP TABLE IF EXISTS 'NrfSystemOptions';
$ DROP TABLE IF EXISTS 'NrfEventTransactions';
```

5. Exit from MySQL prompt and SQL node

> **Note:**
>
> Execute the commands on any SQL node of standalone site.

Procedure for complete removal of MySql database and username

This procedure explains the steps to complete removal of MySql database and username in below cases:

1. OCNRF is not going to be install on that cluster.
2. Change the MySql database name or MySql user name.

Procedure

1. Login to the machine which has permission to access the SQL nodes of NDB cluster.
2. Connect to the SQL node of NDB cluster successively. MySQL commands must be run on all the SQL nodes.
3. Login to the MySQL prompt using root permission or user, which has permission to drop the tables. For example: `mysql -h 127.0.0.1 -uroot -p`

> **Note:**
>
> This command may vary from system to system, path for mysql binary, root user and root password. After executing this command, user need to enter the password specific to the user mentioned in the command.

4. Execute the following command to remove OCNRF database:

> **Caution:**
>
> Removal of database from any one of the SQL node from any one of the cluster will remove the database from all Geo-redundant site.

Remove OCNRF application database

```
$ DROP DATABASE if exists <OCNRF application database>;
```

Example

```
$ DROP DATABASE if exists nrfApplicationDB;
```

Remove OCNRF network scoped database:

```
$ DROP DATABASE if exists <OCNRF network scoped database>;
```

Example

```
$ DROP DATABASE if exists nrfNetworkDB;
```

5. Execute the following command to remove the OCNRF MySql Users:
Remove OCNRF privileged user:

```
$ DROP USER IF EXISTS <OCNRF Privileged-User Name>;
```

Example

```
 $ DROP USER IF EXISTS nrfPrivilegedUsr;
```

Remove OCNRF application user:

```
$ DROP USER IF EXISTS <OCNRF Application User Name>;
```

Example

```
$ DROP USER IF EXISTS nrfApplicationUsr;
```

> **Caution:**
>
> Removal of Mysql Users must be done on all the SQL nodes from all the OCNRF sites.

6. Exit from MySQL prompt and SQL node.

6
Troubleshooting OCNRF

This section provides information to troubleshoot the common error which can be encountered during the installation and upgrade of Oracle Communications Network Repository Function (OCNRF).

Following are the troubleshooting procedures:

Generic Checklist

The following sections provide generic checklist for troubleshooting tips.

Deployment related tips

Perform the following checks before the deployment:

- Are OCNRF deployment, pods and services created, running and available?
  Execute following the command:

  ```
  # kubectl -n <namespace> get deployments,pods,svc
  ```

  Inspect the output, check the following columns:

  – AVAILABLE of deployment
  – READY, STATUS and RESTARTS of pod
  – PORT(S) of service
- Is the correct image used and the correct environment variables set in the deployment?
  Execute following the command:

  ```
  # kubectl -n <namespace> get deployment <deployment-name> -o yaml
  ```

  Inspect the output, check the environment and image.

  ```
  # kubectl -n nrf-svc get deployment ocnrf-nfregistration -o yaml
  apiVersion: extensions/v1beta1
  kind: Deployment
  metadata:
    annotations:
      deployment.kubernetes.io/revision: "1"
      kubectl.kubernetes.io/last-applied-configuration: |
  ```

