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Cloud Native Core, Network Repository Function User Guide



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The following text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
<i>italic</i>	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
monospace	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

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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
AF	Application Function
AMF	Access and Mobility Management Function
ASM	Aspen Service Mesh
BSF	Oracle Communications Cloud Native Core, Binding Support Function
CA	Certificate Authority
CCA	Client Credentials Assertion
CDS	Cache data Service. Caching Microservice which is responsible for syncing and caching the data
CHF	Charging Function
CM	Configuration Management
CMPv2	Certificate Management Protocol Version 2
CNC	Cloud Native Core
CNC Console	Oracle Communications Cloud Native Configuration Console
CNE	Oracle Communication Cloud Native Core, Cloud Native Environment
CNI	Multus Container Network Interface
CNLB	Cloud Native Load Balancer
CNPCRf	Oracle Communications Cloud Native Core, Policy and Charging Rules Function
CUSTOMER_REPO	Docker registry address including the port number, if the docker registry has an associated port.
cnDBTier	Oracle Communications Cloud Native Core, cnDBTier
GUAMI	Globally Unique AMF Identifier
HTTPS	Hypertext Transfer Protocol Secure
IMAGE_TAG	Image tag from release tar file. You can use any tag number. However, make sure that you use that specific tag number while pushing docker image to the docker registry.
IMS	IP Multimedia Subsystem
JOSE	Javascript Object Signing and Encryption
JSON	JavaScript Object Notation
JWT	JSON Web Token
LBVM	Load Balancing of Virtual Machine
LCM	Life Cycle Management
MCC	Mobile Country Code
MCPTT	Mission-critical push-to-talk
METALLB_ADDRESS_POOL	Address pool configured on metallb to provide external IPs
MNC	Mobile Network Code
NAD	Network Attachment Definitions
NEF	Oracle Communications Cloud Native Core, Network Exposure Function

Table (Cont.) Acronyms and Terminologies

Acronym	Definition
NF	Network Function
NPLI	Network Provided Location Information
NRF	Oracle Communications Cloud Native Core, Network Repository Function
NSI	Network Slice Instances
NWDAF	Oracle Communications Networks Data Analytics Function
OAM	Operations Administration and Maintenance
OCI	Oracle Cloud Infrastructure
OCCM	Oracle Communications Cloud Native Core, Certificate Management
OCNADD	Oracle Communications Networks Analytics Data Director
PDB	Pod Disruption Budget
PCF	Oracle Communications Cloud Native Core, Policy Control Function
PCRF	Oracle Communications Cloud Native Core, Policy and Charging Rules Function
PCEF	Policy and Charging Enforcement Function
PDS	Policy Data Service
PRA	Presence Reporting Area
PRE	Policy Runtime Engine
PDU	Protocol Data Unit
PVC	Persistent Volume Chain
Policy	Oracle Communications Cloud Native Core, Converged Policy
QoS	Quality of Service
RAN	Radio Access Network
SAN	Subject Alternate Name
SBI	Service Based Interface
SNSSAI	Single Network Slice Selection Assistance Information
SMF	Session Management Function
SNAT	Source Network Address Translation
SRA	Successful Resource Allocation
STR	Session Termination Request (Rx)
UDR	Oracle Communications Cloud Native Core, Unified Data Repository
UE	User Equipment
UPF	User Plane Function
UPSI	UE Policy Section Identifier
URSP	UE Route Selection Policies
Local NRF set state data	NF instances and NF subscription data that is stored in the local cnDBTier of an NRF instance. It is the state data from the local cnDBTier and replicated state data from the georedundant NRF.
Remote NRF set state data	NF registrations and NF subscriptions data that is stored in remote NRF set instances within the same segment. It is the state data from peer NRF set in the same segment
Periodic syncing	It refreshes the local cache periodically.
State Data	The state data is the dynamic data that contains the NFInstances and NFSubscriptions of the NFs.

What's New in This Guide

This section lists the documentation updates for release 26.1.2xx.

Release 26.1.201- G55937-01, July 2026

Feature Updates

- **New Features**
 - **Setting SBI Message Priority**
 - * Added the [Setting SBI Message Priority](#) section to describe the functionality of the feature.
 - * Added the following CNC Console configurations for the feature:
 - * [SBI Message Priority](#)
 - * [SBI Service Operations](#)
 - * [Priority Mapping Rules](#)
 - * [Request SMP Headers](#)
 - * Added the following metrics in the [NRF NF Metrics](#) section:
 - * `ocnrf_smp_parsing_error_total`
 - * `ocnrf_smp_no_match_total`
 - * Added the following metrics in the [Egress Gateway Metrics](#) section:
 - * `oc_egressgateway_smp_parsing_error_total`
 - * `oc_egressgateway_smp_no_match_total`
 - * Added the following metrics in the [Ingress Gateway Metrics](#) section:
 - * `oc_ingressgateway_smp_parsing_error_total`
 - * `oc_ingressgateway_smp_no_match_total`
 - Added the [Automatic Recovery of Missing NRF Database Records Across Georeplicated Sites](#) section for the feature.
 - Gzip Compression for Cache Data Microservice
 - Added the [Gzip Compression for Cache Data Microservice](#) section to describe the functionality of the feature.
 - Added the following CNC Console parameters:
 - * **Enable Compression For Subscription To CDS** in the [NF Management Options](#)
 - * **Enable Compression For Discovery To CDS** in the [NF Discovery Options](#)
 - * **Enable Compression For CDS To CDS** in the [NRF Growth Options](#)
 - **Efficient Subscription Notification Processing:**
 - Added the feature description in the [Efficient Subscription Notification Processing](#) section.
 - Added the `ocnrf_active_subscriptions_count` metric in the [NRF NF Metrics](#) section.
 - Added the following dimensions in the [NRF Metrics](#) section:

- * SubscrReqNfType
- * SubscrCondType
- * nfSetId
- Added the following KPIs in the [Efficient Subscription Notification Processing](#) section:
 - * Active Subscriptions per Subscriber NF Type
 - * Active Subscriptions per Subscription Condition Type
 - * Active Subscriptions per Subscriber NF Type and Subscription Condition Type
- Removed the NfStatusNotify dimension from the ocnrf_db_fallback_total metric in the [NRF Cache Data Metrics](#) section because subscription data is now maintained in an in-memory cache.
- Updated the behavior of NfStatusNotify in the [Enhanced NRF Set Based Deployment \(NRF Growth\)](#) and [Impacted Service Operations](#) sections.
- **Enhancements**
 - **Feature Enhancements:**
 - * Support for cnDBTier Georeplication Configuration and Control APIs in CNC Console
 - * Updated the description of the feature in the [Support for cnDBTier APIs in CNC Console](#) section.
 - * Added the following sections in CNC Console:
 - * [IP Family Preference for Replication Channel](#)
 - * [Gracefully Stop and Start Georeplication](#)
 - * **Increase in Active Subscription Count:** Updated the [NRF Supported Services](#) section with the maximum number of active NFSubscriptions from 1500 to 2000.
 - * **Increase in NF Profile Count:** Updated the [NRF Supported Services](#) section with the maximum number of NF Profile count that NRF supports from 600 NFs to 1000 NF Profiles.
 - * **Support for TLSv1.3 on Internal API Communication**
 - * Updated the description for the Ingress and Egress Gateway behavior, removed the Helm configurations added for Ingress and Egress Gateway in the [Support for TLSv1.3 on Internal API Communication](#) section.
 - * Removed the oc_ingressgateway_ip_addresses_fetch_failure metric from the [Support for TLSv1.3 on Internal API Communication](#) and [Ingress Gateway Metrics](#) sections as it is no longer supported in Ingress Gateway.
 - * Removed the OcnrfIngressGatewayFetchFailureForDestinationIPAddresses alert from the [Support for TLSv1.3 on Internal API Communication](#) and [Service Level Alerts](#) sections as it is no longer supported in Ingress Gateway.
 - * Updated the summary and description for the [OcnrfServicesFetchFailureForDestinationIPAddresses](#) alert.
 - * Removed the following note "Applicable for nfaccessstoken, nfdiscovery, nfregristration, nfsubscription, nrfartisan, nrfauditor, nrfcachedata, and nrfconfiguration microservices." from the following metrics as it is applicable for all the microservices in the [CNC Jetty Metrics](#) section:
 - * oc_cnc_jetty_service_discovery_duration_seconds_[suffix]

- * `oc_cnc_jetty_service_discovery_fallbacks_total`
- * `oc_cnc_jetty_service_discovery_up`
- * Added the [OcnrfEgressGatewayPodStateInDangerOfCongestion](#) and [OcnrfEgressGatewayPodStateInCongested](#) alerts in the [Egress Gateway Pod Protection Using Rate Limiting](#) and [Egress Gateway Pod Protection Using Rate Limiting](#) sections.
- * Added the [OcnrfIngressGatewayPodCpuUsageInDangerOfCongestionState](#) and [OcnrfIngressGatewayPodInCongestedState](#) alerts in the [Ingress Gateway Pod Protection Using Rate Limiting](#) and [Ingress Gateway Pod Protection Using Rate Limiting](#) sections.
- * Removed the following note from the [Server Header Details](#) section as a strict validation of `nfType` and `nfInstanceId` is supported.
"In case any one or both the values of `nfType` and `nfInstanceId` attributes are empty, NRF does not add the server header in the error responses."
- * Added the 0NRF-IGW-E184 error code in the [Ingress Gateway Service](#) section.
- * Added the Direction dimension for the [Table 6-383](#) KPI in the [NRF Service KPIs](#) section.
- * Updated the value of the Direction dimension from `egress` to `egressOut` for the following KPIs in the [NRF Service KPIs](#) section:
 - * [Table 6-384](#)
 - * [Table 6-385](#)
 - * [Table 6-386](#)
- * Added a note to the `load_level` metric in the [Overload Control](#) section indicating that only the perf-info leader pod metric should be used, based on the `isLeader` dimension.
- * Updated the following Gateway metric names as part of the Spring Boot (SB) upliftment:
 - * Renamed the metric name from `oc_ingressgateway_cca_certificate_info` to `oc_ingressgateway_cca_certificate` in the following sections:
 - * [CCA Header Validation in NRF for Access Token Service Operation](#)
 - * [Ingress Gateway Metrics](#)
 - * [OcnrfCcaRootCertificateExpiringIn1Day](#)
 - * [OcnrfCcaRootCertificateExpiringIn4Hours](#)
 - * [OcnrfCcaRootCertificateExpiringIn5Days](#)
 - * Renamed the metric name from `oc_ingressgateway_congestion_level_bucket_total` to `oc_ingressgateway_congestion_level_group_total` in the following sections:
 - * [Ingress Gateway Pod Protection Using Rate Limiting](#)
 - * [Ingress Gateway Metrics](#)
 - * Updated the Congestion Level Bucket KPI expression with the metric name in the [Ingress Gateway Pod Protection Using Rate Limiting](#)

- * Renamed the metric name from `oc_egressgateway_congestion_level_bucket_total` to `oc_egressgateway_congestion_level_group_total` in the following sections:
 - * [Egress Gateway Pod Protection Using Rate Limiting](#)
 - * [Egress Gateway Metrics](#)
 - * Updated the Congestion Level Bucket KPI expression with the metric name in the [Egress Gateway Pod Protection Using Rate Limiting](#).

— Documentation Enhancements

- * Added a table with the details about configuration type and status of each feature in the [NRF Features](#) section.
- * Updated the existing note for the **Default Priority** and **Priority Header Name** parameters in the [Pod Protection By Rate Limiting](#) and [Pod Protection By Rate Limiting](#) sections.
- * Updated the data type for the **Percentage** parameter from Integer to Number in the [Pod Protection By Rate Limiting](#) and [Pod Protection By Rate Limiting](#) sections.
- * Updated the data type for the **Priority** parameter from String to Integer in the [SLF Options](#) section.
- * Updated the attribute name from `populateSlfDiscoveredCandidateList` to `populateSlfCandidateList` in the [Dynamic Selection of SLF](#) section.
- * Updated the description of all the rate KPIs in the [NRF KPIs](#) section.
- * Added information about `NF_PROFILE_CHANGED` notification behavior and notification payload handling during replication failure conditions in the [NRF Last Known Response](#) section.
- * Added a note to the following metrics in the [Egress Gateway Metrics](#) section to indicate that certain flags should be set to true to include the dimensions.
 - * `oc_egressgateway_http_requests_total` for including Host dimension.
 - * `oc_egressgateway_http_responses_total` for including DestinationHost and error-reason dimensions.
- * Added [Supported Headers](#) appendix to include the supported 3gpp headers.
- * Enhanced the verbiage for description and examples in the [Loop Detection and Loop Prevention in NRF Forwarding Scenarios](#) section.
- * Enhanced the feature overview description in the [Discovery Parameter Value Based Skip SLF Lookup](#) section.
- * Updated the description for **Use Remote Data When Replication Down** parameter in the [Georedundancy Options](#) section to include the supported service operations.
- * Added [Skip SLF Lookup](#) section to describe the feature behavior.
- * Updated the description in the [Content-Encoding Header](#) section to describe the response behavior when gzip response compression is disabled.
- * Updated the parameter dependency note to clarify that the Maximum Hop Count value can be greater than or equal to the Maximum SLF Attempts value in the [General Options](#) section.

1

Introduction

This document provides information about the role of Oracle Communications Cloud Native Core, Network Repository Function (NRF) in 5G Service Based Architecture, how to configure, and use NRF.

NRF is a key component of the 5G Service Based Architecture. NRF maintains an updated repository of all the Network Functions (NFs) available in the operator's network. It also maintains the services provided by each of the NFs in the 5G core that is expected to be instantiated, scaled, and terminated with minimal to no manual intervention. In addition to serving as a repository of the services, NRF also supports discovery mechanisms that allow NFs to discover each other and get the updated status of the desired NFs.

Note

The performance and capacity of the NRF system may vary based on the call model, Feature or Interface configuration, and underlying CNE and hardware environment.

The NRF installation is supported over the following platforms:

- *Oracle Communications Cloud Native Core, Cloud Native Environment (CNE)*
- *Oracle Communications Cloud Native Core OCI Adaptor, NF Deployment in OCI*

For more information, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

NRF supports the following functions:

- Maintains the profiles of the available NF instances and their supported services in the 5G core network.
- Allows consumer NF instances to discover other provider's NF instances in the 5G core network.
- Allows NF instances to track the status of other NF instances.
- Provides OAuth2 based Access Token service for consumer NF authorization.
- Provides specific NF Type selection based on subscriber identity like SUPI, GPSI.
- Supports forwarding of messages from one NRF to another NRF.
- Supports georedundancy to ensure service availability.
- Supports roaming to serve 5G subscribers roaming in a non-home network also known as visited or serving networks, consumer network functions in visited or serving networks need to access the NF Profiles located in the home network of 5G subscribers.

NRF interacts with every other NF in the 5G core network and it supports the above functions through the following services:

- Management Service
- Discovery Service

- AccessToken Service

NRF Availability

NRF availability is dependent on many factors. NRF applications are designed to achieve 99.999% availability, according to the applicable Telecommunications Industry Association TL9000 standards, with the following deployment requirements:

- Deploy on a Cloud Native Environment with at least 99.999% Availability.
- Deploy with $n + k$ application redundancy, where k is greater than or equal to one.
- Maintain production software within $n-3$ software releases, where n is the current general availability release.
- Apply bug fixes, critical patches, and configuration recommendations provided by Oracle promptly.
- Maintain disaster recovery procedures external to the applications for the reconstruction of lost or altered files, data, programs, or Cloud Native environment.
- Install, configure, operate, and maintain NRF as per Oracle's applicable installation, operation, administration, and maintenance specifications.
- Maintain an active support contract and provide access to the deployed NRF and your personnel to assist Oracle in addressing any outage.

NRF availability is measured for each calendar year and is calculated as follows:

Table 1-1 Measuring NRF Availability

Availability	Description
Planned Product Availability	(Product available time in each month) less (Excluded Time (defined below) in each month).
Actual Product Availability	(Planned Product Availability) less (any Unscheduled Outage)
Product Availability Level	(Actual Product Availability across all Production instances divided by Planned Product Availability across all Production instances) x 100

Note

Excluded Time means:

- Scheduled maintenance time.
- Lack of power or backhaul connectivity, except to the extent that such lack of backhaul connectivity was caused directly by the CNC NF.
- Hardware failure.
- Issues arising out of configuration errors or omissions.
- Failures caused by third-party equipment or software not provided by Oracle.
- Occurrence of any event under Force Majeure.
- Any time associated with failure to maintain the recommended architecture and redundancy model requirements above.

1.1 References

Following are the reference documents:

- *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*
- *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*
- *Oracle Communications Cloud Native Core, Network Repository Function Network Impact Report*
- *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*
- *Oracle Communications Cloud Native Core, Cloud Native Environment User Guide*
- *Oracle Communications Cloud Native Core, cnDBTier User Guide*
- *Oracle Communications Cloud Native Configuration Console User Guide*
- *Oracle Communications Cloud Native Core Automated Test Suite User Guide*
- *Oracle Communications Cloud Native Core, OCI Deployment Guide*
- *Oracle Communications Cloud Native Core, OCI Adaptor User Guide*
- *Oracle Communications Cloud Native Core, Certificate Management User Guide*
- *Oracle Communications Network Analytics Data Director User Guide*
- *Oracle Communications Cloud Native Core, Network Function Data Collector User Guide*
- *Oracle Communications Cloud Native Core Release Notes*
- *Oracle Communications Cloud Native Core Licensing Information User Guide*
- *Oracle Communications Cloud Native Core Solution Installation, Upgrade, and Fault Recovery Guide*
- *Oracle Communications Cloud Native Core Security Guide*

2

NRF Supported Services

This section includes information about the services supported by NRF.

NRF supports the following services:

NRF Management Service

The NRF Management service is identified by the service name `Nnrf_NFManagement`.

NRF supports the following management services:

Note

The respective service name is mentioned next to each service.

- **Register NF instance** (NFRegister): Allows the NF instance to register its NF profile in the NRF along with the list of services provided by the NF instance.
- **Update NF instance** (NFUpdate): Enables the NF instance to partially update or replace the parameters of its NF profile in the NRF. It also allows to add or delete services provided by the NF instance.
This operation supports the following:
 - Complete replacement of NF profile
 - Add, remove or update attributes of NF Profile
 - Heart beat and load information of NF
- **Deregister NF instance** (NFDeregister): Enables the NF instance to deregister its NF profile and the services provided by the NF instance from the 5G network.
- **Subscribe to Status** (NFStatusSubscribe): Enables the NF instance to subscribe to the status changes of other NF instances registered in the NRF.
- **Unsubscribe to Status** (NFStatusUnsubscribe): Enables the NF instance to unsubscribe the status changes of other NF instances.
- **Notifications of Status** (NFStatusNotify): Sends status notifications to subscribed NFs.
- **Retrieval of NF list** (NFListRetrieval): Allows the retrieval of a list of NF Instances that are currently in the registered state in NRF. This service operation is not allowed to be invoked from the NRF in a different PLMN.
- **Retrieval of NF Profiles** (NFProfileRetrieval): Allows the retrieval of the NF profile of a given NF instance that are currently in the registered state in NRF. This service operation is not allowed to be invoked from the NRF in a different PLMN.

NRF Discovery Service

The NRF discovery service is identified by the service name `Nnrf_NFDiscovery Service`.

NRF supports the following discovery service:

- **Discover NF instance (NFDiscover):** NRF supports the discovery of the NRF profile of the NF instances or NF services that match certain input criteria.

NRF Access Token Service

The NRF Access Token service handles 3GPP defined Access Token service operations. OAuth2.0 based token is provided by NRF according to inputs provided by consumer network function in access token request. The NRF Access Token service is identified by the service name Nnrf_AccessToken.

NRF supports the following access token service:

- Access Token (Nnrf_AccessToken): NRF supports issuing OAuth2 token to consumer NFs for accessing specific Producer Services.

Note

The performance and capacity of the NRF system may vary based on the call model, Feature or Interface configuration, and underlying CNE and hardware environment.

Maximum Supported NFProfiles and NFSubscriptions Count Across NRF Sets

NRF supports maximum of 1000 NFProfiles.

NRF supports maximum of 2000 active NFSubscriptions.

Ensure that Gzip Compression for Cache Data Microservice feature is enabled to support a maximum of 1000 NF instances and 2000 subscriptions. For more information about the feature, see [Gzip Compression for Cache Data Microservice](#).

It is recommended that the NFs are distributed almost equally between the NRF sets or upto a maximum of 70% of the NFs in one set and the remaining 30% of NFs in the other set.

2.1 Supported NF Types

NRF supports the following NF Types. All NRF service operations are supported for these NF Types.

