Oracle® Communications
Cloud Native Core, Certificate Management User Guide

Release 24.2.3
F96510-04
April 2025

Oracle Communications Cloud Native Core, Certificate Management User Guide, Release 24.2.3

F96510-04

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Acronyms

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

Table Acronyms and Terminologies

Acronym	Definition
3GPP	3rd Generation Partnership Project
API	Application Programming Interface
CCA	Client Credentials Assertions
CMP	Certificate Management Protocol
CNC	Cloud Native Core
CNC Console	Cloud Native Configuration Console
OCCM	Oracle Communications Certificate Management
CA	Certification Authority is a trusted entity that issues Secure Sockets Layer (SSL) certificates. CAs are also called issuer in this document.
DNS	Domain Name Server
EE	End Entity
ECC	Elliptic Curve Cryptography
HSM	Hardware Security Module
IDP	Identity Provider
PKI	Public Key Infrastructure
RA	Registration Authority
RSA	Rivest-Shamir-Adleman
SAN	Subject Alternative Name
URI	Uniform Resource Indicator
URN	Uniform Resource Name
CMP Identity Key	Private Key used by Certificate Management to sign the CMPv2 requests and establish trust between Certificate Management and CA.
CMP Identuty Certificate	Certificate that corresponds to and certifies the CMP Identity Key. It is included in the CMPv2 requests for authentication by CA.

What's New in This Guide

This section introduces the documentation updates for Release 24.2.x.

Release 24.2.3 - F96510-04, April 2025

There are no updates in this release.

Release 24.2.2 - F96510-03, January 2025

There are no updates in this release.

Release 24.2.1 - F96510-02, October 2024

- Updated the screenshots to reflect the latest GUI screens and added the sample configuration to create NF certificates with DER encoding in the Creating NF Certificate Using OCCM - Sample Configuration section.
- Updated the OccmFailureMinor description.

Release 24.2.0 - F96510-01, July 2024

- Added the procedure to recreate certificates using existing configurations in the Recreating Certificates section.
- Updated the `operationType` metric dimension in the OCCM Metrics section to include the recreate functionality.
- Added the Recreating Certificates - Sample Configuration section with sample configuration for recreating certificates.
- Updated the entire guide to reflect that the **CMP Client Authentication Options for OCCM Certificate** field has been renamed to **Initial CMP Client(OCCM) Authentication Options**.
- Updated the entire guide to reflect that the **LCM Type** field has been renamed to **Creation Mode.**

1 Introduction

Oracle Communications Cloud Native core, Certificate Management (OCCM) is an automated solution for managing the certificates needed for Oracle 5G Network Functions (NFs). OCCM constantly monitors and renews the certificates based on their validity or expiry period.

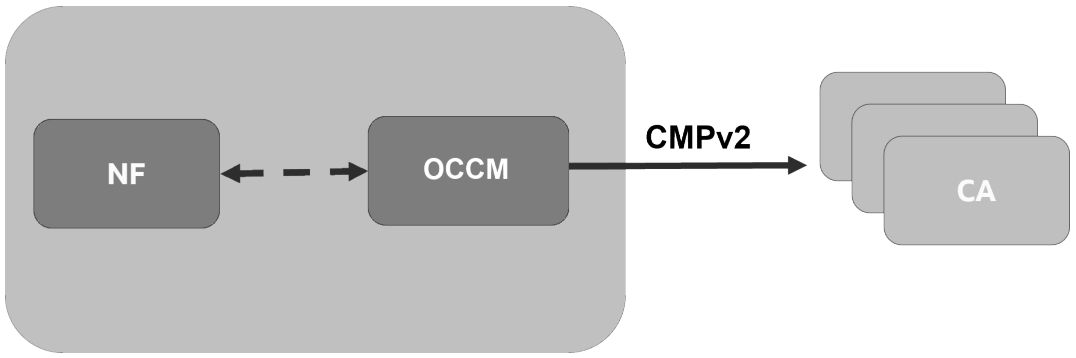
As 3GPP recommends using separate certificates based on the client or server mode and the type of workflow, it leads to many certificates in the network. Automated certificate management eliminates any possibilities of network disruption due to expired certificates. In SBA network deployments, the Network Functions (NFs) are required to support multiple operator certificates for different purposes and interfaces. This amounts to hundreds of certificates in the network with varying validity periods and unwieldy to monitor and renew the certificates manually. Hence, automation of certificate management becomes important to avoid network disruptions due to expired certificates.

1.1 Overview

OCCM integrates with the Certificate Authority(s) using Certificate Management Protocol Version 2 (CMPv2) and RFC4210 to facilitate these certificate management operations:

- Operator-initiated certificate creation
- Operator-initiated certificate recreation
- Automatic certificate monitoring and renewal

Figure 1-1 OCCM Integration with CA



OCCM supports transport of CMPv2 messages using HTTP-based protocol.

OCCM provides the following mechanisms to establish initial trust between OCCM and CA(s):

1. Certificate-based message signing
2. Pre-shared key or MAC based authentication

All the subsequent CMPv2 procedures are authenticated using the certificate-based mechanism in compliance with 3GPP TS 33.310.

The keys and X.509 certificates are managed using Kubernetes secrets.

1.2 Reference

Refer to the following documents for more information:

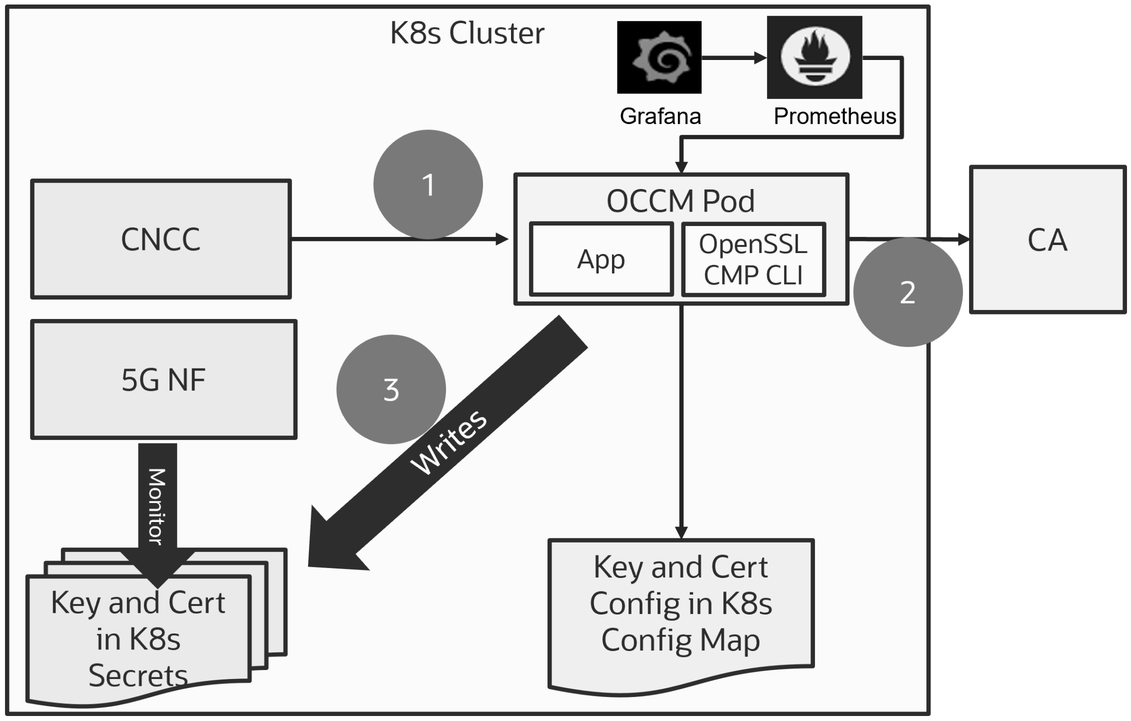
- *Oracle Communications Cloud Native Core, Certificate Management Installation, Upgrade, and Fault Recovery Guide*
- *Oracle Communications Cloud Native Core, Certificate Management Troubleshooting Guide*
- *Oracle Communications Cloud Native Core, Certificate Management REST Specification Guide*
- *Oracle Communications Cloud Native Core, Security Guide*
- *Oracle Communications Cloud Native Core, Solution Upgrade Guide*

2

OCCM Architecture

OCCM is a Cloud Native application consisting of a single microservice. OCCM is packaged and delivered as a CSAR or Helm chart.

Figure 2-1 OCCM Architecture



Architecture Description

OCCM is deployed as a single Kubernetes POD and has a small resource footprint. The OCCM application uses a set of OpenSSL Certificate Management Protocol (CMP) CLI commands based on the provided configuration and the certificate management procedure that needs to be carried out at a point in time. The Output – Key and Certificate – is stored in configuration defined Kubernetes secret.

Operator provides the desired key and certificate configuration through Console. OCCM contacts the CA for certificate signing. After successful Certificate creation, OCCM writes the key and cert in Kubernetes secrets.

OCCM provides the following deployment models to support certificate management for the integrated NF(s) instantiated within the same cluster:

- Dedicated deployment model - OCCM resides in the same Kubernetes namespace as the NF or Components.
- Shared deployment model - OCCM is deployed in a separate Kubernetes namespace and can manage certificates of multiple NFs or components deployed in other Kubernetes namespaces.

Appropriate permissions must be assigned to OCCM using Kubernetes Service Account, Role and Role Binding, based on the selected deployment model.

3
OCCM Supported Features

This section describes the features supported by Oracle Communications Cloud Native core, Certificate Management (OCCM).

3.1 Integration with Certificate Authority

OCCM integrates with one or more Certificate Authorities (CAs) using the Certificate Management Protocol version 2 (CMPv2), as proposed by the 3GPP TS33.310. Operators have the flexibility to configure OCCM to integrate with a single CA or multiple CAs, depending on the layout of CA hierarchy deployed in the network. However, it is recommended that each intermediate CA manage multiple certificates of the same type.

The two CMPv2 procedures used by OCCM are:

- Initialization procedure: This is used to create certificates.
- Key update procedure: This is used for certificate renewal scenarios.

OCCM employs two modes to establish initial trust between OCCM and CAs for initial trust establishment:

- Using a pre-shared key
- Using a key and certificate

These options are available when the first request is made towards the CA. For all subsequent requests, OCCM uses the certificate based mechanism to sign the CMPv2 requests in compliance with 3GPP standards.

Note

OCCM supports HTTP 1.0 and HTTP 1.1 versions. OCCM initiates the request using HTTP 1.0. If the CA supports HTTP 1.1 only, then OCCM shifts to using HTTP 1.1 version.

3.1.1 Establishing Initial Trust Between OCCM and CA

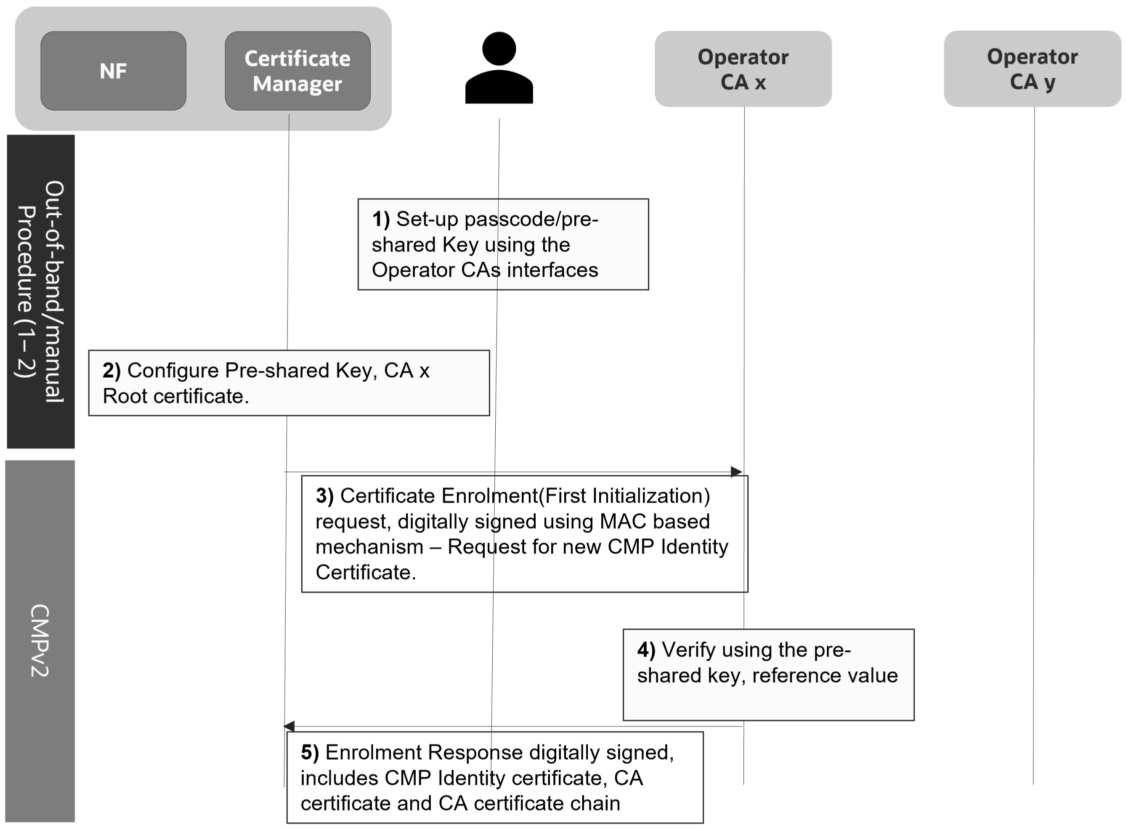
OCCM can be configured to establish trust between Oracle Communication Certificate (OCCM) and Certificate Authorities (CAs) by enabling PKI message protection in the following ways:

- MAC based trust establishment
- Certificate based trust establishment

3.1.1.1 MAC Based Trust Establishment

OCCM supports initial trust establishment with each of the configured CAs using the preconfigured pre-shared (MAC) key.

Figure 3-1 MAC Based Trust Establishment

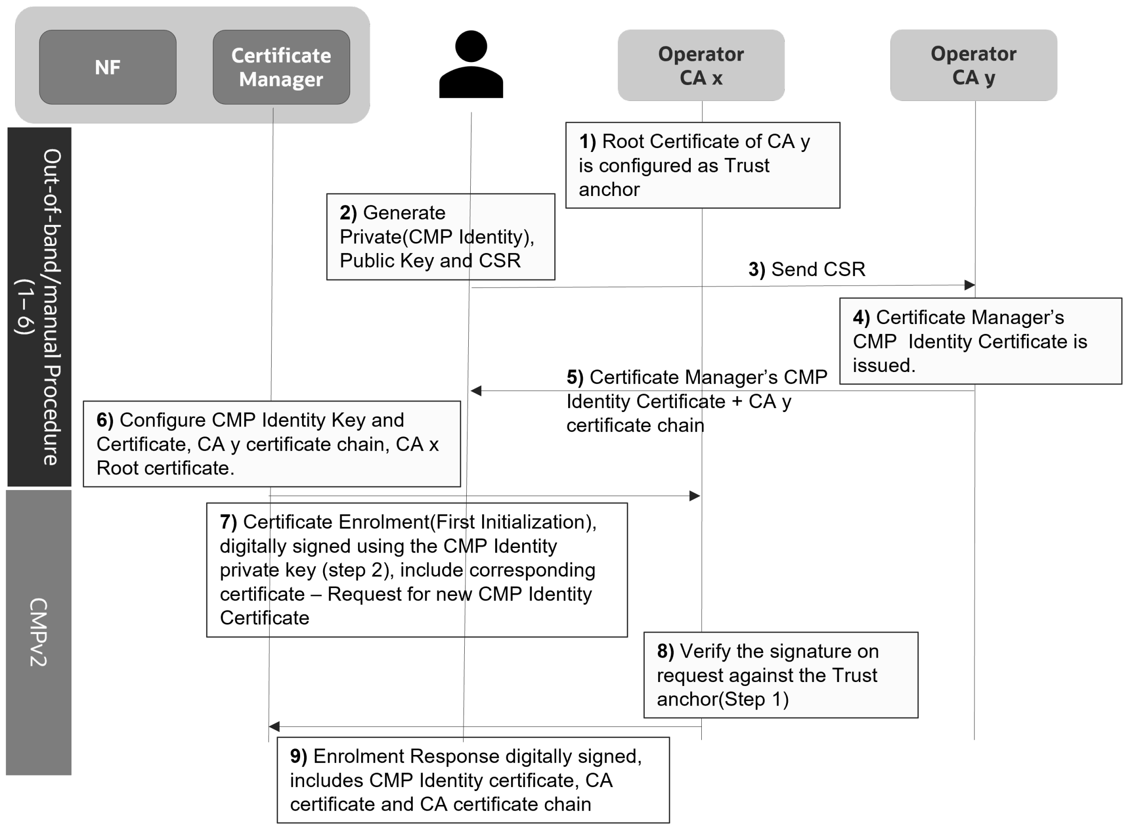

NF
Certificate Manager
Operator CA x
Operator CA y
Out-of-band/manual Procedure (1 – 2)
CMPv2
1) Set-up passcode/pre-shared Key using the Operator CAs interfaces
2) Configure Pre-shared Key, CA x Root certificate.
3) Certificate Enrolment(First Initialization) request, digitally signed using MAC based mechanism – Request for new CMP Identity Certificate.
4) Verify using the pre-shared key, reference value
5) Enrolment Response digitally signed, includes CMP Identity certificate, CA certificate and CA certificate chain

OCCM generates the key pair and requests for the OCCM certificate for each of the configured CAs using the first Initialization Request. The first Initialization Request towards each of the CAs is signed using the preshared key. The CA authenticates the initialization request and signs the OCCM Certificate. OCCM can be configured to authenticate the responses of the first initializing procedure using the preshared (MAC) key. All subsequent requests are always signed using the OCCM key and certificate.

3.1.1.2 Certificate Based Trust Establishment

OCCM supports initial trust establishment with CA using the preconfigured private key and x.509 certificate.

Figure 3-2 Certificate Based Trust Establishment


NF
Certificate Manager
Operator CA x
Operator CA y
Out-of-band/manual Procedure (1 – 6)
CMPv2
1) Root Certificate of CA y is configured as Trust anchor
2) Generate Private(CMP Identity), Public Key and CSR
3) Send CSR
4) Certificate Manager's CMP Identity Certificate is issued.
5) Certificate Manager's CMP Identity Certificate + CA y certificate chain
6) Configure CMP Identity Key and Certificate, CA y certificate chain, CA x Root certificate.
7) Certificate Enrolment(First Initialization), digitally signed using the CMP Identity private key (step 2), include corresponding certificate – Request for new CMP Identity Certificate
8) Verify the signature on request against the Trust anchor(Step 1)
9) Enrolment Response digitally signed, includes CMP Identity certificate, CA certificate and CA certificate chain

OCCM signs the first initialization request towards a CA using preconfigured key or certificate.

OCCM can be configured to:

- Continue using the same key and certificate to sign the subsequent CMPv2 requests OR
- Generate a new certificate using the first Initialization Request

In case OCCM uses the same key and certificate to sign the subsequent CMPv2 requests, OCCM requests for generation of the NF certificate in the first Initialization Request.

In case OCCM generates a new certificate using the first Initialization Request, OCCM requests for generation of OCCM certificate in the first Initialization Request. NF Certificate generation is requested from next Initialization Request onwards.

3.2 Support for HTTPs Encryption

Managing HTTPs Encryption

This feature enables you to encrypt the traffic between OCCM and CAs using HTTPs. HTTPs encryption at the transport layer adds an additional layer of security.

OCCM, as a HTTP Client, supports HTTPs connections with CAs using One-Way TLS when authenticating the identity if the CAs. OCCM manages a TrustStore (CA Bundle) to validate the certificates presented by the CAs in the certificate message of the TLS handshake procedure. You can either use the same CA Bundle configuration for all the configured CAs, or different CA Bundles as per your requirements.

OCCM validates the CA certificate as per the RFC 5280 standards, and the TLS handshake can get rejected if the certificate is invalid, or expired:

- Certificate Path validation
- Certificate expiry
- Certificate Strict checking

OCCM supports the following TLS configurations:

- Version TLSv1.2 and TLSv1.3 including support for version rollback to TLSv1.2 in case the CA does not support TLSv1.3
- OCCM acts as the HTTP(s) client while communicating with CA and all the relevant requirements apply.

Configuring HTTPs Encryption

The HTTPs functionality can be manually configured by the operator. The operator can:

- Configure and manually update the CA Bundle used to validate the TLS handshake.
- Enable and disable the strict checking of the X.509 certificates presented for HTTPs. This verifies if the certificates are RFC 5280 compliant.
- Enable or disable the checking of X.509 certificate critical extensions.

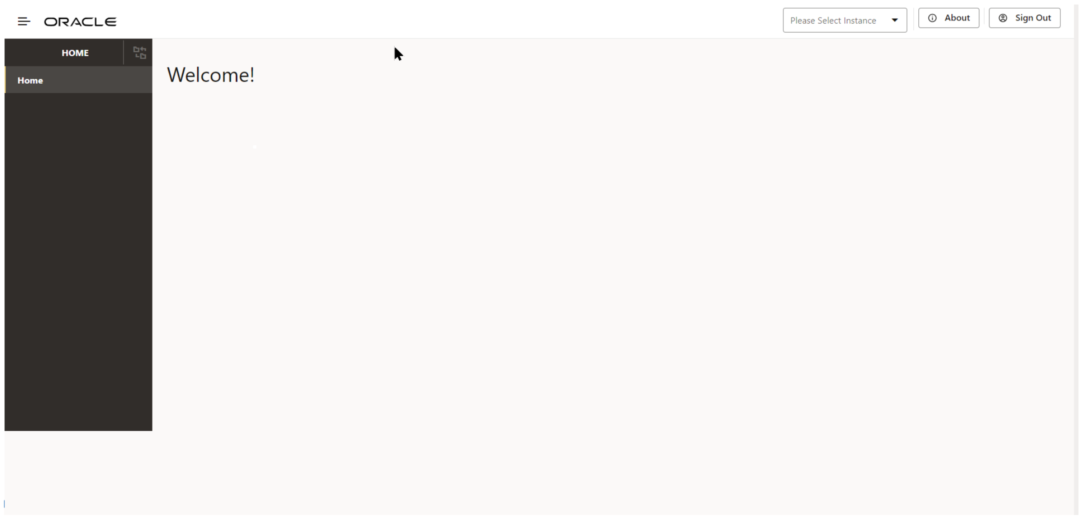
3.3 Accessing OCCM from CNC Console

This section describes the procedure to access the OCCM cluster from the CNC Console GUI.

To access OCCM from CNC Console:

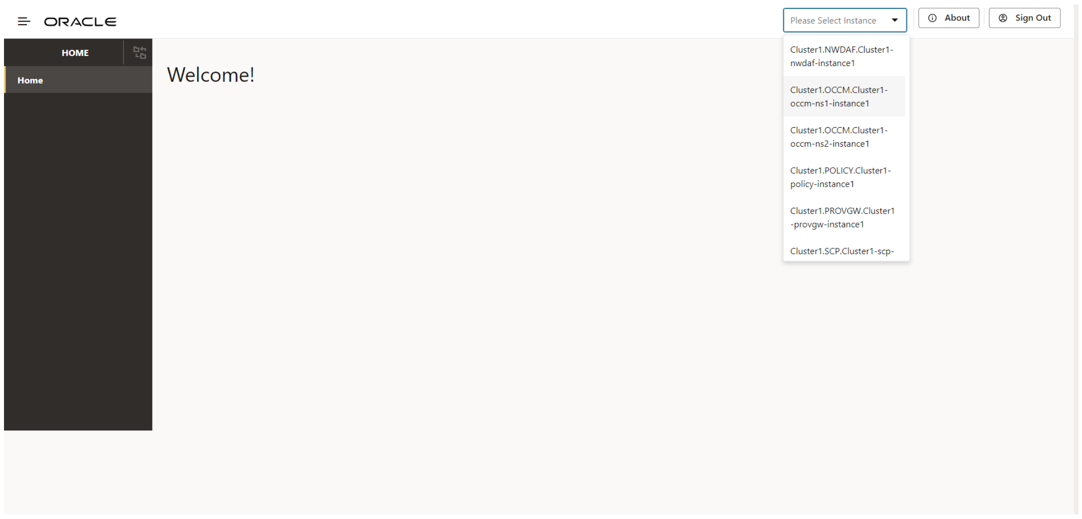
1. Log in to CNC Console using your login credentials.

Figure 3-3 CNC Console Landing Page



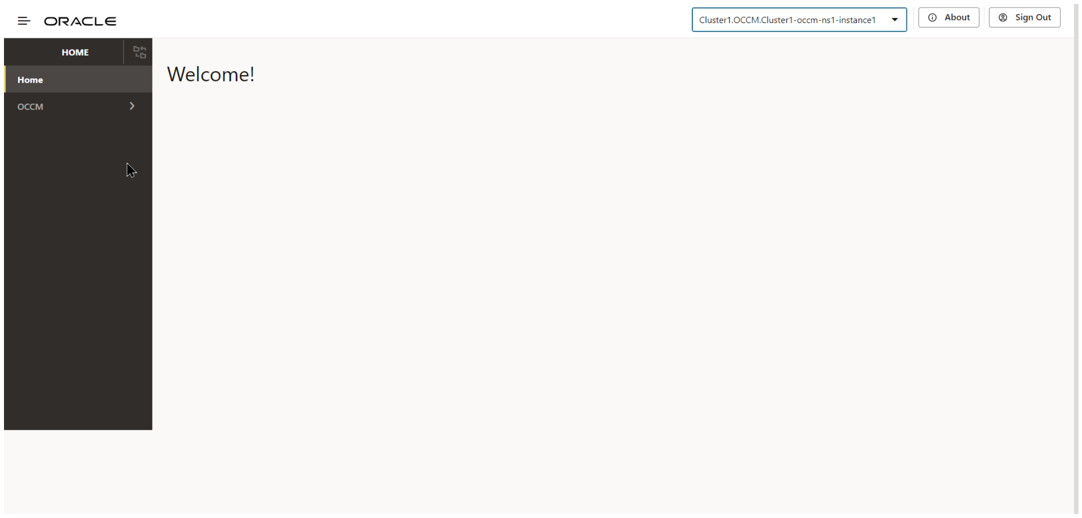
2. From the **Select Instance** drop-down, select the **OCCM** Instance.

Figure 3-4 OCCM Instance


ORACLE
Please Select Instance
About
Sign Out
HOME
Home
Welcome!
Cluster1.NWDAF.Cluster1-nwdaf-instance1
Cluster1.OCCM.Cluster1-occm-ns1-instance1
Cluster1.OCCM.Cluster1-occm-ns2-instance1
Cluster1.POLICY.Cluster1-policy-instance1
Cluster1.PROVGW.Cluster1-provgw-instance1
Cluster1.SCP.Cluster1-scp-

The OCCM menu appears on the left pane.

Figure 3-5 OCCM Configuration Options



3.4 Managing Issuers

Issuers, also called Certificate Authorities (CAs), are a trusted entity that issues Secure Sockets Layer (SSL) certificates. OCCM supports the following aspects of issuer management:

- Pre-configuration for OCCM Bootstrapping
- Creating Issuers
- Updating Issuers
- Deleting Issuers

3.4.1 Pre-configuration for OCCM Bootstrapping

The following secrets can be pre-configured for OCCM bootstrapping:

- **MAC Secret:** The MAC secret is a manually configured pre-shared key or password based MAC secret and reference. This is used by OCCM to sign the first initialization request. CA then validates the request and issues a signed OCCM certificate. For more information see the 'Using the pre-shared key' section in OCCM Certificate Configuration Modes.
  To create the MAC Secret, run the following command:

  ```
  kubectl create secret generic <k8s secret name> --from-literal=<mac secret
  key>=<mac secret value> --from-literal=<reference key>=<reference value> -
  n <namespace>
  ```

  For example:

  ```
  kubectl create secret generic ca1-mac-secret --from-
  literal=pwd='pass:****' --from-literal=ref='abcd' -n ns1
  ```

- **CMP Identity Secret:** The CMP Identity secret is a manually configured private key and certificate, using which OCCM certificate is requested from CA. This is used by OCCM to sign the first initialization request. CA then validates the request and issues a signed OCCM certificate. You can also use the same private key and certificate as OCCM certificate. For more information, see the 'Using the pre-configured private key and certificate' section in OCCM Certificate Configuration Modes
  To create the CMP Identity Key, run the following command:

  ```
  kubectl create secret generic <k8s secret name> --from-file=<cmp key file
  location> --from-file=<cmp cert file location> -n <namespace>
  ```

  For example:

  ```
  kubectl create secret generic ca1-cmp-identity-secret --from-
  file=cmpkey.pem --from-file=cmpcert.pem -n ns1
  ```

- **OCCM Trust Store Secret:** The OCCM Trust Store secret holds OCCM trust store information (CA certificates), and is used as a trust anchor when validating the digital signature included in the CMP responses.
  To create the OCCM Trust Store secret, run the following command:

  ```
  kubectl create secret generic <k8s secret name> --from-file=<CA root cert
  file location> --from-file=<Intermediate CA cert file location> --from-
  file=<CMP server cert file location> -n <namespace>
  ```

  For example:

  ```
  kubectl create secret generic ca1-occm-trust-store-secret --from-
  file=caroot.pem --from-file=intcacert.pem --from-file=servercert.pem -n ns1
  ```

- **TLS Trust Store Secret:** If TLS is enabled for issuer, TLS Trust Store secret should be provided else it should be skipped. It holds the CA certificates to be used as trust anchors when authenticating the TLS server certiifcate. To create the TLS Trust Store secret, run the following command:

```
kubectl create secret generic <k8s secret name> --from-file=<CA cert file
location> -n <namespace>
```

For example:

```
kubectl create secret generic ca1-tls-trust-store-secret --from-
file=caroot1.pem -n ns1
```

HTTPS communication between OCCM and CA

OCCM supports HTTPS connections with CA using one-way TLS. To enable the same, the operator has to set enableTLS option in the issuer configuration to true and configure the HTTPS schemed server URL. TLS trust store has to be configured with trust anchors in order to authenticate the TLS server.

