Oracle® Communications

Network Analytics Suite Security Guide

Release 23.1.0

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Oracle Communications Network Analytics Suite Security Guide, Release 23.1.0

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A Network Port Flows

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Acronyms

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

Table Acronyms

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

Table (Cont.) Acronyms

Acronym	Description
SCP	Service Communication Proxy
SEPP	Security Edge Protection Proxy
SMF	Session Management Function
SNMP	Simple Network Management Protocol
SVC	Services
SUPI	Subscription Permanent Identifier
UDM	Unified Data Management
UE	User Equipment
URI	Uniform Resource Identifier

What's New in This Guide

This section lists the documentation updates for Network Analytics Suite release *23.1.0* .

Release 23.1.0 - F77607-01, March 2023

- Updated the document for release 23.1.0.
- Added MTLS Configurations under TLS Configuration.

1 Introduction

The Security Guide provides an overview of the security information applicable to the Oracle Communications Network Analytics Suite of products.

This document contains recommendations and step-by-step instructions to assist the customer in hardening the Network Analytics Suite system, it also provides a simplified trust model for the system.

1.1 Audience

- Technology consultants
- Installers
- Security consultants
- System administrators

1.2 References

The following references provide additional background on product operations and support:

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

2
Overview

2.1 OCNWDAF Overview

Deployment Environment

The OCNWDAF can be deployed in a variety of possible configurations and environments:

Table 2-1 Deployment Environment

Type	Host	CNE	Description
Cloud	Customer Cloud	CNE	The CNE is deployed on the cloud provided by the customer. The OCNWDAF is deployed on the Kubernetes cluster managed by CNE.

OCNWDAF 3GPP Standards

Table 2-2 OCNWDAF 3GPP Standards

Network Function	Abbreviation	Description	3GPP Standard
Networks Data Analytics Function	OCNWDAF	Assists in collecting and analyzing data in a 5G network.	• 3GPP TS 23.288 v16 • 3GPP TS 23.288 v17.4.0 • 3GPP TS 29.520 v17.6.0 • 3GPP TS 29.508 v17.5.0 • 3GPP TS 29.518 v17.5.0 • 3GPP TS 23.501 v17.5.0 • 3GPP TS 23.502 v17.4.0 • 3GPP TS 33.521 v17.1.0

2.2 OCNADD Overview

Deployment Environment

The OCNADD can be deployed in a variety of possible configurations and environments:

Table 2-3 Deployment Environment

Type	Host	CNE	Description
Cloud	Customer Cloud	CNE	The CNE is deployed on the cloud provided by the customer. The OCNADD is deployed on the Kubernetes cluster managed by CNE.
Cloud	Customer CNE	Customer CNE(TANZU)	The customer provides the CNE and deploys the OCNADD directly into the environment. The Oracle provided DBTier is used. The list of all other required software is listed in the install guide *Oracle Communications Network Analytics Data Director Installation, Upgrade and Fault Recovery Guide* section "Software Requirements".

OCNADD Services

Table 2-4 OCNADD Services

Services	Descriptio
Admin Service	The Admin Service administers the Kafka Cluster and it provides an interface to create and delete a Consumer Adapter deployment.
Aggregation Service	The Aggregation Service collects and aggregates network traffic from multiple NFs (For example: SCP 1 and 2 and/or SEPP, NRF, 3rd party NF, and so on).
Alarm Service	The OCNADD Alarm service is used to store the alarms generated by other OCNADD services.
Backend Router Service	The Backend Router Service is the gateway that forwards GUI requests to various other backed services like Configuration, Health, Alarm, Prometheus, etc.
Configuration Service	The Configuration Service is used by the OCNADD UI service to configure 3rd party message feed.

Table 2-4 (Cont.) OCNADD Services

Services	Descriptio
Consumer Adapter Service	The Consumer Adapter Service manages the third-party specific connection parameters and provide secure message transport towards the third-party consumer application.
Health Monitoring Service	The Health Monitoring Service monitors the health of each OCNADD service and provides alerts related to the overall health of the OCNADD.
Kafka Broker Service	The Kafka Broker Service stores the incoming network traffic from different NFs. It also stores the intermediate processed data from different microservices.
GUI service	The GUI service is used as an interface between the CNC Console and OCNADD that provides the user interface to configure the Data Feeds.

3
Secure Development Practices

Given below are the practices followed for a secure development environment:

3.1 Vulnerability Handling

For details about the vulnerability handling, refer Oracle Critical Patch Update Program. The primary mechanism to backport fixes for security vulnerabilities in Oracle products is quarterly Critical Patch Update (CPU) program.

In general, the OCNWDAF and OCNADD Software is on a quarterly release cycle, with each release providing feature updates and fixes and updates to relevant third party software. These quarterly releases provide cumulative patch updates.

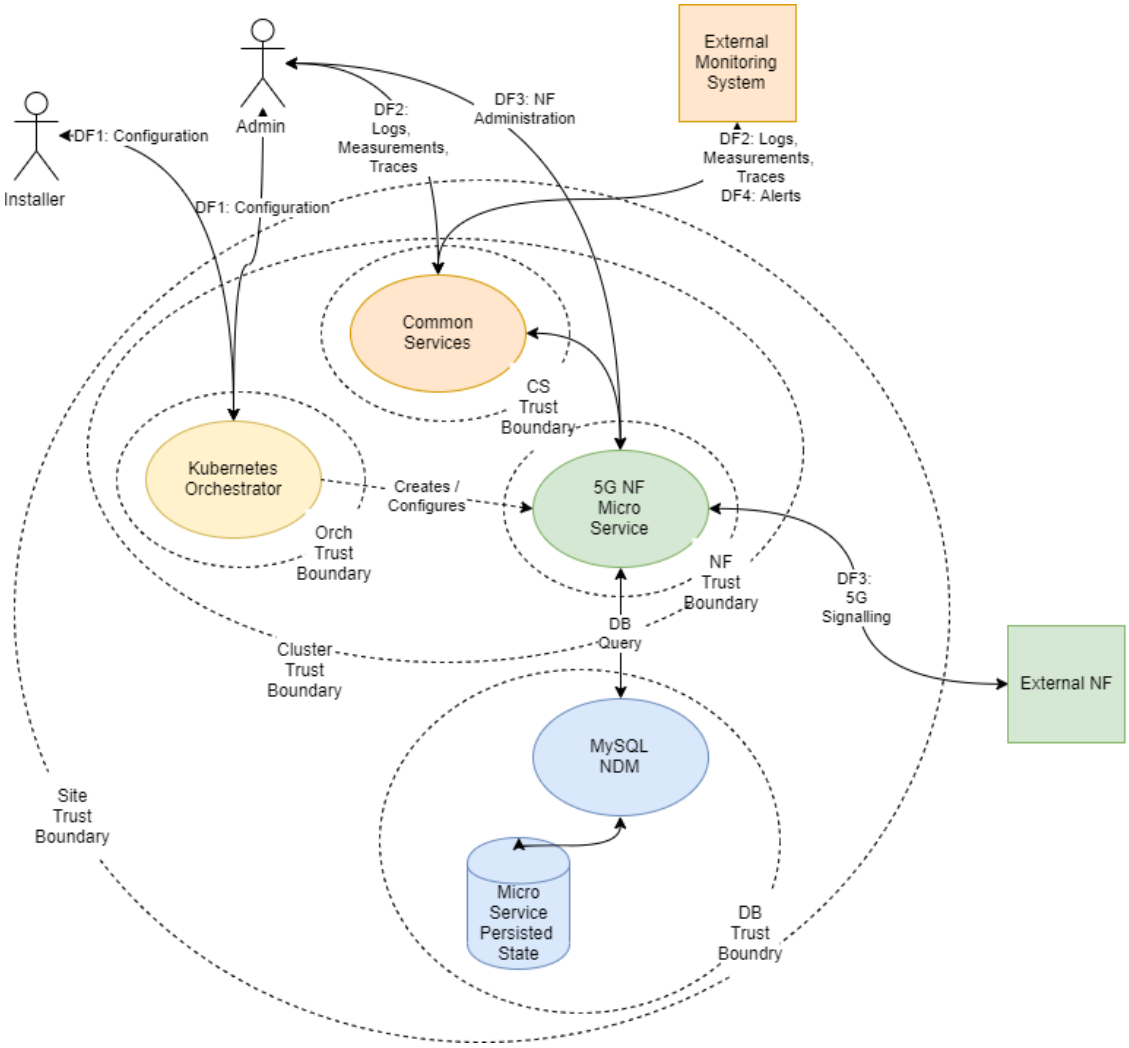
3.2 Trust Model for OCNWDAF

The following Trust Model depicts the reference trust model (regardless of the target environment). The model describes the critical access points and controls site deployment.