Table 2-1 Supported NF Types

Network Function	Definition
5G_EIR	5G Equipment Identity Register
AF	Application Function
AMF	Access and Mobility Management Function
AUSF	Authentication Server Function
BSF	Binding Support Function
CBCF	Cell Broadcast Center Function
CHF	Charging Function
DRA	Diameter Routing Agent
GMLC	Gateway Mobile Location Center
ICSCF	Interrogating Call Session Control Function
IMS_AS	IP Multimedia Subsystem Application Server
LMF	Location Management Function

Table 2-1 (Cont.) Supported NF Types

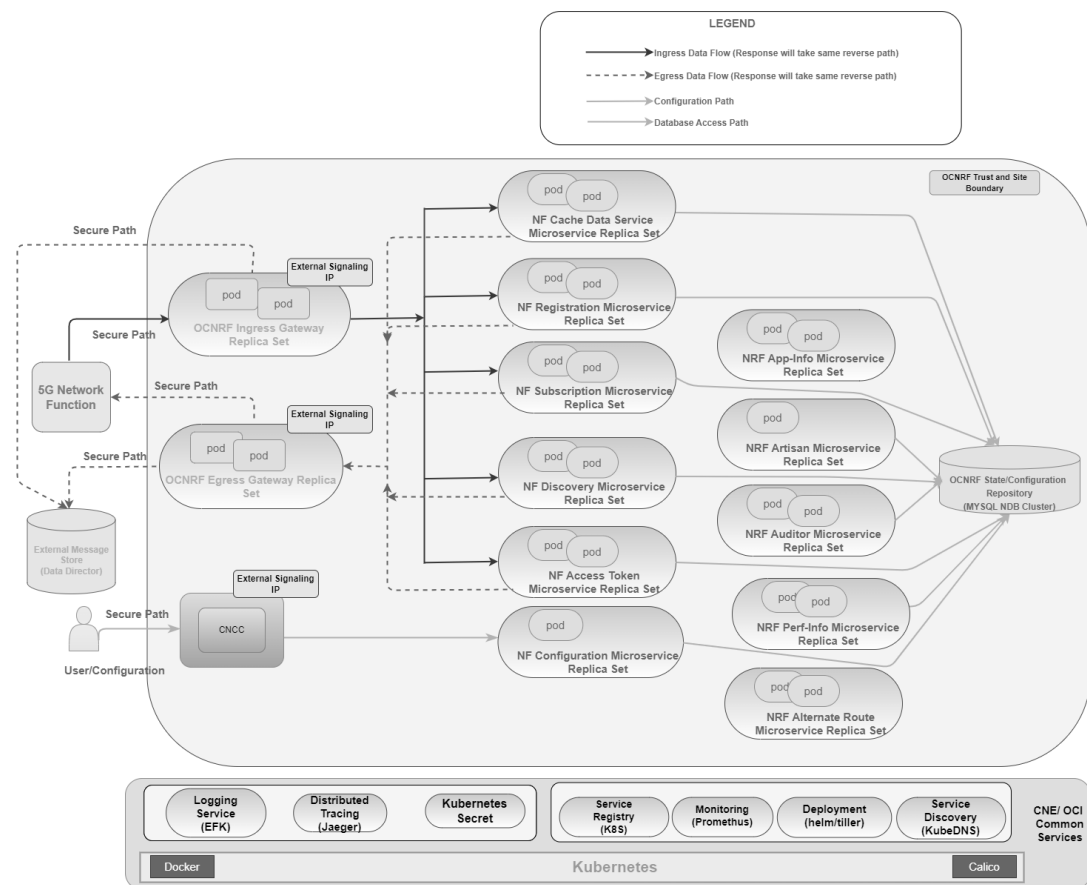
Network Function	Definition
MME	Mobility Management Entity
N3IWF	non-3GPP Interworking Function
NEF	Network Exposure Function
NRF	Network Repository Function
NSSF	Network Slice Selection Function
NSSAAF	Network Slice Specific Authentication and Authorization Function
NWDAF	Network Data Analytic Function
PCF	Policy Control Function
SCP	Service Communication Proxy
SCEF	Service Capability Exposure Function
SCSAS	Security Assurance Specification
SEPP	Security Edge Protection Proxy
SMF	Session Management Function
SMSF	Short Message Service Function
SPAF	Secured Packet Application Function
SOR_AF	Steering of Roaming Application Function
UCMF	UE Capability Management Function
UDR	Unified Data Repository
UDM	Unified Data Management
UDSF	Unstructured Data Storage Function
UPF	User Plane Function

3

NRF Architecture

NRF comprises various microservices deployed in Kubernetes based Cloud Native Environment (CNE) and Oracle Cloud Infrastructure (OCI). Some common services like logs or metrics data collection, analysis, and graphs or charts visualization, and so on are provided by the environment. The microservices integrate with the environment and provide the necessary data.

Figure 3-1 NRF Architecture



Following are the components of the NRF product:

- **NF Registration Microservice**
This microservice receives and handles the following service operations:
 - NFRegister service requests from the NFs
 - NFUpdate service requests from the NFs
 - NFDeregister service requests from the NFs
 - NFListRetrieval service requests from the NFs

- NFProfileRetrieval service requests from the NFs
- Heart-beat messages from the NFs
- **NF Subscription Microservice**
This microservice performs the following service operations:
 - receives and handles NFStatusSubscribe service requests from the NFs
 - receives and handles NFStatusUnsubscribe service requests from the NFs
 - sends NFStatusNotify service requests towards the subscribed NFs
- **NF Discover Microservice**
This microservice receives and handles the following service operations:
 - NFDiscover service requests from the NFs
- **NF Access Token Microservice**
This microservice handles 3GPP-defined AccessToken service operations. OAuth2.0 based token is provided by NRF according to inputs provided by consumer network function in access token request.
- **NRF Auditor Microservice**
This microservice is internal to NRF. This microservice performs the following tasks:
 - finds and deletes the expired subscription records
 - finds and deletes the profile records which have been SUSPENDED for a very long time
 - monitors the heart-beat expiry, mark the NF profiles as suspended and act appropriately on the suspended NF profiles
- **NRF Configuration Microservice**
This microservice is used to configure NRF. These configurations can be changed dynamically by an operator or user using REST based interface. This configuration data is managed by the NRF configuration service and is stored in a separate data store.
- **NRF Ingress Gateway Microservice**
This microservice is an entry point for accessing NRF supported service operations.
- **NRF Egress Gateway Microservice**
This microservice is responsible to route NRF initiated egress messages to other NFs.
- **App-Info Microservice**
This microservice is responsible to get the status of microservices related to NFManagement Service operations (that is, NF Registration microservice, NF Subscription microservice, NRF Auditor microservice).

NF Registration, NF Subscription, NRF Auditor microservices uses this microservice to get the status of other two microservices. In case any of the services is found as down, status asking microservice will reject the incoming messages. This microservice is also responsible to fetch DB replication status whether it is active or inactive.
- **NRF Artisan Microservice**
This is an optional utility microservice which gets deployed to perform feature specific tasks. For example, building candidate SLFs to which NRF will send SLF Query.
- **Perf-Info Microservice**
This is an optional microservice which gets deployed to enable overload control in NRF. It helps in computing CPU or Memory utilization of NRF core services and performs Overload Control Manager role.
- **Alternate-Route Microservice**

This is an optional microservice which gets deployed when NRF needs to perform DNS SRV based queries to the DNS server to resolve Virtual FQDNs or update NAPTR records.

- **Cache Data Microservice**

The microservice is responsible for caching the state data in memory from the database. The NfRegistration, NfSubscription, NfDiscovery, NfAccesstoken, NrfConfiguration, and NrfArtisan microservices query the Cache Data Service (CDS) to get the state data to process NRF supported service operations.

CDS builds and maintains the state data of the local NRF set by reading the state data from cnDBTier. If the NRF Growth feature is enabled, CDS maintains the state data of the remote NRF sets by synching with the remote NRF sets periodically. In case of CDS failure, NRF microservices rely on the cnDBTier to obtain the state data and fulfill the service operation.

Ingress and Egress Gateway Traffic Management

For more information on Ingress and Egress Gateway Traffic Management, see *Oracle Communications Cloud Native Core, Cloud Native Environment User Guide*.

4

NRF Features

This section explains the NRF features.

NRF Features List with Configuration Status

Table 4-1 NRF Features List with Configuration Status

Feature Name	Enabled or Disabled by Default	Configuration Type (Helm, REST API, CNC Console, None)	Licensing SKU Name
Setting SBI Message Priority	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Automatic Recovery of Missing NRF Database Records Across Georeplicated Sites	Enabled	None	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Efficient Subscription Notification Processing	Enabled	None	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Gzip Compression for Cache Data Microservice	Disabled	Helm, REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Simultaneous Support for HTTP and HTTPS Connections	Disabled	Helm, REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Egress Gateway Pod Protection Using Rate Limiting	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Ingress Gateway Pod Protection Using Rate Limiting	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
NF Profile Size Limit	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual

Table 4-1 (Cont.) NRF Features List with Configuration Status

Feature Name	Enabled or Disabled by Default	Configuration Type (Helm, REST API, CNC Console, None)	Licensing SKU Name
Egress Gateway Pod Throttling	Enabled	Helm	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Traffic Segregation	Disabled	Helm	Oracle Communications Cloud Native Core, Advanced Cloud Native Environment – 25K Active Subscribers Perpetual
Support for Server Header	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Support for TLS	Disabled	Helm	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Support for TLSv1.3 on Internal API Communication	Disabled	Helm	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Error Response Enhancement for NRF	NA	Helm	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Error Log Messages Enhancement	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Limiting Number of NFProfiles in NFDiscover Response (3gpp defined behavior)	Enabled	None	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Support for cnDBTier APIs in CNC Console	Enabled	CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual

Table 4-1 (Cont.) NRF Features List with Configuration Status

Feature Name	Enabled or Disabled by Default	Configuration Type (Helm, REST API, CNC Console, None)	Licensing SKU Name
Enhanced NRF Set Based Deployment (NRF Growth)	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Support for Automated Certificate Lifecycle Management	NA	None	Oracle Communications Cloud Native Core, Certificate Management - 25K Active Subscribers
Egress Gateway Route Configuration for Different Deployments (Not a feature)	Enabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Routing Egress Messages through SCP • SLF Requests • Notifications Requests • NRF Forwarding Requests • Roaming Requests	Disabled	Helm, REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Ingress Gateway Pod Protection	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Network Slice Specific Metrics (Not a feature)	Enabled	None	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
CCA Header Validation in NRF for Access Token Service Operation	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Monitoring the Availability of SCP Using SCP Health APIs	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Controlled Shutdown of NRF	Enabled	Helm, REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
User-Agent Header for Outgoing Requests	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual

Table 4-1 (Cont.) NRF Features List with Configuration Status

Feature Name	Enabled or Disabled by Default	Configuration Type (Helm, REST API, CNC Console, None)	Licensing SKU Name
Support for Kubernetes Resource: Node Selector	Disabled	Helm	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Support for Kubernetes Resource:Kubernetes Probes	Enabled	Helm	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Support for Kubernetes Resource:Pod Disruption Budget	Enabled	Helm	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Support for Kubernetes Resource:Network Policies	Disabled	None	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Support for Kubernetes Resource:Tolerations	Disabled	Helm	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Support for Kubernetes Resource: Dual Stack	NA	None	Oracle Communications Cloud Native Core, Advanced Networking – 25K Active Subscribers Perpetual
Pod Protection Support for NRF Subscription Microservice	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Pre and Post Install/Upgrade Validations NRF Infrastructure Validation NRF Preinstallation Validation NRF Postinstallation Validations NRF Preupgrade Validation NRF Postupgrade Validation	Disabled	Helm	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Ignore Unknown Attribute in NFDDiscover Search Query	Disabled	Helm	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual

Table 4-1 (Cont.) NRF Features List with Configuration Status

Feature Name	Enabled or Disabled by Default	Configuration Type (Helm, REST API, CNC Console, None)	Licensing SKU Name
NF Authentication using TLS Certificate: XFCC Header Validation	Disabled	Helm, REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
NF Authentication using TLS Certificate: TLS SNI Header Validation	Disabled	Helm	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Subscriber Location Function: Static Selection of SLF	NA	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Dynamic Selection of SLF	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Support for Configurable Port and Routing Parameter Selection	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Rerouting SLF Requests Using Alternate SCP and Alternate SLF	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Rerouting SLF Requests Based on Server Header Value	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Skip SLF Lookup	Enabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Discovery Parameter Value Based Skip SLF Lookup	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
NRF Forwarding	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual

Table 4-1 (Cont.) NRF Features List with Configuration Status

Feature Name	Enabled or Disabled by Default	Configuration Type (Helm, REST API, CNC Console, None)	Licensing SKU Name
NRF Georedundancy	Disabled	Helm, REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
NRF Last Known Response	Disabled	Helm	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
NF Heartbeat Enhancement	NA	None	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Service mesh for intra-NF communication	NA	None	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
NF Screening	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
REST Based NRF State Data Retrieval	NA(only configuration)	REST API	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Key-ID for Access Token	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
NRF Access Token Service Usage Details (3gpp defined behavior)	Enabled	None	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Access Token Request Authorization	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Preferred Locality (3gpp defined behavior)	NA	None	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual

Table 4-1 (Cont.) NRF Features List with Configuration Status

Feature Name	Enabled or Disabled by Default	Configuration Type (Helm, REST API, CNC Console, None)	Licensing SKU Name
Extended Preferred Locality	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Limiting the Number of Producers Based on NF Set Ids	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
NFService Priority Update	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Roaming Support	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
EmptyList in Discovery Response	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Overload Control	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
DNS NAPTR Update	Disabled	Helm, REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
Notification Retry	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual
NRF Message Feed	Disabled	Helm	Oracle Communications Network Analytics Data Director, Network Repository Function Data Feed
Subscription Limit	Disabled	REST API, CNC Console	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual

Table 4-1 (Cont.) NRF Features List with Configuration Status

Feature Name	Enabled or Disabled by Default	Configuration Type (Helm, REST API, CNC Console, None)	Licensing SKU Name
Automated Test Suite Support	NA	None	Oracle Communications Cloud Native Core, Network Repository Function - 25K Active Subscribers Perpetual

4.1 Setting SBI Message Priority

3GPP defines a standard message-level priority mechanism that uses an HTTP header to ensure consistent end-to-end prioritization for SBI communications.

This feature enables NRF to set the 3GPP SBI message priority using the 3gpp-Sbi-Message-Priority header. This feature enables consistent priority handling for:

- responses generated by NRF
- requests initiated by NRF
- requests and responses handled in NRF Forwarding and roaming scenarios.

NRF determines the priority value by inspecting the configured HTTP headers in incoming requests. When a priority header is present, NRF extracts and validates the value to ensure that it is within the supported range of 0 to 31. If the header is absent, invalid, or unusable, NRF uses the configured default priority associated with the corresponding SBI service operation.

NRF then applies the configured priority mapping rules to derive the final priority value from the input priority value. NRF evaluates the mapping rules in a defined order and selects the applicable rule based on exact-match, range-match, or default conditions. The resulting value is added to the 3gpp-Sbi-Message-Priority header in the outgoing messages. If the required mapping configuration is unavailable, NRF does not include the 3gpp-Sbi-Message-Priority header in the outgoing message.

Use Cases: For detailed use case scenarios and corresponding behavior, see [Use Cases for Setting SBI Message Priority](#).

Managing the feature

Enable

- **Enable using REST API:** Set the value of enabled attribute to true in the `{apiRoot}/nrf/nf-common-component/v1/global-configuration/sbimessagepriority` URI.
- **Enable using CNC Console:** Toggle the **Enabled** parameter to **true** in the [SBI Message Priority](#).

Configure

Note

All supported configurations are preloaded during installation or upgrade. You can modify the configurations and enable the feature as required.

- **Configure using REST API:** Use the following APIs to configure the feature:
 - Service Operations Configuration: Configure the appropriate values for the attributes in the {apiRoot}/nrf/nf-common-component/v1/global-configuration/sbiserviceoperations URI to configure service operation behavior. For more details, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
 - Priority Mapping Rules Configuration: Configure the appropriate values for the attributes in the {apiRoot}/nrf/nf-common-component/v1/global-configuration/prioritymappingrules URI to configure priority mapping rules. For more details, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
 - Request Header Configuration: Configure the appropriate values for the attributes in the {apiRoot}/nrf/nf-common-component/v1/global-configuration/requestsmphheaders URI to configure the headers used for priority extraction. For more details, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Configure using CNC Console:** Use the following parameters to configure the feature:
 - Service Operations Configuration: Configure the appropriate values for the parameters in the [SBI Service Operations](#) to configure service operation behavior.
 - Priority Mapping Rules Configuration: Configure the appropriate values for the parameters in the [Priority Mapping Rules](#) to configure priority mapping rules.
 - Request Header Configuration: Configure the appropriate values for the parameters in the [Request SMP Headers](#) to configure the headers used for priority extraction.

Observability**Metrics**

The following metrics are added for this feature:

- [NRF NF Metrics](#)
 - ocnrf_smp_parsing_error_total
 - ocnrf_smp_no_match_total
- [Ingress Gateway Metrics](#)
 - oc_ingressgateway_smp_parsing_error_total
 - oc_ingressgateway_smp_no_match_total
- [Egress Gateway Metrics](#)
 - oc_egressgateway_smp_parsing_error_total
 - oc_egressgateway_smp_no_match_total

For more details about the metrics, see [NRF Metrics](#).

Alerts

There are no alerts defined for this feature.

KPIs

There are no KPIs defined for this feature.

Maintain

If you encounter alerts at system or application levels, see the [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

1. Collect the logs: For more information on collecting logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. Raise a service request: See [My Oracle Support](#) for more information on how to raise a service request.

4.2 Automatic Recovery of Missing NRF Database Records Across Georeplicated Sites

In a georeplicated NRF deployment, NRF sites rely on MySQL NDB replication to keep NRF database records synchronized across sites. However, in certain failure or replication disruption scenarios, insert or update events for NRF database records might not be replicated to one or more peer sites. Over time, this can cause database inconsistencies across NRF sites.

NRF relies on the default MySQL NDB replication behavior, which is controlled by the NDB logging configuration. With the default configuration, update events do not contain sufficient row information to recreate rows that are missing on peer sites.

If a row is inserted on one site and the insert operation is not replicated to peer sites, a subsequent or later update on the source site does not automatically create the missing row on the peer sites. As a result, the source site contains the updated row, while the peer sites do not contain the row.

This feature enables automatic database recovery for selected NRF tables during record updates. After upgrading to release 26.1.201, NRF configures MySQL NDB replication so that update events for supported NRF tables include the complete row details. This allows a missing row on a peer site to be recreated, or an existing row to be synchronized, when an update is replicated from the source site. This feature provides a database-level auto recovery mechanism. Recovery occurs only when a subsequent update to a supported record is replicated to the affected site.

During installation or upgrade to release 26.1.201, NRF pre-installation and pre-upgrade hooks insert entries for supported NRF tables into `mysql.ndb_replication` table with `binlog_type` set to 3.

The `binlog_type=3` setting maps to the following MySQL NDB logging behavior:

Table 4-2 MySQL NDB Log Behavior

Parameter	Value in Previous Releases	Value from Release 26.1.201 and Later
<code>ndb-log-updated-only</code>	ON	OFF
<code>ndb-log-update-as-write</code>	OFF	ON

Table 4-2 (Cont.) MySQL NDB Log Behavior

Parameter	Value in Previous Releases	Value from Release 26.1.201 and Later
ndb-log-update-minimal	ON	OFF

Supported Tables

This feature applies to the following NRF tables:

Table 4-3 Supported NRF Tables

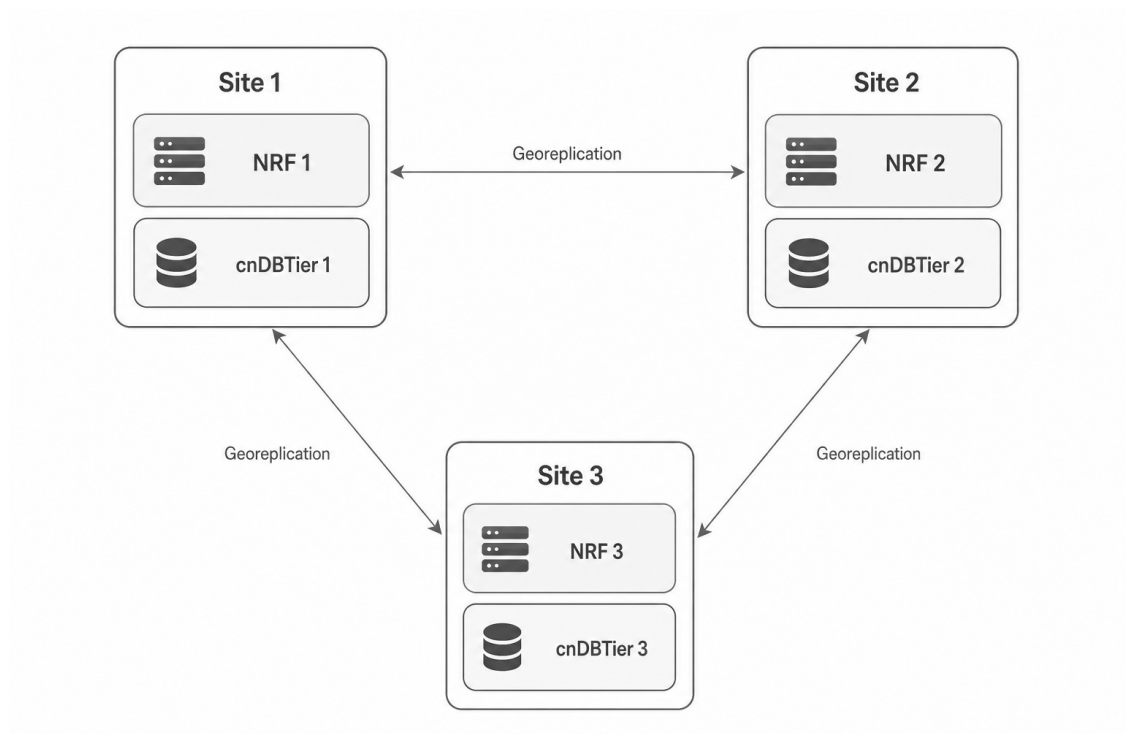
Database	Table
nrfApplicationDB	NfInstances
nrfApplicationDB	NfStatusMonitor
nrfApplicationDB	NfSubscriptions
nrfApplicationDB	NrfSystemOptions
nrfApplicationDB	NfScreening
nrfApplicationDB	SiteIdToNrfInstanceIdMapping
leaderElectionDB	NrfAuditorLeaderPod
nrfNetworkDB	NfScreening_backup
nrfNetworkDB	NrfSystemOptions_backup
nrfNetworkDB	SiteIdToNrfInstanceIdMapping_backup

Automatic database recovery applies only when all the following conditions are met:

- The affected record belongs to one of the supported NRF tables.
- The affected row is updated by NRF through an NF-driven event, such as NFUpdate, or through NRF Audit, and the update is replicated to the inconsistent site. Periodic background reconciliation of NRF records across sites is not performed.