In order to enable or disable strict checking of the X.509 certificates presented for HTTPs, the following deployment time (helm) parameters can be configured.

- **occmConfig.cmp.config.tls.enableX509StrictCheck:** This field when set to true enables strict checking of the X.509 certificates presented for HTTPs. Errors are thrown for the certificates which are not compliant with RFC 5280.
- **occmConfig.cmp.config.tls.ignoreCriticalExtensionsCheck:**
  This field when set to true ignores checking of the critical extensions in X.509 certificates presented for HTTPs.

  Normally if an unhandled critical extension is present that is not supported by OpenSSL the certificate is rejected in compliance with RFC 5280.

> **Note**
>
> This configuration will be applied only when TLS is enabled for an issuer.

3.4.2 Creating Issuer

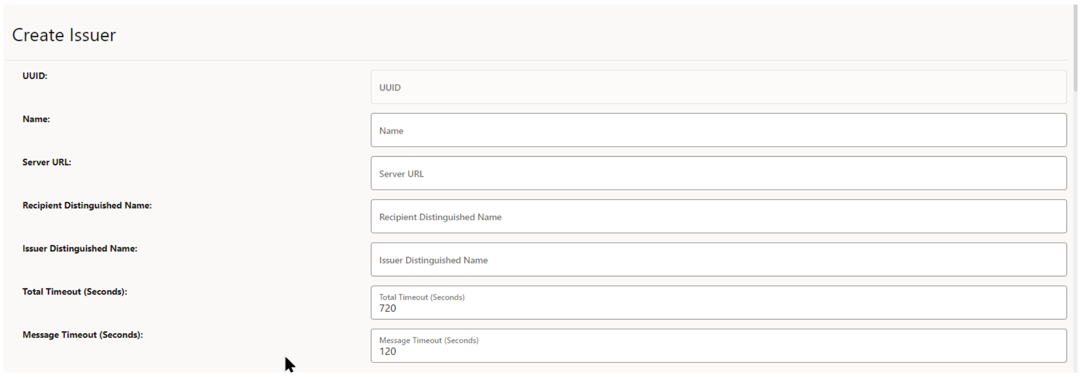
Issuers are resources that represent CAs and are able to generate signed certificates. You can configure issuers through REST API or using the CNC Console GUI. The maximum number of issuers that can be supported at a time is 30.

Configuring Issuer Using CNC Console GUI

To manually configure issuer using CNC Console GUI:

1. Log in to CNC Console using your login credentials and select the OCCM Instance.
2. Click **OCCM** from the left pane and then click **Issuer**.
3. Click **Add**. The **Create Issuer** page appears.

Figure 3-6   Create Issuer


Create Issuer

UUID:	UUID
Name:	Name
Server URL:	Server URL
Recipient Distinguished Name:	Recipient Distinguished Name
Issuer Distinguished Name:	Issuer Distinguished Name
Total Timeout (Seconds):	Total Timeout (Seconds) 720
Message Timeout (Seconds):	Message Timeout (Seconds) 120

4. Enter the following information on the Create Issuer page:

Table 3-1   Create Issuer

Field Name	Description
Name	Name of the Issuer.
Recipient Distinguished Name	Distinguished name(DN) of the CMP server (usually the addressed CA) used in the recipient field of CMP request message headers. The argument must be formatted as /type0=value0/type1=value1/type2=.... Special characters may be escaped by \ (backslash); whitespace is retained. Empty values are permitted, but the corresponding type will not be included. Giving a single / will lead to an empty sequence of RDNs (a NULL-DN). Multi-valued RDNs can be formed by placing a + character instead of a / between the AttributeValueAssertions (AVAs) that specify the members of the set. For example: `/DC=org/DC=OpenSSL/DC=users/UID=123456+CN=John Doe`
Server URL	Domain URL of CA
Issuer Distinguished Name	X509 issuer Distinguished Name of the CA server to place in the requested certificate template in IR or KUR. The argument must be formatted as /type0=value0/type1=value1/type2=.... Special characters may be escaped by \ (backslash); whitespace is retained. Empty values are permitted, but the corresponding type will not be included. Giving a single / will lead to an empty sequence of RDNs (a NULL-DN). Multi-valued RDNs can be formed by placing a + character instead of a / between the AttributeValueAssertions (AVAs) that specify the members of the set. For example: `/DC=org/DC=OpenSSL/DC=users/UID=123456+CN=John Doe`
Total Timeout (Seconds)	The total time in seconds allowed for the CMP transaction to complete.

Table 3-1 (Cont.) Create Issuer

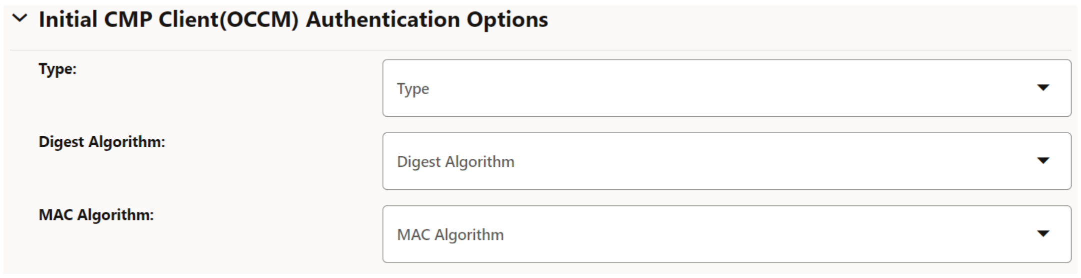
Field Name	Description
Message Timeout (Seconds)	The total time (in seconds) a CMP request-response message round trip is allowed to take.

5. Under **Initial CMP Client(OCCM) Authentication Options**, enter the following information:

Table 3-2 Initial Authentication Options

Field Name	Possible Values
Type	MAC, SIGNATURE For more information, see OCCM Certificate Configuration Modes.
Digest Algorithm	SHA256, SHA384, SHA512
MAC Algorithm	HMACSHA256, HMACSHA384, HMACSHA512

Figure 3-7 Initial CMP Client(OCCM) Authentication Options



Initial CMP Client(OCCM) Authentication Options

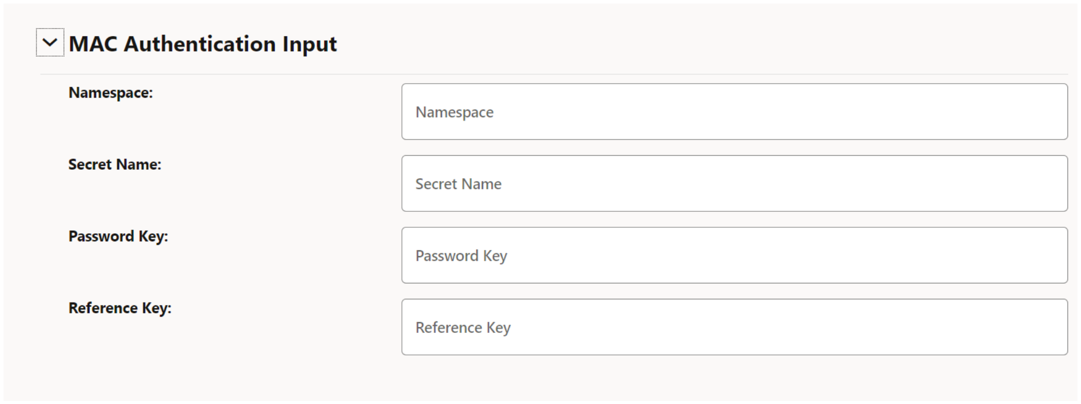
Type:	Type
Digest Algorithm:	Digest Algorithm
MAC Algorithm:	MAC Algorithm

6. If you are using the password based MAC authentication mechanism, then under **MAC Authentication Input**, enter the following information:

Table 3-3 MAC Authentication Input

Field Name	Description
Namespace	Name of the Kubernetes namespace.
Secret Name	Kubernetes secret name.
Password Key	Kubernetes secret data key against which MAC secret is provided.
Reference Key	Kubernetes secret data key against which reference string is provided.

Figure 3-8 MAC Authentication Input


MAC Authentication Input

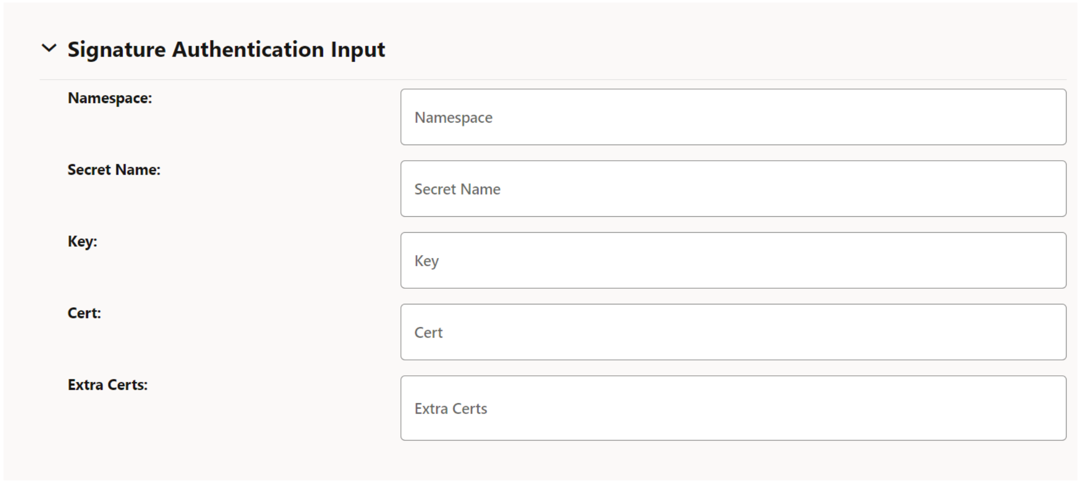
Namespace:	Namespace
Secret Name:	Secret Name
Password Key:	Password Key
Reference Key:	Reference Key

7. Under **Signature Authentication Input,** enter the following information:

Table 3-4 Signature Authentication Input

Field Name	Description
Namespace	Name of the Kubernetes namespace.
Secret Name	A unique secret name.
Key	Kubernetes secret data key against which the pre-configured private key file (private key file for the client's current CMP signer certificate) is provided.
Cert	Kubernetes secret data key against which the pre-configured certificate (client's current CMP signer certificate) is provided.
Extra Certs	Extra Certificates, if any, for client authentication.

Figure 3-9 Signature Authentication Input


Signature Authentication Input

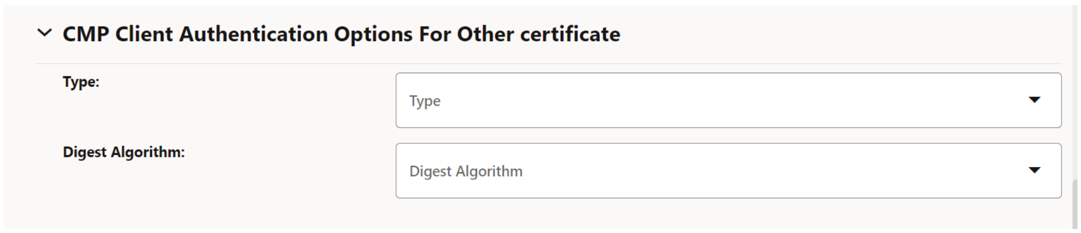
Namespace:	Namespace
Secret Name:	Secret Name
Key:	Key
Cert:	Cert
Extra Certs:	Extra Certs

8. Under **CMP Client Authentication Options For Other certificate**, enter the following information:

Table 3-5 CMP Client Authentication Options For Other certificate

Field Name	Possible Values
Type	SIGNATURE
Digest Algorithm	SHA256, SHA384, SHA512

Figure 3-10 CMP Client Authentication Options For Other certificate



CMP Client Authentication Options For Other certificate

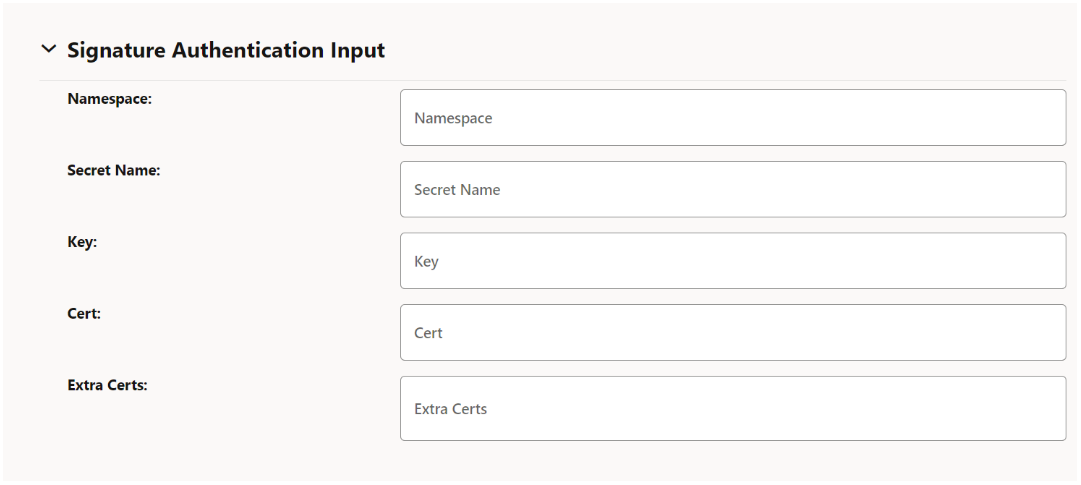
Type:	Type
Digest Algorithm:	Digest Algorithm

9. Under **Signature Authentication Input,** enter the following information:

Table 3-6 Signature Authentication Input

Field Name	Description
Namespace	Name of the Kubernetes namespace
Secret Name	A unique secret name
Key	Kubernetes secret data key against which OCCM key is provided or created based on whether OCCM certificate is created in manual or automatic mode.
Cert	Kubernetes secret data key against which OCCM certificate is provided or created based on whether OCCM cert is created in manual or automatic mode.
Extra Certs	List of Kubernetes secret data keys against which the certificates to append in the extraCerts field can be provided or will be created (if received from CA) along with the OCCM certificate, based on whether OCCM cert is created in manual or automatic mode.

Figure 3-11   Signature Authentication Input

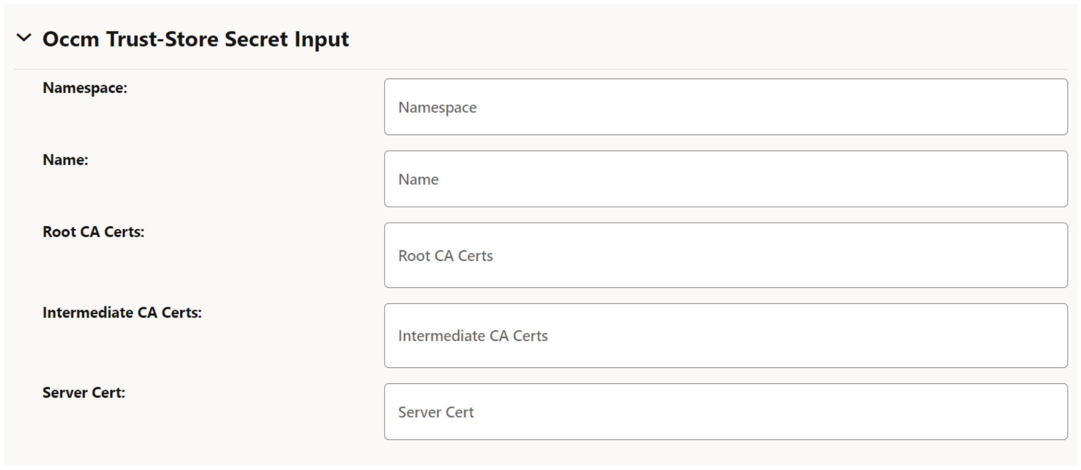


10. Under **Occm Trust-Store Secret Input**, enter the following information:

Table 3-7   Occm Trust-Store Secret Input

Field	Description
Namespace	Name of the Kubernetes namepace.
Name	Kubernetes secret which holds OCCM trust store information (CA certificates).
Root CA Certs	The certificate(s), typically of root CAs, the client uses as trust anchors when validating the certificate issued by CA. **Note**: If server certtificate is present, this is ignored.
Intermediate CA Certs	Any untrusted intermediate CA certificate(s) to use when validating newly enrolled certificates.
Server Cert	CMP server or CA server's certificate to expect and directly trust when validating the certificate issued by CA. **Note**: If this is present, root CA certificates will be ignored.

Figure 3-12 Occm Trust-Store Secret Input


Occm Trust-Store Secret Input

Namespace: Namespace

Name: Name

Root CA Certs: Root CA Certs

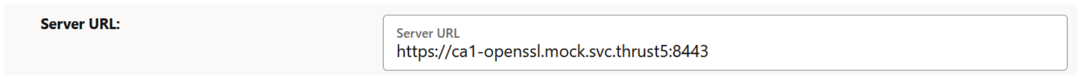
Intermediate CA Certs: Intermediate CA Certs

Server Cert: Server Cert

11. Enter either the root CA certificates and intermediate CA certificate, or the server certificate in the respective fields.
12. Under TLS Configuration, enter the following information:

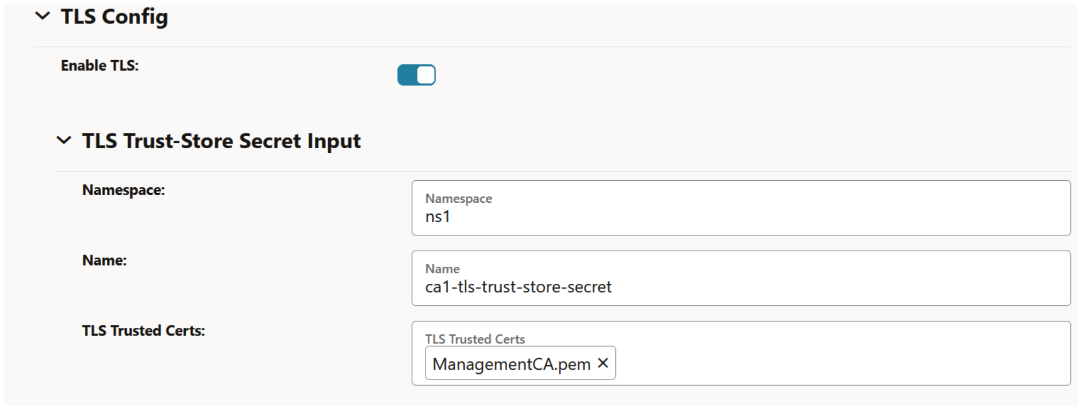
Field	Description
Enable TLS	When set to true, HTTPS connection to CA is made. Ensure selecting scheme as HTTPS in server URL if this is set to true.

Figure 3-13 TLS Configuration


Server URL: Server URL https://ca1-openssl.mock.svc.thrust5:8443

Field	Description
Namespace	Kubernetets namespace where TLS trust store secret is present.
Name	Kubernetes secret which holds TLS trust store information (CA certificates).
TLS trusted Certs	Trusted certificate(s) to use for validating the TLS server certificate.

Figure 3-14 Enable TLS



Enable TLS: on

Namespace: ns1

Name: ca1-tls-trust-store-secret

TLS Trusted Certs: ManagementCA.pem ✕

13. Click **Save**.

3.4.3 Updating Issuer

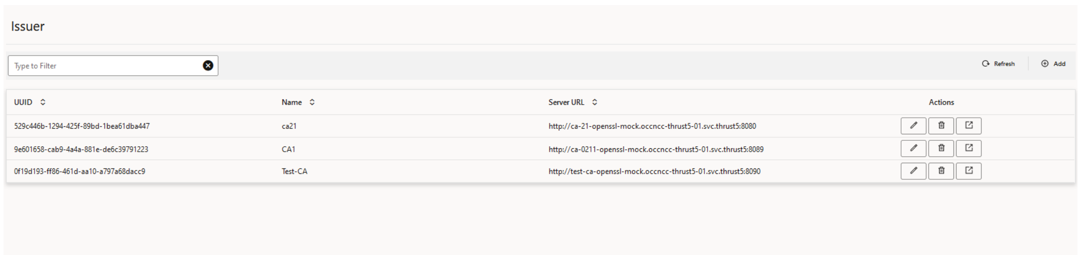
You can update all the fields in Edit issuer if no certificate configuration is attached to it. However, if any certification configuration is mapped to the given issuer, only the following fields can be edited:

- Server URL
- TLS Configuration

To update the issuer:

1. Log in to CNC Console using your login credentials and select the OCCM Instance.
2. Click **OCCM** from the left pane and then click **Issuer**.

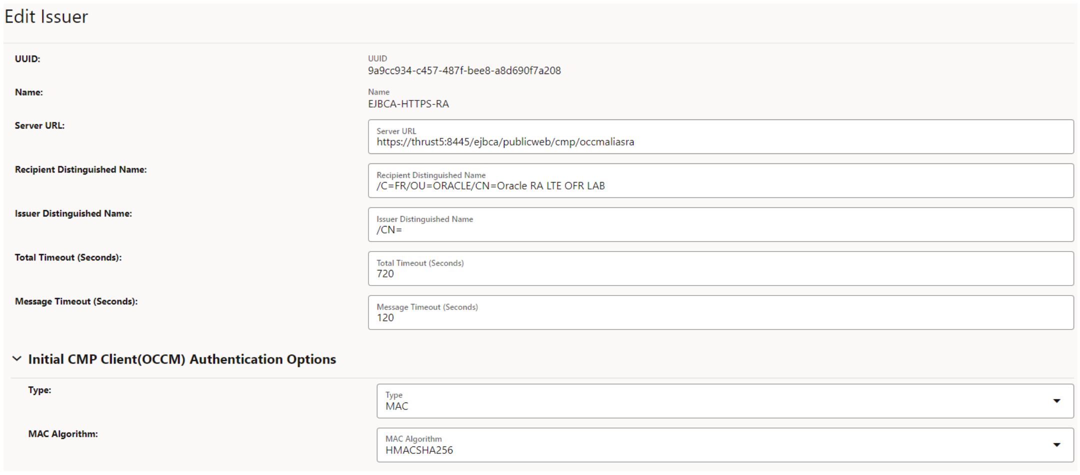
Figure 3-15 Issuer Page



UUID	Name	Server URL	Actions
529c446b-1294-425f-89bd-1bea61dba447	ca21	http://ca-21-openssl-mock.occncc-thrust5-01.svc.thrust5:8080	
9e601658-cab9-4a4a-881e-de6c39791223	CA1	http://ca-0211-openssl-mock.occncc-thrust5-01.svc.thrust5:8089	
0f19d193-ff86-461d-aa10-a797a68dacc9	Test-CA	http://test-ca-openssl-mock.occncc-thrust5-01.svc.thrust5:8090	

3. Click the pencil icon next to the issuer that you want to update. The Edit Issuer page appears.

Figure 3-16 Edit Issuer


Edit Issuer

UUID:	UUID 9a9cc934-c457-487f-bee8-a8d690f7a208
Name:	Name EJBCA-HTTPS-RA
Server URL:	Server URL https://thrust5:8445/ejbca/publicweb/cmp/occmaliasra
Recipient Distinguished Name:	Recipient Distinguished Name /C=FR/OU=ORACLE/CN=Oracle RA LTE OFR LAB
Issuer Distinguished Name:	Issuer Distinguished Name /CN=
Total Timeout (Seconds):	Total Timeout (Seconds) 720
Message Timeout (Seconds):	Message Timeout (Seconds) 120

Initial CMP Client(OCCM) Authentication Options

Type:	Type MAC
MAC Algorithm:	MAC Algorithm HMACSHA256

4. Edit the fields that you need to update and then click **Save**.

> **Note**
>
> Issuer can't be edited if it is in use by any certificate.

3.4.4 Deleting Issuers

To delete issuers:

1. Log in to CNC Console using the login credentials, and select the OCCM Instance.
2. Click **OCCM** from the left pane and then click **Issuer**.
3. Click **Delete** and click **OK** on the confirmation prompt to delete the issuer.

> **Note**
>
> An issuer can only be deleted if there are no certificates referring to this issuer entry.

3.5 Managing Certificates

OCCM creates a new key-pair (private and public key) for each of the certificates to be created. This is applicable to both NF and OCCM certificates.

OCCM supports the following key aspects of certificate management:

- Creating OCCM Certificates
- Creating NF Certificates
- Monitoring and Renewing OCCM and NF Certificates

Note

- Grafana dashboards can be used to visualize certificate status such as expiry time, etc.
- The maximum number of certificates supported (OCCM certificates and NF certificates combined) is 100.
- OCCM supports the generation of certificates in compliance with 3GPP TS 33.310 version 17.3.0, release 17, section 6.1.3c.3. You must refer to the 3GPP specification when configuring certificates.

3.5.1 Creating OCCM Certificates

Each certificate configuration in OCCM is a certificate request. It specifies input fields that are used to generate a private key pair and certificate signing request to obtain a signed certificate from the referenced issuer.

To create an OCCM certificate:

- A CMPv2 Initialization Request (IR) is sent to the CA. Each request supports one certificate request. A separate IR for each certificate request is used.
- The IRs and Certificate Confirms are digitally signed by the CMP Identity Key.
- OCCM supports Proof of Possession (PoP) in the initialization request. PoP of the signing key contains the algorithm identifier and signature. This signature is based on the certificates template structure.
- The recommended signing algorithms for the CMPv2 messages and Proof of Possession are RSA Encryption and ECDSA.
- The recommended hash algorithms for the CMPv2 messages and Proof of Possession are SHA-256 and SHA-384.

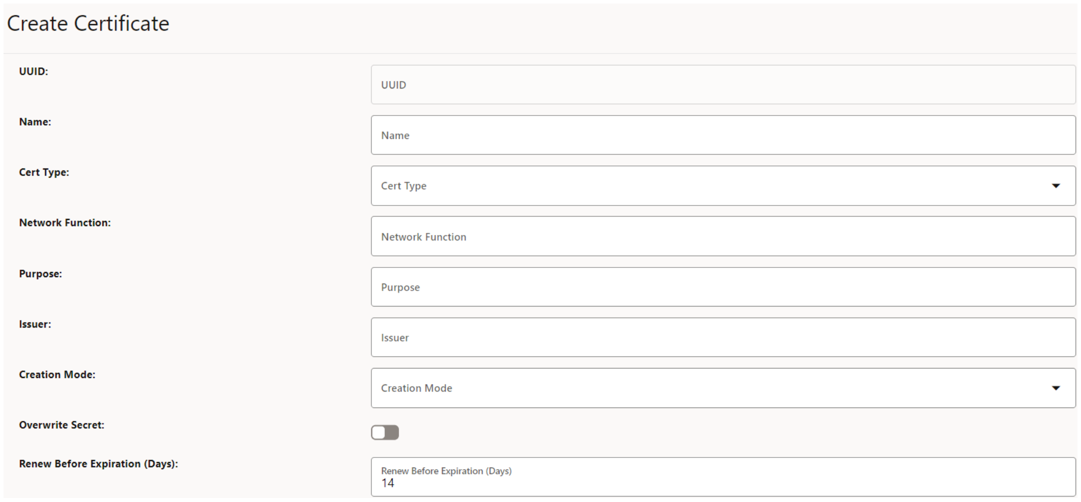
When the preshared key mechanism is used to establish the initial trust between OCCM and CA, the first OCCM certificate, also known as CMP Identity Key Certificate, corresponding to a particular CA is created in the first initialization procedure.

When certificate based initial trust is established, then the operator can choose to continue with the preconfigured OCCM certificate, or can choose to create a new OCCM certificate using the first initialization procedure, which is configurable.

To create OCCM Certificates:

1. Login to CNC Console using your login credentials and select the OCCM Instance.
2. Click **OCCM** from the left pane and then click **Certificate**.
3. Click **Add**. The **Create Certificate** page appears.

Figure 3-17 Create OCCM Certificate



Create Certificate

UUID:	UUID
Name:	Name
Cert Type:	Cert Type
Network Function:	Network Function
Purpose:	Purpose
Issuer:	Issuer
Creation Mode:	Creation Mode
Overwrite Secret:	
Renew Before Expiration (Days):	Renew Before Expiration (Days) 14

4. Enter the following information:

Table 3-8 Create OCCM Certificate

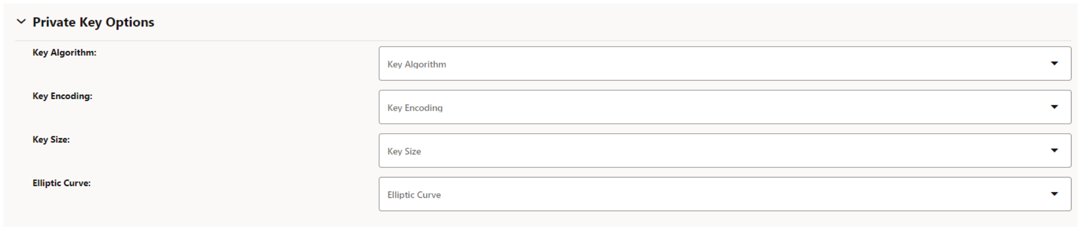
Field Name	Description and Possible Values
Name	Name of the certificate.
Cert Type	Select OCCM for OCCM certificates.
Network Function	OCCM
Purpose	Purpose of the OCCM Certificate.
Issuer	Name of the issuer for the certificate.
Creation Mode	Possible values are MANUAL and AUTOMATIC. For more information, see OCCM Certificate Configuration Modes.