While the model shows a single 5G NF microservice deployed, several NFs are also deployed in individual clusters.

3.2.1 Context diagram

Figure 3-1 Context Diagram



3.2.2 Key Trust Boundaries

Following are the key trust boundaries:

Table 3-1 Key Trust Boundaries

Trust Boundary	Includes	Access Control
Site Trust Boundary	All the NFs and other supporting elements for a given site.	Cluster Access Policies are implemented using some kind of Access Control Group (or Security Group) mechanism.

Table 3-1 (Cont.) Key Trust Boundaries

Trust Boundary	Includes	Access Control
Cluster Trust Boundary	All the compute elements for a given cluster	Network Policies control traffic ingress and egress. Pod Security Policies manage the workloads allowed in the cluster (For example, no pods requiring privilege escalation).
DB Trust Boundary	All the DBTier elements for a given cluster	Firewall Policies control traffic ingress and egress. DB grants access and other permission mechanisms that provide authorization for users.
Orchestrator Trust Boundary (Orch Trust Boundary)	The orchestration interface and keys	Firewall Policies control the access to a Bastion server which provides orchestration services. Access to the Bastion host uses Secure Socket Shell (SSH) protocol. The cluster orchestration keys are stored on the Bastion host.
CS Trust Boundary	The common services implementing logging, tracing, and measurements.	Each of the common services provides independent Graphical User Interfaces (GUIs) that are currently open. The customer may want to introduce an api-gateway, implement authentication and authorization mechanisms to protect the OAM (Operations, Administrations, and Maintenance) data. The common services can be configured to use Transport Layer Security (TLS). When TLS is used, certificates must be generated and deployed through the orchestrator.
NF Trust Boundaries	A collection of 5G Network Functions deployed as a service.	Some 5G NF microservices provide OAM access through a GUI. 5G NF microservices provide Signaling access through a TLS protected HTTP2 interface. The certificates for these interfaces are managed via the certificate manager.

3.2.3 External Data Flows

The following are external data flows:

Table 3-2 External Data Flows

Data Flow	Protocol	Description
DF1: Configuration	SSH	The installer or administrator accesses the orchestration system hosted on the Bastion Server. The installer or administrator must use ssh keys to access the bastion to a special orchestration account (not root). Password access is not allowed.
DF2: Logs, Measurements, Traces	HTTP/HTTPS	The administrator or operator interacts with the common services using web interfaces.
DF3: 5G Signaling	HTTP2 (w/TLS)	All signaling interaction between NFs at a site and NFs at an external site is sent through TLS protected HTTP2.
DF4: Alerts	SNMP (Trap)	Alerting is performed using SNMP traps.

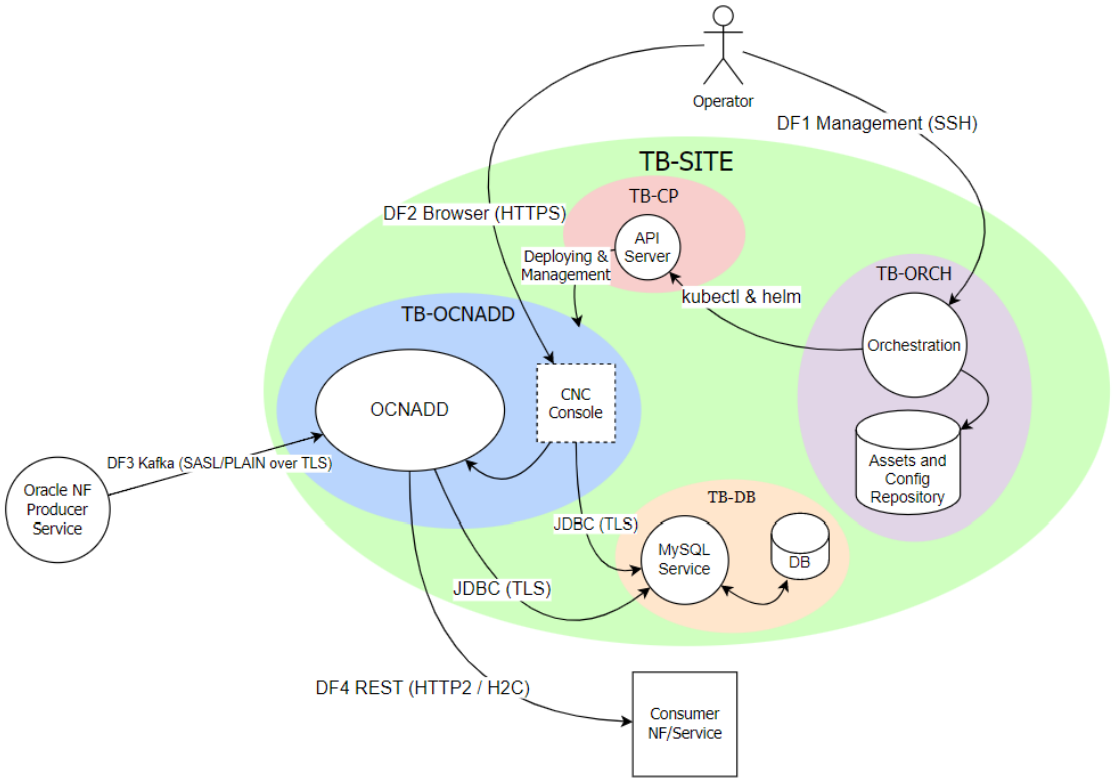
The complete list of network flows including service types and ports are available in Network Port Flows.

3.3 Trust Model for OCNADD

The following Trust Model depicts the reference trust model (regardless of the target environment). The model describes the critical access points and controls site deployment.

3.3.1 Context Diagram

Figure 3-2 Context Diagram



3.3.2 Key Trust Boundaries

Following are the key trust boundaries:

Table 3-3 Key Trust Boundaries

Trust Boundary	Access Control
OCNADD	Kubernetes Namespace for OCNADD where its internal micro-services are deployed.
Site	Where the Kubernetes cluster is deployed.
Control Plane	This trust boundary delineates the control plane elements of the clusters, that is, API Server, kubelet, containerd and etcd. The configuration database (ETCD service) is isolated so that only control plane services can access it.

Table 3-3 (Cont.) Key Trust Boundaries

Trust Boundary	Access Control
Database	MySQL service deployed in a separate Kubernetes namespace.
CNE Infra	Namespace containing all the infrastructure related services (like Prometheus). Provided by CNE.
Orchestration	Includes the orchestration server and the Code and Image Repository.

3.3.3 External Data Flows

Table 3-4 External Data Flows

Data Flow	Protocol	Description
DF1 : Management	SSH	Operator will login to the orchestration server through SSH for deploying OCNADD and/or managing the OCNADD Kubernetes deployment using helm.
DF2 : Browser	HTTPS	Operator uses CNCC to create, manage feed configuration and monitor OCNADD. CNCC will be accessed through browser and Operator will be authenticated with username, password before access is granted.
DF3 : Kafka	SASL_SSL	Oracle NFs write the 5G SBI data or messages into the Kafka exposed by OCNADD in the respective topics. OCNADD will then process according to the feed configurations. The communications are encrypted using TLS and Oracle NF will authenticate themselves to Kafka through SASL/PLAIN (username and password).
DF4 : Consumer NF	HTTP2(w/TLS)	OCNADD will forward the message feed to respective consumer NF/s as HTTP2 (over TLS) or H2C (HTTP2 clear text) messages according to the feed configurations.