Examples

The following image provides an high-level view of an NRF georedundant deployment showing Site 1, Site 2, and Site 3, where each site contains an NRF instance and corresponding cnDBTier, and database records are synchronized across sites through georeplication.

Figure 4-1 NRF Georedundant Deployment

The following table provides examples for supported tables.

Table 4-4 Example

Example	Result Without Database Autorecovery	Result With Database Autorecovery
The NfInstance record is inserted on the source site (Site 1) but the insert operation is not replicated to the peer sites (Site 2 or Site 3). Later, NfInstance update is performed on the source site.	The missing row is not created on the peer sites.	The missing row is created on the peer site.
The NfInstance record exists on all sites, but NfInstance update is missed on one or more peer sites. Later, NfInstance update is performed on the source site (Site 1).	The rows are not synchronized in the peer sites.	The rows are synchronized in the peer sites.
The nfSubscription record is inserted on the source site (Site 1) but the insert operation is not replicated to the peer sites (Site 2 or Site 3). Later, nfSubscription update is performed on the source site (Site 1).	The missing row is not created on the peer sites.	The missing row is created on the peer sites.
The nfSubscription record exists on all sites, but nfSubscription update is missed on one or more peer sites. Later, nfSubscription update is performed on the source site (Site 1).	The rows are not synchronized in the peer sites.	The rows are synchronized in the peer sites.

Note

Similar examples are applicable to the other tables listed in [Table 4-3](#).

- **Upgrade Impact**

Before upgrading to release 26.1.201, grant an additional privilege to the NRF privileged user.

Run the following command to grant the NRF privileged user permission on the `mysql.ndb_replication` table before starting the upgrade to 26.1.201.

```
GRANT SELECT, INSERT ON mysql.ndb_replication TO 'nrfPrivilegedUsr'@'%';
```

For more information about upgrade tasks, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

- **Rollback Impact**

When rolling back from release 26.1.201 to earlier releases, the entries in the `mysql.ndb_replication` table remain unchanged and are not removed automatically.

Removing the entries from the `mysql.ndb_replication` table during rollback is optional. The auto-recovery functionality continues to work with NRF release 25.2.2xx and database release 25.2.2xx.

To revert this behavior after rollback, manually delete the NRF table entries from the `mysql.ndb_replication` table and restart the DBTier SQL pods.

- **Rollback Cleanup Steps**

Remove the corresponding entries from the `mysql.ndb_replication` table. For multisite deployments, perform this step only on Site 1 and on one of the `ndbappmysqld` nodes. Oracle recommends using `ndbappmysql-0`.

1. Log in to the SQL terminal on the selected `ndbappmysqld` node:

```
mysql -h127.0.0.1 -u<nrfApplicationUsr> -p<nrfApplicationPasswd>
```

2. Run the following SQL statements:

```
DELETE FROM mysql.ndb_replication WHERE db='nrfApplicationDB';
DELETE FROM mysql.ndb_replication WHERE db='leaderElectionDB';
DELETE FROM mysql.ndb_replication WHERE db='nrfNetworkDB';
```

3. Restart all `ndbappmysqld` and `ndbmysqld` pods across all sites in the DBTier deployment.

```
kubectl -n <cndbtier-namespace> delete pod <ndbappmysqld-pod>
kubectl -n <cndbtier-namespace> delete pod <ndbmysqld-pod>
```

For more information about rollback tasks, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Managing the Feature

Enable

This feature is enabled by default. It does not provide an enable or disable option. To disable the feature, remove or revert the supported table entries in the `mysql.ndb_replication` table and restart the DBTier SQL pods.

Observability**Metrics**

There are no new metrics introduced for this feature.

Alerts

There are no alerts associated with this feature.

KPIs

There are no KPIs related to this feature.

Maintain

If you encounter alerts at system or application levels, see the [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

1. Collect logs. For more information, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. Raise a service request. See [My Oracle Support](#) for more information.

4.3 Efficient Subscription Notification Processing

The NRF subscription microservice handles service operations such as `NfStatusSubscribe`, `NfStatusUnsubscribe`, and `NfStatusNotify`.

NRF retrieves subscription data dynamically from the Cache Data Microservice (CDS) for each notification event processing.

This feature allows each subscription microservice pod to maintain an in-memory cache of subscription data to improve notification processing efficiency and support higher subscription counts. Hence avoiding signalling or messaging between subscription and CDS for each notification event.

This behavior is enabled by default.

Managing the Feature**Enable**

This feature does not support enable or disable operations. However, you can configure the required parameters using Helm.

Configure

You can configure this feature using Helm:

1. Open the `ocnrf_custom_values_26.1.201.yaml` file.

2. Set `global.nrfSetId` to the current NRF's NF Set Id (`nfSetId`) of the NRF that is deployed. Configure the same `nfSetId` value for all NRFs that belong to the same NRF set.
For more information about the parameters, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
3. Save the file.
4. Install NRF. For more information about the installation procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
5. Run the Helm upgrade if you modify the feature after NRF deployment. For more information about the upgrade procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Observability

Metrics

The `ocnrf_active_subscriptions_count` metric is added for this feature.

For more details, see the [NRF Metrics](#) section.

Alerts

There are no alerts for this feature.

KPIs

The following KPIs are added for this feature:

- Active Subscriptions per Subscriber NF Type
- Active Subscriptions per Subscription Condition Type
- Active Subscriptions per Subscriber NF Type and Subscription Condition Type

For more information about metrics and KPIs related to this feature, see [NRF KPIs](#) section.

Maintain

If you encounter alerts at system or application levels, see the [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

1. Collect the logs: For more information on collecting logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. Raise a service request: See [My Oracle Support](#) for more information on how to raise a service request.

4.4 Gzip Compression for Cache Data Microservice

Currently, communication between NRF microservices and Cache Data microservice (CDS) uses uncompressed HTTP responses resulting in higher payloads.

This feature enables Gzip-based compression for responses sent by CDS microservice. Enabling compression at both the client and server levels reduces payload sizes for large datasets and improves network efficiency and response times. Compression is applied only when it is enabled on both the client and CDS microservice. Client configuration is managed

using REST APIs, and server configuration for CDS microservice is managed using Helm. This feature is enabled by default on the server side and compression is applied only if the client side is enabled using REST APIs.

The `nrfcachedata.responseCompressionGzip` parameter (server) supports Gzip compression when CDS microservice is interacting with NRF microservices (client).

The following NRF microservices (client) support Gzip compression when interacting with CDS microservice.

- Subscription: Enable Gzip compression for communication between the subscription microservice and CDS.
- Discovery: Enable Gzip compression for communication between the discovery microservice and CDS.
- CDS: Enable Gzip compression for communication between the local CDS microservice and the remote CDS microservice.

Note

The `enableCompressionCDSToCDS` attribute is applicable only when the NRF Growth feature is enabled.

Client Side Behavior

The client side behavior is defined as follows:

When the client microservice sends a request to CDS microservice, and if the feature is enabled, it includes the `Accept-Encoding: gzip` header. If the feature is disabled, the request does not include the `Accept-Encoding: gzip` header.

When the client microservice receives a response containing the `Content-Encoding: gzip` header, it decompresses the response before processing it. If the header is not present with Gzip, the response is processed without compression.

Server Side Behavior

The server side behavior is as follows:

When CDS microservice receives a request, it determines whether the response must be compressed based on the following conditions:

- `nrfcachedata.responseCompressionGzip` is set to true.
- The request contains the `Accept-Encoding: gzip` header.

If both conditions are satisfied, CDS microservice compresses the response payload using Gzip and includes the `Content-Encoding: gzip` header in the response. If either condition is not satisfied, CDS microservice sends the response without compression.

The server will perform the compression only if the size of the response is beyond this value 1024 Kb and this value is not configurable.

Managing the feature

Enable

Helm

This feature is enabled by default for the server side.

Perform the following steps to verify and enable Gzip compression on CDS microservice as a server using Helm:

1. Open the `ocnrf_custom_values_26.1.201.yaml` file.
2. Verify that the value of `nrfcachedata.responseCompressionGzip` parameter is *true* to enable response compression on CDS microservice. If this value is *false*, set the value to *true* to enable the feature.
For more information on the Helm parameters, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
3. Save the file.
4. Install NRF. For more information about the installation procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
5. Run the Helm upgrade if you are enabling this feature after NRF deployment. For more information about the upgrade procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Enable Using REST API or CNC Console

Perform the following steps to enable Gzip compression on client microservices using REST API or CNC Console:

Note

Post-upgrade, it is recommended to enable all client-side compression features in the order listed below:

- Enable using REST:
 - Set the value of `enableCompressionSubToCDS` attribute to *true* in the `{apiRoot}/nrf-configuration/v1/nfManagementOptions` URI to enable Gzip compression for communication between the subscription microservice and CDS.
 - Set the value of `enableCompressionDiscToCDS` attribute to *true* in the `{apiRoot}/nrf-configuration/v1/nfDiscoveryOptions` URI to enable Gzip compression for communication between the discovery microservice and CDS.
 - Set the value of `enableCompressionCDSToCDS` attribute to *true* in the `{apiRoot}/nrf-configuration/v1/nrfGrowth/featureOptions` URI to enable Gzip compression for communication between the local CDS microservice and the remote CDS microservice.

For more details, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

- Enable using CNC Console:
 - Set the value of **Enable Compression For Subscription To CDS** parameter to *true* in the [NF Management Options](#) to enable Gzip compression for communication between the subscription microservice and CDS.
 - Set the value of **Enable Compression For Discovery To CDS** parameter to *true* in the [NF Discovery Options](#) to enable Gzip compression for communication between the discovery microservice and CDS.

- Set the value of **Enable Compression For CDS To CDS** parameter to *true* in the [NRF Growth Options](#) to enable Gzip compression for communication between the local CDS microservice and the remote CDS microservice.

Disable

Note

It is recommended not to disable this feature.

Helm

Perform the following steps to disable Gzip compression on CDS microservice as a server using Helm:

1. Open the `ocnrf_custom_values_26.1.201.yaml` file.
2. Verify that the value of `nrfcachedata.responseCompressionGzip` parameter to *false* to disable compression on CDS microservice.
For more information on the Helm parameters, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
3. Save the file.
4. Install NRF. For more information about the installation procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
5. Run the Helm upgrade if you are disabling this feature after NRF deployment. For more information about the upgrade procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Disable Using REST API or CNC Console

Perform the following steps to disable Gzip compression on client using REST API or CNC Console:

- Disable using REST:
 - Set the value of `enableCompressionSubToCDS` attribute to *false* in the `{apiRoot}/nrf-configuration/v1/nfManagementOptions` URI to disable Gzip compression for communication between the subscription microservice and CDS.
 - Set the value of `enableCompressionDiscToCDS` attribute to *false* in the `{apiRoot}/nrf-configuration/v1/nfDiscoveryOptions` URI to disable Gzip compression for communication between the discovery microservice and CDS.
 - Set the value of `enableCompressionCDSToCDS` attribute to *false* in the `{apiRoot}/nrf-configuration/v1/nrfGrowth/featureOptions` URI to disable Gzip compression for communication between the local CDS microservice and the remote CDS microservice.

For more details, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

- Disable using CNC Console:
 - Set the value of **Enable Compression For Subscription To CDS** parameter to *false* in the [NF Management Options](#) to disable Gzip compression for communication between the subscription microservice and CDS.

- Set the value of **Enable Compression For Discovery To CDS** parameter is *false* in the [NF Discovery Options](#) to disable Gzip compression for communication between the discovery microservice and CDS.
- Set the value of **Enable Compression For CDS To CDS** parameter is *false* in the [NRF Growth Options](#) to disable Gzip compression for communication between the local CDS microservice and the remote CDS microservice.

Observability

Metrics

There are no new metrics related to this feature.

Alerts

There are no new alerts related to this feature.

KPIs

There are no new KPIs related to this feature.

Maintain

If you encounter alerts at system or application levels, see the [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

1. Collect the logs: For more information on collecting logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. Raise a service request: See [My Oracle Support](#) for more information on how to raise a service request.

4.5 Simultaneous Support for HTTP and HTTPS Connections

In 5G networks, Network Functions (NFs) establish connections with NRF using either Hypertext Transfer Protocol (HTTP) or Hypertext Transfer Protocol Secure (HTTPS) which is the secured extension of HTTP. HTTPS uses Transport Layer Security (TLS) to encrypt the communication protocols and provides confidentiality and integrity protection to 5G Service Based Interface (SBI) messages.

Currently, NRF supports either HTTP or HTTPS connections with peer NFs for the incoming and outgoing traffic and does not support simultaneous HTTP and HTTPS connections.

With the implementation of this feature, NRF supports HTTP and HTTPS connections simultaneously with peer NFs for incoming (as in server) and outgoing (as in client) traffic.

The following table describes the supported connection types:

Table 4-5 Supported Connection Types

Connection Type	HTTP Only	HTTPS Only	Both (HTTP and HTTPS)
Incoming Connections	Supported	Supported	Supported
Outgoing Connections	Supported	Not supported	Supported

Managing the feature

Enable

This feature is disabled by default.

Perform the following steps to enable this feature using Helm:

1. Open the `ocnrf_custom_values_26.1.201.yaml` file.
2. Set the value of `global.enableIncomingHttp` and `global.enableIncomingHttps` parameters to `true` for the incoming traffic to use both HTTP and HTTPS connections. For more information on the Helm parameters, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
3. Set the value of `global.enableOutgoingHttps` parameter as `true` for the outgoing traffic to use both HTTP and HTTPS connections. For more information on the Helm parameters, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Table 4-6 Parameters Used for Supported Connection Type

Connection Type	HTTP Only	HTTPS Only	Both (HTTP and HTTPS)
Incoming Connections	<code>global.enableIncomingHttp=true</code> <code>global.enableIncomingHttps=false</code>	<code>global.enableIncomingHttp=false</code> <code>global.enableIncomingHttps=true</code>	<code>global.enableIncomingHttp=true</code> <code>global.enableIncomingHttps=true</code>
Outgoing Connections	<code>global.enableOutgoingHttps=false</code>	Not applicable	<code>global.enableOutgoingHttps=true</code>

4. Save the file.
5. Install NRF. For more information about the installation procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
6. Run the Helm upgrade if you are enabling this feature after NRF deployment. For more information about the upgrade procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Configure

Additionally, perform the following configurations only in Egress Gateway microservice for the outgoing traffic. For more information about the configuration, see [Egress Gateway Route Configuration for Different Deployments](#).

- **Configure using REST API:** Perform the following Egress Gateway configuration as described in `{apiRoot}/nrf/nf-common-component/v1/egw/routesconfiguration` in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
- **Configure using CNC Console:** Perform the following Egress Gateway configuration as described in [Routes Configuration](#).

Observability

Metrics

- The `oc_ingressgateway_connection_failure_total` metric is added in the [Ingress Gateway Metrics](#) section.

- The `oc_egressgateway_request_failure_total` metric is added in the [Egress Gateway Metrics](#) section.
- The following existing metrics in the [Ingress Gateway Metrics](#) section are used in this feature:
 - `oc_ingressgateway_http_requests_total`
 - `oc_ingressgateway_incoming_connections`
- The existing `oc_egressgateway_http_requests_total` metric in the [Egress Gateway Metrics](#) section is used in this feature.

Alerts

The following alerts are added in the [NRF Alerts](#) section:

- [OcnrfEgressGatewayFailureForHTTPRequests](#)
- [OcnrfIngressGatewayFailureForIncomingConnections](#)

KPIs

There are no KPIs related to this feature.

Maintain

If you encounter alerts at system or application levels, see the [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

1. **Collect the logs:** For more information on collecting logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.6 Pod Protection Using Rate Limiting

Pod Protection Using Rate Limiting comprises of the following features:

- Ingress Gateway Pod Protection Using Rate Limiting
- Egress Gateway Pod Protection Using Rate Limiting

For more information about these features and their processing, see the following sections:

- [Ingress Gateway Pod Protection Using Rate Limiting](#)
- [Egress Gateway Pod Protection Using Rate Limiting](#)

4.6.1 Egress Gateway Pod Protection Using Rate Limiting

The Egress Gateway microservice manages all outgoing traffic from Network Functions (NFs). The Egress Gateway microservice may become vulnerable due to overload conditions during unexpected traffic spikes, uneven traffic distribution, or bursts caused by network fluctuations. To ensure system stability and prevent potential network outages, a protection mechanism for the Egress Gateway microservice is necessary.

With the implementation of this feature, rate-limiting mechanism is applied for Egress Gateway pods. This mechanism allows to set a maximum number of requests that a pod can process. When the request rate exceeds the threshold, the pods take action to protect themselves. They either reject additional requests with a custom error code or allow them, depending on the

configuration. Each Egress Gateway pod has its own Pod Protection Policer, which is applied individually.

The Egress Gateway's configuration for this feature includes:

- **Fill Rate:** This sets the maximum number of requests a pod can handle in a defined time interval. It is also possible to allocate the specific percentage for various path or method combinations.
- **Error Code Profiles:** This allows to reject the requests with a predefined error code profile.
- **Congestion Configuration:** This allows to configure the congestion levels based on CPU resource utilization.
- **Default Priority:** This allows to configure the priority for different routes.
- **Denied Request Actions:** This defines the action to be taken when the fill rate is exceeded. This action is based on the priority defined in the denied request actions and the action configured. The possible options for action are 'CONTINUE', which allows requests to be processed, or 'REJECT', which rejects requests with a specified error code. Egress Gateway will reject all the requests which exceeds the fill rate unless specific 'CONTINUE' action is defined in the denied request actions.

The fill rate represents the maximum number of requests a pod can handle when traffic is uniformly distributed within a span of one second interval. However, in bursty traffic scenarios where the traffic is not uniformly distributed within a span of one second interval, even if the average traffic received is within the fill rate, still traffic failure may be expected.

Congestion level is checked in a fixed interval (`congestionconfig.refreshInterval`) and the action will be decided based on the congestion level in that interval. It is possible that the CPU levels might toggle between these intervals causing the congestion levels to switch frequently. To know the detected congestion level, see the metric `oc_egressgateway_congestion_level_bucket_total`.

The following table describes NRF's configuration for different congestion levels for Egress Gateway pods:

Table 4-7 Congestion Levels of Pods

Level Value	Abatement Threshold	Onset Threshold	Level Name	Description
1	58	65	Normal	The default congestion level of pod is "0". The pod moves from Normal to default when the CPU is less than the abatement of Normal (58). The pod moves from default to Normal state when the CPU exceeds onset of Normal (65). The pod moves from Danger of Congestion to Normal state, when the CPU is less than abatement of Danger of Congestion (70).
2	70	75	Danger of Congestion	The pod moves from Danger of Congestion to Normal, when the CPU is less than abatement of Danger of Congestion (70). The pod moves from Normal to Danger of Congestion state when the CPU exceeds onset of Danger of Congestion (75). The pod moves from Congested to Danger of Congestion when the CPU is less than abatement of Congested (80).

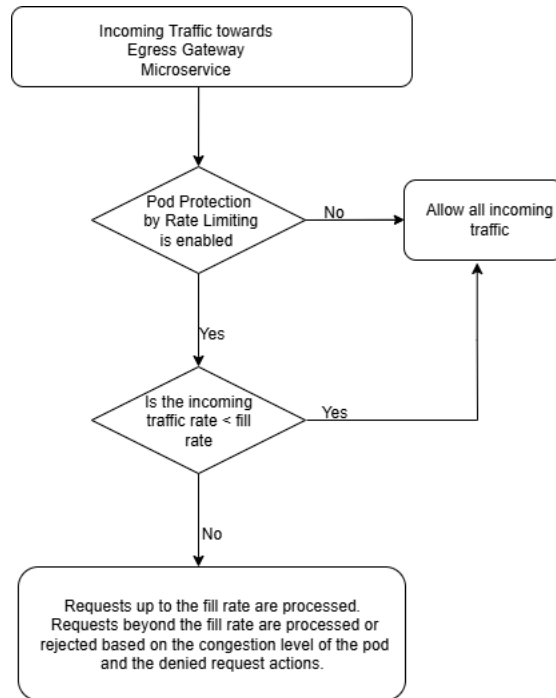
Table 4-7 (Cont.) Congestion Levels of Pods

Level Value	Abatement Threshold	Onset Threshold	Level Name	Description
3	80	85	Congested	The pod moves from Congested to Danger of Congestion when the CPU is less than abatement of Congested (80). The pod moves from Danger of Congestion to Congested state when the CPU exceeds onset of Congested (85).

Note

- If the current level is at L3 (Congested with onset value of 85) and the CPU value is 66, the level would be marked as L1 (Normal). The abatement value is considered only when the switching is between the adjacent levels (L2 (Danger of Congestion) to L1 (Normal) and L3 (Congested) to L2 (Danger of Congestion)).
- When NRF Discovery microservice receives an overload response from Egress Gateway microservice, it does not retry or re-route this request. An error response will be generated based on the specific feature configurations like NRF Forwarding, Subscriber Location Function, and Roaming.
- Egress Gateway microservice performs routes validation before applying any other gateway service filters. Consequently, requests that don't match a valid route in routesConfig in REST are not subject to rate limiting. NRF has always a default route configured. Unless the routes are not explicitly removed, all the EGW messages will go through rate limiting. For more details on routesConfig, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

The following diagram explains the Egress Gateway Pod Protection Using Rate Limiting mechanism:

Figure 4-2 Egress Gateway Pod Protection Using Rate Limiting

1. NRF send traffic to the Egress Gateway microservice.
2. Egress Gateway pod checks if the Pod Protection Using Rate Limiting feature is enabled or not.
 - a. If the feature is enabled, Egress Gateway compares the outgoing traffic rate with the fill rate that is defined for the rate limiting feature.
 - If the outgoing request rate is below the fill rate, all the outgoing traffic are processed.
 - If the outgoing request rate exceeds the fill rate, requests up to the fill rate are processed. The requests beyond the fill rate are processed or rejected based on the congestion level of the pod and the denied request actions (priority and action defined). If there is no priority defined in the denied request actions all the requests will be rejected.
 - At default or Normal congestion levels all the requests are processed.
 - At Danger of Congestion, the requests with the defined priority (1-2) traffic are processed.
 - At Congested level, only the highest priority traffic (priority 1) is processed; lower-priority traffic is rejected.