5. Under **Private Key Options**, enter the following information:

Table 3-9 Private Key Options

Field Name	Possible Values
Key Algorithm	RSA, EC
Key Encoding	DER, PEM
Key Size	KEYSIZE_2048, KEYSIZE_4096
Elliptic Curve	SECP256r1, SECP384r1

Figure 3-18 Private Key Options



Private Key Options

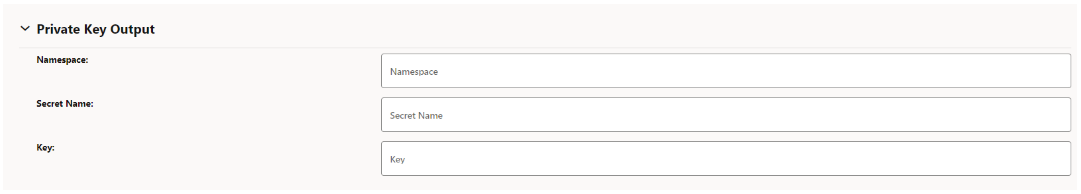
Key Algorithm:	Key Algorithm
Key Encoding:	Key Encoding
Key Size:	Key Size
Elliptic Curve:	Elliptic Curve

6. The **Private Key Output** section is auto populated from corresponding issuer after the certificate is saved. You can skip this section.

Table 3-10 Private Key Output

Field Name	Description
Namespace	Name of the namespace.
Secret Name	Kubernetes Secret Name.
Key	Kubernetes secret key against which the key-pair will be stored.

Figure 3-19 Private Key Output


Private Key Output

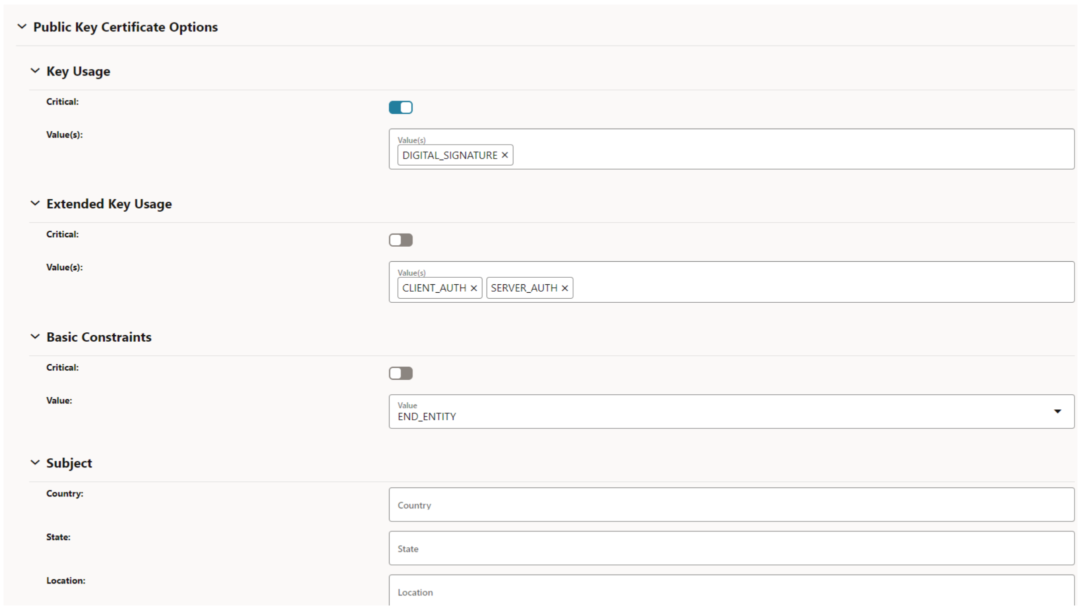
Namespace:	Namespace
Secret Name:	Secret Name
Key:	Key

7. Under **Public Key Certificate Options**, enter the following:

Table 3-11 Public Key Certificate Options

Field Name	Description
Key Usage	Value(s): DIGITAL_SIGNATURE
Extended Key Usage	Value(s): CLIENT_AUTH and SERVER_AUTH
Basic Constraints	Value(s): END_ENTITY
Subject	Country: Enter country code: State: Enter state code. Location: City or town where company is legally located. Organization: Name of your organization. Organisation Unit: Name of business unit. Common Name: The Common Name (CN) represents the server name to be protected by the certificate. Requested Validity (Days): Number of days requested for which the certificate will be valid.

Figure 3-20 Public Key Certificate Options

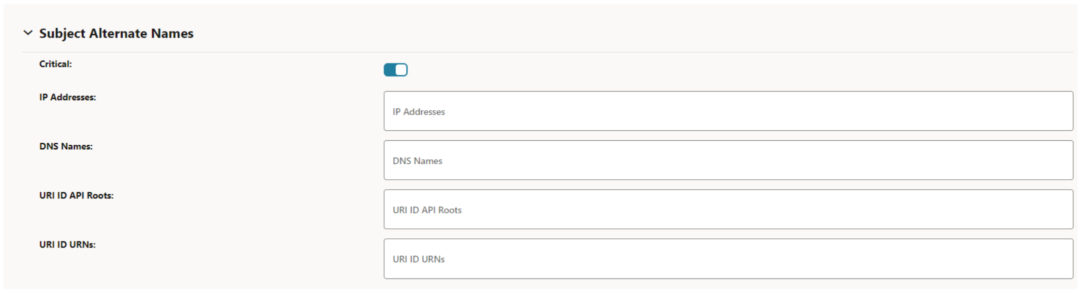


8. Under **Subject Alternate Names**, enter the following:

Table 3-12 Subject Alternate Names

Field Name	Description
IP Address	The IPs you want to protect under this certificate.
DNS Names	List of DNS domain names.
URI ID API Roots	List of URI IDs.
URI ID URNs	List of URI IDs.

Figure 3-21 Subject Alternate Names



9. The **Certificate Output** section is auto populated from corresponding issuer after the certificate is saved. You can skip this section.

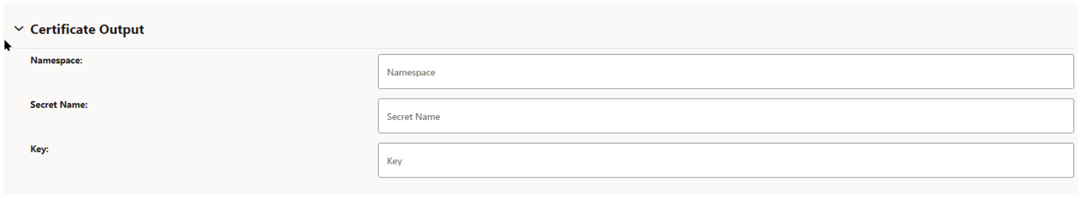
Table 3-13 Certificate Output

Field Name	Description
Namespace	Name of the namespace.
Secret Name	Name of the secret.

Table 3-13 (Cont.) Certificate Output

Field Name	Description
Key	The key against which the certificate will be populated.

Figure 3-22 Certificate Output

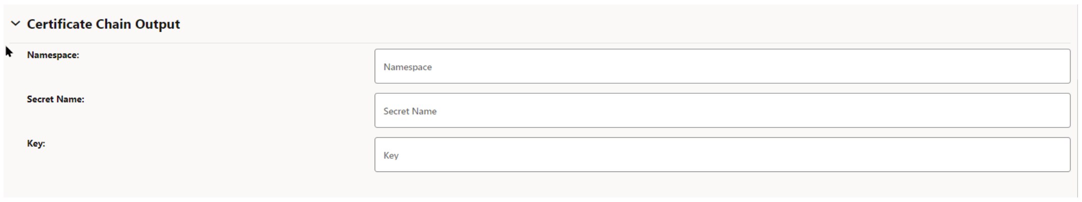


10. (Optional) Under **Certificate Chain Output**, enter the following:

Table 3-14 Certificate Chain Output

Field Name	Description
Namespace	Name of the namespace.
Secret Name	Name of the secret.
Key	Kubernetes secret key against which the certificate chain will be stored.

Figure 3-23 Certificate Chain Output



If the **Certificate Chain Output** section is filled, then the certificate chain can either be obtained from the CA or can be configured manually. This is based on the `extractCertChainFromCmpResponse` helm parameter. For more information, see *Oracle Communications Cloud Native Core, Certificate Management Installation, Upgrade, and Fault Recovery Guide*

> **Note**
>
> `extractCertChainFromCmpResponse:` This field when set true specifies that certificate chain will be extracted from CA's CMP response message. When false, the operator can configure the chain manually. This certificate chain is used in the TLS handshake along with the certificate.

11. Click **Save**.

3.5.1.1 OCCM Certificate Configuration Modes

The following section highlights the configuration applicable to these modes and control how the OCCM certificates are generated. The purpose of the following issuer configuration and certificate configuration sections is to highlight the difference in the fields for different modes.

OCCM can be configured with one of the following modes available to establish the initial Trust with the CA(s):

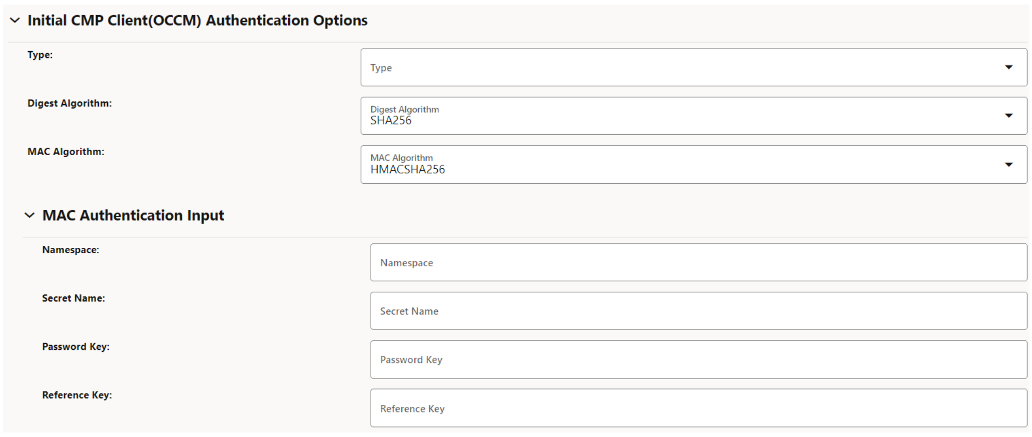
- Using the pre-shared key
- Using the pre-configured private key and certificate

Using the Pre-shared Key

With this mode of configuration, OCCM signs the first initialization request using the pre-shared key. CA validates the request and issues a signed OCCM certificate.

1. **Issuer configuration**
   To configure the issuer using the pre-shared key,
   a. The MAC authentication input must be provided under **Initial CMP Client (OCCM) Authentication Options**.

Figure 3-24 Initial CMP Client(OCCM) Authentication Options



Initial CMP Client(OCCM) Authentication Options

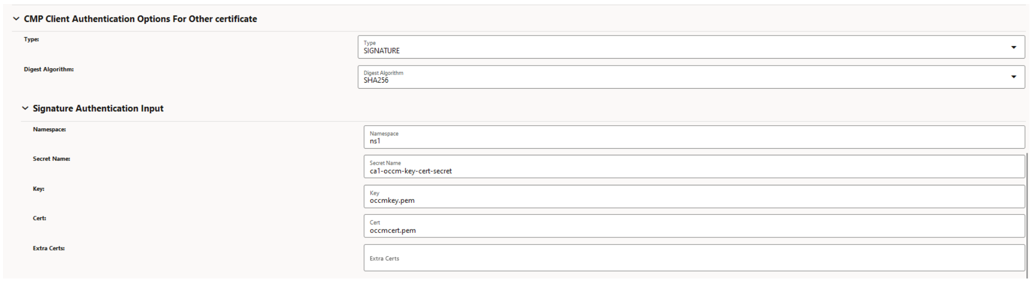
Type:	Type
Digest Algorithm:	Digest Algorithm SHA256
MAC Algorithm:	MAC Algorithm HMACSHA256

MAC Authentication Input

Namespace:	Namespace
Secret Name:	Secret Name
Password Key:	Password Key
Reference Key:	Reference Key

   b. OCCM key and certificate output location must be specified under **CMP Client Authentication Options for Other Certificate**. OCCM certificate received from CA will be written here.

Figure 3-25 CMP Client Authentication Options for Other Certificate



CMP Client Authentication Options For Other certificate

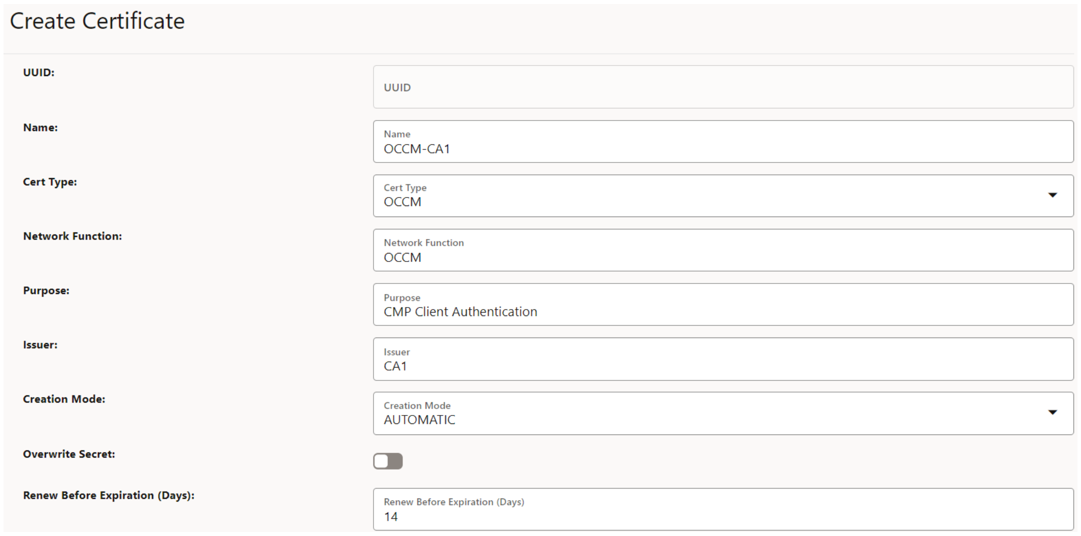
Type:	Type SIGNATURE
Digest Algorithm:	Digest Algorithm SHA256

Signature Authentication Input

Namespace:	Namespace ns1
Secret Name:	Secret Name ca1-occm-key-cert-secret
Key:	Key occmkey.pem
Cert:	Cert occmcert.pem
Extra Certs:	Extra Certs

2. **Certificate configuration**
   To configure the OCCM Certificate using the pre-shared key, select OCCM from the **Cert Type** drop down, and select AUTOMATIC from **Creation Mode** on the **Create Certificate** page.

Figure 3-26 OCCM Certificate Configuration using Pre-shared Key



Create Certificate

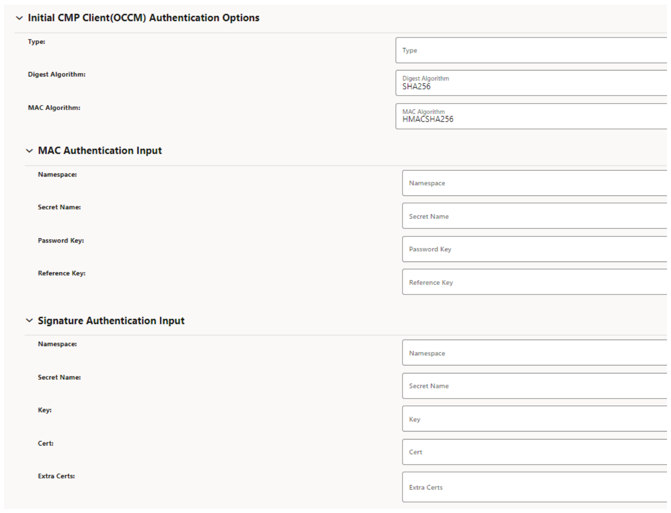
UUID:	UUID
Name:	Name: OCCM-CA1
Cert Type:	Cert Type: OCCM
Network Function:	Network Function: OCCM
Purpose:	Purpose: CMP Client Authentication
Issuer:	Issuer: CA1
Creation Mode:	Creation Mode: AUTOMATIC
Overwrite Secret:	
Renew Before Expiration (Days):	Renew Before Expiration (Days): 14

Using the pre-configured private key and certificate

The pre-configured private key and certificate mode can be used in the following two ways:

1. OCCM signs the first initialization request using the pre-configured private key and certificate. CA validates the request and issues a signed OCCM certificate.
   a. **Issuer Configuration**
      Here, to configure the issuer,
      i. Provide the Signature authentication input under **Initial CMP Client(OCCM) Authentication Options.**

Figure 3-27 Initial CMP Client(OCCM) Authentication Options



Initial CMP Client(OCCM) Authentication Options

Type:	Type
Digest Algorithm:	Digest Algorithm: SHA256
MAC Algorithm:	MAC Algorithm: HMACSHA256

MAC Authentication Input

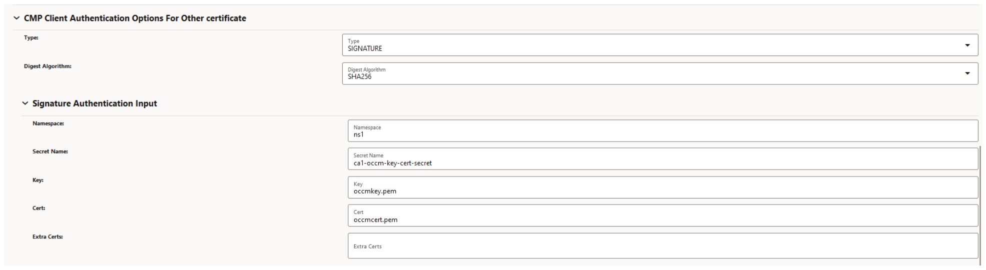
Namespace:	Namespace
Secret Name:	Secret Name
Password Key:	Password Key
Reference Key:	Reference Key

Signature Authentication Input

Namespace:	Namespace
Secret Name:	Secret Name
Key:	Key
Cert:	Cert
Extra Certs:	Extra Certs

ii. OCCM key and certificate output location needs to be specified under **CMP Client Authentication Options for Other Certificate.** OCCM certificate received from CA will be written here.

Figure 3-28 CMP Client Authentication Options for Other Certificate



CMP Client Authentication Options For Other certificate

Type:	SIGNATURE
Digest Algorithm:	SHA256

Signature Authentication Input

Namespace:	ns1
Secret Name:	ca1-occm-key-cert-secret
Key:	occmkey.pem
Cert:	occmcert.pem
Extra Certs:	

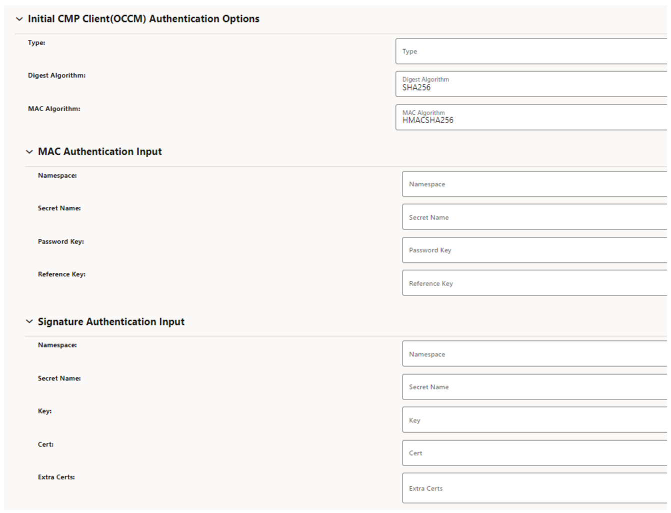
b. **OCCM Certificate Configuration**
To configure the OCCM Certificate, select OCCM from the **Cert Type** drop down, and select AUTOMATIC from the **Creation Mode** on the **Create Certificate** page.

2. The pre-configured private key and certificate (generated out of band) can itself be used as the OCCM certificate.

   a. **Issuer Configuration**

      i. Here, you must skip the **Initial CMP Client(OCCM) Authentication Options.**

Figure 3-29 Issuer Configuration



Initial CMP Client(OCCM) Authentication Options

Type:	
Digest Algorithm:	SHA256
MAC Algorithm:	HMACSHA256

MAC Authentication Input

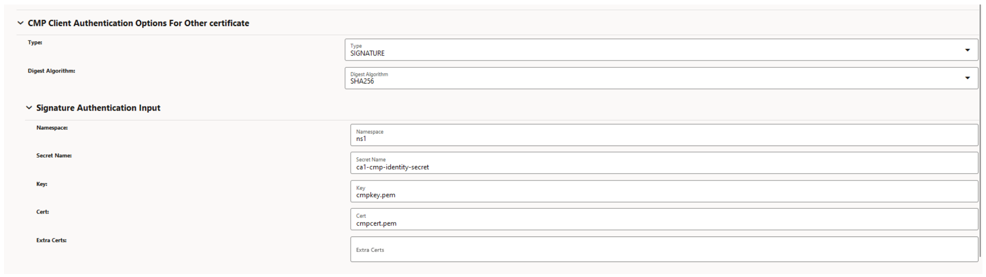
Namespace:	
Secret Name:	
Password Key:	
Reference Key:	

Signature Authentication Input

Namespace:	
Secret Name:	
Key:	
Cert:	
Extra Certs:	

ii. OCCM key and certificate output location needs to be specified under **CMP Client Authentication Options for Other Certificate.** Manually created OCCM key and certificate location should be specified here.

Figure 3-30   CMP Client Authentication Options for Other Certificate



CMP Client Authentication Options For Other certificate

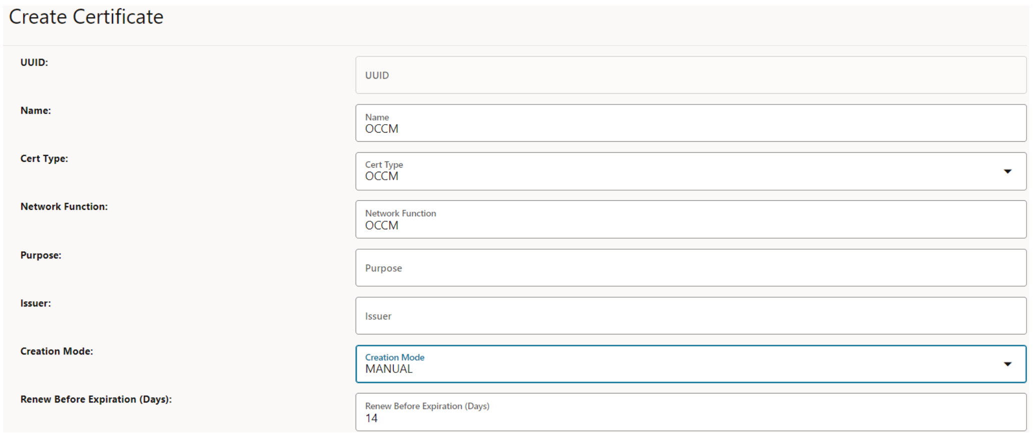
Type:	Type SIGNATURE
Digest Algorithm:	Digest Algorithm SHA256

Signature Authentication Input

Namespace:	Namespace ns1
Secret Name:	Secret Name ca1-cmp-identity-secret
Key:	Key cmpkey.pem
Cert:	Cert cmpcert.pem
Extra Certs:	Extra Certs

b. **OCCM Certificate Configuration**
To configure the OCCM Certificate, select OCCM from the **Cert Type** drop down, and select MANUAL from the **Creation Mode** on the **Create Certificate** page.

Figure 3-31   OCCM Certificate Configuration



Create Certificate

UUID:	UUID
Name:	Name OCCM
Cert Type:	Cert Type OCCM
Network Function:	Network Function OCCM
Purpose:	Purpose
Issuer:	Issuer
Creation Mode:	Creation Mode MANUAL
Renew Before Expiration (Days):	Renew Before Expiration (Days) 14

Note

This configuration is available for each of the issuers, therefore the modes for the CAs can be controlled individually.

3.5.2 Create NF Certificates

To create an NF certificate:

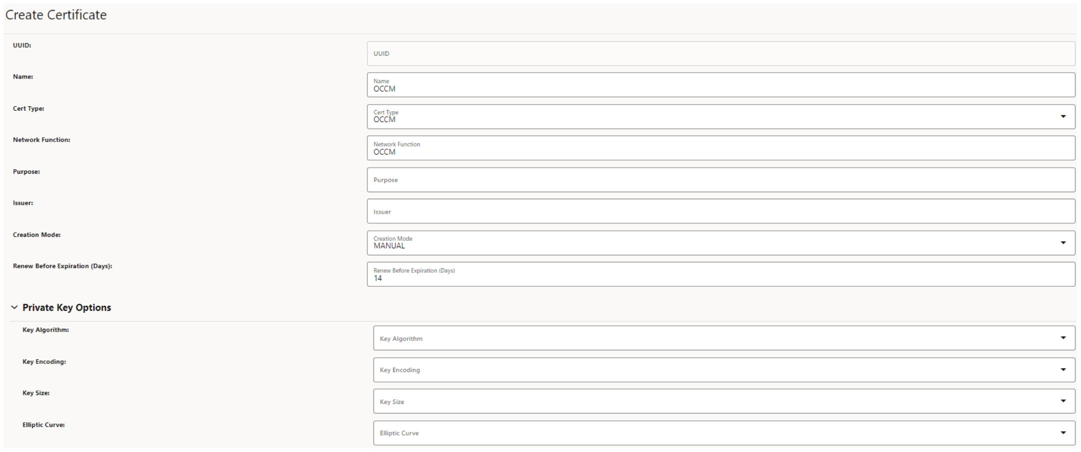
- A CMPv2 Initialization Request (IR) is sent to the CA. Each request supports one certificate request. A separate initialization request for each certificate request is used.
- The IRs and Certificate Confirms are digitally signed by the CMP Identity Key.
- OCCM supports Proof of Possession (PoP) in the initialization request. PoP of the signing key contains the algorithm identifier and signature. This signature is based on the certificates template structure.
- The recommended signing algorithms for the CMPv2 messages and Proof of Possession are RSA Encryption and ECDSA.
- The recommended hash algorithms for the CMPv2 messages and Proof of Possession are SHA-256 and SHA-384.

You can configure NF certificates through REST API or using the CNC Console GUI.

To create NF Certificates using CNC Console GUI:

1. Log in to CNC Console using your login credentials and select the OCCM Instance.
2. Click **OCCM** from the left pane and then click **Certificate**.
3. Click **Add**. The **Create Certificate** page appears.

Figure 3-32 Create NF Certificate



Create Certificate

UUID:	UUID
Name:	Name OCCM
Cert Type:	Cert Type OCCM
Network Function:	Network Function OCCM
Purpose:	Purpose
Issuer:	Issuer
Creation Mode:	Creation Mode MANUAL
Renew Before Expiration (Days):	Renew Before Expiration (Days) 14

Private Key Options

Key Algorithm:	Key Algorithm
Key Encoding:	Key Encoding
Key Size:	Key Size
Elliptic Curve:	Elliptic Curve

4. Enter the following information:

Table 3-15 Create NF Certificate

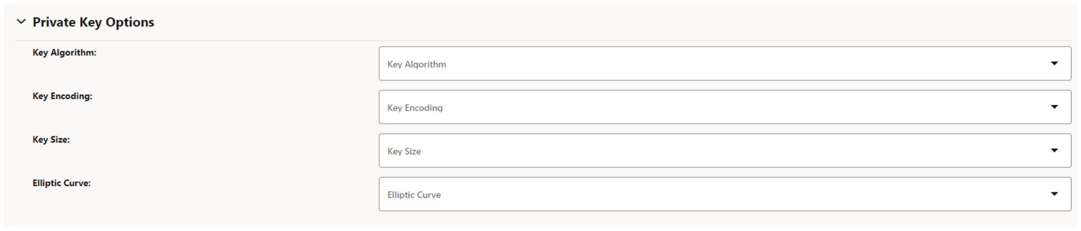
Field Name	Description and Possible Values
Name	Name of the certificate.
Cert Type	Select OTHER for NF certificates.
Network Function	Name of the NF.
Purpose	Purpose of the NF certificate.
Issuer	Name of the issuer for the certificate.
Creation Mode	Possible values are MANUAL and AUTOMATIC.

5. Under **Private Key Options**, enter the following information:

Table 3-16 Private Key Options

Field Name	Possible Values
Key Algorithm	RSA, EC
Key Encoding	DER, PEM
Key Size	KEYSIZE_2048, KEYSIZE_4096
Elliptic Curve	SECP256r1, SECP384r1

Figure 3-33 Private Key Options

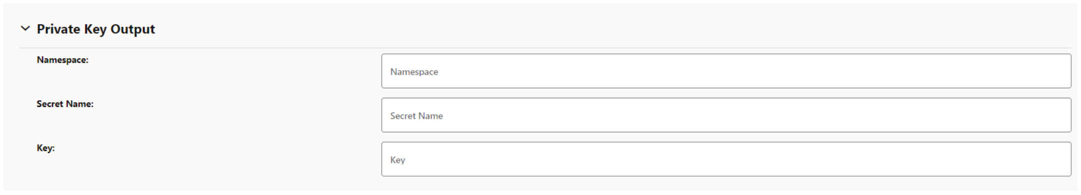


6. **Under Private Key Output,** enter the following information:

Table 3-17 Private Key Output

Field Name	Description
Namespace	Name of the namespace.
Secret Name	Kubernetes Secret Name.
Key	Kubernetes secret key against which the key-pair will be stored.