4

Implementing Security Recommendations and Guidelines

4.1 Implementing Security Recommendations and Guidelines for OCNWDAF

This section provides specific recommendations and guidelines for Oracle Communications Network Data Analytics Function (OCNWDAF) security.

4.1.1 Common Security Recommendations and Procedures

This section provides details of the common security recommendations and guidelines.

4.1.1.1 4G and 5G Application Authentication and Authorization

Cloud Native Core NFs support integration with platform service meshes and mTLS may be provided by the platform service mesh, thereby securing communication flows between all applications that participate in the platform service mesh. mTLS also encrypts the data flows so that only the endpoints of the mTLS session can access the contents of the communication data.

4G and 5G NFs use Mutual Transport Layer Security (mTLS) authentication to secure communication. All NFs require establishing a trust relationship with all peers by exchanging and trusting peer root or intermediate certificates. The peer certificates must be available in the truststore (K8s Secrets) to establish secure communication.

4G and 5G NFs also support manual importation and a semiautomatic import using the cert-manager external provider.

4.1.1.2 DB-Tier Authentication and Authorization

The DB-Tier provides a highly available multisite database used to store NF state and configuration. When installed, the MySQL DB is configured with a root account whose password is randomly generated. Each NF must have additional accounts for that particular NF. The procedures in this section explains how to change these account passwords. Additionally, communication between the NFs and the MySQL query nodes are protected using TLS.

Procedure: Modify MySQL NDB Root Password

This procedure is executed by the DB Administrator

For each of the MySQL Query nodes, perform the following steps :

Table 4-1 Modify MySQL NDB Root Password

Step	Description	Est Time
1.	Log into the next query node using ssh: `$ ssh admusr@<mysql query node>`	1m
2.	Execute the following command to make the node as root: `$ sudo su`	1m
3.	Invoke mysql using existing DB Root credentials: `# mysql -h 127.0.0.1 -uroot -p` Enter password: `<enter existing root password>`	1m
4.	Change the DB Root credentials: `mysql> ALTER USER'root'@'localhost'IDENTIFIED BY'<NEW_PASSWORD>';` `mysql> FLUSH PRIVILEGES;`	1m
5	Repeat steps 1 through 4 for each MySQL Query node.	

Note

If you are accessing a DB instance for the first time, the DB Root password is stored in the `/var/occnedb/mysqld_expired.log` file. (The system generates a random password at installation time).

Note

Recommendation 1: Separation of Roles

The roles of DB Administrator and Cluster Administration must be kept separate. The DB Administrator must be responsible for securing and maintaining the DB-Tier MySQL NDM cluster. The Cluster Administrator must be responsible for securing and operating the Bastion Host and K8s Cluster. When 5G NFs are installed, the DB Administrator is required to create new NF database and NF DB accounts (using the DB Root credentials). Once this is completed, the Cluster Administrator installs the NF (using helm).

Recommendation 2: Use Strong Passwords

The DB Administrator must choose a complex DB Root password as per their organization's security. guidelines.

Procedure: Configure TLS for MySQL NDB Query Nodes

The MySQL NDB comes preconfigured to use a self-signed certificate that expires after 365 days. User can replace this certificate using the following procedure:

Table 4-2 Configure TLS for MySQL NDB Query Nodes

Step	Description	Est Time
1.	Create private CA and a set of Keys/Certificate pairs for use in securing MySQL : `$ my_ssl_rsa_setup`	1m

Table 4-2 (Cont.) Configure TLS for MySQL NDB Query Nodes

Step	Description	Est Time
2.	The available set of PEM files containing CA, server, and client certificates and keys must be installed on all the MySQL Query Nodes.	
3.	Using SCP, copy the PEM files to the MySQL Query Node: `$ scp *.pem admusr@<mysql query node>`	1m
4.	Login to the MySQL Query Node using ssh: `$ ssh admusr@<mysql query node>`	1m

5	Create a directory to hold the TLS keys and certs, and move them into root:
	`$ sudo mkdir /var/occnedb/opensslcerts`
	`$ sudo chmod 700 /var/occnedb/opensslcerts`
	`$ sudo mv ~admusr/*pem /var/occnedb/opensslcerts`
		1m

6	Configure MySQL to use the new TLS certs and keys by executing the following command: `$ sudo vi /etc/my.cnf`
	Update the [mysqld] section as follows:
	`[mysqld]`
	`ssl-ca=/var/occnedb/opensslcerts/ca.pem`
	`ssl-cert=/var/occnedb/opensslcerts/server-cert.pem`
	`ssl-key=/var/occnedb/opensslcerts/server-key.pem`
	`tls_version=TLSv1.2`
	`ssl-cipher=DHE-RSA-AES128-GCM-SHA256`
		5m

7	Restart the mysql daemon: `$ sudo /etc/init.d/mysql.server restart`	1m
	Repeat steps 3 through 7 for each MySQL Query node.	

> **Note**
>
> It is possible to integrate into an existing Public Key Infrastructure (PKI) by creating signing requests and having the PKI to generate the needed key/certificate pairs.

4.1.1.3 Cloud Native Core Ingress and Egress Gateways Specific Security Recommendations and Guidelines

This section provides Ingress and Egress Gateways specific security recommendations and guidelines.

> **Note**
>
> The following procedures can be performed by any authenticated user who has privileged access to the system. This user can create different roles for specific operations. For creation of role and role binding, see the NF or component-specific Installation and Upgrade Guide.

The procedures are:

- **Enabling TLS and Ciphers in Ingress and Egress Gateway**
- **Certificate Management and Dynamic Reload of Certificates in Gateways**

Enabling TLS and Ciphers in Ingress and Egress Gateway

Use the following procedure to enable TLS and Ciphers:

1. Helm Configuration to enable TLS:
   To open HTTPS port in Ingress Gateway, set the `enableIncomingHttps` parameter to true.

   To configure the HTTPS client in Ingress Gateway, set the `enableOutgoingHttps` parameter to true.
2. Create the following files:
   a. RSA or ECDSA Private key (Example: `rsa_private_key_pkcs1.pem`)
   b. Truststore password (Example: `trust.txt`)
   c. Key store password (Example: `key.txt`)
   d. Certificate chain for truststore (Example: `caroot.cer`)
   e. Signed server certificate (Example: `ocingress.cer`) or Signed client certificate (Example: `ocegress.cer`)

   Note: Creation of private keys, certificates, and passwords is at the discretion of user.
3. Run the following command to create secret:

```
$ kubectl create secret generic ocingress-secret --from-
file=rsa_private_key_pkcs1.pem
--from-file=trust.txt --from-file=key.txt --from-file=ocingress.cer --from-
file=caroot.cer -n ocingress
```

4. Enable the cipher suites:
   - Cipher Suites to be enabled on Server side (Ingress Gateway).
   - Cipher Suites to be enabled on Client side (Egress Gateway).

   cipher Suites:

```
-TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384
- TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384
- TLS_ECDHE_RSA_WITH_CHACHA20_POLY1305_SHA256
- TLS_DHE_RSA_WITH_AES_256_GCM_SHA384
- TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256
- TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256
```

Certificate Management and Dynamic Reload of Certificates in Gateways

Whenever certificates get compromised or a new certificate chain is required to be added to the truststore, you can update the key and truststore used by the application.

To update the key and the truststore, update or replace the secret:

```
$ kubectl create secret generic ocingress-secret --from-
file=rsa_private_key_pkcs1.pem
 --from-file=trust.txt --from-file=key.txt --from-file=tmp.cer --from-
file=caroot.cer --dry-run -o yaml
 -n ocingress| kubectl replace -f - -n ocingress
```

Whenever there is an update in the certificate chain or signed certificate placed in secret, Kubernetes watcher implemented in update container checks for a change in file state and replaces the key and truststore accordingly in the mounted shared volume.

Dynamic reload of certificates is not supported in Ingress Gateway as of now, so a manual restart of pod is required when any update in the configuration is made with respect to https.

In case of Egress Gateway, update container will trigger the rest endpoint to reload key and truststore dynamically. Then Egress Gateway will pickup new store files from shared volume and reload trust and key managers. Egress Gateway will use the replaced store to establish new connections and gracefully terminate existing connections by sending a GOAWAY frame.