```
      {"apiVersion":"apps/v1","kind":"Deployment","metadata":
{"annotations":{},"name":"ocnrf-nfregistration","namespace":"nrf-
svc"},"spec":{"replicas":1,"selector":{"matchLabels":
{"app":"ocnrf-nfregistration"}},"template":{"metadata":
{"labels":{"app":"ocnrf-nfregistration"}},"spec":
{"containers":[{"env":[{"name":"MYSQL_HOST","value":"mysql"},
{"name":"MYSQL_PORT","value":"3306"},
{"name":"MYSQL_DATABASE","value":"nrfdb"},
{"name":"NRF_REGISTRATION_ENDPOINT","value":"ocnrf-
nfregistration"},{"name":"NRF_SUBSCRIPTION_ENDPOINT","value":"ocnrf-
nfsubscription"},{"name":"NF_HEARTBEAT","value":"120"},
{"name":"DISC_VALIDITY_PERIOD","value":"3600"}],"image":"dsr-
master0:5000/ocnrf-
nfregistration:latest","imagePullPolicy":"Always","name":"ocnrf-
nfregistration","ports":
[{"containerPort":8080,"name":"server"}]}]}}}}
  creationTimestamp: 2018-08-27T15:45:59Z
  generation: 1
  name: ocnrf-nfregistration
  namespace: nrf-svc
  resourceVersion: "2336498"
  selfLink: /apis/extensions/v1beta1/namespaces/
nrf-svc/deployments/ocnrf-nfregistration
  uid: 4b82fe89-aa10-11e8-95fd-fa163f20f9e2
spec:
  progressDeadlineSeconds: 600
  replicas: 1
  revisionHistoryLimit: 10
  selector:
    matchLabels:
      app: ocnrf-nfregistration
  strategy:
    rollingUpdate:
      maxSurge: 25%
      maxUnavailable: 25%
    type: RollingUpdate
  template:
    metadata:
      creationTimestamp: null
      labels:
        app: ocnrf-nfregistration
    spec:
      containers:
      - env:
        - name: MYSQL_HOST
          value: mysql
        - name: MYSQL_PORT
          value: "3306"
        - name: MYSQL_DATABASE
          value: nrfdb
        - name: NRF_REGISTRATION_ENDPOINT
          value: ocnrf-nfregistration
        - name: NRF_SUBSCRIPTION_ENDPOINT
          value: ocnrf-nfsubscription
        - name: NF_HEARTBEAT
```

```
            value: "120"
          - name: DISC_VALIDITY_PERIOD
            value: "3600"
          image: dsr-master0:5000/ocnrf-nfregistration:latest
          imagePullPolicy: Always
          name: ocnrf-nfregistration
          ports:
          - containerPort: 8080
            name: server
            protocol: TCP
          resources: {}
          terminationMessagePath: /dev/termination-log
          terminationMessagePolicy: File
        dnsPolicy: ClusterFirst
        restartPolicy: Always
        schedulerName: default-scheduler
        securityContext: {}
        terminationGracePeriodSeconds: 30
status:
  availableReplicas: 1
  conditions:
  - lastTransitionTime: 2018-08-27T15:46:01Z
    lastUpdateTime: 2018-08-27T15:46:01Z
    message: Deployment has minimum availability.
    reason: MinimumReplicasAvailable
    status: "True"
    type: Available
  - lastTransitionTime: 2018-08-27T15:45:59Z
    lastUpdateTime: 2018-08-27T15:46:01Z
    message: ReplicaSet
"ocnrf-nfregistration-7898d657d9" has successfully progressed.
    reason: NewReplicaSetAvailable
    status: "True"
    type: Progressing
  observedGeneration: 1
  readyReplicas: 1
  replicas: 1
  updatedReplicas: 1
```

- Check if the micro-services can access each other via REST interface. Execute following command:

  ```
  # kubectl -n <namespace> exec <pod name> -- curl <uri>
  ```

  Example:

  ```
  # kubectl -n nrf-svc exec $(kubectl -n nrf-svc get pods -o name|cut
  -d'/' -f2|grep nfs) --
          curl http://ocnrf-nfregistration:8080/nnrf-nfm/v1/nf-
  instances


  # kubectl -n nrf-svc exec $(kubectl -n nrf-svc get pods -o name|cut
  -d'/' -f2|grep nfr) --
  ```

```
        curl http://ocnrf-nfsubscription:8080/nnrf-nfm/v1/nf-
instances
```

> **Note:**
>
> These commands are in their simple form and display the logs only if there is 1 nrf<registration> and nf<subscription> pod deployed.

Application related tips

Check the application logs and look for exceptions, by executing the following command:

```
# kubectl -n <namespace> logs -f <pod name>
```

You can use '-f' to follow the logs or 'grep' for specific pattern in the log output.

Example:

```
# kubectl -n nrf-svc logs -f $(kubectl -n nrf-svc get pods -o name|cut
-d'/' -f2|grep nfr)
 # kubectl -n nrf-svc logs -f $(kubectl -n nrf-svc get pods -o name|cut
-d'/' -f2|grep nfs)
```

> **Note:**
>
> These commands are in their simple form and display the logs only if there is 1 nrf<registration> and nf<subscription> pod deployed.

Helm Install Failure

This section describes the various scenarios in which `helm install` might fail. Following are some of the scenarios:

- Incorrect image name in ocnrf-custom-values files
- Docker registry is configured incorrectly
- Continuous Restart of Pods

Incorrect image name in ocnrf-custom-values files

Problem

`helm install` might fail if incorrect image name is provided in the *ocnrf-custom-values* file.

Error Code/Error Message

When `kubectl get pods -n <ocnrf_namespace>` is executed, the status of the pods might be ImagePullBackOff or ErrImagePull.

Solution

Perform the following steps to verify and correct the image name:

1. Edit *ocnrf-custom-values* file and provide release specific image name and tags. Refer to Customizing OCNRF for OCNRF images details.
2. Execute `helm install` command.
3. Execute `kubectl get pods -n <ocnrf_namespace>` to verify if the status of all the pods is **Running**.

Docker registry is configured incorrectly

Problem

`helm install` might fail if docker registry is not configured in all primary and secondary nodes.

Error Code/Error Message

When `kubectl get pods -n <ocnrf_namespace>` is executed, the status of the pods might be ImagePullBackOff or ErrImagePull.

Solution

Configure docker registry on all primary and secondary nodes.

Continuous Restart of Pods

Problem

`helm install` might fail if MySQL primary and secondary hosts may not be configured properly in ocnrf-custom-values.yaml.

Error Code/Error Message

When `kubectl get pods -n <ocnrf_namespace>` is executed, the pods restart count increases continuously.

Solution

MySQL servers(s) may not be configured properly according to the pre-installation steps as mentioned in Configuring MySql database and user.

Custom Value File Parse Failure

This section explains troubleshooting procedure in case of failure during parsing custom values file.

Problem

Not able to parse *ocnrf-custom-values-x.x.x.yaml*, while running helm install.

Error Code/Error Message

Error: failed to parse ocnrf-custom-values-x.x.x.yaml: error converting YAML to JSON: yaml

Symptom

While creating the *ocnrf-custom-values-x.x.x.yaml* file, if the above mentioned error is received, it means that the file is not created properly. The tree structure may not have been followed and/or there may also be tab spaces in the file.

Solution

Following the procedure as mentioned:

1. Download the latest NRF templates zip file from OHC. Refer to Installation Tasks for more information.
2. Follow the steps mentioned in the Installation Tasks section.

Kubernetes Node Failure

Problem

Kubernetes nodes goes down.

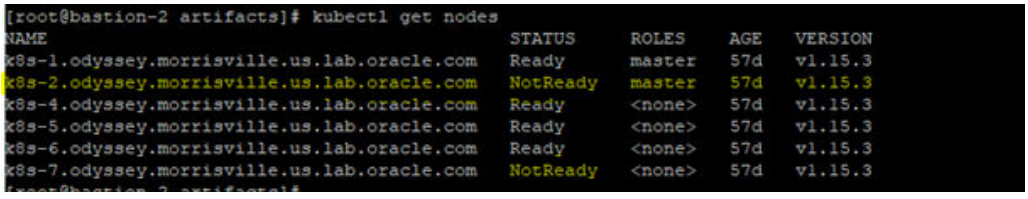
Error Code/Error Message

"NotReady" status is displayed against the Kubernetes node.

Symptom

On running the command **kubectl get nodes**, "NotReady" status is displayed, as shown below:

Figure 6-1 Kubernetes Nodes Output



Solution

Following is the procedure to identify the kubernetes nodes failure:

1. Execute the following command to describe the node:
   `kubectl describe node <kubernete_node_name>`

   Example: `kubectl describe node k8s-1.odyssey.morrisville.us.lab.oracle.com`
2. Check Nodes utilization by running the command:
   `kubectl top nodes`

Tiller Pod Failure

Problem

Tiller Pod is not ready to run helm install.

Error Code/Error Message

The error '*could not find a ready tiller pod*' message is received.

Symptom

When `helm ls` is executed, '*could not find a ready tiller pod*' message is received.

Solution

Following is the procedure to install helm and tiller using the below commands:

1. Delete the pre-installed helm:

```
kubectl delete svc tiller-deploy -n kube-system
kubectl delete deploy tiller-deploy -n kube-system
```

2. Install helm and tiller using this commands:

```
helm init --client-only
helm plugin install https://github.com/rimusz/helm-tiller
helm tiller install
helm tiller start kube-system
```