Figure 3-34 Private Key Output

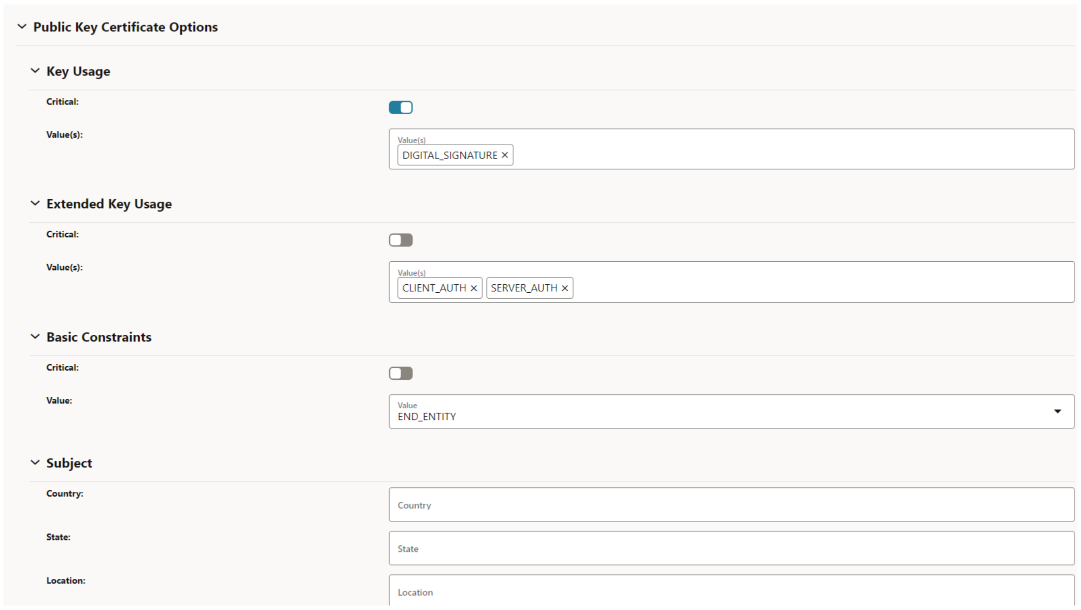


7. Under **Public Key Certificate Options**, enter the following:

Table 3-18 Public Key Certificate Options

Field Name	Description
Key Usage	Value(s): DIGITAL_SIGNATURE
Extended Key Usage	Value(s): CLIENT_AUTH and SERVER_AUTH
Basic Constraints	Value(s): END_ENTITY
Subject	Country: Enter country code: State: Enter state code. Location: City or town where company is legally located. Organization: Name of your organization. Organisation Unit: Name of business unit. Common Name: The Common Name (CN) represents the server name to be protected by the certificate. Requested Validity (Days): Number of days requested for which the certificate will be valid.

Figure 3-35 Public Key Certificate Options



Public Key Certificate Options

Key Usage

Critical:

Value(s): DIGITAL_SIGNATURE ×

Extended Key Usage

Critical:

Value(s): CLIENT_AUTH × SERVER_AUTH ×

Basic Constraints

Critical:

Value: END_ENTITY

Subject

Country: Country

State: State

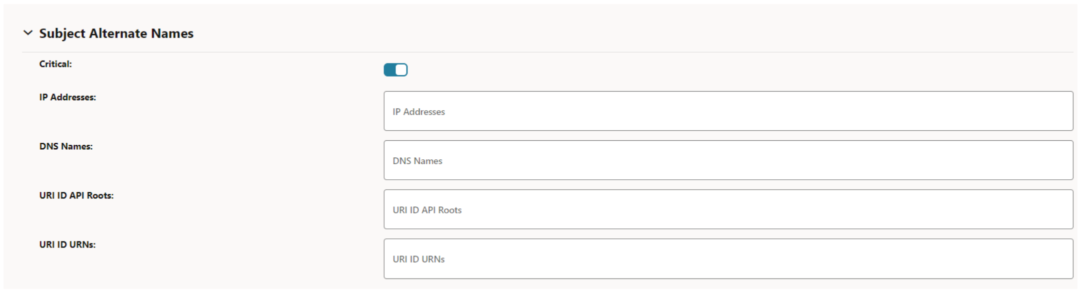
Location: Location

8. Under **Subject Alternate Names**, enter the following:

Table 3-19 Subject Alternate Names

Field Name	Description
IP Address	The IPs you want to protect under this certificate.
DNS Names	List of DNS domain names.
URI ID API Roots	List of URI ID (API root of the NF Instance).
URI ID URNs	List of URI ID (URN of the NFInstanceId).

Figure 3-36 Subject Alternate Names



Subject Alternate Names

Critical:

IP Addresses: IP Addresses

DNS Names: DNS Names

URI ID API Roots: URI ID API Roots

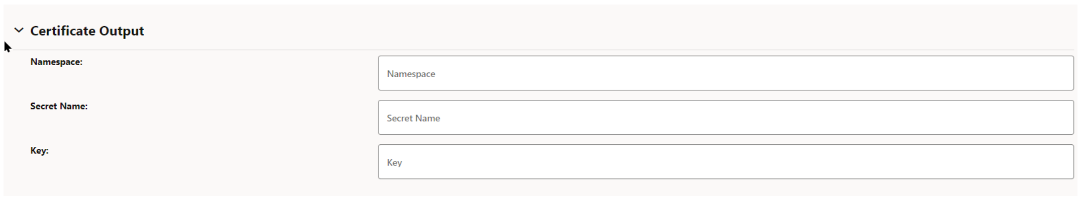
URI ID URNs: URI ID URNs

9. Under Certificate Output, enter the following for the NF certificate:

Table 3-20 Certificate Output

Field Name	Description
Namespace	Name of the namespace.
Secret Name	Name of the secret.
Key	The key against which the certificate will be populated.

Figure 3-37 Certificate Output


Certificate Output

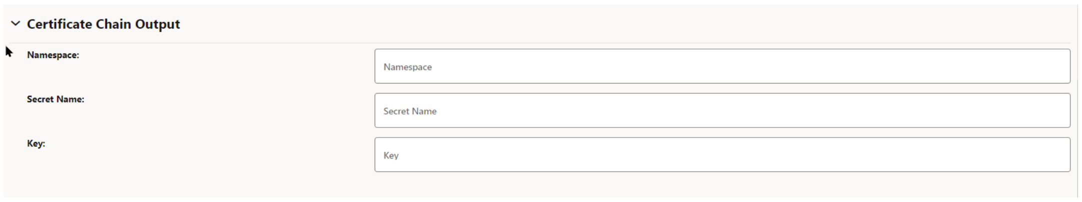
Namespace:	Namespace
Secret Name:	Secret Name
Key:	Key

10. (Optional) Under **Certificate Chain Output**, enter the following:

Table 3-21 Certificate Chain Output

Field Name	Description
Namespace	Name of the namespace.
Secret Name	Name of the secret.
Key	Kubernetes secret key against which the certificate chain will be stored.

Figure 3-38 Certificate Chain Output


Certificate Chain Output

Namespace:	Namespace
Secret Name:	Secret Name
Key:	Key

If the **Certificate Chain Output** section is filled, then the certificate chain can either be obtained from the CA or can be configured manually. This is based on the `extractCertChainFromCmpResponse` helm parameter. For more information, see *Oracle Communications Cloud Native Core, Certificate Management Installation, Upgrade, and Fault Recovery Guide*

Note

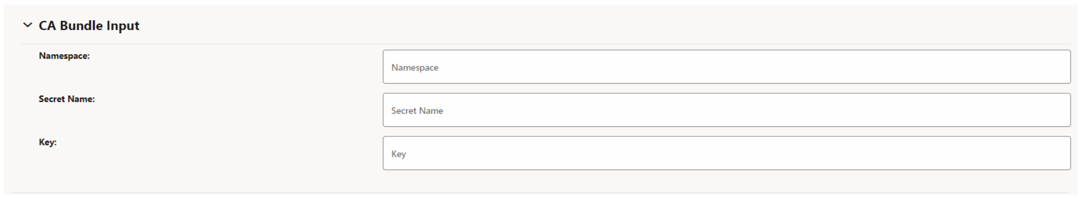
`extractCertChainFromCmpResponse:` This field when set true specifies that certificate chain will be extracted from CA's CMP response message. When false, the operator can configure the chain manually. This certificate chain is used in the TLS handshake along with the certificate.

11. (Optional) under **CA Bundle Input**, enter the following information:

Table 3-22 CA Bundle Input

Field Name	Description
Namespace	Name of the namespace.
Secret Name	Name of the secret.
Key	Kubernetes secret key against which CA bundle certificate(s) will be stored.

Figure 3-39 CA Bundle Input


CA Bundle Input

Namespace:	Namespace
Secret Name:	Secret Name
Key:	Key

12. Click **Save**.

For sample NF configuration, see Creating NF Certificate Using OCCM - Sample Configuration.

3.5.3 Renew NF Certificates

To renew NF certificates:

- OCCM sends CMPv2 Key Update Request (KUR) to the CA.
- KUR is used to renew OCCM certificate (CMP Identity Key) and NF Certificates.
- The KUR can be signed either by the OCCM key and certificate or by the certificate that is being renewed and its corresponding key. The corresponding certificate is included in extraCerts.

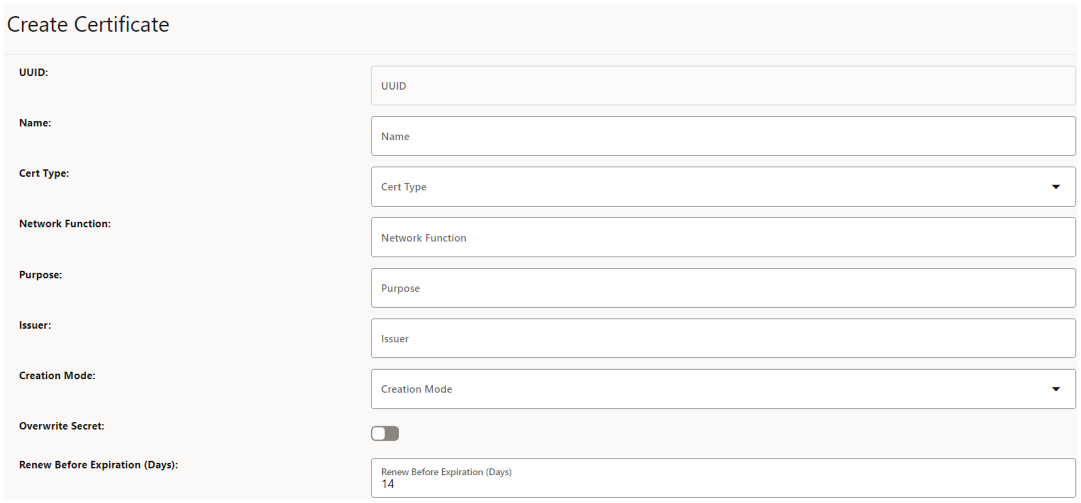
To renew certificates:

1. **Set the Key Update Request mode:**
   Certificate renewal is a CMP KUR procedure. You can configure OCCM to sign the KUR in two ways:
   - Using OCCM key and certificate.
   - Using the certificate that is being renewed and its corresponding key.

   You can use the `occmConfig.cmp.config.useOccmCertSignForKur` parameter to determine how OCCM will sign the KUR at the time of deployment.
   - If `occmConfig.cmp.config.useOccmCertSignForKur` is set to true, OCCM key and certificate will be used to sign the CMP KUR message.
   - If `occmConfig.cmp.config.useOccmCertSignForKur` is set to false, the certificate that is being renewed will be used.

   By default, this parameter is set to false.
2. **Configure Renew Before Expiration (days)**:
   OCCM monitors the certificate validity and initiates automatic certificate renewal based on the renew before period configuration. You can update the **Renew Before Expiration (Days)** field on the **Create Certificate** page at the time of certificate creation. This field specifies the number of days before the certificate expiry date when the certificate must be renewed.

Figure 3-40 Renew Before Expiration (Days)

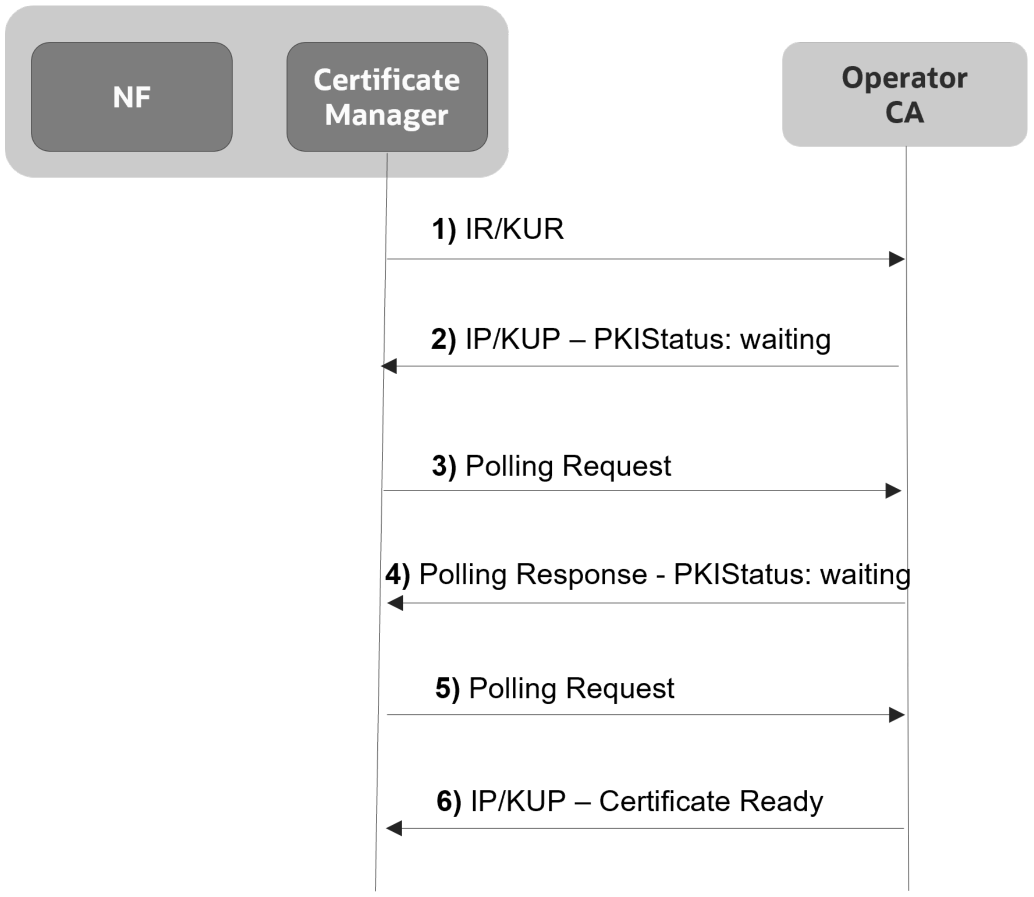

Create Certificate

UUID:	UUID
Name:	Name
Cert Type:	Cert Type
Network Function:	Network Function
Purpose:	Purpose
Issuer:	Issuer
Creation Mode:	Creation Mode
Overwrite Secret:	
Renew Before Expiration (Days):	Renew Before Expiration (Days) 14

3.5.4 Polling for Certificates

After the Initialization Response or Key Update Response, if the certificate is not available yet, the CA responds with PKI status 'Waiting'. The application keeps polling until the CA is ready with the certificate. Openssl implicitly handles polling. No additional configuration is required at the application level in this regard. However, the Total Timeout field can be set in the issuer configuration, which can restrict this polling time. It is the maximum total number of seconds a transaction may take, including polling etc. If the time specified by total timeout has elapsed, the polling will stop.

Figure 3-41 Polling for Certificates


NF
Certificate Manager
Operator CA
1) IR/KUR
2) IP/KUP – PKIStatus: waiting
3) Polling Request
4) Polling Response - PKIStatus: waiting
5) Polling Request
6) IP/KUP – Certificate Ready

3.5.5 Deleting the Certificate Configuration

To delete the certificate configuration:

1. Log in to CNC Console using your log in credentials and select the **OCCM** Instance.
2. Click **OCCM** from the left pane and then click **Certificate**.
3. Click **Delete** and click **OK** on the confirmation prompt to delete the certificate.

Note

This procedure only deletes the certificate configuration from OCCM.
Run the following command to delete the Kubernetes secret holding the certificates:

```
kubectl delete secrets <secret name> -n <namespace>
```

For example:

```
kubectl delete secrets nrf-tls-secret -n ns1
```

3.5.6 Recreating Certificates

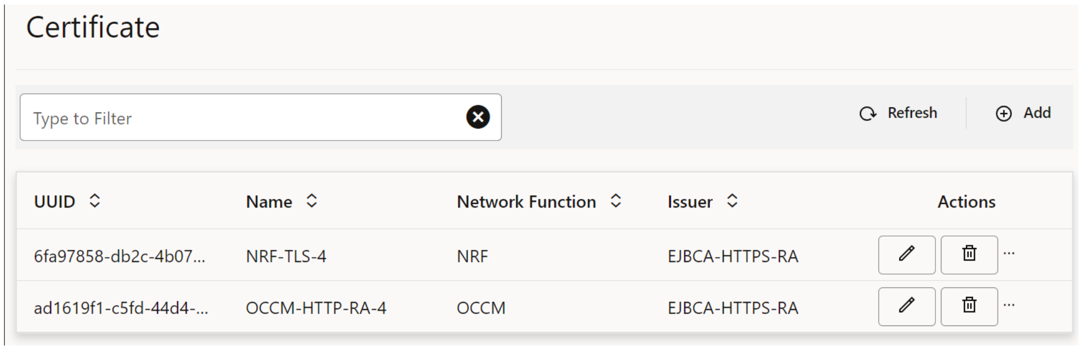
This feature enables you to recreate certificates using the existing certificate configuration on CNC Console GUI. Certificate recreation uses CMPv2 initialization request and response procedures.

You can recreate any certificate that is in ready or expired status. This enhances OCCM's usablity in managing certificate lifecycle operations. For example, if a certificate has been deleted, revoked or has expired, the operator can recreate it using existing configurations.

To recreate a certificate:

1. Log in to CNC Console using your login credentials and select the OCCM Instance.
2. Click **OCCM** from the left pane and then click **Certificate**.
3. Click **Edit** under **Actions** for the certificate you want to recreate.

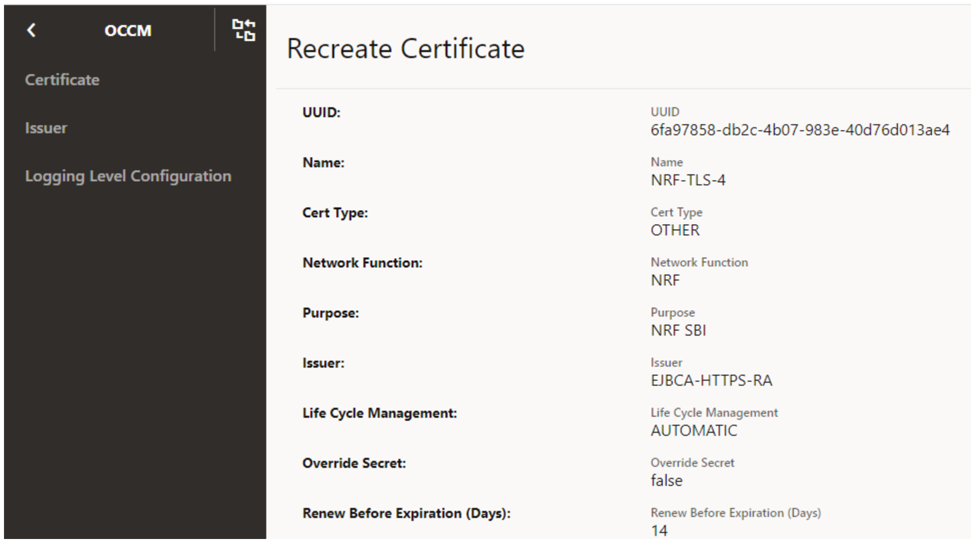
Figure 3-42 Certificate Page



UUID	Name	Network Function	Issuer	Actions
6fa97858-db2c-4b07...	NRF-TLS-4	NRF	EJBCA-HTTPS-RA	
ad1619f1-c5fd-44d4-...	OCCM-HTTP-RA-4	OCCM	EJBCA-HTTPS-RA	

The **Recreate Certificate** page appears. The configurations on this page are not editable.

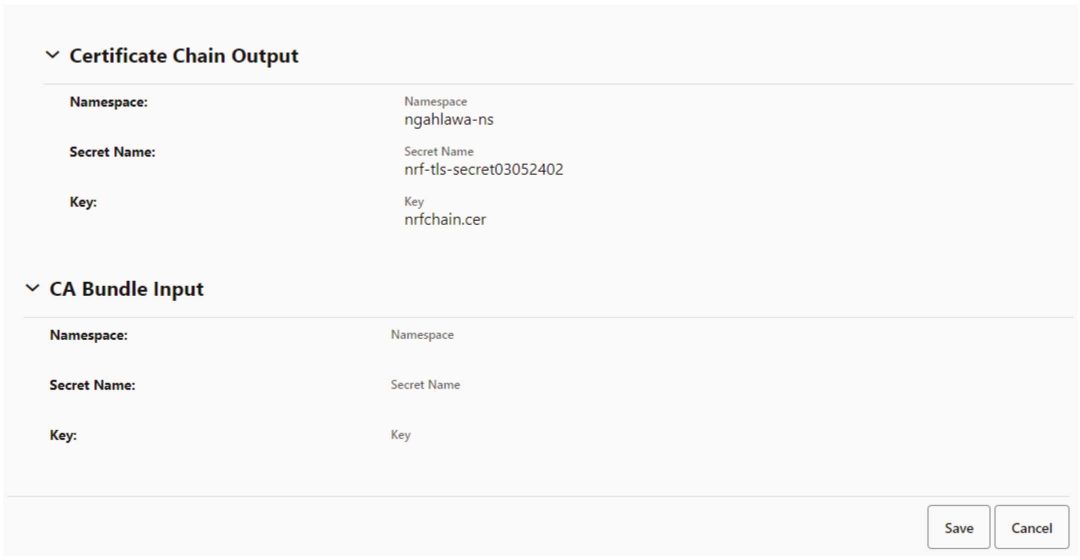
Figure 3-43 Recreate Certificate Page



UUID:	UUID 6fa97858-db2c-4b07-983e-40d76d013ae4
Name:	Name NRF-TLS-4
Cert Type:	Cert Type OTHER
Network Function:	Network Function NRF
Purpose:	Purpose NRF SBI
Issuer:	Issuer EJBCA-HTTPS-RA
Life Cycle Management:	Life Cycle Management AUTOMATIC
Override Secret:	Override Secret false
Renew Before Expiration (Days):	Renew Before Expiration (Days) 14

4. On the **Recreate Certificate** page, click **Save** to trigger the recreate request.

Figure 3-44 Click Save



Certificate Chain Output

Namespace:	Namespace ngahlawa-ns
Secret Name:	Secret Name nrf-tls-secret03052402
Key:	Key nrfchain.cer

CA Bundle Input

Namespace:	Namespace
Secret Name:	Secret Name
Key:	Key

5. Monitor OCCM Metrics or Grafana dashboard for certificate recreation status.

3.6 OCCM Retry on Failure

OCCM supports retry on encountering failures during the certificate creation, certificate renewal and manipulation of Kubernetes secrets.

- The procedure is retried until successful or interrupted by an action executed by the operator.
- Retry is not controlled through any maximum limit.
- The retry interval is an pre-defined value and set to 30s.

Some of the failure scenarios for which retries will be attempted:

- CA is unavailable, not reachable, or busy
- Any errors returned by CA

OCCM also provides a retry mechanism for errors encountered during Kubernetes secret update with the generated key and certificate. Based on the error encountered (insufficient permissions, Kubernetes internal errors etc), once the User fixes the issue, the Kubernetes secrets are automatically updated due to the ongoing retries.

Note

In this case, there is no attempt to recreate the Key and Certificate. The retry is restricted to updating the Kubernetes secrets with the key and certificate that are already generated.

3.7 Network Policies

Network Policies are an application-centric construct that allows you to specify how a pod communicates with various network entities. It creates pod-level rules to control communication between the cluster pods and services, and to determine which pods and services can access one another inside a cluster.

Previously, the pods under deployment could be contacted by any other pods in the Kubernetes cluster without any restrictions. Now, Network Policy provides namespace-level isolation, which allows secured communications to and from OCCM with rules defined in the respective Network Policies. The network policies enforce access restrictions for all the applicable data flows except communication from Kubernetes node to pod for invoking container probe. For example, OCCM internal microservices can't be contacted directly by any other pods.

Managing Support for Network Policies

Enable

To use this feature, network policies need to be applied to the namespace wherein OCCM is applied.

Configure

You can configure this feature using Helm. For information about Configuring Network Policy for OCCM deployment, see *Oracle Communications Certificate Management Installation, Upgrade, and Fault Recovery Guide.*

Observe

There are no specific metrics and alerts required for the Support of Network Policy functionality.

3.8 Support for Traffic Segregation

The traffic segregation feature enable OCCM users to manage egress traffic, that is, all outgoing data and communication from OCCM to CAs, It ensures that the traffic directed towards CAs is segregated and managed to help maintain security and efficiency.

Incoming traffic like REST API requesta ate managed separately using CNC Console. CNC Console is responsible for managing and processing these incoming requests, ensuring that they are appropriately routed and secured.

Managing Traffic Segregation

Enable and Configure
This feature is disabled by default. To enable this feature, you must configure the network attachment annotations in the custom values file. For more information, see the Installing OCCM Package section in the *Oracle Communications Certificate Management Installation, Upgrade, and Fault Recovery Guide.*

Observe
There are no metrics, KPIs, or alerts required for this feature.

4

Introducing OCCM in an Existing NF Deployment

This section describes the procedure to introduce OCCM in an existing NF deployment where certificates are managed manually. OCCM helps in automating certificate management.

You can move from manual management to automated manages in one of 2 ways:

- Using existing key and certificate.
- Using a new key and certificate.

Moving NFs from Manual Certificate Management to Automated Certificate Management with Existing Key and Certificate

To move NFs from manual certificate management to automated certificate management with existing key and certificate:

1. Configure a key and certificate on OCCM. You must reuse the same Kubernetes secret and the content as used by NF with manually generated key and certificate. The NF configuration must not be updated.
2. OCCM monitors the existing key and certificate in the configured Kubernetes secret and renews it. The metrics attached to the key and certificate are generated.

> **Note**
>
> The existing key and certificate are not validated against the configuration. However, the renewed certificate will be aligned with the configuration.

Moving NFs from Manual Certificate Management to Automated Certificate Management With new Key and Certificate

To move NFs from manual certificate management to automated certificate management with new key and certificate:

1. Configure a key and certificate on OCCM making sure to reuse the same Kubernetes secret as used by NF with manually generated key and certificate. Reusing the Kubernetes secret make sure that the NF configuration is not updated.
2. OCCM creates a new key and certificate in the configured Kubernetes secret and deletes the old key and certificate. The old key and certificate is deleted to generate OCCM metrics attached to the certificate creation.

Procedure

The operator can select the following values for the Creation Mode field:

- Manual (With existing key and certificate)
- Automatic (With new key and certificate)

Manual

- In Manual mode, existing certificates are configured at OCCM so that OCCM can manage the lifecycle of certificates. For example, the certificates that are already being used by NFs can be monitored by OCCM and further renewed by OCCM. In this case, the same Kubernetes secret and the content as used by NF with manually generated key and certificate is reused by OCCM.

Note

The existing key and certificate are not validated against the configuration. Renewed certificate will be aligned with the configuration though.

Automatic

- In Automatic mode, OCCM can create fresh certificates, or overwrite the existing certificate with a new one. For example, if NFs want to create a new key and certificate to overwrite old one through OCCM, and monitor them, then a key and certificate can be created on OCCM using the same Kubernetes secret as used by NF with manually generated key and certificate
- OCCM creates a new key and certificate in the configured Kubernetes secret and deletes the old key and certificate

Note

While reusing the Kubernetes secret and content, you must ensure that the NF configuration is not updated.

Table 4-1 Dependency of Creation Mode on Kubernetes Secret

Creation Mode	Description
Manual	Operator doesn't need to create a new secret. OCCM uses the existing Kubernetes secret.
Automatic	Operator can either create a new secret or use the existing Kubernetes secret with the `overwrite Secret` flag

Table 4-2 Behaviour of different Creation Modes

Creation Mode	Preexisting Kubernetes Secret	overwrite Secret Flag	Behaviour
Automatic	No	No Impact	Certificate is created irrespective of the overwrite flag.

Table 4-2 (Cont.) Behaviour of different Creation Modes

Creation Mode	Preexisting Kubernetes Secret	overwrite Secret Flag	Behaviour
Automatic	Yes	True or False	True: The Kubernetes secret is overridden. False: An error is thrown because you must either use a new secret or set the overwrite flag to true. This error is thrown upfront on the user interface or in the response if APIs are used.
Manual	No	NA	An error is thrown because OCCM expects a preconfigured Kubernetes secret. This error is thrown upfront on the user interface or in the response if APIs are used.
Manual	Yes	NA	Certificate configuration is created at OCCM for further certificate renewal and monitoring.