4.1.2 Oracle Communications Networks Data Analytics Function (OCNWDAF) Specific Security Recommendations and Guidelines

This section provides specific recommendations and guidelines for Oracle Communications Networks Data Analytics Function (OCNWDAF) security.

> **Note**
>
> The following procedures can be performed by any authenticated user who has privileged access to the system. This user can create different roles for specific operations. For creation of role and role binding, see the *Oracle Communications Networks Data Analytics Function Installation and Fault Recovery Guide*.

> **Note**
>
> kubectl commands might vary based on the platform deployment. Replace kubectl with Kubernetes environment-specific command line tool to configure Kubernetes resources through kube-api server. The instructions provided in this document are as per the Oracle Communications Cloud Native Environment (CNE) version of kube-api server.

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

The procedures are:

- Oauth Token Validation Configuration
  - Rest Configuration
  - Public key Update for Changed Access Token
  - Disabling the Signature Validation for Oauth
- Create HTTPS Certificates
- Obtain List of Certificate Providers Allowed
- Configuring Kafka Security
- MySQL Configuration
- OCNWDAF Secret Configuration to Enable HTTPS

Oauth Token Validation Configuration

Use the following procedure for Oauth Token validation configuration:

1. NRF creates access tokens using following private keys:
   - **ECDSA private key**
     Example:

     ```
     ecdsa_private_key_pkcs8.pem
     ```

   - **RSA private key**
     Example:

     ```
     rsa_private_key_pkcs1.pem
     ```

     In order to validate access token secret needs to be created and configured in ocnwdaf ingress gateway with certificates fetched from nrf.

     Example:

     ```
     6faf1bbc-6e4a-4454-a507-a14ef8e1bc5c_ES256.crt
     ```

2. Log in to Bastion Host or server from where kubectl can be executed.
3. Create namespace for the secret.

   ```
   $ kubectl create namespace ocnwdaf
   ```

4. Create Kubernetes secret for NF Access token validation

> **Note**
>
> The file names in below command are same as in Step 1.

```
$ kubectl create secret generic oauthsecret --from-file=6faf1bbc-6e4a-4454-
a507-a14ef8e1bc5c_ES256.crt-n ocnwdaf
```

5. Run the following command to verify if the secret is created successfully:

```
$ kubectl describe secret oauthsecret -n ocnwdaf
```

Rest Configuration

We need REST based configurations to distinguish certificates configured from different NRF and use them properly to validate token received from specific NRF. These configurations can be added from CNCC GUI which internally uses config API and payload as below:

```
“/nwdaf/nf-common-component/v1/igw/oauthvalidatorconfiguration”

Payload:

{
              "keyIdList": [{

                            "keyId": "664b344e74294c8fa5d2e7dfaaaba407",
                            "kSecretName": "samplesecret1",
                            "certName": "samplecert1.crt",
                            "certAlgorithm": "ES256"
                          }],
              "instanceIdList": [{

                            "instanceId": "664b344e74294c8fa5d2e7dfaaaba407",
                            "kSecretName": "samplesecret2",
                            "certName": "samplecert2.crt",
                            "certAlgorithm": "ES256"

                             }],
              "oAuthValidationMode": "INSTANCEID_ONLY"

}
```

The multiple **keyId** and **instanceId** object of different NRFs can be configured.

Using **oAuthValidationMode** mode of validation can be selected.

Example: INSTANCEID_ONLY, KID_ONLY or KID_PREFERRED

KID_PREFERRED is a fall back mode where it checks for keyId in token, if token contains keyId then validation mode is KID_ONLY or else it falls back to INSTANCEID_ONLY.

Public key Update for Changed Access Token

Use the following procedure for public key update for changed access token:

1. Log in to Bastion Host or server from where kubectl can be executed.
2. Update the secret with new or updated details:

```
# Delete the secret and recreate it
$ kubectl delete secret oauthsecret -n ocnwdaf

# Fetch updated certificates from nrf

# Recreate the secret with updated details
$ kubectl create secret generic oauthsecret --from-file=0263663c-
f5c2-4d1b-9170-f7b1a9116337_ES256.crt

-n ocudr
```

3. Certificate configuration update request needs to be sent using CNCC GUI with the updated **keyIdList** and **instanceIdList** with new certificates.

Disabling the Signature Validation for Oauth

If **serviceMeshCheck** flag is enabled under ingress gateway in custom-values file, signature validation is disabled by default.

In this case, only header and payload are validated, and request is successful even if token has wrong signature.

Create HTTPS Certificates

Access to the OCNWDAF subscription endpoint is enabled through the gateway service. To access the endpoint, use a HTTPS version 2 **POST** request.

Endpoint address: `<path>nnwdaf-eventssubscription/v1/subscriptions`

1. To configure HTTPS version 2, enable the property in the configuration file and generate a SSL certificate. Configure the property in the project using the `.properties` file. See below example:
   Example:

```
server.http2.enabled=true
server.ssl.enabled=true
server.ssl.key-store-type=PKCS12
server.ssl.key-store=classpath:localhost.p12
server.ssl.key-store-password=<password>
```

2. To create the certificate, run the following commands:

```
openssl req -x509 -out localhost.crt -keyout localhost.key \
-newkey rsa:2048 -nodes -sha256 \
-subj '/CN=localhost' -extensions EXT -config <( \
printf "[dn]\nCN=localhost\n[req]\ndistinguished_name = dn\n[EXT]
\nsubjectAltName=DNS:localhost\nkeyUsage=digitalSignature\nextendedKeyUsage
=serverAuth")
```

   Two files are generated - a `.crt` file and a `.key` file.

3. Use openssl to create a PKCS truststore file that contains both the certificate and key, see below example:

Example:

```
openssl pkcs12 -export -in localhost.crt -inkey localhost.key -name
localhost -out localhost.p12
```

4. Configure the properties, see below example:
   Example:

```
server.ssl.enabled=true
server.ssl.key-store-type=PKCS12
server.ssl.key-store=classpath:localhost.p12
server.ssl.key-store-password=<password>
```

Obtain List of Certificate Providers Allowed

The following command lists the SSL certificate providers allowed:

```
cd JAVA_HOME/jre/lib/security
keytool -list -keystore cacerts
```

SSL Providers allow `jdk version 17.0.2`.

- actalisauthenticationrootca
- affirmtrustcommercialca
- affirmtrustnetworkingca
- affirmtrustpremiumca
- affirmtrustpremiumeccca
- amazonrootca1
- amazonrootca2
- amazonrootca3
- amazonrootca4
- baltimorecybertrustca
- buypassclass2ca
- buypassclass3ca
- camerfirmachambersca
- camerfirmachamberscommerceca
- camerfirmachambersignca
- cert_100_emsign_root_ca___g1100
- cert_101_emsign_ecc_root_ca___g3101
- cert_102_emsign_root_ca___c1102
- cert_103_emsign_ecc_root_ca___c3103
- cert_104_hongkong_post_root_ca_3104
- cert_106_microsoft_ecc_root_certificate_authority_2017106
- cert_107_microsoft_rsa_root_certificate_authority_2017107