Examples

Consider the following configuration for the `{apiRoot}/nrf/nf-common-component/v1/egw/podProtectionByRateLimiting` API:

```
{
  "enabled": true,
  "fillRate": 2700,
```

```

"routes": [
  {
    "id": 1,
    "methods": [
      "GET"
    ],
    "path": "/nudr-group-id-map/v1/nf-group-ids",
    "percentage": 70,
    "defaultPriority": 3
  },
  {
    "id": 2,
    "methods": [
      "GET"
    ],
    "path": "/nnrf-disc/v1/nf-instances",
    "percentage": 4,
    "defaultPriority": 2
  },
  {
    "id": 3,
    "methods": [
      "POST"
    ],
    "path": "/nnrf-nfm/v1/subscriptions",
    "percentage": 3,
    "defaultPriority": 2
  },
  {
    "id": 4,
    "methods": [
      "POST"
    ],
    "path": "/oauth2/token",
    "percentage": 3,
    "defaultPriority": 2
  },
  {
    "id": 5,
    "methods": [
      "GET"
    ],
    "path": "/nnrf-nfm/v1/nf-instances/**",
    "percentage": 10,
    "defaultPriority": 2
  },
  {
    "id": 6,
    "methods": [
      "POST"
    ],
    "path": "/*",
    "percentage": 10,
    "defaultPriority": 1
  }
],

```

```

"errorCodeProfile": "error429",
"deniedRequestActions": [
  {
    "id": 1,
    "congestionLevel": 0,
    "action": "CONTINUE"
  },
  {
    "id": 2,
    "congestionLevel": 1,
    "action": "CONTINUE"
  },
  {
    "id": 3,
    "priority": "1-2",
    "congestionLevel": 2,
    "action": "CONTINUE"
  },
  {
    "id": 4,
    "priority": "1",
    "congestionLevel": 3,
    "action": "CONTINUE"
  }
],
"priorityHeaderName": "3gpp-Sbi-Message-Priority",
"defaultPriority": 24
}

```

Any requests which are not matching with the action configured and the priority level configured in the denied request actions are rejected.

For example, in congestion level 2, requests other than priority 1 and 2 are candidates for rejection. Similarly for congestion level 3, requests other than priority 1 are candidates for rejection. There is no need for defining rejection explicitly for these actions.

In the above configuration, the total fill rate is set to 2,700. The individual route definitions are as follows:

- Route Id 1: 70% allocation (1890 out of 2700), priority 3
- Route Id 2: 4% allocation (108 out of 2700), priority 2
- Route Id 3: 3% allocation (81 out of 2700), priority 2
- Route Id 4: 3% allocation (81 out of 2700), priority 2
- Route Id 5: 10% allocation (270 out of 2700), priority 2
- Route Id 6: 10% allocation (270 out of 2700), priority 1

Example 1-Handling TPS of 2835 in Danger of Congestion Mode

If the incoming Transactions Per Second (TPS) is 2835, this exceeds the configured fill rate by 135 requests. As a result, the system enters a "Danger of Congestion" state.

Request distribution details:

- Route Ids 2, 3, 4, and 6 receive incoming TPS equal to their allocated fill rates. Therefore, all requests for these routes are accepted and processed:

- Route Id 2: 108 requests (4%)
- Route Id 3: 81 requests (3%)
- Route Id 4: 81 requests (3%)
- Route Id 6: 270 requests (10%)
- Route Id 5 receives 135 requests, which is less than its allocated fill rate of 270 requests (10%). As such, all 135 requests are accepted for processing.
- Route Id 1 receives 2160 requests, exceeding its allocation of 1890 requests (70%). The system initially accepts up to the allocated 1,890 requests for processing. Since Route Id 5 processed fewer requests than its allocation (135 instead of 270), the unused capacity (135 requests) is applied to Route Id 1, allowing a total of 2025 requests for processing on this route.
- The remaining 135 requests from Route Id 1 are rejected, as the configured fill rate is already met and Route Id 1 has the lowest priority (priority 3). According to the specified congestion management policy, requests with priority 3 are rejected at congestion level 2.

Example 2- Handling TPS of 2970 in Congested Mode

When the incoming Transactions Per Second (TPS) reaches 2970, it exceeds the fill rate of 2700 by 270 requests. The system enters Congested mode.

Route processing details

- Route Id 2 receives 108 requests, corresponding to the defined 4%. All 108 requests are accepted for processing.
- Route Id 3 receives 81 requests, which meets the defined 3%. All 81 requests are processed.
- Route Id 4 also receives 81 requests, equaling the defined 3%. All requests are processed.
- Route Id 5 receives 270 requests, aligning with the defined 10%. All 270 requests are allowed.
- Route Id 6 receives 540 requests, exceeding the defined 10%. However, since Route Id 6 has the highest default priority (priority 1) and the denied action request is set to CONTINUE for this priority, all 540 requests are processed.
- Route Id 1 receives 1890 requests, meeting the defined 70% allocation. Due to lower priority (priority 3) under congestion, only 1620 requests are accepted, and the remaining 270 requests are rejected.

Managing the feature

Prerequisite

① Note

This feature is disabled by default. It is recommended to enable the Egress Gateway Pod Protection Using Rate Limiting feature over the Egress Gateway Pod Throttling feature. The Egress Gateway Pod Throttling feature will be deprecated in the upcoming releases. You must disable the Egress Gateway Pod Throttling feature if enabled by performing a Helm upgrade before proceeding to enable this feature. For more information about disabling the existing Egress Gateway Pod Throttling feature, see [Egress Gateway Pod Throttling](#).

This feature uses the following Helm parameters which are preconfigured with the required details:

- `global.egwGeneratedErrorCheckDuringOverLoad`
- `global.egwResponseCodesDuringOverLoad`
- `global.noRetryDuringEgwOverload`

For more information about the above parameters, see the "Global Parameters" section in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Configure

- **Configure using REST API:** Perform the following configurations for this feature:
 - Configure the Error code profile using the `{apiRoot}/nrf/nf-common-component/v1/egw/errorcodeprofiles` API.
 - Configure the congestion level of the pods based on CPU using the `{apiRoot}/nrf/nf-common-component/v1/egw/congestionConfig` API.

For more information about these APIs, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

- **Configure using CNC Console:**
 - Configure the Error code Profiles, as described in [Error Code Profile](#).
 - Create or update the Congestion Level Configuration, as in [Congestion Level Configuration](#).

Enable

- **Enable using REST API:** Configure the attributes in the `{apiRoot}/nrf/nf-common-component/v1/egw/podProtectionByRateLimiting` API to enable the feature. For more information about this API, see "Pod Protection By Rate Limiting" in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Enable using CNC Console:** Configure the parameters as mentioned in [Pod Protection By Rate Limiting](#).

Note

Use the recommended values in the above configuration to enable this feature.

Observability

Metrics

The following metrics are added for this feature:

- `oc_egressgateway_http_request_ratelimit_values_total`
- `oc_egressgateway_http_request_ratelimit_reject_chain_duration_histogram_seconds[suffix]`
- `oc_egressgateway_http_request_ratelimit_reject_chain_length_histogram[suffix]`
- `oc_egressgateway_http_request_ratelimit_denied_count_total`
- `oc_egressgateway_congestion_cpu_state`

- `oc_egressgateway_congestion_system_state`
- `oc_egressgateway_system_state_duration_percentage`
- `oc_egressgateway_congestion_level_total`
- `oc_egressgateway_congestion_level_group_total`
- `oc_egressgateway_congestion_cpu_percentage_[suffix]`

For more information about the metrics, see [Egress Gateway Metrics](#).

Alerts

The following alerts are added in the [Egress Gateway Pod Protection Using Rate Limiting](#) section:

- [OcnrfEgressDiscardDueToRateLimitMajorThreshold](#)
- [OcnrfEgressDiscardDueToRateLimitCriticalThreshold](#)
- [Table 6-784](#)
- [Table 6-785](#)

KPIs

The following KPIs are added for this feature:

- Allowed Requests
- Reject Chain Length
- Discard Action
- Congestion Level
- Congestion Level Bucket

For more information about KPIs, see [Egress Gateway Pod Protection Using Rate Limiting](#).

Maintain

If you encounter alerts at system or application levels, see the [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

1. Collect the logs: For more information on collecting logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. Raise a service request: See [My Oracle Support](#) for more information on how to raise a service request.

4.6.2 Ingress Gateway Pod Protection Using Rate Limiting

The Ingress Gateway microservice manages all incoming traffic from Network Functions (NFs). The Ingress Gateway microservice may become vulnerable due to overload conditions during unexpected traffic spikes, uneven traffic distribution, or bursts caused by network fluctuations. To ensure system stability and prevent potential network outages, a protection mechanism for the Ingress Gateway microservice is necessary.

With the implementation of this feature, rate-limiting mechanism is applied for Ingress Gateway pods. This mechanism allows to set a maximum number of requests that a pod can process. When the request rate exceeds the threshold, the pods take action to protect themselves. They either reject additional requests with a custom error code or allow them, depending on the

configuration. Each Ingress Gateway pod has its own Pod Protection Policier, which is applied individually.

The Ingress Gateway's configuration for this feature includes:

- **Fill Rate:** This sets the maximum number of requests a pod can handle in a defined time interval. It is also possible to allocate the specific percentage for various path or method combinations.
- **Error Code Profiles:** This allows to reject the requests with a predefined error code profile.
- **Congestion Configuration:** This allows to configure the congestion levels based on CPU resource utilization.
- **Denied Request Actions:** This defines the action to be taken when the fill rate is exceeded. The options are 'CONTINUE', which allows requests to be processed, or 'REJECT', which rejects requests with a specified error code. Ingress Gateway will reject all the requests which exceeds the fill rate unless specific 'CONTINUE' action is defined in the denied request actions.

The fill rate represents the maximum number of requests a pod can handle when traffic is uniformly distributed within a span of one second interval. However, in bursty traffic scenarios where the traffic is not uniformly distributed within a span of one second interval, even if the average traffic received is within the fill rate, still traffic failure may be expected.

Congestion level is checked in a fixed interval (`congestionconfig.refreshInterval`) and the action will be decided based on the congestion level in that interval. It is possible that the CPU levels might toggle between these intervals causing the congestion levels to switch frequently. To know the detected congestion level, see the metric `oc_ingressgateway_congestion_level_bucket_total`.

The following table describes NRF's configuration for different congestion levels for Ingress Gateway pods:

Table 4-8 Congestion Levels of Pods

Level Value	Abatement Threshold	Onset Threshold	Level Name	Description
1	58	65	Normal	The default congestion level of pod is "0". The pod moves from Normal to default when the CPU is less than the abatement of Normal (58). The pod moves from default to Normal state when the CPU exceeds onset of Normal (65). The pod moves from Danger of Congestion to Normal state, when the CPU is less than abatement of Danger of Congestion (70).

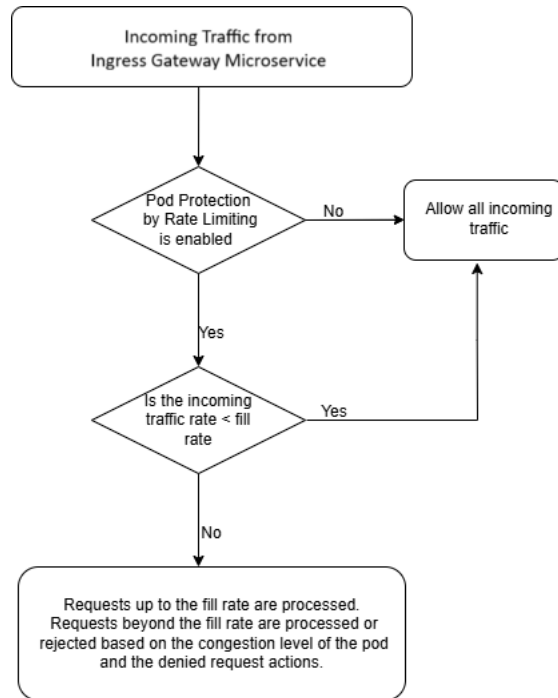
Table 4-8 (Cont.) Congestion Levels of Pods

Level Value	Abatement Threshold	Onset Threshold	Level Name	Description
2	70	75	Danger of Congestion	The pod moves from Danger of Congestion to Normal, when the CPU is less than abatement of Danger of Congestion (70). The pod moves from Normal to Danger of Congestion state when the CPU exceeds onset of Danger of Congestion (75). The pod moves from Congested to Danger of Congestion when the CPU is less than abatement of Congested (80).
3	80	85	Congested	The pod moves from Congested to Danger of Congestion when the CPU is less than abatement of Congested (80). The pod moves from Danger of Congestion to Congested state when the CPU exceeds onset of Congested (85).

Note

- If the current level is at L3 (Congested with onset value of 85) and the CPU value is 66, the level would be marked as L1 (Normal). The abatement value is considered only when the switching is between the adjacent levels (L2 (Danger of Congestion) to L1 (Normal) and L3 (Congested) to L2 (Danger of Congestion)).
- When NRF rejects the requests, it is expected that the consumer NFs reroute to alternate NRFs.
- Ingress Gateway microservice rate limiting only applies to signaling messages and does not impact internal messages, such as requests from perf-info to Ingress Gateway microservice, message copy requests.
- Ingress Gateway microservice performs routes validation before applying any other gateway service filters. Consequently, requests that don't match a valid route in routesConfig in Helm are not subject to rate limiting. For more details on routesConfig, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

The following diagram explains the Ingress Gateway Pod Protection Using Rate Limiting mechanism:

Figure 4-3 Ingress Gateway Pod Protection Using Rate Limiting

1. Consumer NFs send traffic to the Ingress Gateway microservice.
2. Ingress Gateway pod checks if the Pod Protection Using Rate Limiting feature is enabled or not.
 - a. If the feature is enabled, Ingress Gateway compares the incoming traffic rate with the fill rate that is defined for the rate limiting feature.
 - i. If the incoming request rate is below the fill rate, all the incoming traffic are processed.
 - ii. If the incoming request rate exceeds the fill rate, requests up to the fill rate are processed. The requests beyond the fill rate are processed or rejected based on the congestion level of the pod and the denied request actions.

Consider the following examples:

- if fillRate is configured as 1000,
 - if the incoming Transaction Per Second (TPS) is 1100, congestionLevel is Normal, and action is configured as CONTINUE, all the 1100 requests are processed.
 - if the incoming TPS is 1300, congestionLevel is Danger of Congestion, and action is configured as CONTINUE, all the 1300 requests are processed.
 - if the incoming TPS is 1500, congestionLevel is Congested, and action is configured as REJECT, 1000 requests are processed successfully and the 500 requests are rejected with the configured error code.
- if two routes, id1 configured with 30 percentage and id2 with 70 percentage, and fillRate is configured as 1000,
 - if the incoming TPS is 1100, congestionLevel is Normal, and action is configured as CONTINUE, all the 1100 requests are processed.

- if the incoming TPS is 1300, fill rate is 1000, congestionLevel is Danger of Congestion, and action is configured as CONTINUE, all requests are processed successfully.
- if the incoming TPS is 1500, congestionLevel is Congested, and action is configured as REJECT, 300 requests from route id1 is processed and 700 requests from route id2 is processed, and 500 remaining TPS will be rejected.

Managing the feature

Prerequisites

Note

It is recommended to enable the Ingress Gateway Pod Protection Using Rate Limiting feature over the Ingress Gateway pod protection feature. The [Ingress Gateway Pod Protection](#) feature will be deprecated in the upcoming releases. You must disable the Ingress Gateway Pod Protection before proceeding to this feature. For more information about disabling the existing pod protection feature, see [Ingress Gateway Pod Protection](#).

Configure

- **Configure using REST API:** Perform the following configurations for this feature:
 - Configure the Error code profile using the `{apiRoot}/nrf/nf-common-component/v1/igw/errorcodeprofiles` API.
 - Configure the congestion level of the pods based on CPU using the `{apiRoot}/nrf/nf-common-component/v1/igw/congestionConfig` API. For more information about these APIs, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Configure using CNC Console:**
 - Configure the Error code Profiles, as described in [Error Code Profile](#).
 - Create or update the Congestion Level Configuration, as in [Congestion Level Configuration](#).

Enable

- **Enable using REST API:** Configure the attributes in the `{apiRoot}/nrf/nf-common-component/v1/igw/podProtectionByRateLimiting` API to enable the feature. For more information about this API, see "Pod Protection By Rate Limiting" in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Enable using CNC Console:** Configure the parameters as mentioned in [Pod Protection By Rate Limiting](#).

Note

Use the recommended values in the above configuration to enable this feature.

Observability

Metrics

The following metrics are added for this feature:

- `oc_ingressgateway_http_request_ratelimit_values_total`
- `oc_ingressgateway_http_request_ratelimit_reject_chain_duration_histogram_seconds_[suffix]`
- `oc_ingressgateway_http_request_ratelimit_reject_chain_length_histogram_[suffix]`
- `oc_ingressgateway_http_request_ratelimit_denied_count_total`
- `oc_ingressgateway_congestion_cpu_state`
- `oc_ingressgateway_congestion_system_state`
- `oc_ingressgateway_system_state_duration_percentage`
- `oc_ingressgateway_congestion_level_total`
- `oc_ingressgateway_congestion_level_group_total`
- `oc_ingressgateway_congestion_cpu_percentage_[suffix]`

For more information about the metrics, see [Ingress Gateway Metrics](#).

Alerts

The following alerts are added in the [Ingress Gateway Pod Protection Using Rate Limiting](#) section.

- [OcnrlIngressDiscardDueToRateLimitMajorThreshold](#)
- [OcnrlIngressDiscardDueToRateLimitCriticalThreshold](#)

KPIs

The following KPIs are added for this feature:

- Allowed Request Rate Per Route Id
- Total Rejections Chain Length
- Discard Request Action Traffic Rate
- Congestion Level Bucket
- Congestion Level

For more information about KPIs, see [Ingress Gateway Pod Protection Using Rate Limiting](#).

Maintain

If you encounter alerts at system or application levels, see the [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

1. **Collect the logs:** For more information on collecting logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.7 NF Profile Size Limit

The `Nnrf_NFManagement` service allows an NF to register, update, or deregister its profile in the NRF. The NF Profile consists of general parameters of the NF Instance and also the parameters of the different NF service instances exposed by the NF Instance. NRF uses the registered profiles for service operations like `NfListRetrieval`, `NfProfileRetrieval`, `NfDiscover`, and `NfAccessToken`. It is observed that when the size of the NF Profile registered is large, the performance of these service operations degrades due to increased processing time of larger profiles and can cause higher resource utilization and latency.

This feature allows to specify the maximum limit of the NF Profile size that can be registered with NRF. The NF Profile size is evaluated during the `NFRegister` or `NFUpdate` service operation, and if the size is within the configured maximum limit, the service operation is allowed. If the profile size breaches the configured thresholds, the service operation gets rejected.

NRF behavior for each of the service operations is defined as follows:

- **NFRegister or NFUpdate (PUT):**
 - NRF receives the NF Profile from the NF and evaluates the size of the NF Profile against the configured maximum allowed size.
 - The `NFRegister` or `NFUpdate` service operation succeeds if the NF Profile size is below the configured size.
 - If the size of the NF Profile has breached the configured size, the `NFRegister` or `NFUpdate` service operation fails with a configurable error response.
- **NFUpdate (Partial Update):**

NRF receives the update that the NF wishes to apply on NF Profiles registered at NRF. NRF evaluates the size of the NF Profile after applying the updates on registered `nfProfile`.

If the size of the NF Profile is below the configured size, the `NFUpdate` service operation succeeds.

If the size of the NF Profile has breached the configured size, the `NFUpdate` service operation fails with a configurable error response.
- **NFHeartBeat:**

`NfProfile` size is not evaluated for `NFHeartbeat` service operation. The NFs can continue to Heartbeat even if their profile size has breached the threshold. This can occur only if the bigger profile was registered before enabling the feature.

The `ocnrf_nfProfile_size_limit` metric shows the size of the `nfProfile` registered at NRF. The size of the `nfProfile` is calculated as per the payload received while registering or updating the `nfProfile`.

Calculating NF Profile Size

To calculate the size of the `nfProfiles` payload before registering or updating it, use the following steps:

1. Save the profile payload in a text file without spaces.
2. Verify the size of the `nfProfile` payload using Linux tools like `wc`.