Moving Back to Manual Certificate Management

- If the operator wants to move back to manual certificate monitoring, then they can delete the entry from the OCCM configuration. OCCM doesn't delete the secret when the entry is deleted and the certificate can be monitored manually (if operator used same secret location).
- If user creates a separate secret during certificate management from OCCM, and the operator doesn't want to use the secret further, then operator can delete the entry from OCCM and must also delete the Kubernetes secret.

5

Accessing OCCM Resources Through Curl and Postman

CNC Console provides a secure option for accessing OCCM resources through curl and postman using the CNC Console IAM access token. This section describes how to generate access tokens and access OCCM APIs.

5.1 Generate Access Tokens

CNC Console IAM provides a REST API for generating and refreshing access tokens.

To generate access tokens:

1. Send a POST request to the following URL to get an access token from CNC Console IAM:
   `http://${cncc-iam-ingress-extrenal-ip}:${cncc-iam-ingress-service-port}/cncc/auth/realms/${realm}/protocol/openid-connect/token`

   For example: `https://{host}:{port}/cncc/auth/realms/cncc/protocol/openid-connect/token`
2. The body of the request must be *x-www-form-urlencoded* encoded as follows:

   ```
   'client_id': 'your_client_id',
   'username': 'your_username',
   'password': 'your_password',
   'grant_type': 'password'
   ```

   For example:

   ```
   'client_id': 'cncc-api-access',
   'username': 'user1',
   'password': '********',
   'grant_type': 'password'
   ```
3. Run the following curl command to generate access tokens:

   ```
   curl --location --request POST 'http://{host}:{port}/cncc/auth/realms/cncc/
   protocol/openid-connect/token' \
   --header 'Content-Type: application/x-www-form-urlencoded' \
   --data-urlencode 'grant_type=password' \
   --data-urlencode 'username=user1' \
   --data-urlencode 'password=********' \
   --data-urlencode 'client_id=cncc-api-access'
   ```
4. In response, you will get an **access_token** and a **refresh_token**:

   ```
   {
       "access_token": "eyJhbGc...O9l2Q",
   ```

```
        "expires_in": 300,
        "refresh_expires_in": 1800,
        "refresh_token": "eyJhbG...5vKPF-ZIg",
        "token_type": "bearer",
        "not-before-policy": 0,
        "session_state": "6c42d978-14ac-4793-a1e3-789cfbdb2b74",
        "scope": "email profile"
    }
```

5.2 Refresh Access Tokens

If the access token has expired, you can refresh it by sending a POST request to the same URL, but containing the refresh token instead of username and password:

Perform the following procedure to refresh the access tokens:

If the access_token has expired, it can be refreshed by sending a POST request to the same URL as above; but the POST method must have the refresh token instead of username and password. The format is as follows:

```
'client_id': 'your_client_id',
'refresh_token': refresh_token_from_previous_request,
'grant_type': 'refresh_token'
```

For Example:

```
'client_id': 'cncc-api-access',
'refresh_token': 'eyJhbGciOiJIU...dKnmFb5vKPF-ZIg',
'grant_type': 'refresh_token'
```

In response, you will receive a new **access_token** and **refresh_token**.

5.3 Issuer Configuration API Access

You need the CNC Console IAM access tokens to access the OCCM Issuer APIs through CNC Console.

You must include the following headers when you send an API request:

- Authorization: The access token must be used in every request to a NF resource by placing it in the *Authorization* header.
- oc-cncc-id: M-CNCC uses the oc-cncc-id header to find the agent or master owning the instance.
- oc-cncc-instance-id: A-CNCC Core (or M-CNCC Core) uses the oc-cncc-instance-id header to find the NF instance for routing.

Following headers must be passed in the curl or postman request while accessing the OCCM Issuers resource:

HTTP Request:

```
curl --request POST 'http://${occm-external-ip}:${occm-service-port}/occm-
config/v1/issuers/'
--header 'Content-Type: application/json'
```

```
--header 'oc-cncc-id: Cluster1'
--header 'oc-cncc-instance-id: Cluster1-occm-instance1'
--header 'Authorization: Bearer <Token>'
--data-raw '{
    "name": "CA1",
    "server": "http://ca1-openssl-mock.ns1.svc.thrust5:8090",
    "recipientDN": "/CN=x.company.com",
    "issuerDN": "/CN=x.company.com",
    "totalTimeout": "720",
    "messageTimeout": "120",
    "cmpProtectionOccmCert": {
        "type": null,
        "digestAlgorithm": null,
        "macAlgorithm": null,
        "macK8sSecretIn": {
            "namespace": "",
            "name": "",
            "passKey": "",
            "refKey": ""
        },
        "signK8sSecretIn": {
            "namespace": "",
            "name": "",
            "key": "",
            "cert": "",
            "extraCerts": []
        }
    },
    "cmpProtectionOtherCert": {
        "type": "SIGNATURE",
        "digestAlgorithm": "SHA256",
        "signK8sSecretIn": {
            "namespace": "ns1",
            "name": "ca1-cmp-identity-secret",
            "key": "cmpkey.pem",
            "cert": "cmpcert.pem",
            "extraCerts": []
        }
    },
    "occmTrustStoreK8sSecretIn": {
        "namespace": "ns1",
        "name": "ca1-occm-trust-store-secret",
        "rootCACerts": [
            "caroot.pem"
        ],
        "intCACerts": [
            "intcacert.pem"
        ],
        "serverCert": "servercert.pem"

  },
    "tlsConfig": {
        "enableTLS": false,
        "tlsTrustStoreK8sSecretItem": {
        "namespace": "",
        "name": "",
        "tlsTrustedCerts": []
        }
    }
}'
```

HTTPS Request

```
curl --request POST 'http://${occm-external-ip}:${occm-service-port}/occm-
config/v1/issuers/'
--header 'Content-Type: application/json'
--header 'oc-cncc-id: Cluster1'
--header 'oc-cncc-instance-id: Cluster1-occm-instance1'
--header 'Authorization: Bearer <Token>'
--data-raw '{
    "name": "CA1",
    "server": "https://ca1-openssl-mock.ns1.svc.thrust5:8443",
    "recipientDN": "/CN=x.company.com",
    "issuerDN": "/CN=x.company.com",
    "totalTimeout": "720",
    "messageTimeout": "120",
    "cmpProtectionOccmCert": {
        "type": null,
        "digestAlgorithm": null,
        "macAlgorithm": null,
        "macK8sSecretIn": {
            "namespace": "",
            "name": "",
            "passKey": "",
            "refKey": ""
        },
        "signK8sSecretIn": {
            "namespace": "",
            "name": "",
            "key": "",
            "cert": "",
            "extraCerts": []
        }
    },
    "cmpProtectionOtherCert": {
        "type": "SIGNATURE",
        "digestAlgorithm": "SHA256",
        "signK8sSecretIn": {
            "namespace": "ns1",
            "name": "ca1-cmp-identity-secret",
            "key": "cmpkey.pem",
            "cert": "cmpcert.pem",
            "extraCerts": []
        }
    },
    "occmTrustStoreK8sSecretIn": {
        "namespace": "ns1",
        "name": "ca1-occm-trust-store-secret",
        "rootCACerts": [
            "caroot.pem"
        ],
        "intCACerts": [
            "intcacert.pem"
        ],
        "serverCert": "servercert.pem"

  },
    "tlsConfig": {
        "enableTLS": true,
        "tlsTrustStoreK8sSecretItem": {
        "namespace": "ns1",
        "name": "ca1-tls-trust-store-secret",
        "tlsTrustedCerts": ["caroot.cer"]
        }
    }
}'
```

5.4 Certificate Configuration API Access

You need the CNC Console IAM access token that you generated to access OCCM Certificates Configuration API:

```
curl --request POST 'http://${occm-external-ip}:${occm-service-port}/occm-
config/v1/certs/'
--header 'Content-Type: application/json'
--header 'oc-cncc-id: Cluster1'
--header 'oc-cncc-instance-id: Cluster1-occm-instance1'
--header 'Authorization: Bearer <Token>'
--data-raw ' {

    "name": "NRF TLS Cert",
    "lcmType": "AUTOMATIC",
    "certType": "OTHER",
    "renewBefore": "14",
    "certPurpose": "NRF SBI",
    "issuer": "CA1",
    "privateKey": {
        "keyAlgo": "RSA",
        "keySize": "KEYSIZE_2048",
        "keyEncoding": "PEM",
        "ecCurve": null,
        "privateKeyK8sSecretOut": {
            "namespace": "ns1",
            "name": "nrf-tls-secret",
            "key": "nrfkey.pem"
        }
    },
    "csr": {
        "extendedKeyUsage": {
            "critical": false,
            "extendedKeyUsageValues": [
                "CLIENT_AUTH",
                "SERVER_AUTH"
            ]
        },
        "keyUsage": {
```

```
                    "critical": true,
                    "keyUsageValues": [
                        "DIGITAL_SIGNATURE"
                    ]
                },
                "basicConstraints": {
                    "critical": false,
                    "basicConstraintsValue": "END_ENTITY"
                },
                "subject": {
                    "country": "IN",
                    "state": "KA",
                    "location": "BLR",
                    "organization": "Oracle",
                    "organizationUnit": "CGBU",
                    "commonName": "a.company.com"
                },
                "days": "365",
                "subjectAltName": {
                    "critical": false,
                    "ipAddress": [
                        "10.10.10.20",
                        "10.10.10.21"
                    ],
                    "dns": [
                        "y.company.com",
                        "z.company.com"
                    ],
                    "uriIdApiRoot": null,
                    "uriIdUrn": [
                        "urn:uuid:f81d4fae-7dec-11d0-a765-00a0c91e6bf6"
                    ]
                },
                "certK8sSecretOut": {
                    "namespace": "ns1",
                    "name": "nrf-tls-secret",
                    "key": "nrfcert.pem"
                },
                "certChainK8sSecretOut": {
                    "namespace": "ns1",
                    "name": "nrf-tls-secret",
                    "key": "nrfcertchain.pem"
                }
            },
            "caBundleK8sSecretIn": {
                "namespace": "ns1",
                "name": "ca-bundle-secret",
                "key": "ca-bundle.pem"
            },
            "nf": "NRF",
            "overrideSecret": false
        }'
```

5.5 Logging API Access

You need the CNC Console IAM access token that you generated to access OCCM Logging APIs.

```
curl --location --request PUT 'http://host:port/occm-config/v1/occm/logging' \
--header 'oc-cncc-id: Cluster1' \
--header 'oc-cncc-instance-id: Cluster1-occm-instance1' \
--header 'Authorization: Bearer eyJhbGciOiJSUzI1NiIs...' \
--header 'Content-Type: application/json' \
--data-raw '{
    "appLogLevel": "DEBUG",
    "packageLogLevel": [
        {
            "packageName": "root",
            "logLevelForPackage": "ERROR"
        }
```

6 OCCM Metrics

This chapter provides information about metrics for OCCM.

Dimension Description

The following table describes different types of metric dimensions:

Table 6-1 OCCM Dimension Description

Dimension	Description	Possible Values
method	Http method	GET, PUT, POST, DELETE
httpVersion	Http protocol version	HTTP/1.1
scheme	Http protocol scheme	HTTP, UNKNOWN
uri	URL of requested API	/occm-config/v1/certs
nfType	API called by NF	eg: SCP, NRF, OCCM
statusCode	Http status code	200, 202
certUuid	Unique ID for the purpose of logging and tracking	eg: 7523a545-089b-49e9-a05c-ae5141db544b
requestType	Type of request	IR, KUR
certName	Name of the certificate	NRFTLS-1, SCPTLS-1
certPurpose	Purpose of the certificate creation	NRF SBI
issuerName	Name of the Issuer	CA
errorReason	Reason of the error	eg:ERR_K8S_SECRET_CREATION_ERROR
operationType	Type of operation	CREATE, RENEW, DELETE, RECREATE
host	Application hosted on cluster	eg: occm.occncc-thrust5-01.svc.thrust5
application	Name of the application	OCCM
caServer	URL of the Certificate Authority (Issuer)	eg:http://ca1-openssl-mock.occncc-thrust5-01.svc.thrust5:8089, https://ca2-openssl-mock.occncc-thrust5-01.svc.thrust5:8443
status	To know the status of openssl CMP cmd	SUCCESS, FAILED

6.1 occm_config_http_requests_total

Table 6-2 occm_config_http_requests_total

Field	Details
Description	OCCM Configuration total HTTP request counter metric
Type	Counter

Table 6-2 (Cont.) occm_config_http_requests_total

Field	Details
Dimensions	• host • application • httpVersion • scheme • method • nfType • uri
Example	ccm_config_http_requests_total{app_kubernetes_io_application="occm", app_kubernetes_io_component="occm", app_kubernetes_io_engVersion="24.2.3", app_kubernetes_io_instance="occm", app_kubernetes_io_managed_by="Helm", app_kubernetes_io_microservice="occm", app_kubernetes_io_mktgVersion="24.2.3.0.0", app_kubernetes_io_name="occm", app_kubernetes_io_part_of="occm", app_kubernetes_io_vendor="Oracle", app_kubernetes_io_version="24.2.3.0.0", application="occm", container="occm", endpoint="cnc-metrics", helm_sh_chart="occm-24.2.3", host="occm.occncc-thrust5-01.svc.thrust5", httpVersion="HTTP/1.1", instance="10.233.121.228:9000", job="occne-infra/occne-nf-cnc-podmonitor", method="POST", namespace="occncc-thrust5-01", nfType="NRF", pod="occm-occm-67764765f8-7rpm8", pod_template_hash="67764765f8", scheme="http", uri="/occm-config/v1/certs"}

6.2 occm_config_http_response_total

Table 6-3 occm_config_http_response_total

Field	Details
Description	OCCM Configuration total HTTP response counter metric
Type	Counter
Dimensions	• host • httpVersion • scheme • method • nfType • statusCode • uri
Example	occm_config_http_responses_total{app_kubernetes_io_application="occm", app_kubernetes_io_component="occm", app_kubernetes_io_engVersion="24.2.3", app_kubernetes_io_instance="occm", app_kubernetes_io_managed_by="Helm", app_kubernetes_io_microservice="occm", app_kubernetes_io_mktgVersion="24.2.3.0.0", app_kubernetes_io_name="occm", app_kubernetes_io_part_of="occm", app_kubernetes_io_vendor="Oracle", app_kubernetes_io_version="24.2.3.0.0", application="occm", container="occm", endpoint="cnc-metrics", helm_sh_chart="occm-24.2.3", host="occm.occncc-thrust5-01.svc.thrust5", httpVersion="HTTP/1.1", instance="10.233.121.228:9000", job="occne-infra/occne-nf-cnc-podmonitor", method="POST", namespace="occncc-thrust5-01", nfType="NRF", pod="occm-occm-67764765f8-7rpm8", pod_template_hash="67764765f8", scheme="http", statusCode="202", uri="/occm-config/v1/certs"}

6.3 occm_cmp_requests_total

Table 6-4 occm_cmp_requests_total

Field	Details
Description	OCCM total CMP request counter metric
Type	Counter
Dimensions	• certUuid • certName • nfType • requestType • issuerName • caServer

Example	occm_cmp_requests_total{app_kubernetes_io_application="occm", app_kubernetes_io_component="occm", app_kubernetes_io_engVersion="24.2.3", app_kubernetes_io_instance="occm", app_kubernetes_io_managed_by="Helm", app_kubernetes_io_microservice="occm", app_kubernetes_io_mktgVersion="24.2.3.0.0", app_kubernetes_io_name="occm", app_kubernetes_io_part_of="occm", app_kubernetes_io_vendor="Oracle", app_kubernetes_io_version="24.2.3.0.0", application="occm", caServer="http://ca90-openssl-mock.occncc-thrust5-01.svc.thrust5:8083", certName="NRFTLS-47", certUuid="c0578b02-caab-454a-bd97-422b0e1c575b", container="occm", endpoint="cnc-metrics", helm_sh_chart="occm-24.2.3", instance="10.233.121.228:9000", issuerName="CA90", job="occne-infra/occne-nf-cnc-podmonitor", namespace="occncc-thrust5-01", nfType="NRF", pod="occm-occm-67764765f8-7rpm8", pod_template_hash="67764765f8", requestType="ir"}
	occm_cmp_requests_total{app_kubernetes_io_application="occm", app_kubernetes_io_component="occm", app_kubernetes_io_engVersion="24.2.3", app_kubernetes_io_instance="occm", app_kubernetes_io_managed_by="Helm", app_kubernetes_io_microservice="occm", app_kubernetes_io_mktgVersion="24.2.3.0.0", app_kubernetes_io_name="occm", app_kubernetes_io_part_of="occm", app_kubernetes_io_vendor="Oracle", app_kubernetes_io_version="24.2.3.0.0", application="occm", caServer="http://ca90-openssl-mock.occncc-thrust5-01.svc.thrust5:8083", certName="NRFTLS-47", certUuid="c0578b02-caab-454a-bd97-422b0e1c575b", container="occm", endpoint="cnc-metrics", helm_sh_chart="occm-24.2.3", instance="10.233.121.228:9000", issuerName="CA90", job="occne-infra/occne-nf-cnc-podmonitor", namespace="occncc-thrust5-01", nfType="NRF", pod="occm-occm-67764765f8-7rpm8", pod_template_hash="67764765f8", requestType="kur"}

6.4 occm_cmp_responses_total

Table 6-5 occm_cmp_responses_total

Field	Details
Description	OCCM total CMP response counter metric
Type	Counter
Service Operation	

Table 6-5 (Cont.) occm_cmp_responses_total

Field	Details
Dimensions	• certUuid • certName • nfType • requestType • status • statusCode • issuerName • caServer
Example	occm_config_http_responses_total{app_kubernetes_io_application="occm", app_kubernetes_io_component="occm", app_kubernetes_io_engVersion="24.2.3", app_kubernetes_io_instance="occm", app_kubernetes_io_managed_by="Helm", app_kubernetes_io_microservice="occm", app_kubernetes_io_mktgVersion="24.2.3.0.0", app_kubernetes_io_name="occm", app_kubernetes_io_part_of="occm", app_kubernetes_io_vendor="Oracle", app_kubernetes_io_version="24.2.3.0.0", application="occm", container="occm", endpoint="cnc-metrics", helm_sh_chart="occm-24.2.3", host="occm.occncc-thrust5-01.svc.thrust5", httpVersion="HTTP/1.1", instance="10.233.121.228:9000", job="occne-infra/occne-nf-cnc-podmonitor", method="POST", namespace="occncc-thrust5-01", nfType="NRF", pod="occm-occm-67764765f8-7rpm8", pod_template_hash="67764765f8", scheme="http", statusCode="202", uri="/occm-config/v1/certs"}

6.5 occm_cert_expiry

Table 6-6 occm_cert_expiry

Field	Details
Description	OCCM Cert expiry gauge metrics. It will indicate Certificate expiry timestamp.
Type	Gauge
Dimensions	• certUuid • certName • nfType • issuerName • certPurpose
Example	occm_cert_expiry{app_kubernetes_io_application="occm", app_kubernetes_io_component="occm", app_kubernetes_io_engVersion="24.2.3", app_kubernetes_io_instance="occm", app_kubernetes_io_managed_by="Helm", app_kubernetes_io_microservice="occm", app_kubernetes_io_mktgVersion="24.2.3.0.0", app_kubernetes_io_name="occm", app_kubernetes_io_part_of="occm", app_kubernetes_io_vendor="Oracle", app_kubernetes_io_version="24.2.3.0.0", application="occm", certName="NRFTLS-47", certPurpose="NRF SBI", certUuid="c0578b02-caab-454a-bd97-422b0e1c575b", container="occm", endpoint="cnc-metrics", helm_sh_chart="occm-24.2.3", instance="10.233.121.228:9000", issuerName="CA90", job="occne-infra/occne-nf-cnc-podmonitor", namespace="occncc-thrust5-01", nfType="NRF", pod="occm-occm-67764765f8-7rpm8", pod_template_hash="67764765f8"}

6.6 occm_cert_status

Table 6-7 occm_cert_status

Field	Details
Description	OCCM Cert status gauge metric. It will indicate Certificate status CREATING(1), READY(2), FAILED(3), DELETED(6), EXPIRED(7), WAITING(8)
Type	Gauge
Dimensions	• certUuid • nfType • certName • certPurpose • issuerName
Example	occm_cert_status{app_kubernetes_io_application="occm", app_kubernetes_io_component="occm", app_kubernetes_io_engVersion="24.2.3", app_kubernetes_io_instance="occm", app_kubernetes_io_managed_by="Helm", app_kubernetes_io_microservice="occm", app_kubernetes_io_mktgVersion="24.2.3.0.0", app_kubernetes_io_name="occm", app_kubernetes_io_part_of="occm", app_kubernetes_io_vendor="Oracle", app_kubernetes_io_version="24.2.3.0.0", application="occm", certName="NRFTLS-47", certPurpose="NRF SBI", certUuid="c0578b02-caab-454a-bd97-422b0e1c575b", container="occm", endpoint="cnc-metrics", helm_sh_chart="occm-24.2.3", instance="10.233.121.228:9000", issuerName="CA90", job="occne-infra/occne-nf-cnc-podmonitor", namespace="occncc-thrust5-01", nfType="NRF", pod="occm-occm-67764765f8-7rpm8", pod_template_hash="67764765f8"}

6.7 occm_cmp_cli_durations

Table 6-8 occm_cmp_cli_durations

Field	Details
Description	OCCM cmp cli duration histogram metrics . CMP cli time taken in between request and response from CA
Type	Histogram
Dimensions	• certUuid • nfType • certName • requestType • caServer
Example	occm_cmp_cli_durations_bucket{app_kubernetes_io_application="occm", app_kubernetes_io_component="occm", app_kubernetes_io_engVersion="24.2.3", app_kubernetes_io_instance="occm", app_kubernetes_io_managed_by="Helm", app_kubernetes_io_microservice="occm", app_kubernetes_io_mktgVersion="24.2.3.0.0", app_kubernetes_io_name="occm", app_kubernetes_io_part_of="occm", app_kubernetes_io_vendor="Oracle", app_kubernetes_io_version="24.2.3.0.0", application="occm", caServer="http://ca90-openssl-mock.occncc-thrust5-01.svc.thrust5:8083", certName="NRFTLS-47", certUuid="c0578b02-caab-454a-bd97-422b0e1c575b", container="occm", endpoint="cnc-metrics", helm_sh_chart="occm-24.2.3", instance="10.233.121.228:9000", job="occne-infra/occne-nf-cnc-podmonitor", le="5.0", namespace="occncc-thrust5-01", nfType="NRF", pod="occm-occm-67764765f8-7rpm8", pod_template_hash="67764765f8", requestType="kur"}

6.8 occm_cert_request_status_total

Table 6-9 occm_cert_request_status

Field	Details
Description	OCCM Certificate request status counter metric. It will indicate certificate status, error reason, operation type whether Create, Renew, or Recreate etc.
Type	Counter
Dimensions	• certName • certUuid • errorReason • issuerName • nfType • operationType
Example	occm_cert_request_status_total{app_kubernetes_io_application="occm", app_kubernetes_io_component="occm", app_kubernetes_io_engVersion="24.2.3", app_kubernetes_io_instance="occm", app_kubernetes_io_managed_by="Helm", app_kubernetes_io_microservice="occm", app_kubernetes_io_mktgVersion="24.2.3.0.0", app_kubernetes_io_name="occm", app_kubernetes_io_part_of="occm", app_kubernetes_io_vendor="Oracle", app_kubernetes_io_version="24.2.3.0.0", application="occm", certName="NRFTLS-47", certUuid="c0578b02-caab-454a-bd97-422b0e1c575b", container="occm", endpoint="cnc-metrics", errorReason="OK", helm_sh_chart="occm-24.2.3", instance="10.233.121.228:9000", issuerName="CA90", job="occne-infra/occne-nf-cnc-podmonitor", namespace="occncc-thrust5-01", nfType="NRF", operationType="RENEW", pod="occm-occm-67764765f8-7rpm8", pod_template_hash="67764765f8"}

7
OCCM Alerts

This section describes the alerts available for OCCM.

Note

Alert file is packaged with OCCM CSAR package.

- Review the occm_alerting_rules_promha_<version>.yaml file and edit the value of the parameters in the occm_alerting_rules_promha_<version>.yaml file (if needed to be changed from default values) before configuring the alerts. See above table for details.
- kubernetes_namespace is configured as kubernetes namespace in which OCCM is deployed. Default value is occm. Please update the occm_alerting_rules_promha_<version>.yaml file to reflect the correct OCCM kubernetes namespace.

7.1 OccmCertExpiryWithinMinorThreshold

Table 7-1 OccmCertExpiryWithinMinorThreshold

Field	Details
Description	OCCM Certificate Expiry Alert The certificate {{$labels.certName}} used by {{$labels.nfType}} for {{$labels.certPurpose}} will expire soon within 90 days
Summary	namespace: {{$labels.namespace}}, podname: {{$labels.pod}}, timestamp: {{ with query "time()" }}{{ . | first | value | humanizeTimestamp }}{{ end }}: The certificate {{$labels.certName}} used by {{$labels.nfType}} for {{$labels.certPurpose}} will expire soon within 90 days
Severity	Minor
Condition	Certificate will expire soon within 90 days
OID	1.3.6.1.4.1.323.5.3.54.1.2.7001
Metric Used	occm_cert_expiry
Recommended Actions	Information that Certificate is going to expire within 90 days. The alert is cleared when the certificate is renewed so that the Certificate expiry days falls below the Minor threshold or when the Certificate expiry days crosses the Major threshold, in which case theOccmCertExpiryWithinMajorThreshold alert is raised. Note: The threshold is configurable in the occm_alertingrules_<version>.yaml file. Steps: 1. Check certificate configuration for renew before days. 2. If this is unexpected, contact My Oracle Support.

7.2 OccmCertExpiryWithinMajorThreshold

Table 7-2 OccmCertExpiryWithinMajorThreshold

Field	Details
Description	OCCM Certificate Expiry Alert The certificate {{$labels.certName}} used by {{$labels.nfType}} for {{$labels.certPurpose}} will expire soon within 30 days
Summary	namespace: {{$labels.namespace}}, podname: {{$labels.pod}}, timestamp: {{ with query "time()" }}{{ . | first | value | humanizeTimestamp }}{{ end }}: The certificate {{$labels.certName}} used by {{$labels.nfType}} for {{$labels.certPurpose}} will expire soon within 30 days
Severity	Major
Condition	Certificate will expire soon within 30 days
OID	1.3.6.1.4.1.323.5.3.54.1.2.7001
Metric Used	occm_cert_expiry
Recommended Actions	Information that Certificate is going to expire within 30 days. The alert is cleared when the certificate is renewed or when the Certificate expiry days crosses the Critical threshold, in which case OccmCertExpiryWithinCriticalThreshold alert is raised. Note: The threshold is configurable in the occm_alertingrules_<version>.yaml file. Steps: 1. Check certificate configuration for renew before days. 2. Refer to the application logs on Kibana and filter based on occm service name. Check for ERROR WARNING logs related to thread exceptions. 3. Depending on the failure reason, take the resolution steps. 4. If this is unexpected, contact My Oracle Support.

7.3 OccmCertExpiryWithinCriticalThreshold

Table 7-3 OccmCertExpiryWithinCriticalThreshold

Field	Details
Description	OCCM Certificate Expiry Alert The certificate {{$labels.certName}} used by {{$labels.nfType}} for {{$labels.certPurpose}} will expire soon within 1 week
Summary	namespace: {{$labels.namespace}}, podname: {{$labels.pod}}, timestamp: {{ with query "time()" }}{{ . | first | value | humanizeTimestamp }}{{ end }}: The certificate {{$labels.certName}} used by {{$labels.nfType}} for {{$labels.certPurpose}} will expire soon within 1 week
Severity	Critical
Condition	Certificate will expire soon within 1 week
OID	1.3.6.1.4.1.323.5.3.54.1.2.7001

Table 7-3 (Cont.) OccmCertExpiryWithinCriticalThreshold

Field	Details
Metric Used	occm_cert_expiry
Recommended Actions	Information that Certificate is going to expire within 1 week. The alert is cleared when the certificate is renewed. Note: The threshold is configurable in the occm_alertingrules_<version>.yaml file. Steps: 1. Check certificate configuration for renew before days. 2. Refer to the application logs on Kibana and filter based on occm service name. Check for ERROR WARNING logs related to thread exceptions. 3. Depending on the failure reason, take the resolution steps. 4. If this is unexpected, contact My Oracle Support.

7.4 OccmCertExpired

Table 7-4 OccmCertExpired

Field	Details
Description	OCCM Certificate has Expired Critical Alert The certificate {{$labels.certName}} used by {{$labels.nfType}} for {{$labels.certPurpose}} is expired
Summary	namespace: {{$labels.namespace}}, podname: {{$labels.pod}}, timestamp: {{ with query "time()" }}{{ . | first | value | humanizeTimestamp }}{{ end }}: The certificate {{$labels.certName}} used by {{$labels.nfType}} for {{$labels.certPurpose}} is expired
Severity	Critical
Condition	Certificate has expired
OID	1.3.6.1.4.1.323.5.3.54.1.2.7002
Metric Used	occm_cert_expiry
Recommended Actions	Information that Certificate has expired. The alert is cleared when the certificate is renewed. Steps: 1. Refer to the application logs on Kibana and filter based on occm service name. Check for ERROR WARNING logs related to thread exceptions. 2. Depending on the failure reason, take the resolution steps. 3. Refer user guide for procedure to renew expired certificate. 4. If this is unexpected, contact My Oracle Support.