- cert_108_e_szigno_root_ca_2017108
- cert_109_certsign_root_ca_g2109
- cert_110_trustwave_global_certification_authority110
- cert_111_trustwave_global_ecc_p256_certification_authority111
- cert_112_trustwave_global_ecc_p384_certification_authority112
- cert_113_naver_global_root_certification_authority113
- cert_114_ac_raiz_fnmt_rcm_servidores_seguros114
- cert_115_globalsign_root_r46115
- cert_116_globalsign_root_e46116
- cert_117_globaltrust_2020117
- cert_118_anf_secure_server_root_ca118
- cert_119_certum_ec_384_ca119
- cert_120_certum_trusted_root_ca120
- cert_121_tuntrust_root_ca121
- cert_122_harica_tls_rsa_root_ca_2021122
- cert_123_harica_tls_ecc_root_ca_2021123
- cert_124_autoridad_de_certificacion_firmaprofesional_cif_a62634068124
- cert_125_vtrus_ecc_root_ca125
- cert_126_vtrus_root_ca126
- cert_127_isrg_root_x2127
- cert_128_hipki_root_ca___g1128
- cert_129_globalsign_ecc_root_ca___r4129
- cert_130_gts_root_r1130
- cert_131_gts_root_r2131
- cert_132_gts_root_r3132
- cert_18_secure_global_ca18
- cert_19_comodo_certification_authority19
- cert_20_network_solutions_certificate_authority20
- cert_22_certigna22
- cert_24_certsign_root_ca24
- cert_25_netlock_arany__class_gold__f__tan__s__tv__ny25
- cert_26_hongkong_post_root_ca_126
- cert_27_securesign_rootca1127
- cert_28_microsec_e_szigno_root_ca_200928
- cert_30_autoridad_de_certificacion_firmaprofesional_cif_a6263406830
- cert_31_izenpe_com31
- cert_40_twca_root_certification_authority40
- cert_42_ec_acc42

- cert_43_hellenic_academic_and_research_institutions_rootca_201143
- cert_50_ca_disig_root_r250
- cert_51_accvraiz151
- cert_52_twca_global_root_ca52
- cert_54_e_tugra_certification_authority54
- cert_56_atos_trustedroot_201156
- cert_69_staat_der_nederlanden_ev_root_ca69
- cert_74_cfca_ev_root74, Feb 22, 2022, trustedCertEntry
- cert_75_oiste_wisekey_global_root_gb_ca75
- cert_76_szafir_root_ca276
- cert_77_certum_trusted_network_ca_277
- cert_81_ac_raiz_fnmt_rcm81
- cert_86_tubitak_kamu_sm_ssl_kok_sertifikasi___surum_186
- cert_87_gdca_trustauth_r5_root87
- cert_88_trustcor_rootcert_ca_188
- cert_89_trustcor_rootcert_ca_289
- cert_90_trustcor_eca_190
- cert_94_ssl_com_ev_root_certification_authority_ecc94
- cert_96_oiste_wisekey_global_root_gc_ca96
- cert_97_uca_global_g2_root97
- cert_98_uca_extended_validation_root98
- cert_99_certigna_root_ca99
- certumca
- certumtrustednetworkca
- chunghwaepkirootca
- comodoaaaca
- comodoeccca
- comodorsaca
- digicertassuredidg2
- digicertassuredidg3
- digicertassuredidrootca
- digicertglobalrootca
- digicertglobalrootg2
- digicertglobalrootg3
- digicerthighassuranceevrootca
- digicerttrustedrootg4
- dtrustclass3ca2
- dtrustclass3ca2ev

- entrust2048ca
- entrustevca
- entrustrootcaec1
- entrustrootcag2
- entrustrootcag4
- geotrustglobalca
- geotrustprimaryca
- geotrustprimarycag2
- geotrustprimarycag3
- geotrustuniversalca
- globalsignca
- globalsigneccrootcar4
- globalsigneccrootcar5
- globalsignr3ca
- globalsignrootcar6
- godaddyclass2ca
- godaddyrootg2ca
- haricaeccrootca2015
- haricarootca2015
- identrustcommercial
- identrustpublicca
- letsencryptisrgx1
- luxtrustglobalroot2ca
- quovadisrootca1g3
- quovadisrootca2
- quovadisrootca2g3
- quovadisrootca3
- quovadisrootca3g3
- secomscrootca1
- secomscrootca2
- securetrustca
- sslrooteccca
- sslrootevrsaca
- sslrootrsaca
- starfieldclass2ca
- starfieldrootg2ca
- starfieldservicesrootg2ca
- swisssigngoldg2ca

- swisssignplatinumg2ca
- swisssignsilverg2ca
- teliasonerarootcav1
- thawteprimaryrootca
- thawteprimaryrootcag2
- thawteprimaryrootcag3
- ttelesecglobalrootclass2ca
- ttelesecglobalrootclass3ca
- usertrusteccca
- usertrustrsaca
- verisignclass3g3ca
- verisignclass3g4ca
- verisignclass3g5ca
- verisignuniversalrootca
- xrampglobalca Kafka security configuration

Configuring Kafka Security

Use the following procedure to configure basic Kafka security:

Prerequisite: SSL certificates and keys.

Configuring Kafka Brokers

1. Configure Kafka to use TLS or SSL encryption, edit the configuration file `server.properties`. This file is usually stored in the Kafka config directory.

   > **Note**
   >
   > Login as *su* to ensure the ownership of the file is not changed.

   ```
   kafka config cmd

   /opt/kafka/config# su -s /bin/bash kafka
   ```

2. Add the following properties for each broker configuration, see below example:
   Example:

   ```
   listeners=PLAINTEXT://kafka-broker-host-name:9092,SSL://kafka-broker-host-
   name:9093
   advertised.listeners=PLAINTEXT://kafka-broker-host-name:9092,SSL://kafka-
   broker-host-name:9093
   ssl.truststore.location=/var/private/ssl/kafka.server.truststore.jks

   ssl.keystore.location=/var/private/ssl/kafka.server.keystore.jks

   ssl.truststore.password=<secret_value>
   ```

```
ssl.keystore.password=<secret_value>

ssl.key.password=<secret_value>

security.inter.broker.protocol=SSL
```

In the above sample configurations, PLAINTEXT and SSL protocols are used for the SSL enabled brokers.

3. Complete the above process for each broker, then restart the Kafka Cluster. Run the following scripts to reset the Kafka Cluster:

```
kafka-server-stop.sh
kafka-server-start.sh
```

4. Enable Client Authentication (two way authentication), run the following command:

```
ssl.client.auth=required
```

Configuring Kafka Client

1. On the client side both certificates and keys are required. Configure all the clients communicating with SSL enabled Kafka Cluster. See below example:
Example:

```
bootstrap.servers=kafka-broker-host-name:9093

security.protocol=SSL

ssl.truststore.location=/var/private/ssl/kafka.client.truststore.jks

ssl.truststore.password=<secret_value>

ssl.keystore.location=/var/private/ssl/kafka.client.keystore.jks

ssl.keystore.password=<secret_value>

ssl.key.password=<secret_value>
```

Where `kafka-broker-host-name` is the FQDN of the broker.

ACL authorization

1. To enable and use the `AclAuthorizer`, set its full class name for your broker configuration in file `server.properties`.
2. Run the following command:

```
authorizer.class.name=kafka.security.authorizer.AclAuthorizer
```

3. Kafka ACLs control the principals that perform operations on Kafka resources. Kafka brokers can use ZooKeeper ACLs by enabling broker configuration in the properties file.

```
zookeeper.set.acl=true
```

4. Create ACLs for every topic, see below example:
   Example:

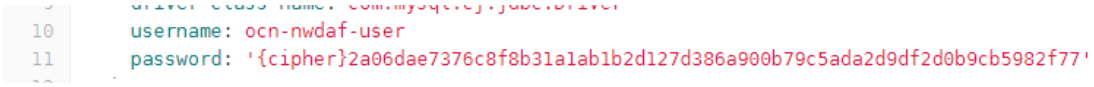
```
kafka-acls --bootstrap-server localhost:9092 --command-config adminclient-
configs.conf --add \
--allow-principal User:* --operation All --topic mesa.report.location
```

MySQL Configuration

DBTier is used for DB connections. This ensures security issues are avoided and the data is encrypted.

OCNWDAF database passwords are encrypted using cipher.

Figure 4-1 OCNWDAF database password



OCNWDAF Secret Configuration to Enable HTTPS

Use the following procedure to create Kubernetes secret for HTTPS:

Prerequisites:

- ECDSA private key and CA signed certificate of CNCC (if initial algorithm is ES256)
- RSA private key and CA signed certificate of CNCC (if initial algorithm is RSA256)
- TrustStore password file
- KeyStore password file
- CA certificate

> **Note**
>
> Private Keys, certificates, passwords are created at the discretion of users.