For example, consider the below payload:

```
{
  "nfInstanceId": "ae137ab7-740a-46ee-aa5c-951806d77b0d",
  "nfType": "BSF",
  "nfStatus": "REGISTERED",
  "heartBeatTimer": 30,
  "plmnList": [
    {
      "mcc": "310",
      "mnc": "14"
    }
  ],
  "sNssais": [
    {
      "sd": "4eaaab",
      "sst": 124
    },
    {
      "sd": "daaac8",
      "sst": 54
    },
    {
      "sd": "f4aaa6",
      "sst": 73
    }
  ],
  "nsiList": [
    "slice-1",
    "slice-2"
  ],
  "fqdn": "BSF.oracle.com",
  "interPlmnFqdn": "BSF.oracle.com",
  "ipv4Addresses": [
    "192.168.2.100",
    "192.168.3.100",
    "192.168.2.110",
    "192.168.3.110"
  ],
  "ipv6Addresses": [
    "2001:0db8:85a3:0000:0000:8a2e:0370:7334"
  ],
  "capacity": 2000,
  "load": 0,
  "locality": "US East",
  "bsfInfo": {
    "ipv4AddressRanges": [
      {
        "start": "192.168.0.0",
        "end": "192.168.0.100"
      }
    ],
    "ipv6PrefixRanges": [
      {
        "start": "2001:db8:8513::/48",
        "end": "2001:db8:8513::/96"
      }
    ],
    "dnnList": [
      "abc",
      "DnN-OrAcLe-32",
      "ggsn-cluster-A.mnc012.mcc345.gprs",
      "lemon"
    ]
  },
  "nfServiceList": {
    "ae137ab7-740a-46ee-aa5c-951806d77b0d": {
      "serviceInstanceId": "ae137ab7-740a-46ee-aa5c-951806d77b0d",
      "serviceName": "nbsf-management",
      "versions": [
        {
          "apiVersionInUri": "v1",
          "apiFullVersion": "1.0.0",
          "expiry": "2018-12-03T18:55:08.871Z"
        }
      ],
      "scheme": "http",
      "nfServiceStatus": "REGISTERED",
      "fqdn": "BSF.oracle.com",
      "interPlmnFqdn": "BSF.oracle.com",
      "apiPrefix": "",
      "capacity": 500,
      "load": 0,
      "supportedFeatures": "80000000"
    }
  }
}
```

For the above nfProfile, the size is calculated as 1177 bytes.

```
$ cat bsf.txt |wc -c
1177
```

Note

- The `{apiRoot}/nrf-configuration/v1/nfManagementOptions` API allows to configure the maximum size of the profile per `nfType`. If not configured for a specific `nfType`, the evaluation is performed using `"ALL_NF_TYPES"`. This is a mandatory configuration.
- The calculated total size of the `NfProfile` may vary due to updates made by the NRF. The size is determined based on the profile after the NRF has applied its modifications. For instance, the NRF may update certain attributes such as `expiry`, which follow a timestamp format.

Managing the feature

Enable

- **Enable Using REST API:** Set the value of `featureStatus` to `ENABLED` in the `{apiRoot}/nrf-configuration/v1/nfManagementOptions` URI. For more details, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Enable Using CNC Console:** Set the value of **Feature Status** to **ENABLED** in the [NF Management Options](#).

Observability

Metrics

The `ocnrf_nfProfile_size_limit_breached` metric is added in the [NRF NF Metrics](#) section.

Alerts

There are no alerts introduced for this feature.

KPIs

The "NF Profile Size Limit Breached" KPI is added in the [NRF Service KPIs](#) section.

Maintain

If you encounter alerts at system or application levels, see the [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

1. **Collect the logs:** For more information on collecting logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.8 Egress Gateway Pod Throttling

Note

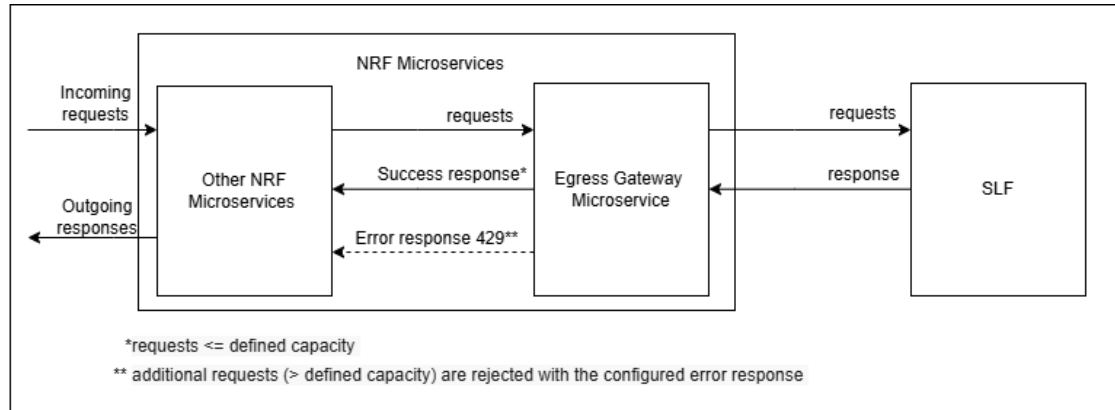
NRF recommends to enable the Egress Gateway Pod Protection Using Rate Limiting feature over the Egress Gateway Pod Throttling feature. The Egress Gateway Pod Throttling feature will be deprecated in the upcoming releases. For more information about enabling the Egress Gateway Pod Protection Using Rate Limiting feature, see [Egress Gateway Pod Protection Using Rate Limiting](#).

Egress Gateway microservice handles all the outgoing traffic from NRF to other NFs. In the event of unexpected high traffic, uneven traffic distribution, or traffic bursts due to network fluctuations, the Egress Gateway pods may get overloaded. This further may impact the system latency and performance. It is required to protect the Egress Gateway microservice from these conditions to prevent high impact on the outgoing traffic.

With the implementation of this feature, each Egress Gateway pod monitors its incoming traffic and if the traffic exceeds the defined capacity, the excess traffic is not processed and gets rejected. The traffic capacity is applied at each pod and applicable to all the incoming requests irrespective of the message type.

Egress Gateway Pod Throttling Mechanism

The following image describes the pod throttling mechanism when the requests received from NRF microservices like NFDDiscovery, NFRegistration, NFSubscription, and NFAccessToken exceeds the defined capacity in Egress Gateway microservice.

Figure 4-4 Egress Gateway Pod Throttling Mechanism

1. NRF microservice sends the requests to the Egress Gateway microservice.
2. Egress Gateway microservice evaluates the number of requests received from the other NRF microservices:
 - a. If the number of incoming requests are 2500 and the maximum defined limit is 2700, then Egress Gateway microservice processes all the 2500 requests.
 - b. If the number of incoming requests are 3000 and the maximum defined limit is 2700, then Egress Gateway microservice processes only 2700 requests, and rejects the additional 300 requests with response code 429 to the NRF microservice.

Note: When NRF Discovery microservice receives an overload response from Egress Gateway microservice, it does not retry or re-reroute this request. An error response will be generated based on the specific feature configurations like NRF Forwarding, Subscriber Location Function, and Roaming.

Managing the Egress Gateway Pod Throttling

Enable

This feature can be enabled or disabled at the time of NRF deployment using the following Helm Parameters:

Perform the following configuration to enable this feature using the Helm:

1. Open the `ocnrf_custom_values_26.1.201.yaml` file.
2. Set the value of `egress-gateway.podLevelMessageThrottling.enabled` to `true` under Egress Gateway Microservice parameters section.

Note

This feature also uses the following parameters which are read-only:

- `egress-gateway.podLevelMessageThrottling.duration`
- `egress-gateway.podLevelMessageThrottling.requestLimit`
- `global.egwGeneratedErrorCheckDuringOverLoad`
- `global.egwResponseCodesDuringOverLoad`
- `global.noRetryDuringEgwOverload`

For more information about the above parameters, see the "Egress Gateway Microservice" and "Global Parameters" sections in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

3. Save the file.
4. Install NRF. For more information about installation procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
5. Run Helm upgrade, if you are enabling this feature after NRF deployment. For more information about upgrade procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Disable

This feature can be disabled using the following Helm Parameter:

Perform the following configuration to disable this feature using Helm:

1. Open the `ocnrf_custom_values_26.1.201.yaml` file.
2. Set the value of `egress-gateway.podLevelMessageThrottling.enabled` to *false* under the Egress Gateway Microservice parameters section. For more information about the parameter, see the "Egress Gateway Microservice" and "Global Parameters" sections in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
3. Save the file.
4. Install NRF. For more information about installation procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
5. Run Helm upgrade, if you are enabling this feature after NRF deployment. For more information about upgrade procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Observability**Metrics**

Following metrics are added in the [Egress Gateway Metrics](#) section:

- `oc_egressgateway_podlevel_throttling_allowed_total`
- `oc_egressgateway_podlevel_throttling_discarded_total`

The `route_id` dimension is added in [NRF Metrics](#).

Alerts

Following alerts are added in the [Egress Gateway Pod Throttling](#) section:

- [OcnrfEgressPerPodDiscardRateAboveMajorThreshold](#)
- [OcnrfEgressPerPodDiscardRateAboveCriticalThreshold](#)

For more information about alerts, see [NRF Alerts](#) section.

KPIs

Added the Egress Gateway Pod Throttling KPI in the [Egress Gateway Pod Throttling](#) section.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alert persists, perform the following:

1. **Collect the logs and Troubleshooting Scenarios:** For more information on how to collect logs and troubleshooting information, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.9 Traffic Segregation

This feature provides an option for traffic segregation at NRF based on traffic types. Within a Kubernetes cluster, traffic segregation can divide applications or workloads into distinct sections such as Operations Administration and Maintenance (OAM), Service Based Interface (SBI), Kubernetes control traffic, and so on. The Multus Container Network Interface (CNI) plugin for Kubernetes enables attaching multiple network interfaces to pods to help segregate traffic to/from NRF edge microservices like Ingress and Egress Gateway microservices.

This feature addresses the challenge of logically separating IP traffic of different traffic types, which are typically handled through a single network (Kubernetes overlay). The new functionality ensures that critical networks are not cross-connected or sharing the same routes, thereby preventing network congestion.

The feature requires configuration of separate networks, Network Attachment Definitions (NADs), and the Cloud Native Load Balancer (CNLB). These configurations are crucial for facilitating Ingress/Egress gateway traffic segregation, and optimizing load distribution in NRF.

Note

The Traffic Segregation feature is only available in NRF if OCCNE is installed with CNLB.

Cloud Native Load Balancer (CNLB)

CNE provides CNLB for managing the ingress and egress network as an alternate to the existing Load Balancing of Virtual Machine (LBVM), lb-controller, and egress-controller solutions. You can enable or disable this feature only during a fresh CNE installation. When this feature is enabled, CNE automatically uses CNLB to control ingress traffic. To manage the

egress traffic, you must preconfigure the egress network details in the `cnlb.ini` file before installing CNE.

For more information about enabling and configuring CNLB, see *Oracle Communications Cloud Native Core, Cloud Native Environment User Guide, and Oracle Communications Cloud Native Core, Cloud Native Environment Installation, Upgrade, and Fault Recovery Guide*.

Network Attachment Definitions for CNLB

A Network Attachment Definition (NAD) is a resource used to set up a network attachment, in this case, a secondary network interface to a pod. NRF supports two types of CNLB NADs:

1. Ingress Network Attachment Definitions

Ingress NADs are used to handle inbound traffic only. This traffic enters the CNLB application through an external interface service IP address and is routed internally using interfaces within CNLB networks.

Naming Convention: `nf-<service_network_name>-int`

2. Egress Only Network Attachment Definitions

Egress Only NADs enable outbound traffic only. An NRF Egress Gateway pod can initiate traffic and route it through a CNLB application, translating the source IP address to an external egress IP address. An egress NAD contains network information to create interfaces for NRF Egress Gateway pods and routes to external subnets.

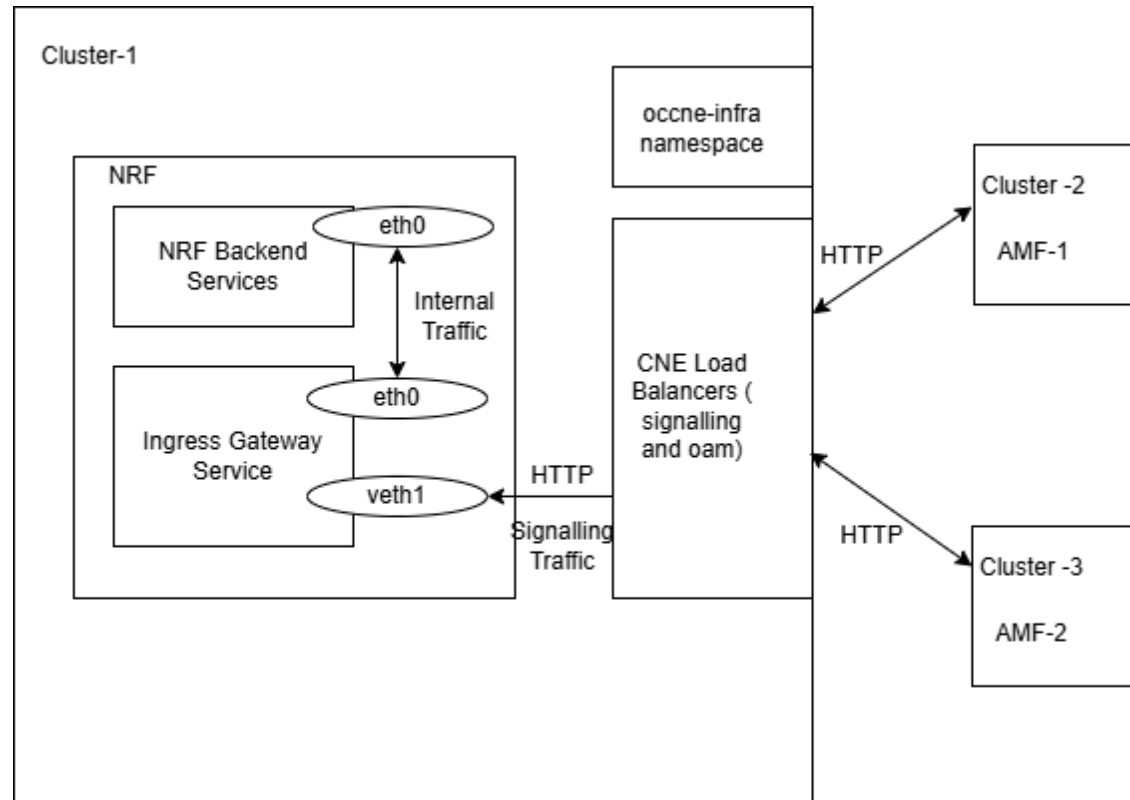
- Prerequisites:

- Ingress NADs are already created for the desired internal networks.
- Destination (egress) subnet addresses are known beforehand and defined under the `cnlb.ini` file's `egress_dest` variable to generate NADs.
- The use of an Egress NAD on a deployment can be combined with Ingress NADs to route traffic through specific CNLB apps.

- Naming Convention: `nf-<service_network_name>-egr`

Ingress Traffic Segregation

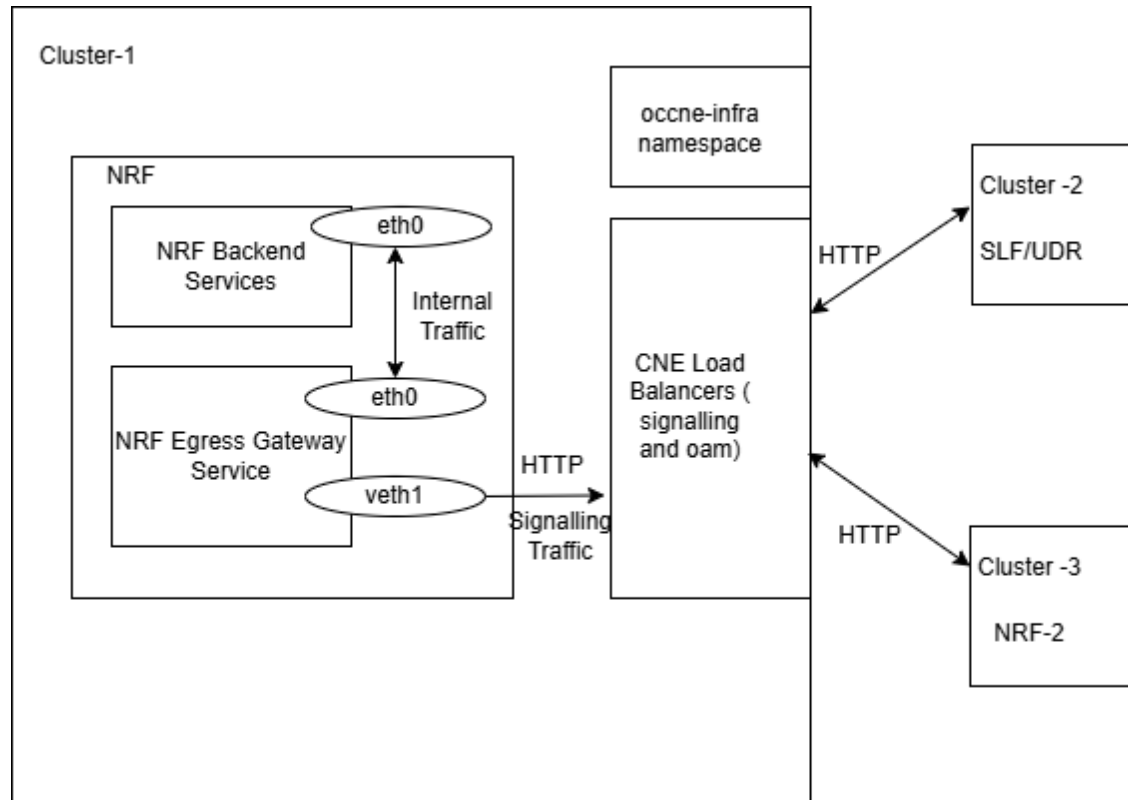
The following image describes the traffic segregation at Ingress Gateway.

Figure 4-5 Ingress Traffic Segregation

Here AMF-1 and AMF-2 send messages to the Ingress Gateway of the NRF. Internal traffic between NRF Backend and the Ingress Gateway travels through the default interface, eth0, which is connected to the pods. The signaling traffic between AMF-1 and NRF, as well as between AMF-2 and NRF, travels through a new interface, veth1, created using the Multus plugin. The Ingress service IPs and ports will be set up in Cloud Native Load Balancers (CNLBs), which will direct traffic to the Ingress Gateway. This gateway will then handle the requests and route them to the NRF.

Egress Traffic Segregation

The following image describes the traffic segregation at Egress Gateway.

Figure 4-6 Egress Traffic Segregation

Here NRF is connected to SLF and another NRF, which are on different PLMNs and different networks. Internal traffic between NRF Backend and the NRF Egress Gateway passes through the default interface, eth0, which is connected to the pods. The signaling traffic between NRF and SLF, as well as between NRF and NRF-2, travels through a new interface, veth1, created using the Multus plugin. Egress IPs will be defined at the CNLBs, which will perform Source Network Address Translation (SNAT) on the IP addresses in requests sent to SLF and NRF-2.

Managing Traffic Segregation

Enable

This feature is disabled by default. To enable this feature, you need to configure the network attachment annotations in the `ocnrf_custom_values_26.1.201.yaml` file.

Configuration

For more information about Traffic Segregation configuration, see "Configuring Traffic Segregation" section in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Observe

There are no Metrics, KPIs, or Alerts available for this feature.

Maintain

To resolve any alerts at the system or application level, see [NRF Alerts](#) section. If the alerts persist, perform the following:

1. Collect the logs: For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. Raise a service request: See [My Oracle Support](#) for more information on how to raise a service request.

4.10 Support for Server Header

NRF handles various requests from consumer Network Functions (NFs) and other network entities over HTTP protocol. On receiving these requests, NRF validates and processes them before responding to these requests. When NRF sends an error response, it includes the source of the error to troubleshoot and take corrective measures.

This feature offers the support for Server Header in NRF responses, which contain information about the origin of an error response.

With this feature, NRF adds or passes the server header in the error responses as described in the following scenarios:

- When NRF acts as a standalone server.
- In NRF Forwarding scenarios, NRF propagates the server header received from peer NRF to the Consumer NF without any changes.
- In NRF Roaming scenarios, NRF propagates the server header received from SEPP or peer NRFs to the Consumer NF without any changes.

This enhancement improves NRF's error-handling scenarios by determining the originator of the error response for better troubleshooting.

When the server header feature is enabled, NRF adds the server header while generating the error responses.

The server header format is as follows:

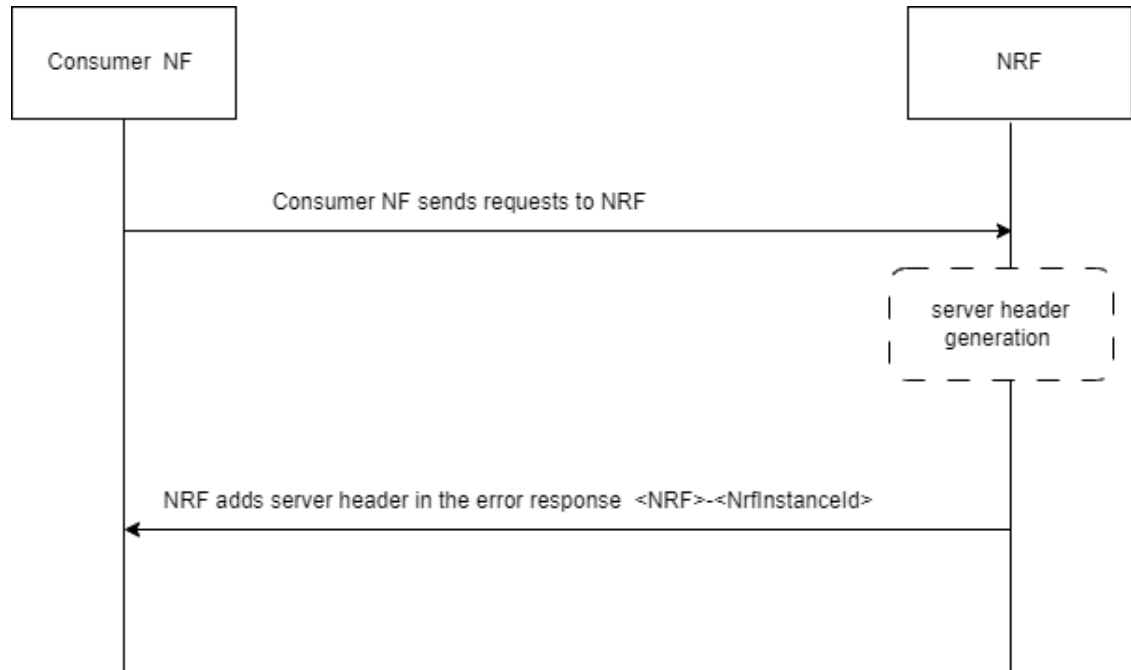
<NRF>-<NrfInstanceId>

Where,

- <NRF> is the NF type.
- <NrfInstanceId> is the unique identifier of the NRF instance.