7.5 OccmServiceDown

Table 7-5 OccmServiceDown

Field	Details
Description	OCCM Service Down Alert New certificates will not be created, and existing ones can not be renewed until OCCM is back
Summary	namespace: {{$labels.namespace}}, podname: {{$labels.pod}}, timestamp: {{ with query "time()" }}{{ . | first | value | humanizeTimestamp }}{{ end }}: OCCM service is down
Severity	Critical
Condition	The pods of the occm service is unavailable.
OID	1.3.6.1.4.1.323.5.3.54.1.2.7004
Metric Used	up **Note:**This is a prometheus metric used for instance availability monitoring. If this metric is not available, use the similar metric as exposed by the monitoring system.
Recommended Actions	The alert is cleared when the occm service is available. Steps: 1. Check the orchestration logs of occm service and check for liveness or readiness probe failures. 2. Refer to the application logs on Kibana and filter based on occm service names. Check for ERROR WARNING logs related to thread exceptions. 3. Depending on the failure reason, take the resolution steps. 4. In case the issue persists, contact My Oracle Support.

7.6 OccmMemoryUsageMinorThreshold

Table 7-6 OccmMemoryUsageMinorThreshold

Field	Details
Description	OCCM Memory Usage Alert OCCM Memory Usage for pod {{ $labels.pod }} has crossed the configured minor threshold (70%) (value={{ $value }}) of its limit.
Summary	namespace: {{$labels.namespace}}, podname: {{$labels.pod}}, timestamp: {{ with query "time()" }}{{ . | first | value | humanizeTimestamp }}{{ end }}: Memory Usage of pod exceeded 70% of its limit.
Severity	Minor
Condition	A pod has reached the configured minor threshold(70%) of its memory resource limits.
OID	1.3.6.1.4.1.323.5.3.54.1.2.7005

Table 7-6 (Cont.) OccmMemoryUsageMinorThreshold

Field	Details
Metric Used	container_memory_usage_bytes, **Note** : This is a kubernetes metric used for instance availability monitoring. If the metric is not available, use the similar metric as exposed by the monitoring system.
Recommended Actions	The alert gets cleared when the memory utilization falls below the Minor Threshold or crosses the major threshold, in which case OccmMemoryUsageMajorThreshold alert shall be raised. Note: The threshold is configurable in the occm_alertingrules_<version>.yaml file. Steps: 1. Refer to the application logs on Kibana and filter based on occm service name. Check for ERROR WARNING logs related to thread exceptions. 2. Depending on the failure reason, take the resolution steps. 3. If this is unexpected, contact My Oracle Support.

7.7 OccmMemoryUsageMajorThreshold

Table 7-7 OccmMemoryUsageMajorThreshold

Field	Details
Description	OCCM Memory Usage Alert OCCM Memory Usage for pod {{ $labels.pod }} has crossed the configured major threshold (80%) (value={{ $value }}) of its limit.
Summary	namespace: {{$labels.namespace}}, podname: {{$labels.pod}}, timestamp: {{ with query "time()" }}{{ . | first | value | humanizeTimestamp }}{{ end }}: Memory Usage of pod exceeded 80% of its limit.
Severity	Major
Condition	A pod has reached the configured major threshold(80%) of its memory resource limits.
OID	1.3.6.1.4.1.323.5.3.54.1.2.7005
Metric Used	container_memory_usage_bytes, **Note** : This is a kubernetes metric used for instance availability monitoring.If the metric is not available, use the similar metric as exposed by the monitoring system.

Table 7-7 (Cont.) OccmMemoryUsageMajorThreshold

Field	Details
Recommended Actions	The alert gets cleared when the memory utilization falls below the Major Threshold or crosses the critical threshold, in which case OccmMemoryUsageMajorThreshold alert shall be raised Note: The threshold is configurable in the occm_alertingrules_<version>.yaml file. Steps: 1. Refer to the application logs on Kibana and filter based on occm service name. Check for ERROR WARNING logs related to thread exceptions. 2. Depending on the failure reason, take the resolution steps. 3. If this is unexpected, contact My Oracle Support.

7.8 OccmMemoryUsageCriticalThreshold

Table 7-8 OccmMemoryUsageCriticalThreshold

Field	Details
Description	OCCM Memory Usage Alert OCCM Memory Usage for pod {{ $labels.pod }} has crossed the configured critical threshold (90%) (value={{ $value }}) of its limit..
Summary	namespace: {{$labels.namespace}}, podname: {{$labels.pod}}, timestamp: {{ with query "time()" }}{{ . | first | value | humanizeTimestamp }}{{ end }}: Memory Usage of pod exceeded 90% of its limit.
Severity	Critical
Condition	A pod has reached the configured critical threshold (90%) of its memory resource limits
OID	1.3.6.1.4.1.323.5.3.54.1.2.7005
Metric Used	container_memory_usage_bytes, Note : This is a kubernetes metric used for instance availability monitoring.If the metric is not available, use the similar metric as exposed by the monitoring system.
Recommended Actions	The alert gets cleared when the memory utilization falls below the Critical Threshold.Note : The threshold is configurable in the alerts.yaml Note: The threshold is configurable in the occm_alertingrules_<version>.yaml file. Steps: 1. Refer to the application logs on Kibana and filter based on occm service name. Check for ERROR WARNING logs related to thread exceptions. 2. Depending on the failure reason, take the resolution steps. 3. If this is unexpected, contact My Oracle Support.

7.9 OccmCPUUsageMinorThreshold

Table 7-9 OccmCPUUsageMinorThreshold

Field	Details
Description	OCCM CPU Usage Alert OCCM Pod {{$labels.pod}} has high CPU usage detected.
Summary	namespace: {{ $labels.namespace}}, podname: {{ $labels.pod}}, timestamp: {{ with query "time()" }}{{ . | first | value | humanizeTimestamp }}{{ end }}: CPU usage is {{ $value | printf "%.2f" }} which is usage is above 70% (current value is: {{ $value }})
Severity	Minor
Condition	CPU usage is above 70%
OID	1.3.6.1.4.1.323.5.3.54.1.2.7006
Metric Used	container_cpu_usage_seconds_total
Recommended Actions	Information regarding CPU usage If it is above 70% The alert gets cleared when the CPU usage falls below the Minor Threshold. Note: The threshold is configurable in the occm_alertingrules_<version>.yaml file. Steps: 1. Refer to the application logs on Kibana and filter based on occm service name. Check for ERROR WARNING logs related to thread exceptions. 2. Depending on the failure reason, take the resolution steps. 3. If this is unexpected, contact My Oracle Support.

7.10 OccmCMPFailureMinor

Table 7-10 OccmCMPFailureMinor

Field	Details
Description	OCCM CMP Command Execution Failure Alert The certificate {{$labels.certName}} used by {{$labels.nfType}} has failed while executing CMP cmd with {{$labels.statusCode}}.
Summary	namespace: {{$labels.namespace}}, podname: {{$labels.pod}}, timestamp: {{ with query "time()" }}{{ . | first | value | humanizeTimestamp }}{{ end }}: The certificate {{$labels.certName}} used by {{$labels.nfType}} has failed while executing CMP cmd with {{$labels.statusCode}}.
Severity	Minor
Condition	Certificate has failed while executing CMP cmds.
OID	1.3.6.1.4.1.323.5.3.54.1.2.7007
Metric Used	occm_cmp_responses_total

Table 7-10 (Cont.) OccmCMPFailureMinor

Field	Details
Recommended Actions	Information that the rate of certificate failure due to CMP command execution error has crossed the threshold. The alert is cleared when the rate of certificate failure due to CMP command execution error falls below the Minor threshold or when the error rate crosses the Major threshold, in which case the OccmCMPFailureMajor alert is raised. Note: The threshold is configurable in the occm_alertingrules_<version>.yaml file. Steps: 1. Refer to the application logs on Kibana and filter based on occm service name. Check for ERROR WARNING logs related to thread exceptions. 2. Depending on the failure reason, take the resolution steps. 3. If this is unexpected, contact My Oracle Support.

7.11 OccmCMPFailureMajor

Table 7-11 OccmCMPFailureMajor

Field	Details
Description	OCCM CMP Command Execution Failure Alert The certificate {{$labels.certName}} used by {{$labels.nfType}} has failed while executing CMP cmd with {{$labels.statusCode}}.
Summary	namespace: {{$labels.namespace}}, podname: {{$labels.pod}}, timestamp: {{ with query "time()" }}{{ . | first | value | humanizeTimestamp }}{{ end }}: The certificate {{$labels.certName}} used by {{$labels.nfType}} has failed while executing CMP cmd with {{$labels.statusCode}}.
Severity	Major
Condition	Certificate has failed while executing CMP cmds
OID	1.3.6.1.4.1.323.5.3.54.1.2.7007
Metric Used	occm_cmp_responses_total
Recommended Actions	Information that the rate of certificate failure due to CMP command execution error has crossed the threshold. The alert is cleared when the rate of certificate failure due to CMP command execution error falls below the Major threshold or when the error rate crosses the Critical threshold, in which case the OccmCMPFailureCritical alert is raised. Note: The threshold is configurable in the occm_alertingrules_<version>.yaml file. Steps: 1. Refer to the application logs on Kibana and filter based on occm service name. Check for ERROR WARNING logs related to thread exceptions. 2. Depending on the failure reason, take the resolution steps. 3. If this is unexpected, contact My Oracle Support.

7.12 OccmCMPFailureCritical

Table 7-12 OccmCMPFailureCritical

Field	Details
Description	OCCM CMP Command Execution Failure Alert The certificate {{$labels.certName}} used by {{$labels.nfType}} has failed while executing CMP cmd with {{$labels.statusCode}}.
Summary	namespace: {{$labels.namespace}}, podname: {{$labels.pod}}, timestamp: {{ with query "time()" }}{{ . | first | value | humanizeTimestamp }}{{ end }}: The certificate {{$labels.certName}} used by {{$labels.nfType}} has failed while executing CMP cmd with {{$labels.statusCode}}.
Severity	Critical
Condition	Certificate has failed while executing CMP cmds
OID	1.3.6.1.4.1.323.5.3.54.1.2.7007
Metric Used	occm_cmp_responses_total
Recommended Actions	Information that the rate of certificate failure due to CMP command execution error has crossed the threshold. The alert is cleared when the rate of certificate failure due to CMP command execution error falls below the Critical threshold. Note: The threshold is configurable in the occm_alertingrules_<version>.yaml file. Steps: 1. Refer to the application logs on Kibana and filter based on occm service name. Check for ERROR WARNING logs related to thread exceptions. 2. Depending on the failure reason, take the resolution steps. 3. If this is unexpected, contact My Oracle Support.

7.13 OccmFailureMinor

Table 7-13 OccmFailureMinor

Field	Details
Description	OCCM Internal Failure Alert The certificate {{$labels.certName}} used by {{$labels.nfType}} has failed while creating cert with {{$labels.errorReason}}.
Summary	namespace: {{$labels.namespace}}, podname: {{$labels.pod}}, timestamp: {{ with query "time()" }}{{ . | first | value | humanizeTimestamp }}{{ end }}: The certificate {{$labels.certName}} used by {{$labels.nfType}} has failed while creating cert with {{$labels.errorReason}}.
Severity	Minor
Condition	Certificate has failed while creating
OID	1.3.6.1.4.1.323.5.3.54.1.2.7008
Metric Used	occm_cert_request_status_total

Table 7-13 (Cont.) OccmFailureMinor

Field	Details
Recommended Actions	Information that the rate of OCCM errors has crossed the threshold. The alert is cleared when the rate OCCM error falls below the Minor threshold or when the error rate crosses the Major threshold, in which case the OccmFailureMajor alert is raised. Note: The threshold is configurable in the occm_alertingrules_<version>.yaml file. Steps: 1. Refer to the application logs on Kibana and filter based on occm service name. Check for ERROR WARNING logs related to thread exceptions. 2. Depending on the failure reason, take the resolution steps. 3. If this is unexpected, contact My Oracle Support.

7.14 OccmFailureMajor

Table 7-14 OccmFailureMajor

Field	Details
Description	OCCM Internal Failure Alert The certificate {{$labels.certName}} used by {{$labels.nfType}} has failed while creating cert with {{$labels.errorReason}}.
Summary	namespace: {{$labels.namespace}}, podname: {{$labels.pod}}, timestamp: {{ with query "time()" }}{{ . | first | value | humanizeTimestamp }}{{ end }}: The certificate {{$labels.certName}} used by {{$labels.nfType}} has failed while creating cert with {{$labels.errorReason}}.
Severity	Major
Condition	Certificate has failed while creating
OID	1.3.6.1.4.1.323.5.3.54.1.2.7008
Metric Used	occm_cmp_responses_total
Recommended Actions	Information that the rate of OCCM errors has crossed the threshold. The alert is cleared when the rate OCCM error falls below the Major threshold or when the error rate crosses the Critical threshold, in which case the OccmFailureCritical alert is raised. Note: The threshold is configurable in the occm_alertingrules_<version>.yaml file. Steps: 1. Refer to the application logs on Kibana and filter based on occm service name. Check for ERROR WARNING logs related to thread exceptions. 2. Depending on the failure reason, take the resolution steps. 3. If this is unexpected, contact My Oracle Support.

7.15 OccmFailureCritical

Table 7-15 OccmFailureCritical

Field	Details
Description	OCCM CMP Command Execution Failure Alert The certificate {{$labels.certName}} used by {{$labels.nfType}} has failed while creating cert with {{$labels.errorReason}}.
Summary	namespace: {{$labels.namespace}}, podname: {{$labels.pod}}, timestamp: {{ with query "time()" }}{{ . | first | value | humanizeTimestamp }}{{ end }}: The certificate {{$labels.certName}} used by {{$labels.nfType}} has failed while creating cert with {{$labels.errorReason}}.
Severity	critical
Condition	Certificate has failed while creating
OID	1.3.6.1.4.1.323.5.3.54.1.2.7008
Metric Used	occm_cmp_responses_total
Recommended Actions	Information that the rate of certificate failure due to CMP command execution error has crossed the threshold. The alert is cleared when the rate of certificate failure due to CMP command execution error falls below the Critical threshold. Note: The threshold is configurable in the occm_alertingrules_<version>.yaml file. Steps: 1. Refer to the application logs on Kibana and filter based on occm service name. Check for ERROR WARNING logs related to thread exceptions. 2. Depending on the failure reason, take the resolution steps. 3. If this is unexpected, contact My Oracle Support.

7.16 OccmRenewBeforValidityCritical

Table 7-16 OccmRenewBeforValidityCritical

Field	Details
Description	OCCM Renew Before is greater than Cert Validity Alert The certificate {{$labels.certName}} used by {{$labels.nfType}} has failed because renew before validity is greater than cert validity {{$labels.errorReason}}.
Summary	namespace: {{$labels.namespace}}, podname: {{$labels.pod}}, timestamp: {{ with query "time()" }}{{ . | first | value | humanizeTimestamp }}{{ end }}: The certificate {{$labels.certName}} used by {{$labels.nfType}} has failed because renew before validity is greater than cert validity {{$labels.errorReason}}.
Severity	critical
Condition	Certificate has failed because renew before validity is greater than cert validity
OID	1.3.6.1.4.1.323.5.3.54.1.2.7009

Table 7-16 (Cont.) OccmRenewBeforValidityCritical

Field	Details
Metric Used	occm_cert_request_status_total
Recommended Actions	Information that the Certificate has failed because renew before validity is greater than cert validity. Steps: 1. Check certificate configuration for renew before days. 2. Also Check the validity requested for the Certificate and validity assigned by the CA. 3. Refer to the application logs on Kibana and filter based on occm service name. Check for ERROR WARNING logs related to thread exceptions. 4. Depending on the failure reason, take the resolution steps. 5. If this is unexpected, contact My Oracle Support.

7.17 OCCM Alert and MIB Configuration in Prometheus

CNE supporting Prometheus HA

This section describes the measurement based Alert rules configuration for OCCM in Prometheus. You must use the updated `occm_alerting_rules_promha_<version>.yaml file`.

Run the following command to create ot update the PrometheusRule resource specified in the alert YAML file:

```
$ kubectl apply -f occm_alerting_rules_promha_<version>.yaml
```

Disabling Alerts

This section describes the procedure to disable the alerts in OCCM. To disable alerts:

1. Edit `occm_alerting_rules_promha_<version>.yaml` file to remove specific alert.
2. Remove complete content of the specific alert from the `occm_alerting_rules_promha_<version>.yaml` file.
   For example, ff you want to remove OccmServiceDown alert, remove the complete content:

```
## ALERT SAMPLE START##
- alert: OccmServiceDown
      annotations:
        description: 'New certificates will not be created, and existing
ones can not be renewed until OCCM is back'
        summary: 'namespace: {{$labels.namespace}}, podname:
{{$labels.pod}}, timestamp: {{ with query "time()" }}{{ . | first | value
| humanizeTimestamp }}{{ end }}: OCCM service is down'
      expr: absent(up{pod=~".*occm.*", namespace="occm-ns"}) or
(up{pod=~".*occm.*", namespace="occm-ns"}) == 0
      labels:
        severity: critical
        oid: "1.3.6.1.4.1.323.5.3.54.1.2.7004"
        namespace: ' {{ $labels.namespace }} '
        podname: ' {{$labels.pod}} '
## ALERT SAMPLE END##
```

3. Perform Alert configuration.

Validating Alerts

Configure and Validate Alerts in Prometheus Server. Refer to OCCM Alert Configuration for procedure to configure the alerts.

After configuring the alerts in Prometheus server, a user can verify that by following steps:

1. Open the Prometheus server from your browser using the <IP>:<Port>
2. Navigate to Status and then Rules
3. Search OCCM. OCCMAlerts list is displayed.

> **Note**
>
> If you are unable to see the alerts, it means that the alert file has not loaded in a format which the Prometheus server accepts. Modify the file and try again.

Configuring SNMP-Notifier

Configure the IP and port of the SNMP trap receiver in the SNMP Notifier using following procedure:

1. Execute the following command to edit the deployment:

   ```
   kubectl edit deploy <snmp_notifier_deployment_name> -n <namespace>
   ```

   Example:

   ```
   $ kubectl edit deploy occne-snmp-notifier -n occne-infra
   ```

2. Edit the destination as follows:

   ```
   --snmp.destination=<destination_ip>:<destination_port>
   ```

   Example:

   ```
   --snmp.destination=10.75.203.94:162
   ```

MIB Files for OCCM

here are two MIB files which are used to generate the traps. The user need to update these files along with the Alert file in order to fetch the traps in their environment.

- `occm_mib_tc_<version>.mib`: This is considered as OCCM top level mib file, where the Objects and their data types are defined

- `occm_mib_<version>.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.

Note

MIB files are packaged along with OCCM CSAR package. Download the file from MOS. For more information, see *Oracle Communications Cloud Native Core, Certificate Management Installation, Upgrade, and Fault Recovery Guide.*

8
OCCM KPIs

This section describes the KPIs available for OCCM.

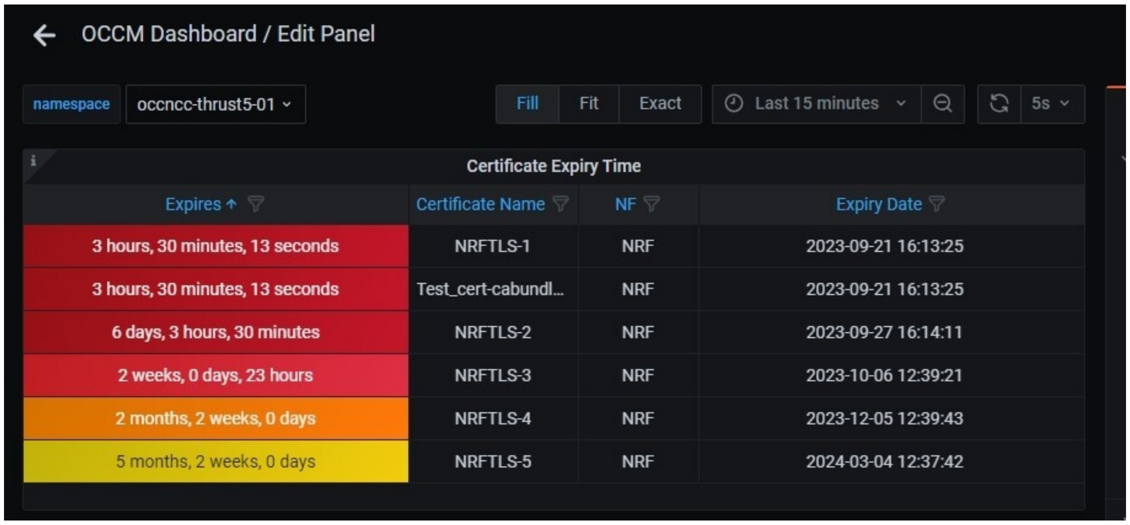
8.1 Certificate Expiry Time

Table 8-1 Certificate Expiry Time

Field	Details
Description	Certificate Expiry Time to list NF, Certificate Name, Expiry Date
Expression	OCCM dashboard in grafana will show Certificate Expiry Time panel with columns. Table visualization listing Expires, NF, Certificate Name, Expiry Date. Expires column uses color coding to indicate near expiry status. all:occm_cert_expiry{namespace="$namespace"} * 1000 != 0 Expires column:((occm_cert_expiry{namespace="$namespace"} != 0)-time())*1000

OCCM KPI Dashboard

Figure 8-1 Certificate Expiry Time



Certificate Expiry Time

Expires	Certificate Name	NF	Expiry Date
3 hours, 30 minutes, 13 seconds	NRFTLS-1	NRF	2023-09-21 16:13:25
3 hours, 30 minutes, 13 seconds	Test_cert-cabundl...	NRF	2023-09-21 16:13:25
6 days, 3 hours, 30 minutes	NRFTLS-2	NRF	2023-09-27 16:14:11
2 weeks, 0 days, 23 hours	NRFTLS-3	NRF	2023-10-06 12:39:21
2 months, 2 weeks, 0 days	NRFTLS-4	NRF	2023-12-05 12:39:43
5 months, 2 weeks, 0 days	NRFTLS-5	NRF	2024-03-04 12:37:42

Color coding description:-

Red (Critical):- Certificate expiring within 0 <= 7 days Or Certificate expired <= 0 days

Light Red(Major):- Certificate expiring within > 7 <= 30 days

Orange (Minor):- Certificate expiring within > 30 <= 90

Yellow :- Certificate expiring within > 90 <= 180

Green :- Certificates not Expiring sooner

8.2 Certificate Readiness Status

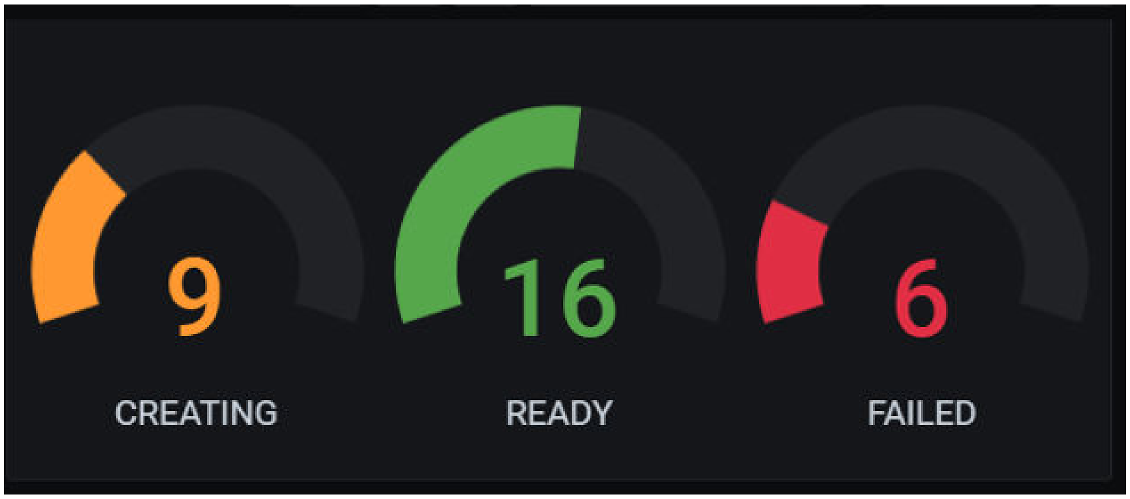
Table 8-2 Certificate Readiness Status

Field	Details
Description	Certificate Readiness Status to indicate if number of Ready and Failed Certificates

Expression	OCCM dashboard in grafana will show Certificate Readiness Status panel gauge visualization to indicate if number of Ready and Failed Certificates
	Creating:count(occm_cert_status{namespace="$namespace"} == 1) (Color:Orange)
	Ready:count(occm_cert_status{namespace="$namespace"} == 2) (Color:Green)
	Failed:count(occm_cert_status{namespace="$namespace"} == 3) (Color:Red)
	Waiting:count(occm_cert_status{namespace="$namespace"} == 8) (Color:Light Orange)
	Expired:count(occm_cert_status{namespace="$namespace"} == 7) (Color:Red)

OCCM KPI Dashboard

Figure 8-2 Certificate Readiness Status



Creating: Orange

Ready: Green

Failed: Red

Waiting: Light Orange

Expired : Red

8.3 CMP Request

Table 8-3 CMP Request

Field	Details
Description	Total CMP requests initiated from OCCM towards CA per NF

Expression	OCCM dashboard in grafana will show CMP Request panel which is total CMP requests per NF.
	all:sum(rate(occm_cmp_requests_total{namespace="$namespace"}[2m]))
	SCP:sum(rate(occm_cmp_requests_total{namespace="$namespace", nfType=~"SCP|scp"}[2m]))
	NRF:sum(rate(occm_cmp_requests_total{namespace="$namespace", nfType=~"NRF|nrf"}[2m]))

8.4 CMP Responses

Table 8-4 CMP Responses

Field	Details
Description	Total CMP responses received from CA per NF by OCCM

Expression	OCCM dashboard in grafana will show CMP Response panel which is total CMP responses per NF.
	all:sum(rate(occm_cmp_responses_total{namespace="$namespace"}[2m]))
	SCP:sum(rate(occm_cmp_responses_total{namespace="$namespace", nfType=~"SCP|scp"}[2m]))
	NRF:sum(rate(occm_cmp_responses_total{namespace="$namespace", nfType=~"NRF|nrf"}[2m]))

8.5 Configuration Requests

Table 8-5 Configuration Requests

Field	Details
Description	Total Issuer and Certificate configuration requests
Expression	OCCM dashboard in grafana will show Config Requests panel. Total Issuer and Certificate configuration requests. all:sum(rate(occm_config_http_requests_total{namespace="$namespace"}[2m])) SCP certs:sum(rate(occm_config_http_requests_total{namespace="$namespace", uri=~".*/certs.*", nfType=~"SCP|scp"}[2m])) NRF certs:sum(rate(occm_config_http_requests_total{namespace="$namespace", uri=~".*/certs.*", nfType=~"NRF\|nrf"}[2m])) issuers:sum(rate(occm_config_http_requests_total{namespace="$namespace", uri=~".*/issuers.*"}[2m]))

8.6 Configuration Responses

Table 8-6 Configuration Responses

Field	Details
Description	Total Issuer and Certificate configuration responses
Expression	OCCM dashboard in grafana will show Config Responses panel. Total Issuer and Certificate configuration responses. all:sum(rate(occm_config_http_responses_total{namespace="$namespace"}[2m])) SCP certs:sum(rate(occm_config_http_responses_total{namespace="$namespace", uri=~".*/certs.*", nfType=~"SCP|scp"}[2m])) NRF certs:sum(rate(occm_config_http_responses_total{namespace="$namespace", uri=~".*/certs.*", nfType=~"NRF\|nrf"}[2m])) issuers:sum(rate(occm_config_http_responses_total{namespace="$namespace", uri=~".*/issuers.*"}[2m]))

8.7 CPU Usage

Table 8-7 CPU Usage

Field	Details
Description	CPU usage of OCCM pod
Expression	Time series indicates CPU usage of OCCM pod. sum(rate(container_cpu_usage_seconds_total{image!="",namespace="$namespace", pod=~"occm-.*."}[2m])) by(pod)

8.8 Memory Usage

Table 8-8 Memory Usage

Field	Details
Description	Memory usage of OCCM pod
Expression	Time series indicates Memory usage of OCCM pod. (avg_over_time(container_memory_usage_bytes{container=~"occm", namespace="$namespace"}[2m]))

8.9 OpenSSL CLI Duration (occm_cmp_cli_durations)

Table 8-9 OpenSSL CLI Duration (occm_cmp_cli_durations)

Field	Details
Description	CMP cli time taken in between request and response from CA
Expression	Used to show the duration of openssl cmp calls occm_cmp_cli_durations_bucket{namespace="occm-ns", uuid="fdsfds-9880-fsd99"}

8.10 Number of requests sent to the CA

Table 8-10 Number of requests sent to the CA

Field	Details
Description	Metric will peg when request cmd prepared and send to CA for generate certificate.
Expression	count(occm_cmp_requests_total{namespace="$namespace"}

8.11 Number of responses received from CA

Table 8-11 Number of responses received from CA

Field	Details
Description	Metric will peg when response received from CA for generate certificate.
Expression	count(occm_cmp_responses_total{namespace="occm-ns"})

8.12 Number of responses based on response code from CA

Table 8-12 Number of responses based on response code from CA

Field	Details
Description	Metric will peg when response received from CA for generate certificate.
Expression	count(occm_cmp_responses_total{namespace="occm-ns", statusCode="OK", status = "SUCCESS"}) or count(occm_cmp_responses_total{namespace="occm-ns", statusCode="ERR_CMP_COMMAND_FAILED", status = "FAILED"})

8.13 Type of request sent to CA

Table 8-13 Type of request sent to CA

Field	Details
Description	Metric will peg when request cmd prepared and send to CA for generate certificate.
Expression	count(occm_cmp_requests_total{namespace="occm-ns", requestType="ir"}) or count(occm_cmp_requests_total{namespace="occm-ns", requestType="kur"})

8.14 Number of certificates issued by CA

Table 8-14 Number of certificates issued by CA

Field	Details
Description	Metric will peg when response received from CA for generate certificate.