1. Log in to Bastion Host or server from where you can run `kubectl` commands.
2. Create a namespace for the secret by following:
   a. Verify if the required namespace already exists in the system:

```
$ kubectl get namespaces
```

   b. In the output of the above command, check if required namespace is available. If unavailable, create the namespace using following command:

> **Note**
>
> This is an optional step. In case required namespace already exists, proceed with next procedures.
>
> ```
> $ kubectl create namespace <required namespace>
> ```
>
> Example:
>
> ```
> $ kubectl create namespace ocnwdaf
> ```

3. Create `nwdaf-tls secret` based on TLS certificates:

```
K8_NAMESPACE=<insert-your-namespace>
CERT_PATH=<certificate-path>
kubectl create secret generic nwdaf-tls \
--save-config \
--dry-run=client \
--from-file=${CERT_PATH}/nwdaf.crt --from-file=${CERT_PATH}/nwdaf.key -o
yaml | \
kubectl -n ${K8_NAMESPACE} apply -f -
```

> **Note**
>
> `.crt` and `.key` files should be named `nwdaf.crt` and `nwdaf.key`

4. After successful secret creation, the following message is displayed:

```
secret/nwdaf-tls created
```

4.2 Implementing Security Recommendations and Guidelines for OCNADD

This section provides specific recommendations and guidelines for OCNADD security.

4.2.1 TLS Configuration

External TLS Communication

DF2: Browser and **DF3: Kafka communication** is over TLS only. No additional steps apart from certificate creation need to be performed. Refer to the next section for more info about certificate creation.

DF4: Consumer NF communication can be configured to use clear text or TLS through the GUI. Refer to the GUI guide for more info on how to do so.

Internal TLS Communication

In addition to the above communications, the customers can also opt to use TLS for internal OCNADD communication. To enable internal TLS, the following steps need to be undertaken:

- Enable internal TLS in Helm Charts.

  Change the value of global.ssl.intraTlsEnabled to *true* in the `ocnadd-custom-values.yaml`. By default it is set to *false*.

  ```
  ssl:
      intraTlsEnabled:true
  ```

  Make Sure to Remove the below line in `ocnadd-custom-values.yaml`:

  ```
  Remove ocnaddadminsvc.ocnadd.admin.env.OCNADD_ADAPTER_SERVER_SSL: false
  (Before helm install or upgrade) Line:273
  Remove
  ocnaddbackendrouter.ocnaddbackendrouter.env.OCNADD_BKNROUTER_CLIENT_SSL_USE
  _TS: true (Before helm upgrade) Line: 313
  ```

- Create TLS certificates for all the internal services.
  - If the **generate_certs** script is used to create the certificates, add entries for internal services in the `ssl_certs/default_values/values` file. Refer to the "Certificate and Secret Generation" section for more details.
  - The following entries should be added to the values file, if not present:

    ```
    [zookeeper]
    client.commonName=zookeeper-zk
    server.commonName=zookeeper
    DNS.1=*.zookeeper.ocnadd-deploy.svc.occne-ocdd
    DNS.2=zookeeper

    [ocnaddbackendrouter]
    client.commonName=ocnaddbackendrouter-client
    server.commonName=ocnaddbackendrouter
    DNS.1=*.ocnaddbackendrouter.ocnadd-deploy.svc.occne-ocdd
    DNS.2=ocnaddbackendrouter

    [ocnaddadminservice]
    client.commonName=ocnaddadminservice-client
    server.commonName=ocnaddadminservice
    DNS.1=*.ocnaddadminservice.ocnadd-deploy.svc.occne-ocdd
    DNS.2=ocnaddadminservice

    [ocnaddalarm]
    client.commonName=ocnaddalarm-client
    server.commonName=ocnaddalarm
    DNS.1=*.ocnaddalarm.ocnadd-deploy.svc.occne-ocdd
    DNS.2=ocnaddalarm

    [ocnaddconfiguration]
    ```

```
client.commonName=ocnaddconfiguration-client
server.commonName=ocnaddconfiguration
DNS.1=*.ocnaddconfiguration.ocnadd-deploy.svc.occne-ocdd
DNS.2=ocnaddconfiguration

[ocnaddhealthmonitoring]
client.commonName=ocnaddhealthmonitoring-client
server.commonName=ocnaddhealthmonitoring
DNS.1=*.ocnaddhealthmonitoring.ocnadd-deploy.svc.occne-ocdd
DNS.2=ocnaddhealthmonitoring

[ocnaddscpaggregation]
client.commonName=ocnaddscpaggregation-client
server.commonName=ocnaddscpaggregation
DNS.1=*.ocnaddscpaggregation.ocnadd-deploy.svc.occne-ocdd
DNS.2=ocnaddscpaggregation

[ocnaddnrfaggregation]
client.commonName=ocnaddnrfaggregation-client
server.commonName=ocnaddnrfaggregation
DNS.1=*.ocnaddnrfaggregation.ocnadd-deploy.svc.occne-ocdd
DNS.2=ocnaddnrfaggregation
```

where, `ocnadd-deploy` is the namespace where OCNADD is deployed and `occne-ocdd` is the Kubernetes cluster name.

Certificate and Secret Generation

The OCNADD services can communicate with each other as well as with external interfaces in both secure encrypted mode as well as in insecure mode. For establishing encrypted communication between the services, there is a necessity to generate TLS certificates and private keys for each microservice.The service certificate is generated using the provided CA certificate. For more information, refer to the *Oracle Communications Network Analytics Data Director Installation, Upgrade, and Fault Recovery Guide*.

The generated service certificates are stored as the K8s secret.The Certificates for the NF producer and OCNADD Consumer can also be created separately, but it is essential that

- The NF producer includes OCNADD's CA certificate in their trust store.
- The third-party consumer certificate is also created by using the same OCNADD's CA.

> **Note**
>
> The default certification creation assumes that internal TLS is enabled and creates the certificates for all the OCNADD services. The customers can choose to delete surplus entries from `ssl_certs/default_values/values` when not using internal TLS. This reduces the number of certificates to be signed by the CA.

Below are sample **values** files with/without internal TLS enabled:

where:

- ocnadd-deploy : is the namespace where OCNADD is deployed
- occne-ocnadd : is the Kubernetes Cluster name

- [ocnaddthirdpartyconsumer] : is the OCNADD consumer
- [oraclenfproducer] : is the Oracle 5G NF/producer

Without Internal TLS

```
# Do not modify any keys in global section. Please edit only values present
in global section.
# Edit only commonName value for Root CA. Do not modify key
# You can add multiple services in same manner as the sample services are
added. The format should be as follows
#service name, common name for service and list of subject alternate name
#e.g.,
#[<service_name>]
#commonName=your.svc.common.name
#IP.1 = 127.0.0.1
#IP.2 = 10.20.30.40
#DNS.1 = localhost
#DNS.2 = svc.cluster.local
# Make sure to provide a single empty line (without space) after end of every
section
# Do not add comments anywhere in this script to avoid parsing error

[global]
countryName=IN
stateOrProvinceName=KA
localityName=BLR
organizationName=ORACLE
organizationalUnitName=CGBU
defaultDays=90

##root_ca
commonName=*.ocnadd-deploy.svc.occne-ocnadd

[kafka-broker1]
client.commonName=kafka-broker1-zk
server.commonName=kafka-broker1
DNS.1=*.kafka-broker1.ocnadd-deploy.svc.occne-ocnadd
DNS.2=kafka-broker1

[kafka-broker2]
client.commonName=kafka-broker2-zk
server.commonName=kafka-broker2
DNS.1=*.kafka-broker2.ocnadd-deploy.svc.occne-ocnadd
DNS.2=kafka-broker2

[kafka-broker3]
client.commonName=kafka-broker3-zk
server.commonName=kafka-broker3
DNS.1=*.kafka-broker3.ocnadd-deploy.svc.occne-ocnadd
DNS.2=kafka-broker3

[kafka-broker4]
client.commonName=kafka-broker4-zk
server.commonName=kafka-broker4
DNS.1=*.kafka-broker4.ocnadd-deploy.svc.occne-ocnadd
```

```
DNS.2=kafka-broker4

[kafka-broker5]
client.commonName=kafka-broker5-zk
server.commonName=kafka-broker5
DNS.1=*.kafka-broker5.ocnadd-deploy.svc.occne-ocnadd
DNS.2=kafka-broker5

[kafka-broker6]
client.commonName=kafka-broker6-zk
server.commonName=kafka-broker6
DNS.1=*.kafka-broker6.ocnadd-deploy.svc.occne-ocnadd
DNS.2=kafka-broker6

[kafka-broker7]
client.commonName=kafka-broker7-zk
server.commonName=kafka-broker7
DNS.1=*.kafka-broker7.ocnadd-deploy.svc.occne-ocnadd
DNS.2=kafka-broker7

[egw]
client.commonName=egw-client
server.commonName=egw
DNS.1=*egw.ocnadd-deploy.svc.occne-ocnadd
DNS.2=ocnaddegressgateway

[ocnaddthirdpartyconsumer]
server.commonName=ocnaddthirdpartyconsumer
DNS.1=*.ocnaddthirdpartyconsumer.ocnadd-deploy.svc.occne-ocnadd
DNS.2=ocnaddthirdpartyconsumer

[oraclenfproducer]
client.commonName=oraclenfproducer
DNS.1=*.oraclenfproducer.ocnadd-deploy.svc.occne-ocnadd
DNS.2=oraclenfproducer

##end
```