For example: NRF-6faf1bbc-6e4a-4454-a507-a14ef8e1bc5c

The following image illustrates the NRF behavior while processing the error responses:

Figure 4-7 Server Header Details

1. Consumer or Client NF sends requests to NRF.
2. NRF receives the requests from the Consumer or Client NF and validates them for further processing.
3. In case, NRF sends an error response while processing the incoming requests, it adds the server header $\{NRF-\langle Nrfinstanceld \rangle\}$ in the error response and sends it back to the Consumer or Client NF.

Managing Support for Server Header

Enable

This feature is disabled by default. This feature can be enabled at global level or at per-route level.

- **Enable using REST API:**
 - **Global:** Set the value of the enabled attribute to true in the $\{apiRoot\}/nrf/nf-common-component/v1/igw/serverheaderdetails$ configuration API. For more information about the API, see "Server Header Details" section in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
 - **Route level:** Set the value of the enabled attribute to true in the $\{apiRoot\}/nrf/nf-common-component/v1/igw/routesconfiguration$ configuration API. For more information about the API, see "Routes Configuration" section in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

Note

Enable this feature only by using the enabled attribute in the serverHeaderDetails for the specific route id in the {apiRoot}/nrf/nf-common-component/v1/igw/routesconfiguration URI. Use the configuration as suggested in the "Routes Configuration" section in Ingress Gateway Configuration" in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*. Accidental deletion of any of the routes in this configuration leads to service outage.

- **Enable using CNC Console:**

- **Global:** Switch **Enabled** on the Server Header Details page to enable the feature. For more information about enabling the feature using CNC Console, see [Server Header Details](#).
- **Route level:** Switch **Enabled** on the Routes Configuration page to enable the feature. For more information about enabling the feature using CNC Console, see [Routes Configuration](#).

Note

Enable this feature only by using the enabled attribute in the serverHeaderDetails for the specific route id in the {apiRoot}/nrf/nf-common-component/v1/igw/routesconfiguration URI. Use the configuration as suggested in the "Routes Configuration" section in Ingress Gateway Configuration" in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*. Accidental deletion of any of the routes in this configuration leads to service outage.

For more information about server header propagation in service-mesh deployment, see [Adding Filters for Server Header Propagation](#).

Configure

Perform the configurations in the following sequence to configure this feature using REST API or CNC Console:

1. Configure {apiRoot}/nrf/nf-common-component/v1/igw/errorcodeserieslist to update the errorcodeserieslist that is used to list the configurable exception or error for an error scenario in Ingress Gateway.
2. Perform the following global configuration in {apiRoot}/nrf/nf-common-component/v1/igw/serverheaderdetails API.
3. (Optional) Perform the following configuration at route level based on the id attribute in {apiRoot}/nrf/nf-common-component/v1/igw/routesconfiguration API.

Note

- If the feature is not configured at route level, global configuration is taken into consideration.
- Route-level configuration will take precedence over the global configuration.

Observability

Metrics

There are no metrics added to this feature.

Alerts

There are no alerts added or updated for this feature.

KPIs

There are no KPIs related to this feature.

Maintain

If you encounter alerts at system or application levels, see the [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

1. **Collect the logs:** For more information on collecting logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.11 Support for TLS

NRF use Hypertext Transfer Protocol Secure (HTTPS) to establish secured connections with Consumer NFs and Producer NFs, respectively. These communication protocols are encrypted using Transport Layer Security (TLS). TLS comprises the following components:

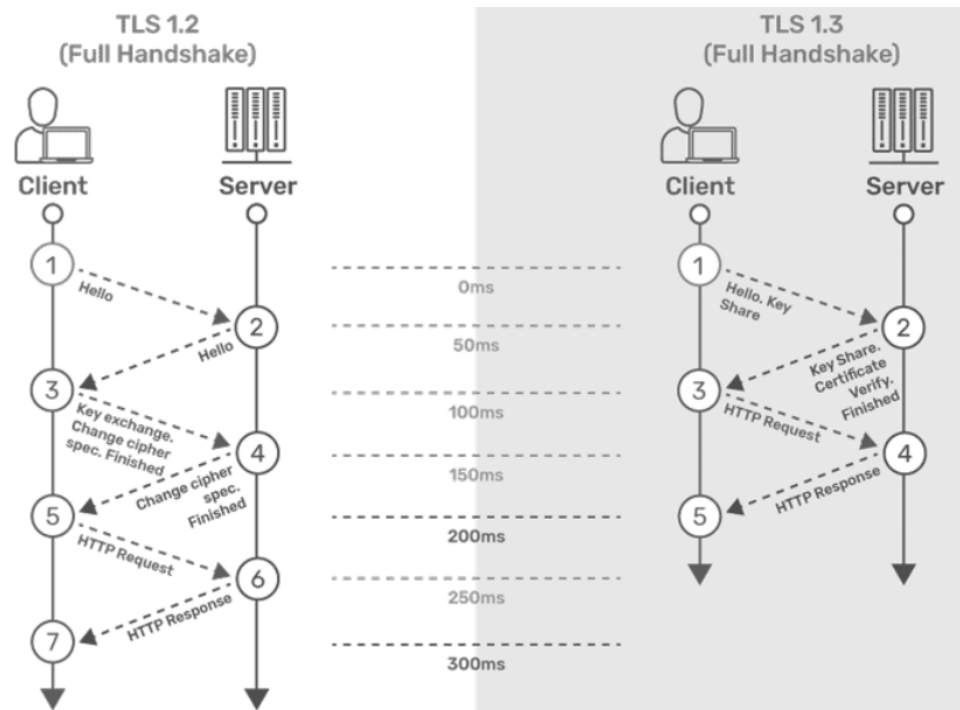
- **Handshake Protocol:** Exchanges the security parameters of a connection. Handshake messages are supplied to the TLS record layer.
- **Record Protocol:** Receives the messages to be transmitted, fragments the data into multiple blocks, secures the records, and then transmits the result. Received data is delivered to higher-level peers.

From Release 24.2.0 onwards, NRF supports TLS 1.3 for all Consumer NFs, Producer NFs, Data Director, SBI Interfaces, and interfaces where TLS 1.2 was supported. TLS 1.2 will continue to be supported.

TLS Handshake

This section describes the differences between TLS 1.2 and TLS 1.3 and the advantages of TLS 1.3 over TLS 1.2 and earlier versions.

Figure 4-8 TLS Handshake

**TLS 1.2**

Step 1: The connection or handshake starts when the client sends a "client hello" message to the server. This message consists of cryptographic information such as supported protocols and supported cipher suites. It also contains a random value or random byte string.

Step 2: To respond to the "client hello" message, the server sends the "server hello" message. This message contains the CipherSuite that the server has selected from the options provided by the client. The server also sends its certificate along with the session ID and another random value.

Step 3: The client verifies the certificate sent by the server. When the verification is complete, it sends a byte string and encrypts it using the public key of the server certificate.

Step 4: When the server receives the secret, both the client and server generate a master key along with session keys (ephemeral keys). These session keys are used to symmetrically encrypt the data.

Step 5: The client sends an "HTTP Request" message to the server to enable the server to switch to symmetric encryption using the session keys.

Step 6: To respond to the client's "HTTP Request" message, the server does the same and switches its security state to symmetric encryption. The server concludes the handshake by sending an HTTP response.

Step 7: The client-server handshake is completed in two round-trips.

TLS 1.3

Step 1: The connection or handshake starts when the client sends a "client hello" message to the server. The client sends the list of supported cipher suites. The client also sends its key share for that particular key agreement protocol.

Step 2: To respond to the “client hello” message, the server sends the key agreement protocol that it has chosen. The “Server Hello” message comprises the server key share, server certificate, and the “Server Finished” message.

Step 3: The client verifies the server certificate, generates keys as it has the key share of the server, and sends the “Client Finished” message along with an HTTP request.

Step 4: The server completes the handshake by sending an HTTP response.

The following digital signature algorithms are supported in TLS handshake:

Table 4-9 Digital Signature Algorithms

Algorithm	Key Size (Bits)	Elliptic Curve (EC)
RS256 (RSA)	2048	NA
	4096 This is the recommended value.	NA
ES256 (ECDSA)	NA	SECP384r1 This is the recommended value.

Comparison Between TLS 1.2 and TLS 1.3

The following table provides a comparison of TLS 1.2 and TLS 1.3:

Table 4-10 Comparison of TLS 1.2 and TLS 1.3

Feature	TLS 1.2	TLS 1.3
TLS Handshake	- The initial handshake was carried out in clear text. - A typical handshake in TLS 1.2 involves the exchange of 5 to 7 packets.	- The initial handshake is carried out along with the key share. - A typical handshake IN TLS 1.3 involves the exchange of up to 3 packets.
Cipher Suites	- Less secure Cipher suites. - Use SHA-256 and SHA-384 hashing – TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384 – TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384 – TLS_ECDHE_RSA_WITH_CHACHA20_POLY1305_SHA256 – TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 – TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256	- More secure Cipher suites. - Apart from all the ciphers supported for TLS 1.2 , the following additional ciphers are supported for only TLS 1.3 : – TLS_AES_128_GCM_SHA256 – TLS_AES_256_GCM_SHA384 – TLS_CHACHA20_POLY1305_SHA256
Round-Trip Time (RTT)	This has a high RTT during the TLS handshake.	This has low RTT during the TLS handshake.
Perfect Forward Secrecy (PFS)	This doesn't support PFS.	TLS 1.3 supports PFS. PFS ensures that each session key is completely independent of long-term private keys, which are keys that are used for an extended period to decrypt encrypted data.
Privacy	This is less secure, as the ciphers used are weak.	This is more secure, as the ciphers used are strong.

Table 4-10 (Cont.) Comparison of TLS 1.2 and TLS 1.3

Feature	TLS 1.2	TLS 1.3
Performance	This has high latency and a less responsive connection.	This has low latency and a more responsive connection.

Advantages of TLS 1.3

TLS 1.3 handshake offers the following improvements over earlier versions:

- all handshake messages after the ServerHello are encrypted.
- improves efficiency in the handshake process by requiring fewer round trips than TLS 1.2. It also uses cryptographic algorithms that are faster.
- better security than TLS 1.2. It addresses known vulnerabilities in the handshake process.
- got rid of data compression.

The following table describes the TLS versions supported in the client and server side. The last column indicates which version will be used.

TLS Version Used

When NRF is acting as a client or a server, it can have different TLS versions.

The following table gives information about which TLS version will be used when you have various combinations of TLS versions between the server and the client.

Table 4-11 TLS Version Used

Client Support	Server Support	TLS Version Used
TLS 1.2, TLS 1.3	TLS 1.2, TLS 1.3	TLS 1.3
TLS 1.3	TLS 1.3	TLS 1.3
TLS 1.3	TLS 1.2, TLS 1.3	TLS 1.3
TLS 1.2, TLS 1.3	TLS v1.3	TLS 1.3
TLS 1.2	TLS 1.2, TLS 1.3	TLS 1.2
TLS 1.2, TLS 1.3	TLS 1.2	TLS 1.2
TLS 1.3	TLS 1.2	Sends an error message. For more information about the error message, see "Troubleshooting TLS Version Compatibilities" section in <i>Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide</i> .
TLS 1.2	TLS 1.3	Sends an error message. For more information about the error message, see "Troubleshooting TLS Version Compatibilities" section in <i>Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide</i> .

Note

- If Egress Gateway is deployed with both the versions of TLS that is TLS 1.2 and TLS 1.3, then Egress Gateway as client will send both versions of TLS in the client hello message during the handshake and the server needs to decide which version to be used.
- If Ingress Gateway is deployed with both the version of TLS that is with TLS 1.2 and TLS 1.3, then Ingress Gateway as the server will use the TLS version received from the client in the server hello message during the handshake.
- This feature does not work in ASM deployment.

Managing Support for TLS 1.2 and TLS 1.3**Enable**

This feature can be enabled or disabled at the time of NRF deployment using the following Helm Parameters:

- **enableIncomingHttps** - This flag is used for enabling/disabling HTTPS/2.0 (secured TLS) in the Ingress Gateway. If the value is set to false, NRF will not accept any HTTPS/2.0 (secured) traffic. If the value is set to true, NRF will accept HTTPS/2.0 (secured) Traffic.
Note: Do not change &enableIncomingHttpsRef reference variable.

For more information on enabling this flag, see the "Enabling HTTPS at Ingress Gateway" section in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

- **enableOutgoingHttps** - This flag is used for enabling/disabling HTTPS/2.0 (secured TLS) in the Egress Gateway. If the value is set to false, NRF will not accept any HTTPS/2.0 (secured) traffic. If the value is set to true, NRF will accept HTTPS/2.0 (secured) traffic. For more information on enabling this flag, see the "Enabling HTTPS at Egress Gateway" section in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Configure

You can configure this feature using Helm parameters.

The following parameters in the Ingress Gateway and Egress Gateway microservices must be customized to support TLS 1.2 or TLS 1.3.

1. Generate HTTPS certificates for both the Ingress and Egress Gateways. Ensure that the certificates are correctly configured for secure communication. After generating the certificates, create a Kubernetes secret for each Gateway (Ingress and Egress). Then, configure these secrets to be used by the respective Gateways. For more information about HTTPS configuration, generating certificates, and creating secrets, see the "Configuring Secrets for Enabling HTTPS" section in the *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
2. Open the `ocnrf_custom_values_26.1.201.yaml` file.
3. Configure the following parameters under Ingress Gateway and Egress Gateway parameters section.
 - Parameters required to support TLS 1.2:
 - `service.ssl.tlsVersion` indicates the TLS version.

- cipherSuites indicates supported cipher suites.
- allowedCipherSuites indicates allowed cipher suites.
- messageCopy.security.tlsVersion indicates the TLS version for establishing communication between Kafka and NF when security is enabled.
- Parameters required to support TLS 1.3:
 - service.ssl.tlsVersion indicates the TLS version.
 - cipherSuites indicates the supported cipher suites.
 - allowedCipherSuites indicates the allowed cipher suites.
 - messageCopy.security.tlsVersion indicates the TLS version for establishing communication between Kafka and NF when security is enabled.
 - clientDisabledExtension is used to disable the extension sent by messages originated by clients during the TLS handshake with the server.
 - serverDisabledExtension is used to disable the extension sent by messages originated by servers during the TLS handshake with the client.
 - tlsNamedGroups is used to provide a list of values sent in the supported_groups extension. These are comma-separated values.
 - clientSignatureSchemes is used to provide a list of values sent in the signature_algorithms extension.

For more information about configuring the values of the above-mentioned parameters, see the "Ingress Gateway Microservice" and "Egress Gateway Microservice" sections in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

4. Save the file.
5. Install NRF. For more information about installation procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
6. Run Helm upgrade, if you are enabling this feature after NRF deployment. For more information about upgrade procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Note

- NRF does not prioritize cipher suites based on priorities. To select a cipher based on priorities, you must write the cipher suites in decreasing order of priority.
- NRF does not prioritize supported groups based on priorities. To select a supported group based on priorities, you must write the supported group values in the decreasing order of priority.
- If you want to provide values for the signature_algorithms extension using the **clientSignatureSchemes** parameter, the following comma-separated values must be provided to deploy the services:
 - rsa_pkcs1_sha512
 - rsa_pkcs1_sha384
 - rsa_pkcs1_sha256
- The mandatory extensions as listed in RFC 8446 cannot be disabled using the **clientDisabledExtension** attribute on the client or using the **serverDisabledExtension** attribute on the server side. The following is the list of the extensions that cannot be disabled:
 - supported_versions
 - key_share
 - supported_groups
 - signature_algorithms
 - pre_shared_key

Observe Metrics

Following metrics are added in the [NRF Gateways Metrics](#) section:

- oc_ingressgateway_incoming_tls_connections
- oc_egressgateway_outgoing_tls_connections
- security_cert_x509_expiration_seconds_[suffix]

For more information about metrics, see [NRF Metrics](#) section.

Alerts

Following alerts are added in the [NRF Alerts](#) section:

- [OcnrfTLSCertificateExpireMinor](#)
- [OcnrfTLSCertificateExpireMajor](#)
- [OcnrfTLSCertificateExpireCritical](#)

Note

Alert gets raised for every certificate that will expire in the above time frame. For example, NRF supports both RSA and ECDSA. So, we have configured two certificates. Accordingly, let us suppose RSA certificate is about to expire in 6 months in this situation only one alert will be raised and if both are about to expire then two alerts will be raised. Moreover, alerts can be differentiated using "serialNumber" tag. For example, serialNumber=4661 is used for RSA and serialNumber =4662 is used for ECDSA.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alert persists, perform the following:

1. **Collect the logs and Troubleshooting Scenarios:** For more information on how to collect logs and troubleshooting information, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.11.1 Support for TLSv1.3 on Internal API Communication

In a Kubernetes-based 5G Core deployment, NRF communicates with the Kubernetes API server (Kube-API-Server) to retrieve the secrets and discover the target IP addresses of microservices.

With the implementation of this feature, NRF supports TLS 1.3 in addition to TLS 1.2 for establishing secure communication with the Kubernetes API server.

This feature interacts with the Kubernetes API server for the following purposes:

- The Ingress Gateway microservice discovers the target IP addresses of microservices.
- The Egress Gateway Microservice discovers the target IP addresses of microservices for internal communication (like Alternate-Route and Perf-Info).
- The AccessToken, Discovery, Registration, Subscription, Artisan, Auditor, CacheData, and Configuration microservices discover the target IP addresses of microservices.

Note

This enhancement does not support both TLS 1.3 and TLS 1.2 simultaneously.

Managing the feature**Configure**

Perform the following configuration for this feature using the Helm:

1. Open the `ocnrf_custom_values_26.1.201.yaml` file.
2. Configure the `global.tlsVersionSupportForKubeApiServer.kubeApiServerTlsVersion` parameter in the Global parameters section to interact with Kubernetes API server.

3. Configure the `global.tlsVersionSupportForKubeApiServer.cipherSuites` parameter in the Global parameters section to configure the appropriate ciphersuites for the selected TLS version.
For more information about the above parameters, see the "Global Parameters" section in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
4. Save the file.
5. Install NRF. For more information about installation procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
6. Run Helm upgrade if you are enabling this feature after NRF deployment. For more information about upgrade procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Observability

Metrics

The following generic metrics are used in this feature and added in the [CNC Jetty Metrics](#) section:

- `oc_cnc_jetty_service_discovery_duration_seconds`
- `oc_cnc_jetty_service_discovery_up`
- `oc_cnc_jetty_service_discovery_fallbacks_total`

For more information about the entire list of metrics, see [NRF Metrics](#).

Alerts

The [OcnrfServicesFetchFailureForDestinationIPAddresses](#) alert is used in this feature.

KPIs

There are no KPIs related to this feature.

Maintain

If you encounter alerts at system or application levels, see the [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

1. **Collect the logs:** For more information on collecting logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See My Oracle Support for more information on how to raise a service request.

4.12 Error Messages Enhancement

NRF sends error messages when there is an error scenario while performing any of the service operations. In order to identify the cause of these errors and fix them quickly, NRF supports the following enhancements:

- [Error Response Enhancement for NRF](#)
- [Error Log Messages Enhancement](#)

4.12.1 Error Response Enhancement for NRF

NRF receives the message requests from Consumer NFs and may send error responses while processing them. The error response generated by NRF included the error description in the detail attribute of the ProblemDetails. This description is used to identify the issue and troubleshoot them.

The sample ProblemDetails before the error details enhancement is as follows:

```
{
  "title": "Not Found",
  "status": 404,
  "detail": "NRF Forwarding Error Occurred",
  "cause": "UNSPECIFIED_MSG_FAILURE"
}
```

With the enhanced error response mechanism, NRF sends additional information such as server FQDN, NF service name, vendor NF name, and application error Id in the detail attribute of the ProblemDetails. This enhancement provides more information about the error and troubleshoot them.

The new format of the ProblemDetails is as follows:

```
{
  "title": "<title of Problem Details>",
  "status": "<status code of Problem Details>",
  "detail": "<Server-FQDN>:<NF Service>:<Application specific problem  
detail>:<VendorNF>-<App-Error-Id>",
  "cause": "<cause value of Problem Details>"
}
```

Example:

```
{
  "title": "Not Found",
  "status": 404,
  "detail": "NRF-d5g.oracle.com: Nnrf_NFManagement: NRF Forwarding Error  
Occurred: ONRF-REG-NFPRFWD-E0299; 404; NRF-d5g.oracle.com: Nnrf_NFManagement:  
Could not find Profile records for NfInstanceId=8cfc6828-  
bd5d-4a3a-93d4-6bdd848d6bab: ONRF-REG-NFPR-E1004",
  "cause": "UNSPECIFIED_MSG_FAILURE"
}
```

The updated format for the detail attribute will be sent only for the error responses generated by NRF application. For all other scenarios (like response generated by the underlying stack) the detail attribute will not provide the information in the updated format.

Note

All responses sent by NRF application towards the peer follows this format. All internal microservice responses and OAM responses may or may not follow this format.