Table 8-14 (Cont.) Number of certificates issued by CA

Field	Details
Expression	count(occm_cmp_responses_total{namespace="occm-ns", status = "SUCCESS", statusCode = "OK"})

8.15 Number of CSRs denied by CA or TLS handshake failures or HTTPs connection failures during CA connection

Table 8-15 Number of CSRs denied by CA or TLS handshake failures or HTTPs connection failures during CA connection

Field	Details
Description	Metric will peg when response received from CA for generate certificate.
Expression	count(occm_cmp_responses_total{namespace="occm-ns", status = "FAILED"}) or count(occm_cmp_responses_total{namespace="occm-ns", statusCode="ERR_CMP_COMMAND_FAILED", status="FAILED"})

8.16 Error while writing the key, certificate, or chain in the Kubernetes secrets

Table 8-16 Error while writing the key, certificate, or chain in the Kubernetes secrets

Field	Details
Description	Metric will peg when cert renew or create worker complete its process
Expression	occm_cert_request_status{namespace="occm-ns", errorReason= "ERR_SECRET_FAILED"}

8.17 Unable to access or read from Kubernetes secrets

Table 8-17 Unable to access or read from Kubernetes secrets

Field	Details
Description	Metric will peg when cert renew or create worker complete its process
Expression	occm_cert_request_status_total{namespace="occm-ns", errorReason= "ERR_SECRET_EXIST"}

8.18 Check Renewed Certificate

Table 8-18 Check Renewed Certificate

Field	Details
Description	Metric will peg when cert renew or create worker complete its process
Expression	occm_cert_request_status_total{namespace="occm-ns", operationType="RENEW"}

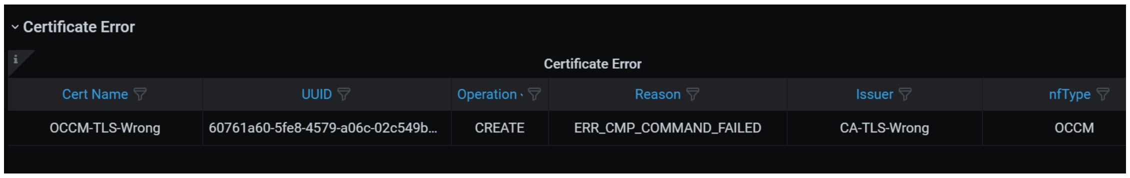
8.19 Certificate Error and Warnings

Table 8-19 Certificate Error and Warnings

Field	Details
Description	List of Certificates having Error and Warnings for duration of 5 mins
Expression	rate(occm_cert_request_status_total{namespace="occm-ns", errorReason!="OK"}[5m])

OCCM KPI Dashboard

Figure 8-3 Certificate Error and Warnings


Certificate Error

Certificate Error

Cert Name	UUID	Operation	Reason	Issuer	nfType
OCCM-TLS-Wrong	60761a60-5fe8-4579-a06c-02c549b...	CREATE	ERR_CMP_COMMAND_FAILED	CA-TLS-Wrong	OCCM

Displayed Columns

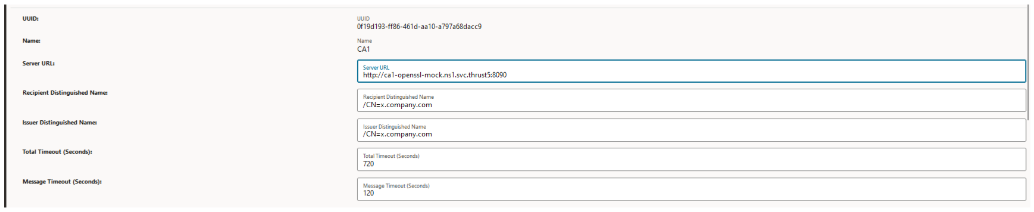
1. Cert Name - Certificate Name
2. UUID - Certificate UUID
3. Operation - Certificate Operation Type (CREATE or RENEW)
4. Reason - Error code indicating Certificate Error or Warning Reason
5. Issuer - Issuer Name linked to the Certificate

A.1 Certificate Configuration Examples

A.1.1 Creating NF Certificate Using OCCM - Sample Configuration

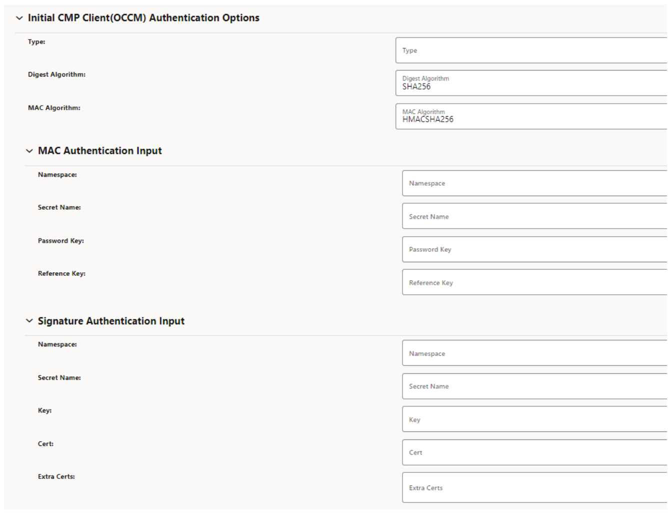
This section describes the sequence of steps to be performed to generate a signed certificate (NF certificate) using OCCM

1. **Create the Issuer**:
   The following screenshots provide a sample configuration for creating the issuer using CNC Console GUI
   a. **Figure 4 Create Issuer**



UUID:	UUID 0f19d193-ff86-461d-aa10-a797a68dacc9
Name:	Name CA1
Server URL:	Server URL http://ca1-openssl-mock.ns1.svc.thrust5:8090
Recipient Distinguished Name:	Recipient Distinguished Name /CN=x.company.com
Issuer Distinguished Name:	Issuer Distinguished Name /CN=x.company.com
Total Timeout (Seconds):	Total Timeout (Seconds) 720
Message Timeout (Seconds):	Message Timeout (Seconds) 120

   b. **Figure 5 Initial CMP Client(OCCM) Authentication Options**



Initial CMP Client(OCCM) Authentication Options

Type:	Type
Digest Algorithm:	Digest Algorithm SHA256
MAC Algorithm:	MAC Algorithm HMACSHA256

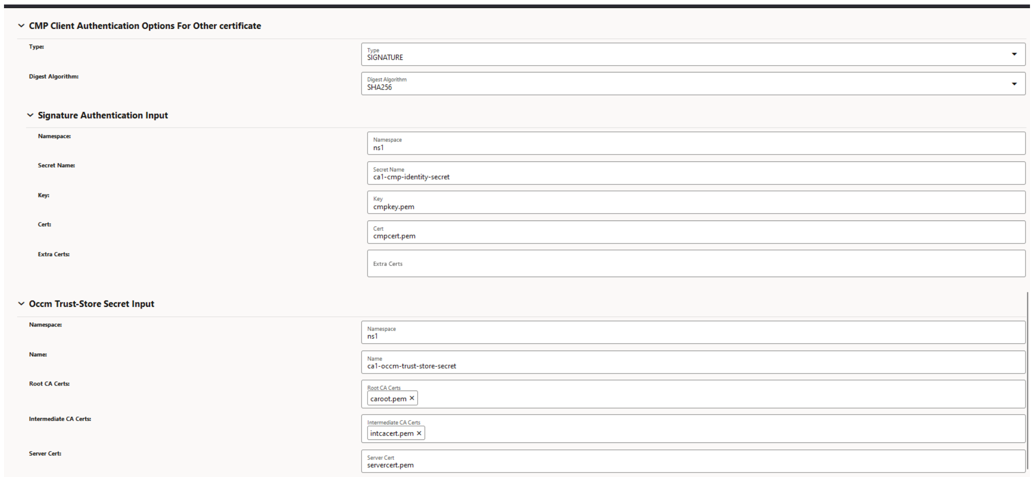
MAC Authentication Input

Namespace:	Namespace
Secret Name:	Secret Name
Password Key:	Password Key
Reference Key:	Reference Key

Signature Authentication Input

Namespace:	Namespace
Secret Name:	Secret Name
Key:	Key
Cert:	Cert
Extra Certs:	Extra Certs

c. **Figure 6 CMP Client Authentication Options for Other Certificate**



CMP Client Authentication Options For Other certificate

Type:	SIGNATURE
Digest Algorithm:	SHA256

Signature Authentication Input

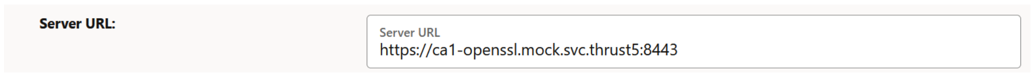
Namespace:	ns1
Secret Name:	ca1-cmp-identity-secret
Key:	cmpkey.pem
Cert:	cmpcert.pem
Extra Certs:	

Occm Trust-Store Secret Input

Namespace:	ns1
Name:	ca1-occm-trust-store-secret
Root CA Certs:	caroot.pem
Intermediate CA Certs:	intcacert.pem
Server Cert:	servercert.pem

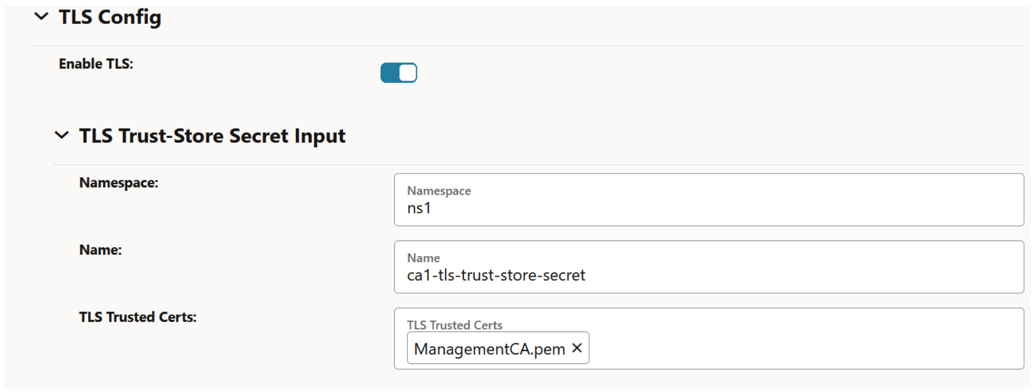
d. To enable HTTPS communication, provide HTTPS scheme in the server URL field and provide the TLS trust store certificates under TLS config.

Figure 7 HTTPS Scheme



Server URL:	https://ca1-openssl.mock.svc.thrust5:8443

Figure 8 Enable TLS Config



TLS Config

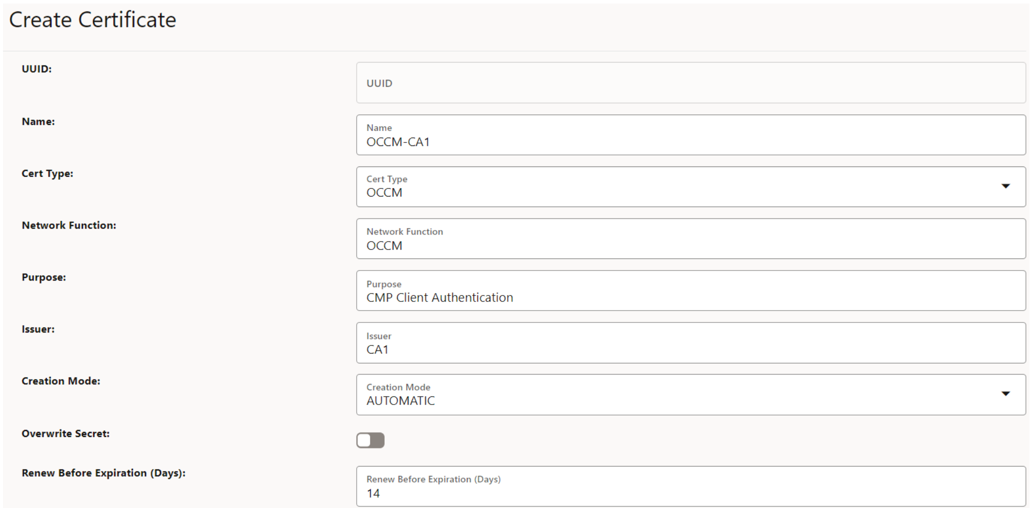
Enable TLS:	On

TLS Trust-Store Secret Input

Namespace:	ns1
Name:	ca1-tls-trust-store-secret
TLS Trusted Certs:	ManagementCA.pem

2. **Create OCCM Certificate:**
The following screenshots provide a sample configuration for creating OCCM Certificate using CNC Console GUI. Here, OCCM certificate is configured manually.

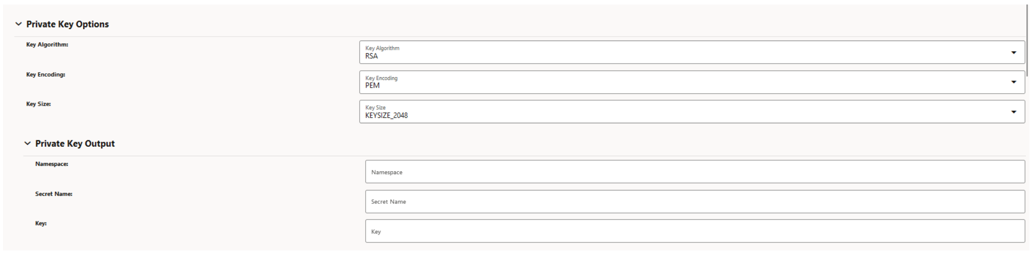
a. **Figure 9 Create OCCM Certificate**



Create Certificate

UUID:	UUID
Name:	OCCM-CA1
Cert Type:	OCCM
Network Function:	OCCM
Purpose:	CMP Client Authentication
Issuer:	CA1
Creation Mode:	AUTOMATIC
Overwrite Secret:	Off
Renew Before Expiration (Days):	14

b. **Figure 10 Private Key Options**



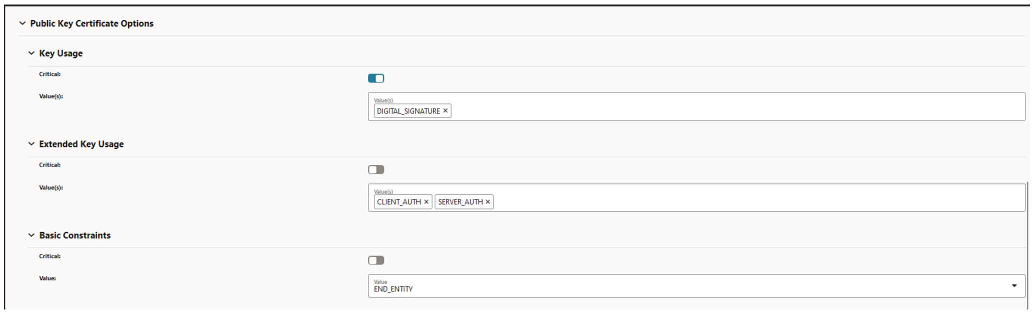
Private Key Options

Key Algorithm:	RSA
Key Encoding:	PEM
Key Size:	KEYSIZE_2048

Private Key Output

Namespace:	Namespace
Secret Name:	Secret Name
Key:	Key

c. **Figure 11 Public Key Certificate Options**



Public Key Certificate Options

Key Usage

Critical:	On
Value(s):	DIGITAL_SIGNATURE

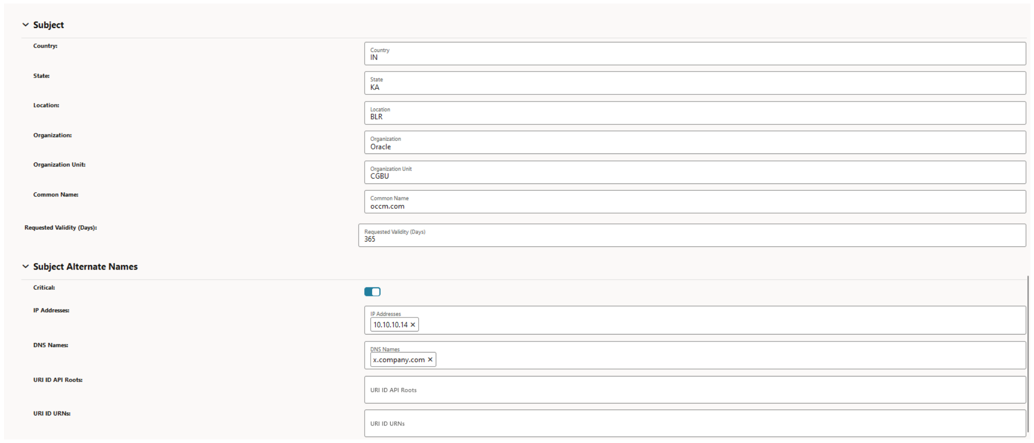
Extended Key Usage

Critical:	Off
Value(s):	CLIENT_AUTH, SERVER_AUTH

Basic Constraints

Critical:	Off
Value:	END_ENTITY

d. **Figure 12 Subject and Subject Alternate Name**



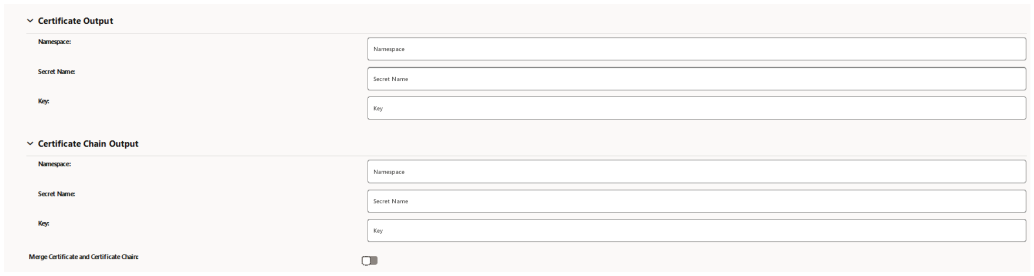
Subject

Country:	Country IN
State:	State KA
Location:	Location BLR
Organization:	Organization Oracle
Organization Unit:	Organization Unit CGBU
Common Name:	Common Name occm.com
Requested Validity (Days):	Requested Validity (Days) 365

Subject Alternate Names

Critical:	
IP Addresses:	IP Addresses 10.10.10.14 ×
DNS Names:	DNS Names x.company.com ×
URI ID API Roots:	URI ID API Roots
URI ID URNs:	URI ID URNs

e. **Figure 13 Certificate Output and Certificate Chain Output**



Certificate Output

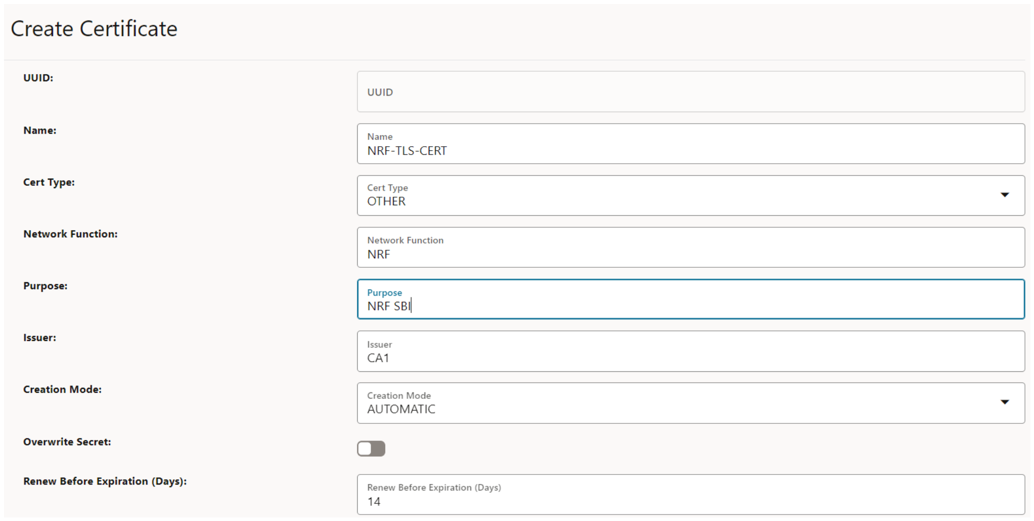
Namespace:	Namespace
Secret Name:	Secret Name
Key:	Key

Certificate Chain Output

Namespace:	Namespace
Secret Name:	Secret Name
Key:	Key
Merge Certificate and Certificate Chain:	

3. **Create NF Certificate (PEM encoding):**
The following screenshots provide a sample configuration for creating NF Certificate using CNC Console GUI.

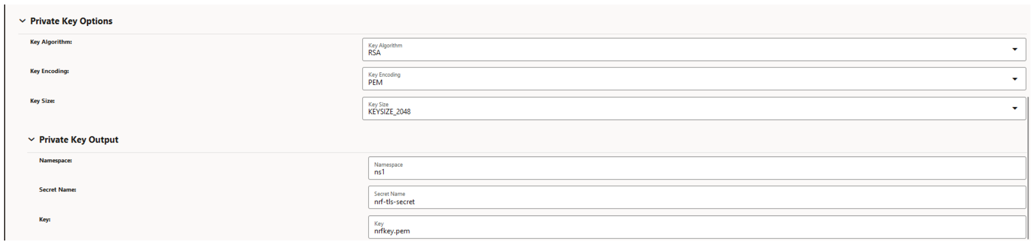
a. **Figure 14 Create NF Certificate**



Create Certificate

UUID:	UUID
Name:	Name NRF-TLS-CERT
Cert Type:	Cert Type OTHER
Network Function:	Network Function NRF
Purpose:	Purpose NRF SBI
Issuer:	Issuer CA1
Creation Mode:	Creation Mode AUTOMATIC
Overwrite Secret:	
Renew Before Expiration (Days):	Renew Before Expiration (Days) 14

b. **Figure 15 Private Key Options**



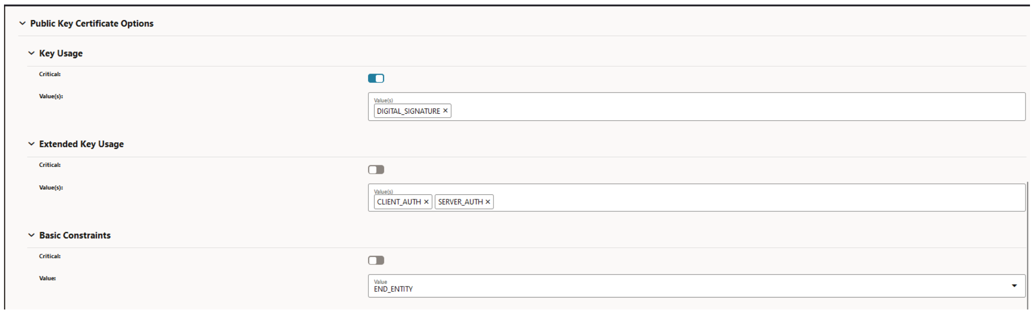
Private Key Options

Key Algorithm:	RSA
Key Encoding:	PEM
Key Size:	KEYSIZE_2048

Private Key Output

Namespace:	ns1
Secret Name:	nrf-tls-secret
Key:	nrfkey.pem

c. **Figure 16 Public Key Options**



Public Key Certificate Options

Key Usage

Critical:	on
Value(s):	DIGITAL_SIGNATURE

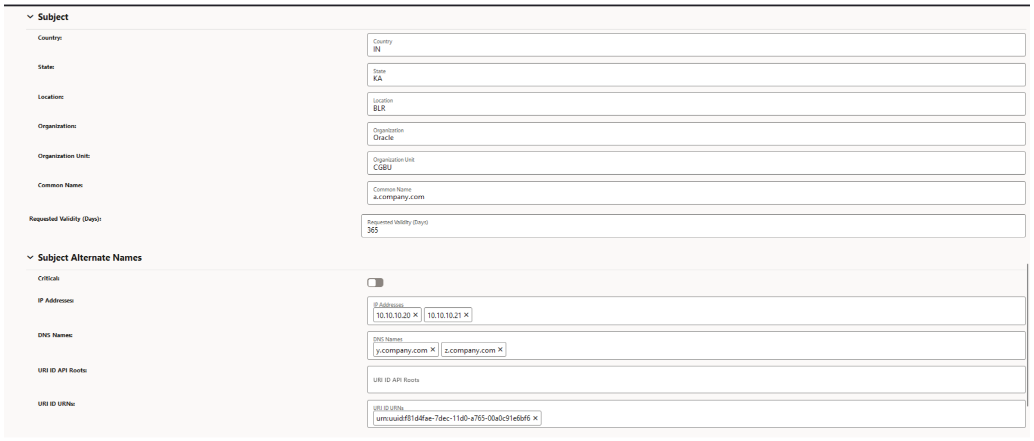
Extended Key Usage

Critical:	off
Value(s):	CLIENT_AUTH, SERVER_AUTH

Basic Constraints

Critical:	off
Value:	END_ENTITY

d. **Figure 17 Subject and Subject Alternate Names**



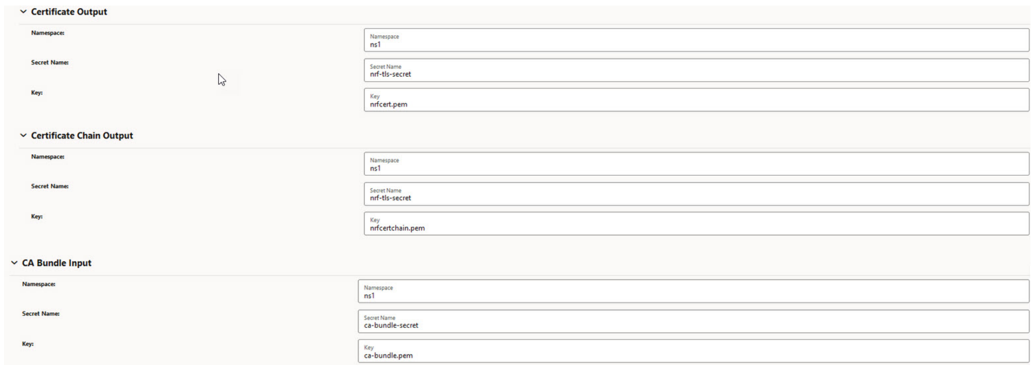
Subject

Country:	IN
State:	KA
Location:	BLR
Organization:	Oracle
Organization Unit:	CGBU
Common Name:	a.company.com
Requested Validity (Days):	365

Subject Alternate Names

Critical:	off
IP Addresses:	10.10.10.20, 10.10.10.21
DNS Names:	y.company.com, z.company.com
URI ID API Roots:	
URI ID URNs:	urn:uuid:f81d4fae-7dec-11d0-a765-00a0c91e6bf6

e. **Figure 18 Certificate Output**



Certificate Output

Namespace:	ns1
Secret Name:	nrf-tls-secret
Key:	nrfcert.pem

Certificate Chain Output

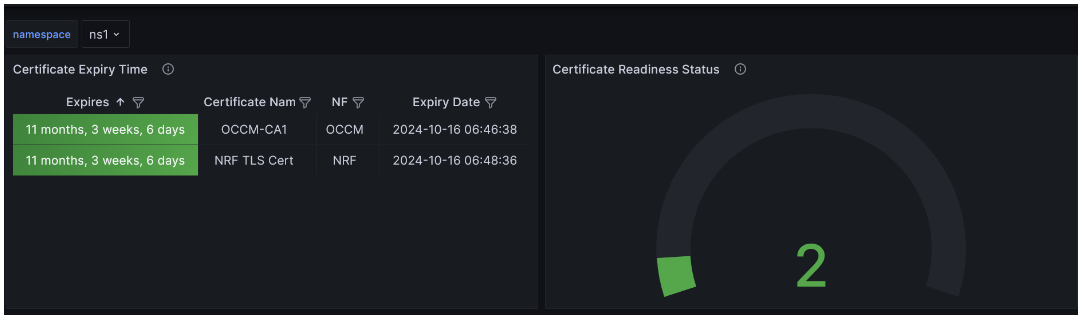
Namespace:	ns1
Secret Name:	nrf-tls-secret
Key:	nrfcertchain.pem

CA Bundle Input

Namespace:	ns1
Secret Name:	ca-bundle-secret
Key:	ca-bundle.pem

4. **Check Grafana Dashboard**
Check the grafana dashboard to view the certificates created.

Figure 19   Sample Grafana Dasboard



Expires	Certificate Nam	NF	Expiry Date
11 months, 3 weeks, 6 days	OCCM-CA1	OCCM	2024-10-16 06:46:38
11 months, 3 weeks, 6 days	NRF TLS Cert	NRF	2024-10-16 06:48:36

The screenshot shows that NRF TLS Cert and CA1 certificates are created successfully. The left panel indicates their expiry time and the right panel shows that both are ready to be consumed.