With Internal TLS

```
# Do not modify any keys in global section. Please edit only values present
in global section.
# Edit only commonName value for Root CA. Do not modify key
# You can add multiple services in same manner as the sample services are
added. The format should be as follows
#service name, common name for service and list of subject alternate name
#e.g.,
#[<service_name>]
#commonName=your.svc.common.name
#IP.1 = 127.0.0.1
#IP.2 = 10.20.30.40
#DNS.1 = localhost
#DNS.2 = svc.cluster.local
# Make sure to provide a single empty line (without space) after end of every
section
```

```
# Do not add comments anywhere in this script to avoid parsing error

[global]
countryName=IN
stateOrProvinceName=KA
localityName=BLR
organizationName=ORACLE
organizationalUnitName=CGBU
defaultDays=365

##root_ca
commonName=*.ocnadd-deploy.svc.occne-ocnadd

[kafka-broker1]
client.commonName=kafka-broker1-zk
server.commonName=kafka-broker1
DNS.1=*.kafka-broker1.ocnadd-deploy.svc.occne-ocnadd
DNS.2=kafka-broker1

[kafka-broker2]
client.commonName=kafka-broker2-zk
server.commonName=kafka-broker2
DNS.1=*.kafka-broker2.ocnadd-deploy.svc.occne-ocnadd
DNS.2=kafka-broker2

[kafka-broker3]
client.commonName=kafka-broker3-zk
server.commonName=kafka-broker3
DNS.1=*.kafka-broker3.ocnadd-deploy.svc.occne-ocnadd
DNS.2=kafka-broker3

[kafka-broker4]
client.commonName=kafka-broker4-zk
server.commonName=kafka-broker4
DNS.1=*.kafka-broker4.ocnadd-deploy.svc.occne-ocnadd
DNS.2=kafka-broker4

[kafka-broker5]
client.commonName=kafka-broker5-zk
server.commonName=kafka-broker5
DNS.1=*.kafka-broker5.ocnadd-deploy.svc.occne-ocnadd
DNS.2=kafka-broker5

[kafka-broker6]
client.commonName=kafka-broker6-zk
server.commonName=kafka-broker6
DNS.1=*.kafka-broker6.ocnadd-deploy.svc.occne-ocnadd
DNS.2=kafka-broker6

[kafka-broker7]
client.commonName=kafka-broker7-zk
server.commonName=kafka-broker7
DNS.1=*.kafka-broker7.ocnadd-deploy.svc.occne-ocnadd
DNS.2=kafka-broker7

[zookeeper]
```

```
client.commonName=zookeeper-zk
server.commonName=zookeeper
DNS.1=*.zookeeper.ocnadd-deploy.svc.occne-ocnadd
DNS.2=zookeeper

[egw]
client.commonName=egw-client
server.commonName=egw
DNS.1=*egw.ocnadd-deploy.svc.occne-ocnadd
DNS.2=ocnaddegressgateway

[ocnaddthirdpartyconsumer]
client.commonName=ocnaddthirdpartyconsumer-client
server.commonName=ocnaddthirdpartyconsumer
DNS.1=*.ocnaddthirdpartyconsumer.ocnadd-deploy.svc.occne-ocnadd
DNS.2=ocnaddthirdpartyconsumer

[oraclenfproducer]
client.commonName=oraclenfproducer
server.commonName=oraclenfproducer-server
DNS.1=*.oraclenfproducer.ocnadd-deploy.svc.occne-ocnadd
DNS.2=oraclenfproducer

[ocnaddbackendrouter]
client.commonName=ocnaddbackendrouter-client
server.commonName=ocnaddbackendrouter
DNS.1=*.ocnaddbackendrouter.ocnadd-deploy.svc.occne-ocnadd
DNS.2=ocnaddbackendrouter

[ocnaddadminservice]
client.commonName=ocnaddadminservice-client
server.commonName=ocnaddadminservice
DNS.1=*.ocnaddadminservice.ocnadd-deploy.svc.occne-ocnadd
DNS.2=ocnaddadminservice

[ocnaddalarm]
client.commonName=ocnaddalarm-client
server.commonName=ocnaddalarm
DNS.1=*.ocnaddalarm.ocnadd-deploy.svc.occne-ocnadd
DNS.2=ocnaddalarm

[ocnaddconfiguration]
client.commonName=ocnaddconfiguration-client
server.commonName=ocnaddconfiguration
DNS.1=*.ocnaddconfiguration.ocnadd-deploy.svc.occne-ocnadd
DNS.2=ocnaddconfiguration

[ocnaddhealthmonitoring]
client.commonName=ocnaddhealthmonitoring-client
server.commonName=ocnaddhealthmonitoring
DNS.1=*.ocnaddhealthmonitoring.ocnadd-deploy.svc.occne-ocnadd
DNS.2=ocnaddhealthmonitoring

[ocnaddfilter]
client.commonName=ocnaddfilter-client
server.commonName=ocnaddfilter
```

```
DNS.1=*.ocnaddfilter.ocnadd-deploy.svc.occne-ocnadd
DNS.2=ocnaddfilter

[ocnaddscpaggregation]
client.commonName=ocnaddscpaggregation-client
server.commonName=ocnaddscpaggregation
DNS.1=*.ocnaddscpaggregation.ocnadd-deploy.svc.occne-ocnadd
DNS.2=ocnaddscpaggregation

[ocnaddnrfaggregation]
client.commonName=ocnaddnrfaggregation-client
server.commonName=ocnaddnrfaggregation
DNS.1=*.ocnaddnrfaggregation.ocnadd-deploy.svc.occne-ocnadd
DNS.2=ocnaddnrfaggregation

[adapter]
client.commonName=adapter
server.commonName=adapter-server
DNS.1=*adapter.ocnadd-deploy.svc.occne-ocnadd
DNS.2=ocnaddconsumeradapter

##end
```

MTLS Configuration

The customers can opt to use MTLS for internal OCNADD communication. To enable internal MTLS, the following steps need to be undertaken:

- Enable internal MTLS in Helm Charts.

  Change the value of global.ssl.mTLS to true in the ocnadd-custom-values.yaml. By default it is set to false.

  ```
  ssl:
      intraTlsEnabled: true
      mTLS: true
  ```

  Make Sure to Remove the below line in `ocnadd-custom-values.yaml`:

  ```
  Remove ocnaddadminsvc.ocnadd.admin.env.OCNADD_ADAPTER_SERVER_SSL: false
  (Before helm install or upgrade) Line: 273
  Remove
  ocnaddbackendrouter.ocnaddbackendrouter.env.OCNADD_BKNROUTER_CLIENT_SSL_USE
  _TS: true Before helm upgrade) Line: 313
  ```

- The certificate creation step remains the same as mentioned in the "**TLS Configuration**" section. Please note it is mandatory to create certificates and secrets for MTLS to work.