The following table describes the detail attribute of the ProblemDetails parameter:

Table 4-12 Detail Attributes of the ProblemDetails

Attribute	Description
<Server-FQDN>	Indicates the NRF FQDN. It is obtained from the nfFqdn Helm parameter. Sample Value: NRF-d5g.oracle.com
<NF Service>	Indicates the service name. This service name can be 3GPP defined NRF service name or an internal one. Possible Values: - Nnrf_NFManagement: This is used by nfregristration, nfsubscription, and nrfauditor microservices. - Nnrf_NFDiscovery: This is used by nfdiscovery microservice. - Nnrf_AccessToken: This is used by nfaccess token microservice. - Nnrf_Internal_CDS: This is used by nrfcachedata microservice. - Nnrf_Internal_Artisan: This is used by nrfauditor microservice. - Nnrf_Internal_Config: This is used by nrfconfiguration microservice for NRF specific configurations. - ingressgateway: This is used by ingressgateway. - egressgateway: This is used by egressgateway. - alternateroute: This is used by alternate-route. - commonconfig: This is used by nrfconfiguration microservice for NRF common configurations such as ingressgateway, egressgateway.
<Application specific problem detail>	Indicates a short description of the error. Sample Value: NRF Forwarding Error occurred
<VendorNF>	Indicates the Oracle NF Type. For NRF, this value is always ONRF. Here, O is the prefixed value. NF type is obtained from the nfType Helm parameter.

Table 4-12 (Cont.) Detail Attributes of the ProblemDetails

Attribute	Description
<App-Error-Id>	Indicates the application specific error Id. This Id is a unique error Id which includes the Microservice ID, Category, and the Error Code. The format of <App-Error-Id> is as follows: <Microservice ID>-<Category>-<Error Code> Where, • <Microservice ID>: Indicates the NRF microservice IDs. For more information of NRF Microservice IDs see the Table 4-13. Sample Value: REG is the Microservice ID for nregistration. • <Category>: Indicates an unique grouping of errors. The presence of category is optional in application error code. For detailed information about the different categories available, see the Table 4-14. Sample Value: NFPRFWD for NFProfileRetrieval service operation during forwarding. • <Error Code>: Indicates the error code in the Exxxx format. Sample Value: E0299 Sample Value: • With category: REG-NFPRFWD-E0299 where, REG is the Microservice ID, NFPRFWD is the Category, and E0299 is the Error Code. • Without category: ONRF-IGW-E002 where, ONRF is the vendor NF, IGW is the Microservice ID, and E002 is the Error Code.

The following table describes the list of available microservices in NRF.

Table 4-13 Microservice Ids List

Microservice Ids	Microservice Name
REG	nregistration
SUB	nfsubscription
DIS	nfdiscovery
ACC	nfaccess token
CDS	nrfcachedata
AUD	nrfauditor
CFG	nrfconfiguration
ART	nrfartisan
IGW	ingressgateway
EGW	egressgateway
ARS	alternate-route

The following table describes the list of available categories in NRF.

Table 4-14 List of Categories

Category Id	Category Description
ACAUTHN	Authentication during Access Token service operation.
ACAUTHZ	Authorization during Access Token service operation.
ACCOPT	Access Token configuration.
ACFWD	Access Token service operation during forwarding.
ACROAM	Access Token service operation during roaming.
ACTOK	Access Token service operation.
AUTHOPT	Authentication options configuration.
CNCCDTN	CNCC Controller configuration.
CSHTOPT	Control shutdown options configuration.
DEREG	NFDeRegister service operation.
DISAUTH	NFDiscover service operation during authorization.
DISC	NFDiscover service operation.
DISCOPT	Discovery options configuration.
DISCSLF	SLF for NFDiscover.
DISCFWD	NFDiscover service operation during forwarding.
DISROAM	NFDiscover service operation during roaming.
FULLUPD	NFUpdate with Full Replacement (PUT) service operation.
FWDOP	Forwarding options configuration.
GENOPT	General options configuration.
GROPT	GeoRedundancy options configuration.
GTSUB	Get subscription.
GWTHFOR	Growth configuration for forwarding.
GWTHOPT	Growth options configuration.
HB	NFHeartbeat service operation.
HBAUD	Heart beat for NRF Auditor service operation.
HBRMAUD	Remote heart beat for NRF Auditor.
INVSROP	UnSupported HTTP Method for service operation.
LOGOPT	Logging options configuration.
MGMOPT	Management options configuration.
NFDTLS	Fetching NF State data
NFINSTS	Get remote discovery instance and remote instance data.
NFLR	NFListRetrieval service operation.
NFPR	NFProfileRetrieval service operation.
NFPRAUD	NRF Auditor service operation for NF profiles.
NFPRFWD	NFProfileRetrieval service operation during forwarding.
NPTRDRG	NRF Artisan for notification event to DNS NAPTR on deleting AMF profile.
NPTROPT	NAPTR options configuration.
NPTRREC	Status API for DNS NAPTR record.
NPTRREG	NRF Artisan for NAPTR registration.
NPTRUPD	NRF Artisan for DNS NAPTR update.

Table 4-14 (Cont.) List of Categories

Category Id	Category Description
NRFCFG	Fetching NRF Configuration.
NRFOPER	NRF operation state configuration.
PARTUPD	NFUpdate with Partial Replacement (PATCH) service operation.
POPROPT	Pod protection options configuration.
REGN	NFRegister service operation.
RELDVER	NRF Auditor service operation for reloading site and network version info.
ROAMOPT	Roaming options configuration.
RTNPTR	Manual cache update of DNS NAPTR records.
SCRNOPT	Screening options configuration.
SCRNRUL	Screening rules configuration.
SLFOPT	SLF options configuration.
SNOTIF	NFStatusNotify service operation.
SUBAUD	NRF Auditor service operation for subscription.
SUBDTLS	Retrieve subscription details based on query attributes for configuring the non-signaling API.
SUBFWD	NFStatusSubscribe service operation during forwarding.
SUBRAUD	NRF Auditor service operation for remote subscription.
SUBROAM	NFStatusSubscribe service operation during roaming.
SUBSCR	NFStatusSubscribe service operation.
UNKSROP	UnSupported media type.
UNSFWD	NFStatusUnsubscribe service operation during forwarding.
UNSR0AM	NFStatusUnsubscribe service operation during roaming.
UNSUBSC	NFStatusUnsubscribe service operation.
UPDSUBS	NFStatusSubscribe update (PATCH) service operation.
UPSFWD	NFStatusSubscribe update (PATCH) service operation during forwarding.
UPSR0AM	NFStatusSubscribe update (PATCH) service operation during roaming.

The error response codes are available in the [Error Response Code Details](#) section.

Managing the Error Response Enhancements for NRF

This section explains the procedure to enable and configure the feature.

Enable

This feature is an enhancement to the existing detail attribute in the ProblemDetails and hence there is no specific flag to enable or disable this feature.

Configure

You can configure the feature using Helm.

Helm

Perform the following configuration for this feature using the Helm:

1. Open the `ocnrf_custom_values_26.1.201.yaml` file.
2. Configure the following parameters under global parameters:
 - `global.nfFqdn` parameter to indicate the NRF FQDN.
 - `global.nfType` parameter to indicate the NF type.
 - `global.maxDetailsLength` is used to determine the maximum length limit of compiled error string by NRF in the details field.
3. Save the file.
4. Install NRF. For more information about installation procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
5. Run Helm upgrade, if you are enabling this feature after NRF deployment. For more information about upgrade procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Observability

Metrics

There are no new metrics added to this feature.

Alerts

There are no alerts added or updated for this feature.

KPIs

There are no new KPIs related to this feature.

Maintain

If you encounter alerts at system or application levels, see the [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

1. Collect the logs: For more information on collecting logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. Raise a service request: See [My Oracle Support](#) for more information on how to raise a service request.

4.12.2 Error Log Messages Enhancement

NRF uses the logs to register the system events along with their date and time of occurrence. They also provide important details about the chain of events that could have led to an error or problem. These log details are further used to identify the source of the error and troubleshoot them. NRF supports various log levels that can be set for a microservice with any of the following values:

- TRACE
- DEBUG
- INFO
- WARN
- ERROR

For more information on details of these log levels, see the “Log Levels” section in *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.

With this feature, NRF adds additional information to the existing “ERROR” log messages. This additional information can provide more details about the error which can help to identify the problem details, error generating entity and subscriber information.

The Error Log Messages Enhancement feature adds the following additional attributes to the existing “ERROR” logs with appropriate values during the failure scenarios:

- `errorStatus`
- `errorTitle`
- `errorDetails`
- `errorCause`
- `sender`
- `receiver`
- `subscriberId`

For more information about the new attributes, see [Table 4-15](#).

Sample enhanced log details for the NRF Subscription Microservice:

```
{
  "instant": {
    "epochSecond": 1717077558,
    "nanoOfSecond": 256932930
  },
  "thread": "boundedElastic-8",
  "level": "ERROR",
  "loggerName": "com.oracle.cgbu.cne.nrf.routes.SubscriptionHandler",
  "message": "Response sent: 500 Subscription global limit breached for uri :
http://ocnrf-ingressgateway.nrf1-ns/nnrf-nfm/v1/subscriptions with the
problem cause : INSUFFICIENT_RESOURCES and problem details : NRF-
d5g.oracle.com: Nnrf_NFManagement: Subscription global limit breached: ONRF-
SUB-SUBSCR-E2003",
  "endOfBatch": false,
  "loggerFqcn": "org.apache.logging.log4j.spi.AbstractLogger",
  "threadId": 39547,
  "threadPriority": 5,
  "messageTimestamp": "2024-05-30T13:59:18.256+0000",
  "configuredLevel": "WARN",
  "subsystem": "NfSubscribe",
  "processId": "1",
  "nrfTxId": "nrf-tx-2103278974",
  "ocLogId": "1717077558225_77_ocnrf-
ingressgateway-854464d548-426bz:1717077558237_110_ocnrf-
nfsubscription-766d45f5c7-t4xp8",
  "xRequestId": "",
  "numberOfRetriesAttempted": "",
  "hostname": "ocnrf-nfsubscription-766d45f5c7-t4xp8",
  "errorStatus": "500",
  "errorTitle": "Subscription global limit breached",
  "errorDetails": "NRF-d5g.oracle.com: Nnrf_NFManagement: Subscription global
limit breached: ONRF-SUB-SUBSCR-E2003",
```

```

    "errorCause": "INSUFFICIENT_RESOURCES",
    "sender": "NRF-6faf1bbc-6e4a-4454-a507-a14ef8e1bc5c",
    "subscriberId": "imsi-345012123123126"
  }

```

In the above example, the following new attributes are added to the error logs.

```

    "errorStatus": "500",
    "errorTitle": "Subscription global limit breached",
    "errorDetails": "NRF-d5g.oracle.com: Nnrf_NFManagement: Subscription global
limit breached: ONRF-SUB-SUBSCR-E2003",
    "errorCause": "INSUFFICIENT_RESOURCES",
    "sender": "NRF-6faf1bbc-6e4a-4454-a507-a14ef8e1bc5c",
    "subscriberId": "imsi-345012123123126"

```

The `additionalErrorLogging` feature flag is added to the logging API for the supported microservices. When the feature flag is enabled, it adds the `errorStatus`, `errorTitle`, `errorDetails`, `errorCause`, `sender`, `receiver` attributes to the ERROR logs.

Additionally, the `logSubscriberInfo` flag is added to the logging API for the supported microservices. When `additionalErrorLogging` and `logSubscriberInfo` are enabled, the subscriber information is also added to the ERROR logs.

When the `logSubscriberInfo` flag is enabled and if the `subscriberId` information is available, then NRF adds the `subscriberId` value in the log messages. If `logSubscriberInfo` is disabled, and the `subscriberId` information is still available NRF adds the `subscriberId` value as XXXX in the log messages.

Note

The `subscriberId` value can be any of the following:

- 3GPP-Sbi-Correlation-Info header present in the request header received at NRF.
- 3GPP-Sbi-Correlation-Info header present in the response header received from the peer in the case of NRF acting as a client.
- Either SUPI or GPSI values or both SUPI and GPSI values.

For more information about the `subscriberId` attribute, see [Table 4-15](#).

Example with both SUPI and GPSI values:

```

{
  "instant": {
    "epochSecond": 1717489820,
    "nanoOfSecond": 998846286
  },
  "thread": "@608f310a-49",
  "level": "ERROR",
  "loggerName": "com.oracle.cgbu.cne.nrf.service.NFDiscoveryService",
  "message": "Response sent: 503 null for uri : /nnrf-disc/v1/nf-instances?
[target-nf-type=[UDR], requester-nf-type=[UDM], supi=[imsi-100000005],
gpsi=[msisdn-77195225555]} with the problem cause : null and problem

```

```

details : NRF-d5g.oracle.com: Nnrf_NFDDiscovery: SLF Lookup Error Occurred:
ONRF-DIS-DISCSLF-E0499; 503; null; 503; null",
  "endOfBatch": false,
  "loggerFqcn": "org.apache.logging.log4j.spi.AbstractLogger",
  "threadId": 49,
  "threadPriority": 5,
  "messageTimestamp": "2024-06-04T08:30:20.998+0000",
  "configuredLevel": "WARN",
  "processId": "1",
  "nrfTxId": "nrf-tx-2050587612",
  "ocLogId": "1717489820750_308_ocnrf-
ingressgateway-54594dfd87-9fq2k:1717489820763_73_ocnrf-
nfdiscovery-744ff58c64-5cdh9",
  "serviceOperation": "NFDDiscover",
  "xRequestId": "",
  "requesterNfType": "UDM",
  "targetNfType": "UDR",
  "discoveryQuery": "/nnrf-disc/v1/nf-instances?{target-nf-type=[UDR],
requester-nf-type=[UDM], supi=[imsi-100000005], gpsi=[msisd-7719522555]}",
  "hostname": "ocnrf-nfdiscovery-744ff58c64-5cdh9",
  "subsystem": "discoveryNfInstances",
  "errorStatus": "503",
  "errorDetails": "NRF-d5g.oracle.com: Nnrf_NFDDiscovery: SLF Lookup Error
Occurred: ONRF-DIS-DISCSLF-E0499; 503; null; 503; null",
  "sender": "NRF-6faf1bbc-6e4a-4454-a507-a14ef8e1bc5c",
  "subscriberId": "imsi-100000005;msisd-7719522555"
}

```

Note

The log with updates attributes will be printed only for the error responses generated by NRF application. For all other scenarios (like error responses generated by the underlying stack) the log with updated attributes will not be printed.

Mapping Error Log Attributes

The following table explains the mapping of the new attributes with the existing attributes of ProblemDetails, subscriberId, sender, and receiver in the error logs.

Table 4-15 Mapping Error Log Attributes

New Attribute in Logs	Value when NRF acting as Standalone Server (Example: NfRegister, NfUpdate, NfListRetrieval, NfProfileRetrieval service operations and so on)	Value when NRF is acting as Standalone Client (Example: NfStatusNotify service operation)	Value when NRF acting as both Server and Client (Example: NRF Forwarding, Roaming, SLF)	
			As Server	As Client
errorStatus	status sent by NRF in ProblemDetails of HTTP response	status received by NRF in ProblemDetails of HTTP response	status sent by NRF in ProblemDetails of HTTP response	status received by NRF in ProblemDetails of HTTP response
errorTitle	title sent by NRF in ProblemDetails of HTTP response	title received by NRF in ProblemDetails of HTTP response	title sent by NRF in ProblemDetails of HTTP response	title received by NRF in ProblemDetails of HTTP response
errorDetails	detail sent by NRF in ProblemDetails of HTTP response	detail received by NRF in ProblemDetails of HTTP response	detail sent by NRF in ProblemDetails of HTTP response	detail received by NRF in ProblemDetails of HTTP response
errorCause	cause sent by NRF in ProblemDetails of HTTP response	cause received by NRF in ProblemDetails of HTTP response	cause sent by NRF in ProblemDetails of HTTP response	cause received by NRF in ProblemDetails of HTTP response
sender	NRF-NRF Instance Id	Server header value as received in the error response.	NRF-NRF Instance Id	Server header value as received in the error response
receiver	Not applicable	NRF-NRF Instance Id	Not applicable	NRF-NRF Instance Id
subscriberId	The priority is considered as follows: 1. if the value of <i>3GPP-Sbi-Correlation-Info</i> header is present in the request. 2. else, only in case of NfDiscover Service operation request, the derived values from SUPI/GPSI query parameters if present.	The priority is considered as follows: 1. if the value of <i>3GPP-Sbi-correlation-Info</i> header is present in the response received when NRF is acting as a client. 2. else, if the value of <i>3GPP-Sbi-correlation-Info</i> header is present in the request. 3. else, only in case of NfDiscover Service operation request, the derived values from SUPI/GPSI query parameters if present.	The priority is considered as follows: 1. if the value of <i>3GPP-Sbi-correlation-Info</i> header is present in the response received when NRF is acting as a client. 2. else, if the value of <i>3GPP-Sbi-correlation-Info</i> header is present in the request. 3. else, only in case of NfDiscover Service operation request, the derived values from SUPI/GPSI query parameters if present.	The priority is considered as follows: 1. if the value of <i>3GPP-Sbi-correlation-Info</i> header is present in the response received when NRF is acting as a client. 2. else, if the value of <i>3GPP-Sbi-correlation-Info</i> header is present in the request. 3. else, only in case of NfDiscover Service operation request, the derived values from SUPI/GPSI query parameters if present.

Note

In case, if any of the above newly added attributes does not have a value, then these attributes will not be present in the log.

Access Token Error Mappings

In case of ERROR generated for Access Token service operation, the failure responses generated can be an instance of problemDetails or an AccessTokenErr. In case of problemDetails, the mappings are mentioned as [Table 4-15](#) table. In case of AccessTokenErr the mapping is as follows:

Table 4-16 Access Token Err

New Attributes in Logs	AccessTokenErr
errorStatus	400
errorTitle	Bad Request
errorDetails	error_description
errorCause	error

Sample AccessTokenErr message

```
{
  "error": "unauthorized_client",
  "error_description": "NRF-d5g.oracle.com: Nnrf_AccessToken: NfType in
oAuth request is different from the registered profile: ONRF-ACC-ACTOK-E4004",
  "error_uri": None
}
```

Sample Error Log Messages for Access Token Error

```
{
  "instant": {
    "epochSecond": 1717078943,
    "nanoOfSecond": 335260003
  },
  "thread": "XNIO-1 task-2",
  "level": "ERROR",
  "loggerName": "com.oracle.cgbu.cne.nrf.rest.NFAccessTokenController",
  "message": "Response sent: 400 Bad Request for uri : http://ocnrf-
ingressgateway.nrf1-ns/oauth2/token with the problem cause : Bad Request and
problem details : Bad Request",
  "endOfBatch": false,
  "loggerFqcn": "org.apache.logging.log4j.spi.AbstractLogger",
  "threadId": 71,
  "threadPriority": 5,
  "messageTimestamp": "2024-05-30T14:22:23.335+0000",
  "configuredLevel": "WARN",
  "subsystem": "accessToken",
  "processId": "1",
  "nrfTxId": "nrf-tx-1682094534",
}
```



```

"ocLogId": "1717078942906_77_ocnrf-
ingressgateway-854464d548-426bz:1717078942947_71_ocnrf-
nfaccess token-79b55d9b45-qm4gn",
"xRequestId": "",
"hostname": "ocnrf-nfaccess token-79b55d9b45-qm4gn",
"errorStatus": "400",
"errorTitle": "Bad Request",
"errorDetails": "NRF-d5g.oracle.com: Nnrf_AccessToken: NfType in oAuth
request is different from the registered profile: ONRF-ACC-ACTOK-E4004",
"errorCause": "unauthorized_client",
"sender": "NRF-6faf1bbc-6e4a-4454-a507-a14ef8e1bc5c",
"subscriberId": "imsi-345012123123129"
}

```

Managing the Error Log Messages Enhancements

This section explains the procedure to enable and configure the feature.

Enable

You can enable the Error Log Messages Enhancements feature using the REST API or Console:

- **Enable Using REST API:** Set the value of the feature flags `additionalErrorLogging` and `logSubscriberInfo` as `ENABLED` for each of the supported microservices as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
Sample API

```

{
  "appLogLevel": "WARN",
  "packageLogLevel": [
    {
      "packageName": "root",
      "logLevelForPackage": "WARN"
    }
  ],
  "additionalErrorLogging": "ENABLED",
  "logSubscriberInfo": "ENABLED"
}

```

- `{apiRoot}/nrf-configuration/v1/nfAccessToken/logging`
- `{apiRoot}/nrf-configuration/v1/nfDiscovery/logging`
- `{apiRoot}/nrf-configuration/v1/nfRegistration/logging`
- `{apiRoot}/nrf-configuration/v1/nfSubscription/logging`
- `{apiRoot}/nrf-configuration/v1/nrfArtisan/logging`
- `{apiRoot}/nrf-configuration/v1/nrfAuditor/logging`
- `{apiRoot}/nrf-configuration/v1/nrfConfiguration/logging`
- `{apiRoot}/nrf-configuration/v1/nrfCacheData/logging`

- **Enable Using CNC Console:** Set the value of the feature flags **Additional Error Logging** and **Log Subscriber Info** as `ENABLED` for each of the supported microservices in **Logging Level Options**. For more information, see [Logging Level Options](#).

Configure

You can configure the feature using Helm.

Perform the following steps to configure this feature using Helm:

1. Open the `ocnrf_custom_values_26.1.201.yaml` file.
2. Configure the following existing parameters:
 - `global.nrfInstanceId` to determine the NRF `NfInstanceId`.
 - `global.nfType` to determine the NF type.
3. Save the file.
4. Install NRF. For more information about the installation procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
5. Run Helm upgrade, if you are enabling this feature after NRF deployment. For more information about the upgrade procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Observability

Metrics

There are no new metrics added for this feature.