5. **Verify Kubernetes secret**
   After the certificate request is submitted, verify whether the k8s secret specified under private key output and certificate output location is created or not.

   Run the following command to get the content of the Kubernetes secret:

```
kubectl get secret <k8s-secret-name> -n <namespace> -o yaml
```

   For example:

```
[user@thrust5-bastion-1 ~]$ kubectl get secret nrf-tls-secret -n ns1 -o
yaml
apiVersion: v1
data:
  nrfcert.pem: LS0tLS1CRUdJTiBDRVJUSUZJQ0FURS0tLS0tCkXXXXXXXXXX
  nrfcertchain.pem: LS0tLS1CRUdJTiBDRVJUSUZJQ0FURS0tXXXXXXXXXXX
  nrfkey.pem: LS0tLS1CRUdJTiBQUklWQVRFIEtFWS0tLS0tCk1XXXXXXXXXXX
kind: Secret
metadata:
  creationTimestamp: ""2023-16-10T06:48:37Z"
  name: nrf-tls-secret
  namespace: ns1
  resourceVersion: "563348905"
  uid: f0eb452d-e977-4809-99b0-c541b154dabe
type: Opaque
```

   Output of openssl x509 command for the certificate:

```
kubectl get secret <k8s-secret-name> -n <namespace> -o=go-
template='{{index .data "<certificate-output-K8s-secret-key>"}}' | base64 -
d | openssl x509 -text -noout
```

   For example:

```
[user@thrust5-bastion-1 ~]$ kubectl get secret nrf-tls-secret -n ns1 -o=go-
template='{{index .data "nrfcert.pem"}}' | base64 -d | openssl x509 -text -
noout
```

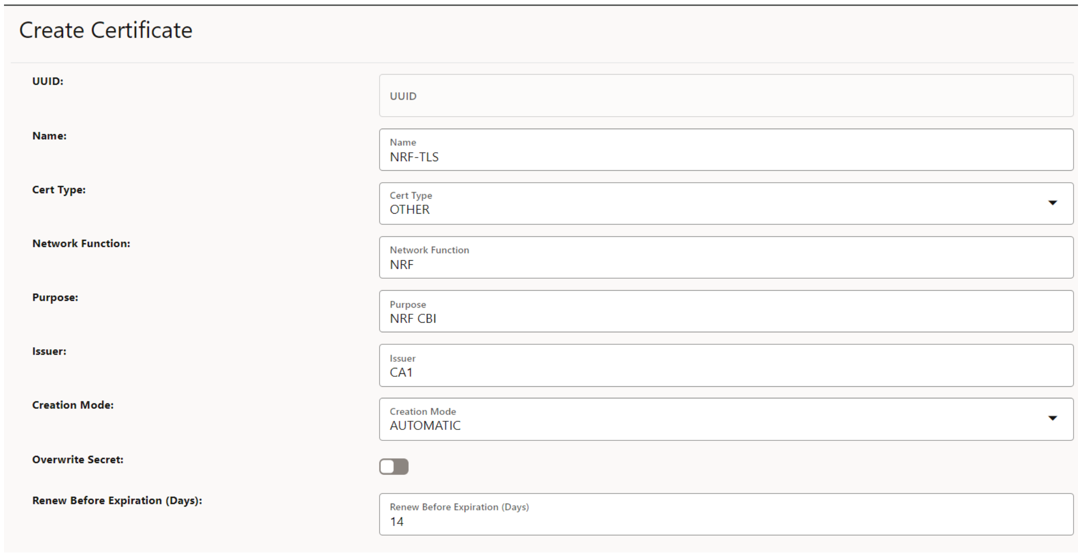
```
Certificate:
  Data:
    Version: 3 (0x2)
    Serial Number:
      XXXXXXXXX
    Signature Algorithm: sha256WithRSAEncryption
    Issuer: CN = x.company.com
    Validity
      Not Before: Oct 16 06:48:37 2023 GMT
      Not After : Oct 16 06:48:36 2024 GMT
    Subject: C = IN, ST = KA, L = BLR, O = Oracle, OU = CGBU, CN =
a.company.com
    Subject Public Key Info:
      Public Key Algorithm: rsaEncryption
        Public-Key: (2048 bit)
        Modulus:
          00:c9:1b:35:bf:21:e6:1f:69:9e:78:25:07:4b:6e:
         XXXXXXXXX

        Exponent: 65537 (0x10001)
    X509v3 extensions:
      X509v3 Key Usage:
        Digital Signature
      X509v3 Extended Key Usage:
        TLS Web Client Authentication, TLS Web Server Authentication
      X509v3 Basic Constraints:
        CA:FALSE
      X509v3 Subject Alternative Name:
                IP Address:10.10.10.20, IP Address:10.10.10.21,
DNS:y.commpany.com, DNS:z.commpany.com, URI:urn:uuid:f81d4fae-7dec-11d0-
a765-00a0c91e6bf6
      X509v3 Subject Key Identifier:
        2B:0D:XXXXXXXXXXXX
      X509v3 Authority Key Identifier:
        20:03:XXXXXXXXXXX
  Signature Algorithm: sha256WithRSAEncryption
  Signature Value:
   XXXXXXXXXXXXXXXXXXXXXXX
```

Create NF Certificate (DER encoding):

The following screenshots provide a sample configuration for creating DER encoded NF Certificate using CNC Console GUI.

1. Certificate metadata

Figure 20   Certificate Metadata

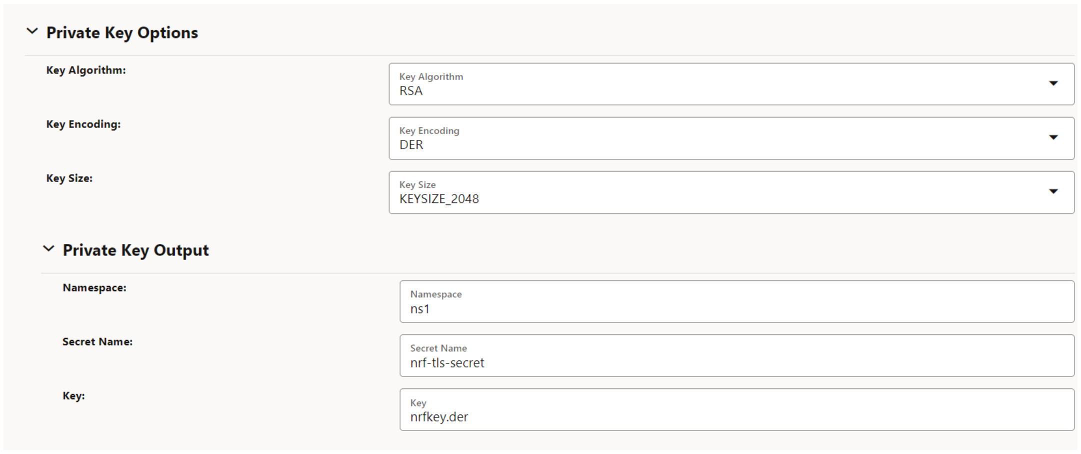


Create Certificate

UUID:	UUID
Name:	Name NRF-TLS
Cert Type:	Cert Type OTHER
Network Function:	Network Function NRF
Purpose:	Purpose NRF CBI
Issuer:	Issuer CA1
Creation Mode:	Creation Mode AUTOMATIC
Overwrite Secret:	
Renew Before Expiration (Days):	Renew Before Expiration (Days) 14

2. Private Key Options

Figure 21   Private Key Options



Private Key Options

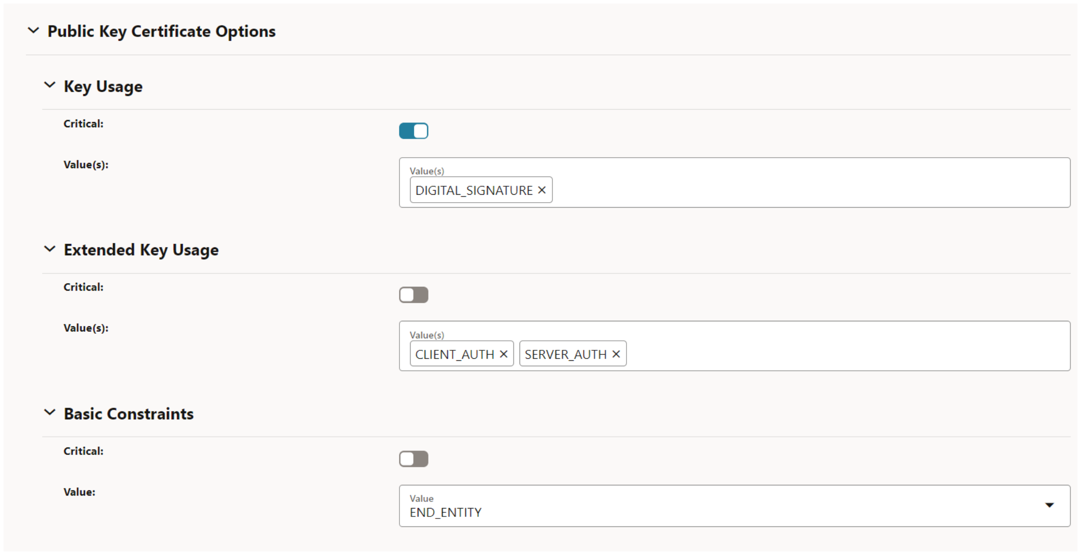
Key Algorithm:	Key Algorithm RSA
Key Encoding:	Key Encoding DER
Key Size:	Key Size KEYSIZE_2048

Private Key Output

Namespace:	Namespace ns1
Secret Name:	Secret Name nrf-tls-secret
Key:	Key nrfkey.der

3. Public Key Certificate Options

Figure 22 Public Key Certificate Options



Public Key Certificate Options

Key Usage

Critical:	On
Value(s):	DIGITAL_SIGNATURE

Extended Key Usage

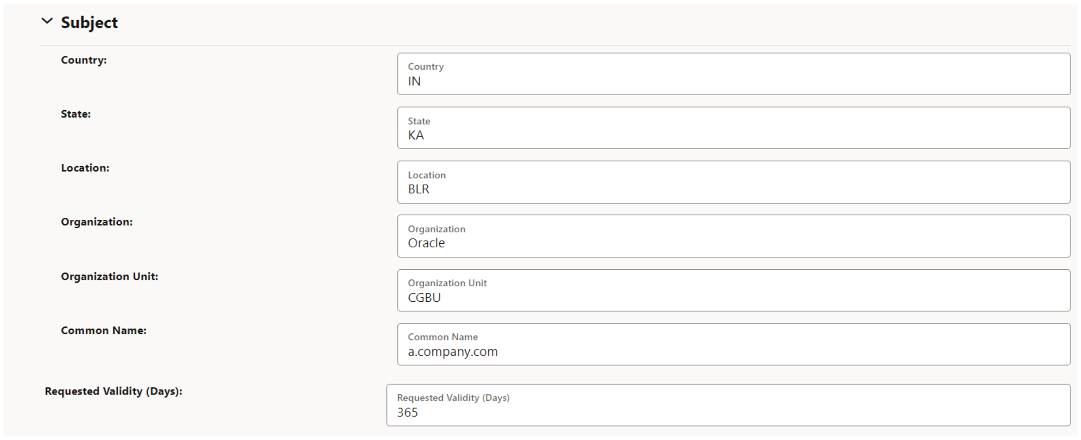
Critical:	Off
Value(s):	CLIENT_AUTH, SERVER_AUTH

Basic Constraints

Critical:	Off
Value:	END_ENTITY

4. Subject

Figure 23 Subject

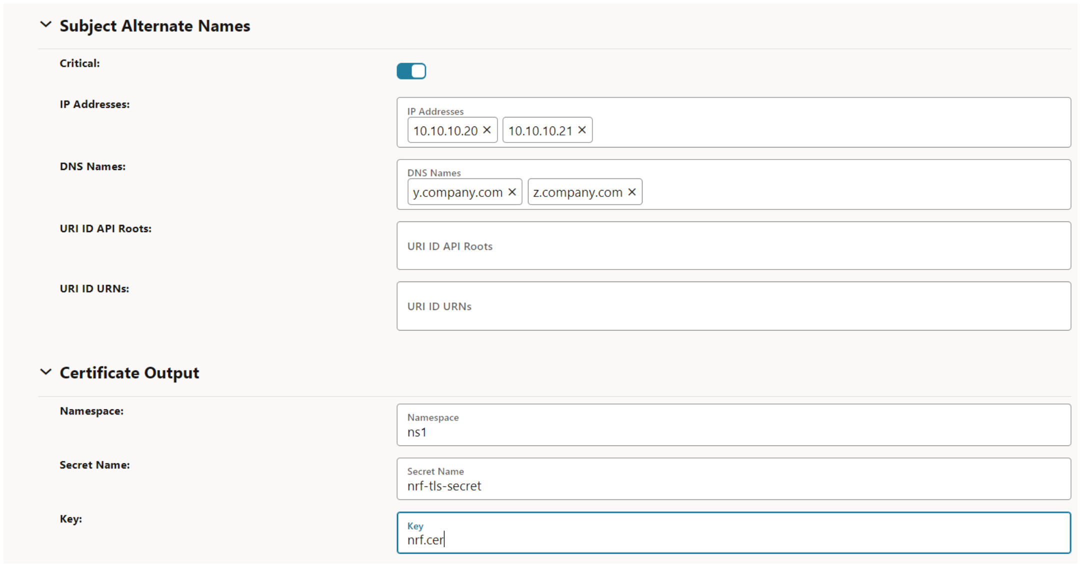


Subject

Country:	IN
State:	KA
Location:	BLR
Organization:	Oracle
Organization Unit:	CGBU
Common Name:	a.company.com
Requested Validity (Days):	365

5. Subject Alternate names

Figure 24 Subject Alternate names



Subject Alternate Names

Critical: (toggle on)

IP Addresses: 10.10.10.20 ✕ 10.10.10.21 ✕

DNS Names: y.company.com ✕ z.company.com ✕

URI ID API Roots: URI ID API Roots

URI ID URNs: URI ID URNs

Certificate Output

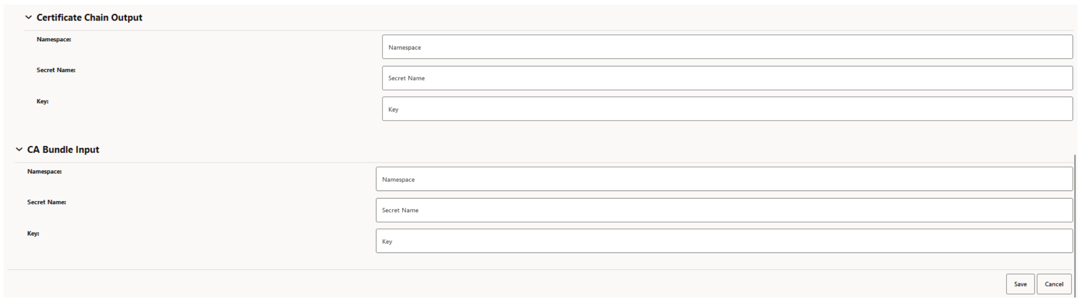
Namespace: ns1

Secret Name: nrf-tls-secret

Key: nrf.cer

6. Optional Certificate chain output and CA bundle input fields

Figure 25 Optional Certificate chain output and CA bundle input fields



Certificate Chain Output

Namespace: Namespace

Secret Name: Secret Name

Key: Key

CA Bundle Input

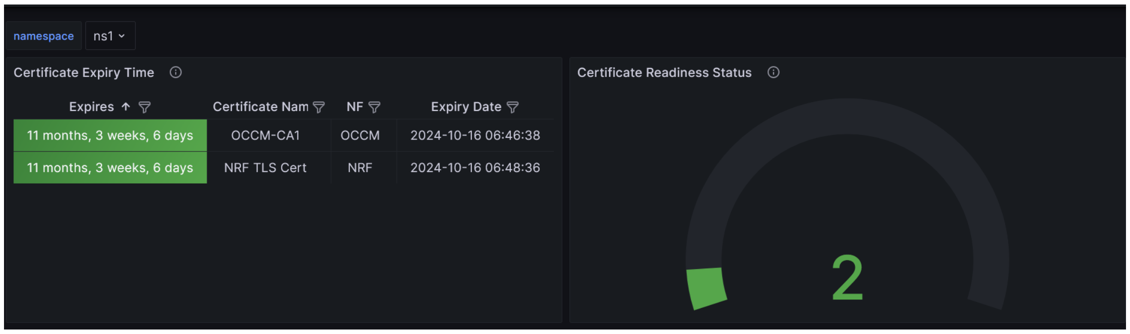
Namespace: Namespace

Secret Name: Secret Name

Key: Key

Check grafana dashboard

Figure 26 Check grafana dashboard



namespace ns1

Certificate Expiry Time

Expires	Certificate Nam	NF	Expiry Date
11 months, 3 weeks, 6 days	OCCM-CA1	OCCM	2024-10-16 06:46:38
11 months, 3 weeks, 6 days	NRF TLS Cert	NRF	2024-10-16 06:48:36

Certificate Readiness Status

2

The screenshot shows that NRF-TLS Certificate is created successfully. The left panel indicates its expiry time and the right panel shows that it is ready to be consumed.

Verify Kubernetes secret

After the certificate request is submitted, verify whether the Kubernetes secret specified under private key output and certificate output location is created or not.

Run the following command to get the content of the Kubernetes secret:

```
kubectl get secret <k8s-secret-name> -n <namespace> -o yaml
```

For example:

```
[user@thrust2a-bastion-1 ~]$ kubectl get secret nrf-tls-secret -n ns1 -o yaml

apiVersion: v1

data:

  nrf.cer: MIIDrTCCApWgAwIBXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

  nrfkey.der: MIIEogIBAAKXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
kind: Secret

metadata:

  creationTimestamp: "2023-10-16T06:48:37Z"

  name: nrf-tls-secret

  namespace: ns1

  resourceVersion: "346496359"

  uid: 2dbdb2d7-313d-45d9-a634-642d14f01fa5

type: Opaque
```

Output of openssl x509 command for the certificate:

```
kubectl get secret <k8s-secret-name> -n <namespace> -o=go-
template='{{index .data "<certificate-output-K8s-secret-key>"}}' | base64 -d
| openssl x509 -text -noout -inform DER
```

For example:

```
[user@thrust2a-bastion-1 ~]$ kubectl get secret nrf-tls-secret -n ns1 -o=go-
template='{{index .data "nrf.cer"}}' | base64 -d | openssl x509 -text -noout -
inform DER
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number:
            3c:47:05:d7:ee:4c:ce:bb:8f:26:07:c2:a1:9b:92:2c:87:e1:7c:3f
        Signature Algorithm: sha256WithRSAEncryption
        Issuer: CN = x.company.com
        Validity
            Not Before: Oct 16 06:48:37 2023 GMT
```

```
                Not After : Oct 16 06:48:36 2024 GMT
            Subject: C = IN, ST = KA, L = BLR, O = Oracle, OU = CGBU, CN =
a.company.com
            Subject Public Key Info:
                Public Key Algorithm: rsaEncryption
                    RSA Public-Key: (2048 bit)
                    Modulus:
                        00:ba:95:23:61:2f:31:55:e3:06:7b:b6:b7:67:cd:
                        XXXXXXX
                    Exponent: 65537 (0x10001)
            X509v3 extensions:
                X509v3 Key Usage: critical
                    Digital Signature
                X509v3 Extended Key Usage:
                    TLS Web Client Authentication, TLS Web Server Authentication
                X509v3 Basic Constraints:
                    CA:FALSE
                X509v3 Subject Alternative Name: critical
                    IP Address:10.10.10.20, IP Address:10.10.10.21,
DNS:y.company.com, DNS:z.company.com
                X509v3 Authority Key Identifier:

keyid:FB:4A:01:07:D4:8D:BB:0B:E4:50:72:75:10:8E:81:57:33:66:0D:3E

                X509v3 Subject Key Identifier:
                    A3:82:F6:67:94:35:37:A6:0B:4B:03:9C:0D:B9:A8:72:8D:59:73:85
        Signature Algorithm: sha256WithRSAEncryption
             0a:c2:81:ec:89:91:b4:aa:24:22:33:54:e1:92:db:07:cf:6f:
             XXXXXXXX
```

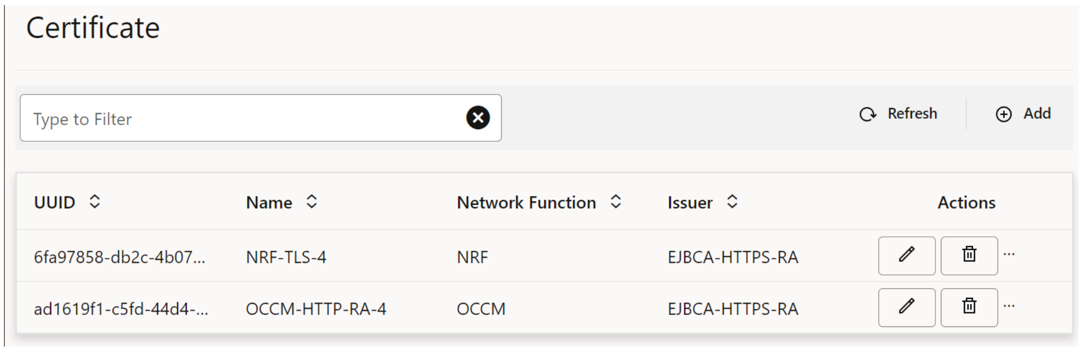
A.1.2 Recreating Certificates - Sample Configuration

This section describes the sequence of steps to be performed to recreate certificates when OCCM or NF certificate configuration has been accepted.

To recreate certificates:

1. Log in to CNC Console using your login credentials and select the OCCM Instance.
2. Click **OCCM** from the left pane and then click **Certificate**.
3. Click **Edit** under **Actions** for the certificate you want to recreate.

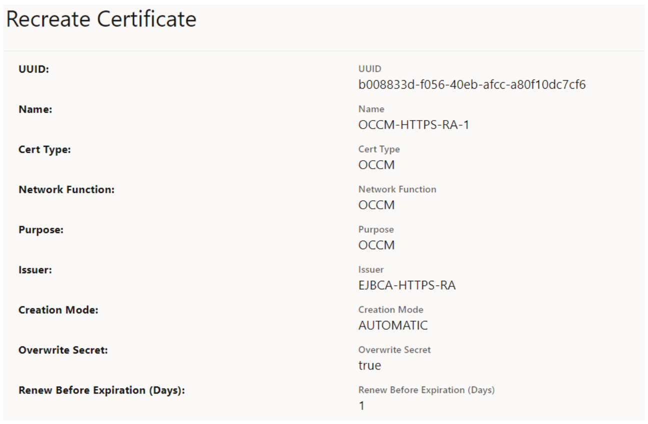
Figure 27 Certificate Page



UUID	Name	Network Function	Issuer	Actions
6fa97858-db2c-4b07...	NRF-TLS-4	NRF	EJBCA-HTTPS-RA	
ad1619f1-c5fd-44d4-...	OCCM-HTTP-RA-4	OCCM	EJBCA-HTTPS-RA	

The **Recreate Certificate** page appears. The configurations on this page are not editable.

Figure 28 Recreate Certificate Page

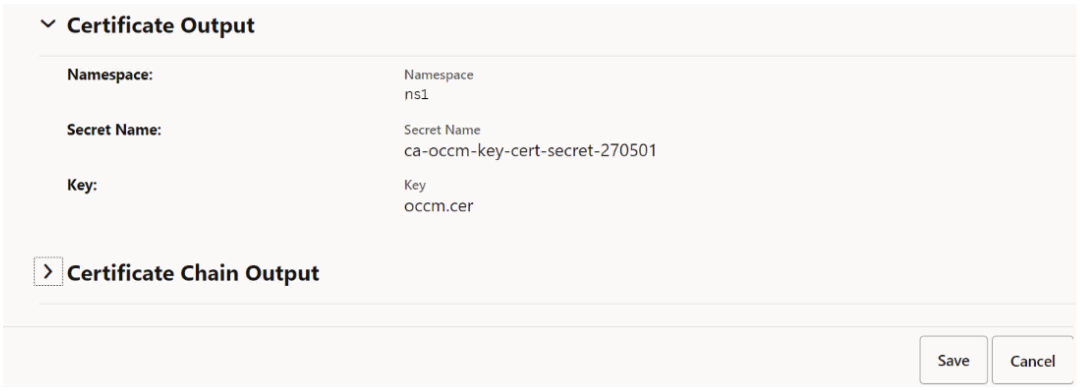


Recreate Certificate

UUID:	UUID b008833d-f056-40eb-afcc-a80f10dc7cf6
Name:	Name OCCM-HTTPS-RA-1
Cert Type:	Cert Type OCCM
Network Function:	Network Function OCCM
Purpose:	Purpose OCCM
Issuer:	Issuer EJBCA-HTTPS-RA
Creation Mode:	Creation Mode AUTOMATIC
Overwrite Secret:	Overwrite Secret true
Renew Before Expiration (Days):	Renew Before Expiration (Days) 1

4. On the **Recreate Certificate** page, click **Save** to trigger the recreate request.

Figure 29 Click Save



Certificate Output

Namespace:	Namespace ns1
Secret Name:	Secret Name ca-occm-key-cert-secret-270501
Key:	Key occm.cer

Certificate Chain Output

5. When the recreate certificate request has been submited, verify if the Kubernetes secret specified under private key output and certificate output has been recreated. Run the following command to verify the Kubernetes secret:

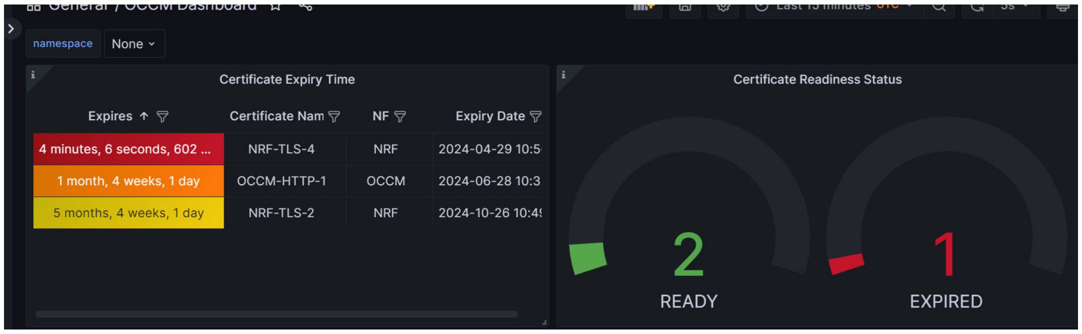
```
kubectl get secret <k8s-secret-name> -n <namespace> -o yaml
```

A sample response is as follows:

```
data:
  nrf.cer:
LS0tLS1CRUdJTiBDRVJUSUZJQ0FURS0tLS0tCk1JSUQ4ekNDQWx1Z0F3SUJBZ0lVSlgvNlBsVXF
haEJaYUVOcm.....
  nrfkey.pem: MHcCAQEEIHtK36V377+977+9akke77+9Xe+/ve+/vQMcHe+/
vRXvv73vv70n77+9VO+/vVPvv73vv70RcE4577+9CgYIKu+/v.....
kind: Secret
metadata:
  creationTimestamp: "2024-05-03T11:05:08Z"
  name: nrf-tls-secret03052402
  namespace: ns1
  resourceVersion: "219805879"
  uid: 7e0d4bbf-291f-4fd2-a3d6-d42b8eff1994
type: Opaque
```

6. Check the grafana dashboard to view the created certificate. A sample of the grafana dashboard when an expired certificate is recreated is as follows:

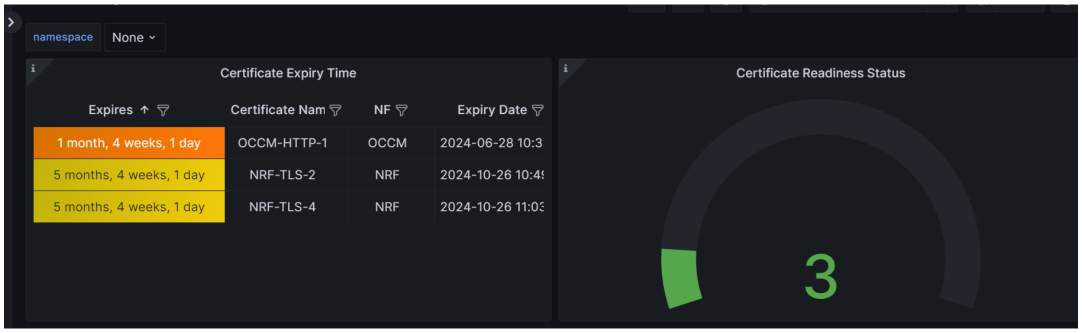
Figure 30 Grafana Dashboard - Certificate Readiness Status



Certificate Expiry Time

Expires	Certificate Nam	NF	Expiry Date
4 minutes, 6 seconds, 602 ...	NRF-TLS-4	NRF	2024-04-29 10:5
1 month, 4 weeks, 1 day	OCCM-HTTP-1	OCCM	2024-06-28 10:3
5 months, 4 weeks, 1 day	NRF-TLS-2	NRF	2024-10-26 10:4

Figure 31 Grafana Dashboard - Certificate Readiness Status



Certificate Expiry Time

Expires	Certificate Nam	NF	Expiry Date
1 month, 4 weeks, 1 day	OCCM-HTTP-1	OCCM	2024-06-28 10:3
5 months, 4 weeks, 1 day	NRF-TLS-2	NRF	2024-10-26 10:4
5 months, 4 weeks, 1 day	NRF-TLS-4	NRF	2024-10-26 11:0