  > **Note**
  >
  > – It is mandatory to create certificates and secrets for MTLS to work
  >
  > – Make sure the above parameter is updated before deployment or upgrade.

4.2.2 Network Policy

The OCNADD is also shipped with Network Policies for ingress connections which are disabled by default.

The Network Policies can be categorized into three categories:

- **Internal service Connections:** The service connections that are internal to the OCNADD namespace. To enable network policies, change the value of global.network.policy.enable to *true* in `<chart-path>/values.yaml` file. By default, it is *false*.

  ```
  network:
      # enable network policies
      policy:
        enable: true
  ```

- **External service Connections:** The service connections that are connecting to the OCNADD namespace. The policy gets applied on connections from OCCNCC, OCSCP, OCNRF and so on which are deployed outside the OCNADD namespace. To allow connections from specific namespaces (when network policies are enabled), add the namespace to the namespaces list in global.network.policy.ingress.namespaces of `<chart-path>/values.yaml` file as below:

  ```
  #allow ingress network connections from below namespaces
  namespaces:
    -occne-infra
    -occncc
  ```

  In the above example, the connections from all pods of occne-infra (prometheus, grafana, etc.) and occncc namespace are allowed. Similarly add the SCP, and NRF namespace to this list.

- **External service Connectionfrom specific IP address**: This can be enabled (disabled by default) to allow connections from specific IP address ranges when Network Policy is enabled. In the below example, the connections from the 10.0.0.0/8 subnet are allowed. In other words, all connections from IP address 10.0.0.0 - 10.255.255.255 are allowed.

  ```
  # to allow external connections from postman, curl, etc.
  # only needed for development/debugging purposes
  external:
     enable:true
     cidrs:
       -10.0.0.0/8
  ```

4.2.3 Kafka Security Configuration

The basic configuration for Kafka security in order to be compliant with product delivery is described below.

Prerequisites

- SSL certificates & keys (generated using ssl scripts which are provided as part of OCNADD release)

Configuring SASL for Kafka

Kafka uses the Java Authentication and Authorization Service (JAAS) for SASL configuration. In OCNADD, by default, all Kafka communication (inter-broker, Kafka-client, and Kafka-broker and between Kafka and Zookeeper) happens with a common user(ocnadd) configured in `<chart-path>/charts/ocnaddkafka/scripts/kafka_server_jass.conf`

Customers can add more users in **<chart-path>/charts/ocnaddkafka/scripts/kafka_server_jass.conf** file.The "ocnadd" user is the default user for all Kafka communication. and should not be modified.

Below is the sample changes to add NRF and SCP user in Kafka:

```
KafkaServer {
org.apache.kafka.common.security.plain.PlainLoginModule required
username="ocnadd"
password="secret_placeholder"
user_ocnadd="ocnadd";
user_NRF="NRF-secret";
user_SCP="SCP-secret";
};
Client {
org.apache.zookeeper.server.auth.DigestLoginModule required
username="ocnadd"
password="secret_placeholder";
};
```

user_NRF="NRF-secret"; is added for NRF user and **user_SCP="SCP-secret";** is added for SCP user.

After doing the above changes continue with the installation steps as in the *Oracle Communications Network Analytics Data Director Installation, Upgrade, and Fault Recovery Guide.*

> **Note**
>
> - The user addition is one time operation and can be done only during installation.
> - It is recommended to use a strong password in **kafka_server_jass.conf**.

4.2.4 MySQL Configuration

The OCNADD uses CnDBtier service for the Database, which provides secure DB connectivity. For Configuration details, refer to the *Oracle Communications Network Analytics Data Director Installation Guide, Upgrade and Fault Recovery Guide*.

A
Network Port Flows

This section describes network port flows for OCCNE and OCNWDAF.

Network Port Flows

- Cluster IP addresses are reachable outside of the cluster and are typically assigned by using a Network Load Balancer.
- Node IP addresses are reachable from the bastion host (and may be exposed outside of the cluster).

OCCNE Port Flows

Table A-1 OCCNE Port Flows

Name	Server/ Container	Ingress Port ext[:int]/ Proto	TLS	Cluster IP (Service IP)	Node IP	Notes
SSH	ALL	22/TCP	Y		SSH Access	Administrative SSH Access. Only root or key is not allowed.
Repository	Bastion Host	80/TCP,443/ TCP, 5000/TCP			Repository Access	Access repositories (YUM, Docker, Helm, and so on.)
MySQL Query	MySQL SQL Node	3306/TCP	N		Microservice SQL Access	The SQL Query interfaces are used for NWDAF to access the database.
ETCD Client	Kubernetes Master Nodes	2379/TCP	Y		Client Access	Keystore DB used by Kubernetes
Kubelet API	Kubernetes Nodes	10250/TCP	Y		Control Plane Node Access	API which allows full node access.
Kubelet State	Kubernetes Nodes	10255/TCP	Y		Node State Access	Unauthenticated read-only port, allowing access to node state.
Kube-proxy	Kubernetes Nodes	10256/TCP	N		Health Check	Health check server for Kube Proxy.
Kube-controller	Kubernetes Nodes	10257/TCP	Y		Controller Access	HTTPS Access
Kube-Scheduler	Kubernetes Node	10259/TCP	Y		Scheduler Access	HTTPS Access

Table A-1 (Cont.) OCCNE Port Flows

Name	Server/ Container	Ingress Port ext[:int]/ Proto	TLS	Cluster IP (Service IP)	Node IP	Notes
Jaeger Agent	Kubernetes Nodes	5775/UDP	N		Agent	Accepts zipkin.thrift in compact Thrift protocol (deprecated; only used by very old Jaeger clients, circa 2016).
Jaeger Agent	Kubernetes Nodes	5778/TCP	N		Agent	Serves SDK configs, namely sampling strategies at /sampling.
Jaeger Agent	Kubernetes Nodes	6831/UDP	N		Agent	UDP Accepts jaeger.thrift in compact Thrift protocol used by most current Jaeger clients.
Jaeger Agent	Kubernetes Nodes	6831/UDP	N		Agent	UDP Accepts jaeger.thrift in binary Thrift protocol used by Node.js Jaeger client (because thriftrw npm package does not support compact protocol).
Jaeger Agent	Kubernetes Nodes	14271/TCP	N		Agent	Admin port: health check at / and metrics at /metrics.
Jaeger Collector	Kubernetes Nodes	9411/TCP	N		Collector	Accepts Zipkin spans in Thrift, JSON and Proto (disabled by default).
Jaeger Collector	Kubernetes Nodes	14250/TCP	N		Collector	Used by jaeger-agent to send spans in model.proto format.
Jaeger Collector	Kubernetes Nodes	14268/TCP	N		Collector	Accepts spans directly from clients in jaeger.thrift format with binary thrift protocol (POST to /api/traces). Also serves sampling policies at /api/sampling, similar to Agent's port 5778.
Jaeger Collector	Kubernetes Nodes	14269/TCP	N		Collector	Admin port: health check at / and metrics at /metrics.
Jaeger-Query	Kubernetes Nodes	80/TCP	N	GUI		Service frontend
Prometheus Server	Kubernetes Nodes	80/TCP	N	GUI		Prometheus Server

Table A-1 (Cont.) OCCNE Port Flows

Name	Server/ Container	Ingress Port ext[:int]/ Proto	TLS	Cluster IP (Service IP)	Node IP	Notes
Prometheus-Exporter	Kubernetes Nodes	9100/TCP	N		Prometheus Exporter	Prometheus Exporter
Alertmanager	Kubernetes Nodes	80/TCP	N	GUI		The Alertmanager handles alerts sent by client applications such as the Prometheus server.

OCNWDAF Port Flows

Table A-2 OCNWDAF Port Flows

Name	Server / Container	Ingress Port [external]:internal	TLS	Cluster IP (Service IP)	Node IP	Notes
NWDAF	Kubernetes Nodes/ NWDAF Service	8080/TCP	Y	Ingress Gateway	ocn-nwdaf-gateway-service	NWDAF
NWDAF Portal	Kubernetes Nodes/ NWDAF Service	80/TCP	Y	GUI	nwdaf-portal	NWDAF GUI web.