Alerts

There are no alerts added or updated for this feature.

KPIs

There are no new KPIs related for this feature.

Maintain

If you encounter alerts at system or application levels, see the [NRF Alerts](#) section for the resolution steps.

In case the alerts still persist, perform the following:

1. **Collect the logs:** For more information on collecting logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.13 Limiting Number of NFProfiles in NFDDiscover Response

When NFDDiscover service operation request is received, NRF returns NFProfiles based on the query attributes. As per 3GPP TS 29.510, the following two attributes play a key role to limit the number of NFProfiles to be returned in the response:

- `limit`: Maximum number of NFProfiles to be returned in the response.
Minimum: 1
- `max-payload-size`: Maximum payload size of the response, expressed in kilo octets.
When present, the NRF limits the number of NFProfiles returned in the response so as to not to exceed the maximum payload size indicated in the request.
Default: 124 kilo octets

Maximum: 2000 (that is, 2 mega octet)

limit Attribute

While returning the NFProfiles in the NFDDiscover service operation response, NRF limits the number of NFProfiles that can be returned after processing the NFDDiscover service operation request based on the value of the `limit` attribute.

In case the `limit` attribute is not present in the NFDDiscover search query, then NRF limits the number of NFProfiles based on the value of the `profilesCountInDiscoveryResponse` attribute in the `{apiRoot}/nrf-configuration/v1/nfDiscoveryOptions` API.

max-payload-size Attribute

While returning the NFProfiles in the NFDDiscover service operation response, NRF limits the number of NFProfiles whose size is within the value of `max-payload-size` attribute, excluding the size of the following attributes defined by 3GPP of the NFDDiscover service operation response:

- `validityPeriod` (Mandatory)
- `nfnInstances` (Mandatory)
- `preferredSearch` (Conditional)
- `nrfSupportedFeatures` (Conditional)

In case this attribute is not present in the NFDDiscover search query, then NRF considers the default value (124 kilo octets) as defined by 3GPP TS 29.510.

4.14 Support for cnDBTier APIs in CNC Console

NRF earlier fetched the status of cnDBTier using the CLI-based mechanism.

With the implementation of this feature, cnDBTier APIs are integrated into the CNC Console. NRF users can view the specific cnDBTier APIs directly on the CNC Console as mentioned in the following tables:

Table 4-17 cnDBTier APIs

Console Parameter	cnDBTier API name	Description
Backup List	<code>http://<base-uri>/ocdbtier/list/backups</code>	This is a read-only API. This API displays the details of completed backups along with backup ID, backup creation timestamp, and backup size.
Backup Manager Health Status	<code>http://<base-uri>/{unique_prefix}/ocdbtier/health-info/backup-mgr-svc/status</code>	This is a read-only API. This API displays the health status of the backup manager service. It checks the following: • if the backup manager service is up or not • if the service can connect to database or not

Table 4-17 (Cont.) cnDBTier APIs

Console Parameter	cnDBTier API name	Description
cnDBTier Backup Status	<code>http://<base-uri>/ocdbtier/backup/status</code>	This is a read-only API. This API displays the current backup status of the cnDBTier. It displays the following: - current system time - current cnDBTier backup status - next scheduled backup time
cnDBTier Health	<code>http://<base-uri>/{unique_prefix}/ocdbtier/health-info</code>	This API lists the health info of cnDBTier pods.
cnDBTier Version	<code>http://<base-uri>/ocdbtier/version</code>	This is a read-only API. This API displays the cnDBTier version.
Database Statistics Report	<code>http://<base-uri>/ocdbtier/statistics/report/dbinfo</code>	This is a read-only API. This API displays the number of available database.
Georeplication Recovery Status	<code>http://<base-uri>/ocdbtier/faultrecovery/status</code>	This is a read-only API. This API is used to monitor the recovery status of georeplication for both FAILED and ACTIVE cnDBTier sites.
Georeplication Status	<code>http://<base-uri>/ocdbtier/status/replication/realtime</code>	This API displays the georeplication status.
Georeplication Status Across All Sites	<code>http://<base-uri>/ocdbtier/replication/status/realtime</code>	This is a read-only API. This API is used to retrieve the georeplication status across all the configured sites, offering a consolidated view of the overall replication status.
Local Cluster Status	<code>http://<base-uri>/ocdbtier/status/cluster/local/realtime</code>	This is a read-only API. This API displays the status of the local cluster.
Monitor Health Status	<code>http://<base-uri>/{unique_prefix}/ocdbtier/health-info/monitor-svc/status</code>	This is a read-only API. This API displays the health status of the monitor service. It checks the following: - if the monitor service is up or not - if the service can connect to database or not - if the metrics are fetched or not (the metrics are fetched when the service is up and vice versa)

Table 4-17 (Cont.) cnDBTier APIs

Console Parameter	cnDBTier API name	Description
NDB Health Status	<code>http://<base-uri>/ {unique_prefix}/ocdbtier/ health-info/ndb-svc/status</code>	This is a read-only API. This API displays the health status of the NDB service pods such as (data pods, sql pods, app-my-sql pods, mgmt pods). It checks if the pods status is up or not.
On Demand Backup	<code>http://<base-uri>/ocdbtier/on-demand/backup/initiate</code>	This API is used to initiate a new backup. This API displays the status of initiated on-demand backups and helps to create a new backup.
Real Time Overall Replication Status	<code>http://<base-uri>/ocdbtier/ status/replication/realtime</code>	This is a read-only API. This API displays the overall replication status in multisite deployments. For example, in a four-site deployment, it provides the replication status between the following sites: site1-site2, site1-site3, site1-site4. This is applicable for all other sites, such as, site 2, site 3, and site 4.
Replication Health Status	<code>http://<base-uri>/ {unique_prefix}/ocdbtier/ health-info/replication-svc/ status</code>	This is a read-only API. This API displays the health status of the replication service. It checks the following: - if the replication service is up or not - if the replication service can connect to database or not
Replication HeartBeat Status	<code>http://<base-uri>/ocdbtier/ heartbeat/status</code>	This is a read-only API. This API displays the connectivity status between the local site and the remote site name to which NRF is connected.
Site Specific Real Time Replication Status	<code>http://<base-uri>/ocdbtier/ status/replication/realtime/ {remoteSiteName}</code>	This is a read-only API. This API displays the site-specific replication status.
Start Georeplication Recovery	<code>http://<base-uri>/ocdbtier/ faultrecovery/start</code>	This API is used to start the georeplication recovery process.
Update Cluster As Failed	<code>http://<base-uri>/ocdbtier/ markcluster/failed</code>	This API is used to mark a disrupted cnDBTier cluster as failed.

Table 4-17 (Cont.) cnDBTier APIs

Console Parameter	cnDBTier API name	Description
IP Family Preference for Replication Channel	<code>http://<base-uri>/ocdbtier/ preferred/ip-family/ preferences/ http://<base-uri>/ocdbtier/ preferred/ip-family/ preferences/ {siteNameAndRemoteSiteName}</code>	This API is used to configure or update the preferred IP family (IPv4 or IPv6) used for communication between the replication channels.
Gracefully Start Georeplication	<code>http://base-uri /ocdbtier/ georeplication/start</code>	This API is used to initiate the georeplication between a primary site and one or more remote sites.
Gracefully Stop Georeplication	<code>http://base-uri /ocdbtier/ georeplication/stop</code>	This API is used to stop georeplication between a primary site and specified remote sites.

For more information about the above-mentioned cnDBTier APIs, see *Oracle Communications Cloud Native Core, cnDBTier User Guide*.

Managing cnDBTier APIs in CNC Console **Enable**

The CNC console section for accessing the cnDBTier APIs is available in NRF if the cnDBTier is configured as an instance during the CNC Console deployment. For more information about integrating cnDBTier APIs in CNC Console, see the "NF Single Cluster Configuration With cnDBTier Menu Enabled" section in *Oracle Communications Cloud Native Configuration Console Installation, Upgrade, and Fault Recovery Guide*.

There is no option to disable this feature.

Configure

cnDBTier APIs can be accessed or configured using the CNC Console. For more information, see [cnDBTier APIs](#) in the CNC Console.

Maintain

If you encounter alerts at system or application levels, see the [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

1. Collect the logs: For more information on collecting logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. Raise a service request: See [My Oracle Support](#) for more information on how to raise a service request.

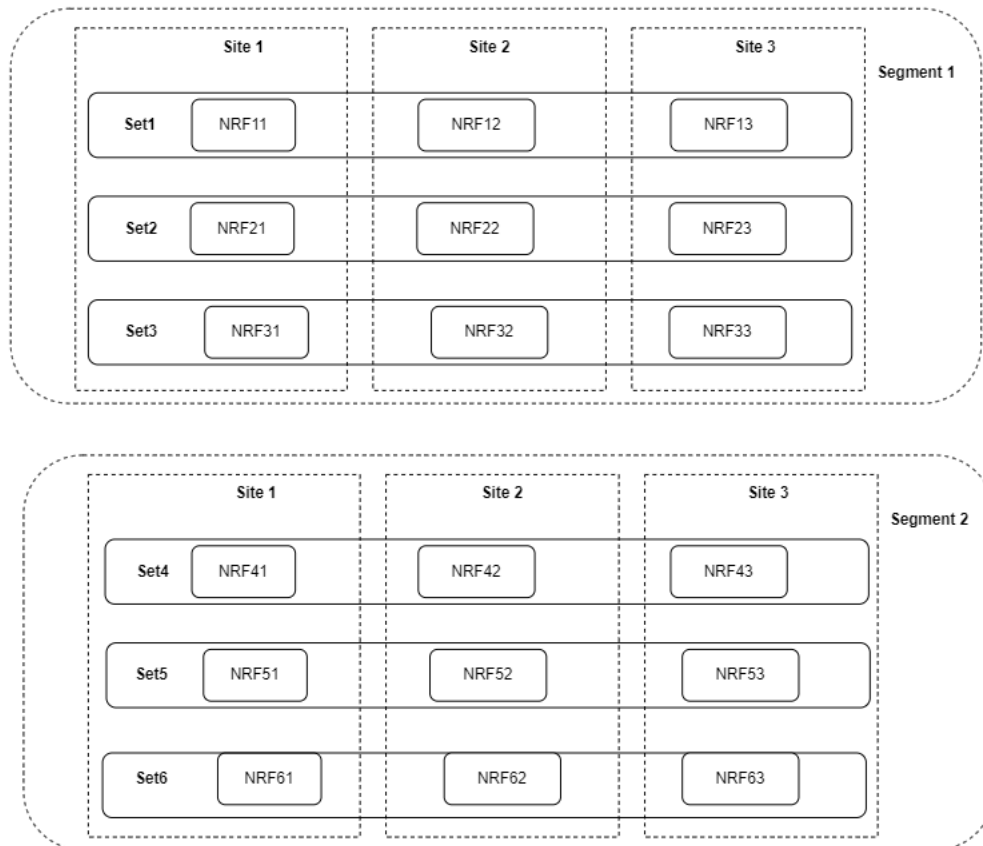
4.15 Enhanced NRF Set Based Deployment (NRF Growth)

NRF was supporting the deployment of two segments of NRF in a network. In the case of capacity expansion of the network to support increased traffic, a single NRF set cannot be scaled beyond a certain capacity.

With the implementation of this feature, NRF supports the deployment of multiple NRF set on the network instead of scaling the capacity of each NRF instance. Each segment in this

network can have a single georedundant set and each set can have up to four georedundant NRFs. The georedundant NRFs in the set share the state data with each other.

Figure 4-9 NRF Segments

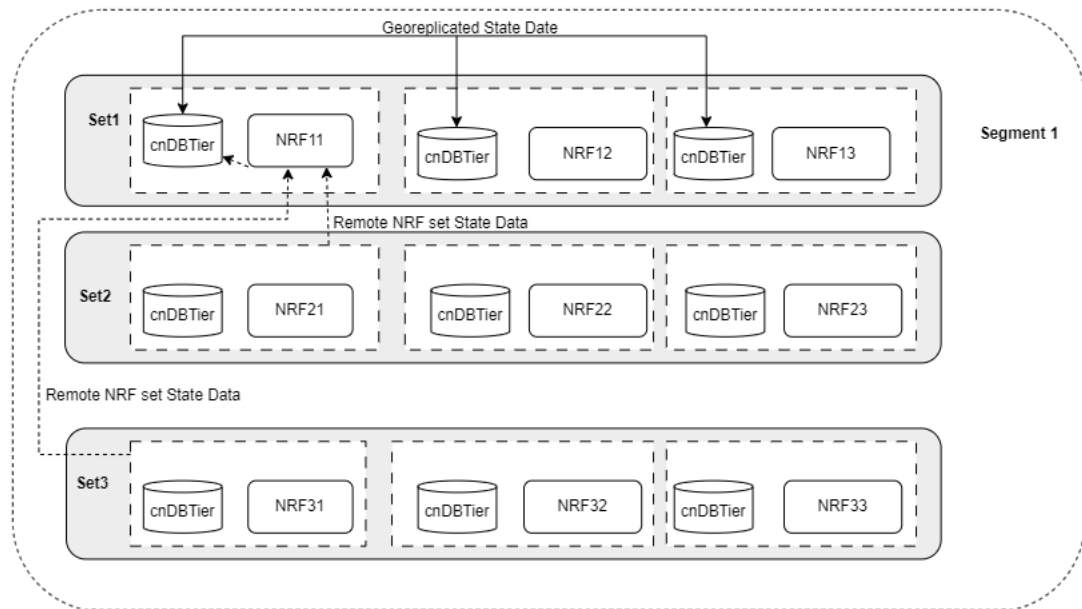


A dedicated cnDBTier instance is deployed for each NRF that is georeplicated within the specific NRF set. Each NRF in the set synchronizes with its most preferred NRFs in the other sets within the segment to retrieve the state data of that set. Thus, every NRF has the complete segment-level view of all the sets in a specific segment.

The state data in each NRF comprises of:

- local data
- georeplicated data of the specific set
- remote data from the other sets.

Figure 4-10 State Data in NRF



The Cache Data Service (CDS), which is multipod deployment, builds and maintains the state data of the local NRF set and the remote NRF sets in the in-memory cache. Each pod of CDS maintains its cache independently. CDS maintains the segment-level view of the state data. This segment-level view is not pushed to cnDBTier. For more information about CDS, see [NRF Architecture](#).

The cache of local NRF set data:

- is built or updated by querying the cnDBTier periodically
- uses the last known information about the NFs when CDS is not updated due to a database error

The cache of remote set data:

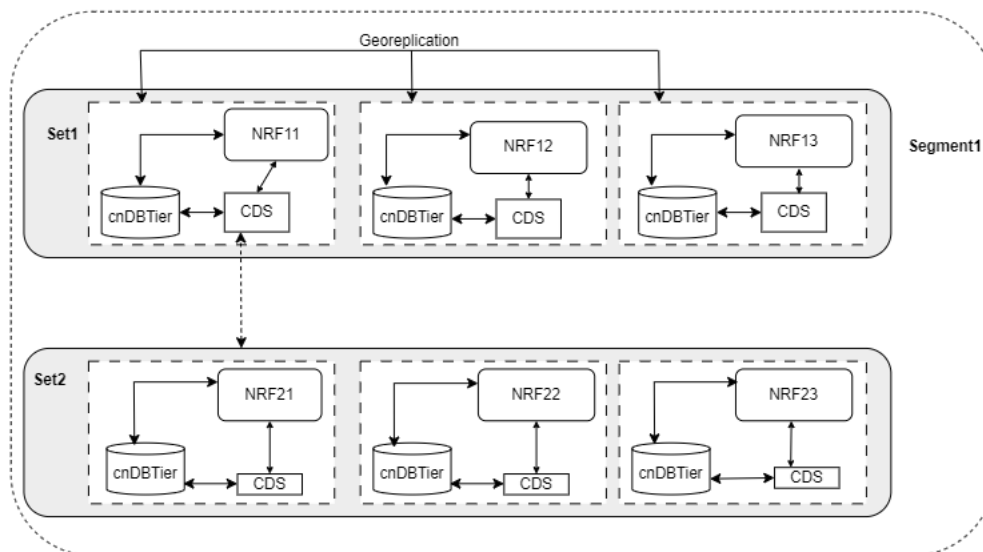
- is built or updated by synchronizing the state data of remote NRF sets periodically.

Note

The periodicity at which the remote NRF set data is synchronized with CDS in-memory cache is 2 seconds. Remote NRF set data synchronization is not performed for each request as it is performed over the WAN network. This may cause higher latency as it involves retries also.

- uses the last known information about the NFs in case remote NRF set sync is failed.

Figure 4-11 Cache Data Service



During pod initialization, the CDS service marks itself as available only after the local and remote set state data is loaded in the in-memory cache. CDS is only used for reading local and remote state data. The NRF microservices continue to write state data directly to the cnDBTier.

Note

CDS tries to fetch the state data from all the NRFs in remote sets. In case all the NRFs in any of the specific remote sets are unavailable, then CDS will come up with the state data of the remaining NRF sets (if any) and the local data.

The following NRF core microservices read data from CDS for various service operation requests as explained below. The write operations are directed to cnDBTier.

- **NF Registration Microservice (nfregistration):** The registration microservice queries the CDS for service operations such as NFListRetrieval and NFProfileRetrieval.
- **NF Subscription Microservice (nfsubscription):** The subscription microservice queries the CDS for service operations such as NFStatusSubscribe, NFStatusSubscribe(Patch), NFStatusUnsubscribe, NFStatusNotify. For NFStatusNotify, the subscription service fetches the subscriptions from its in-memory cache. The in-memory cache is updated periodically by the subscription microservice.
- **NRF Auditor Microservice (nrfauditor):** The auditor microservice queries the CDS to retrieve the total number of NFs per NFtype in the segment.
- **NF Access Token Microservice (nfaccess token):** The AccessToken microservice queries the CDS for processing the access token service operations.
- **NRF Configuration Microservice (nrconfiguration):** The configuration microservice queries CDS for processing the state data API requests.
- **NF Discovery Microservice (nfdiscovery):** The discovery microservice queries the CDS periodically to update its local cache.

For more information about the microservices, see the [Impacted Service Operations](#) section.

Note

All the remaining NRF microservices don't query CDS.

This feature interacts with some of the existing NRF features, for more information about this, see the [Interaction with Existing Features](#) section.

Managing NRF Growth feature**Enable****Prerequisites**

A minimum of two NRF sets are required to enable the feature.

Steps to Enable

1. Upgrade all existing sites to NRF 24.1.0 version or above. Ensure that all the sites are on the same version.
2. Configure a unique nfSetId for each NRF set using the /nrf-configuration/v1/nrfGrowth/featureOptions. Ensure that the same nfSetId must be configured for all the NRFs in the set.
For example: Consider a case of three NRF instances in a set and the nfSetId is **set1**. Set1 has NRF11, NRF12, and NRF13. Configure **set1** as nfSetId for NRF11, NRF12, and NRF13. See [Figure 4-12](#) for more details.
3. Install new NRF set(s) or upgrade an existing NRF set(s) to the NRF 24.1.0 version or above.
For example: Consider the new NRF set as Set2 with three NRF instances, NRF21, NRF 22, and NRF23. See [Figure 4-12](#) for more details.
4. Using the following state data API, retrieve the nf-instances and subscription details in each NRF of each set. Save the output for validation later.
 - a. Use /nrf-state-data/v1/nf-details to retrieve the nf-instances details.
 - b. Use /nrf-state-data/v1/subscription-details to retrieve the subscription details.
For more information about the query parameters, see the [REST Based NRF State Data Retrieval](#) section.
5. Configure the nfSetId of the new NRF set by setting the attribute nfSetId using the API /nrf-configuration/v1/nrfGrowth/featureOptions. Ensure that the same nfSetId must be configured for all the NRFs in the set.
For example: nfSetId of Set2 is **set2**. Configure **set2** as nfSetId for NRF21, NRF 22, and NRF23. See [Figure 4-12](#) for more details.
6. Load the NRF Growth feature specific alerts in both the sets. For more information about the alert configuration, see the [Alert Configuration](#) section.
7. Configure the NRFs of the remote NRF sets in each NRF by setting the attribute nrfHostConfigList using the API /nrf-configuration/v1/nrfGrowth/featureOptions.

Note

- Ensure Primary and alternate NRFs for an NF are configured with NRFs of a single set and does not spread across multiple NRF Sets.
- In case, Virtual FQDN is configured for NRF, ensure the resolved Primary and alternate NRFs belongs to a single NRF Set.
- If the NF needs to be migrated from one set to another, the procedure in [Migration of NFs](#) must be followed.
- Once configured, the NRFs will start syncing with the remote NRF sets. The remote set data will not be used for service operations until the feature is enabled.
- One of the entries in the `staticNrfConfigList` attribute must contain the details of the local NRF set.

For example: Configure the host details of NRFs in Set2 as the remote NRF sets in each NRFs of Set1. For instance, configure the `nrfHostConfigList` attribute in NRF11 of Set1 as remote NRFs host details of NRF21, NRF 22, and NRF23. Similarly, configure each NRFs in Set1 and Set2.

8. Ensure that the following alerts are not present in any of the sets in the network:
 - a. [OcnrfRemoteSetNrfSyncFailed](#)
 - b. [OcnrfSyncFailureFromAllNrfOfAllRemoteSets](#)
 - c. [OcnrfSyncFailureFromAllNrfOfAnyRemoteSet](#)If present, wait for 30 seconds to 1 minute and retry till the alerts are cleared. If the alerts are not cleared, see alerts for resolution steps.
9. Use the state data API to validate the nf-instances and subscriptions as below to ensure that the remote syncing is successful, and all the NFs and subscriptions are synced.
 - a. Use `/nrf-state-data/v1/nf-details?testSegmentData=true` to validate the nf-instances.
 - b. Use `/nrf-state-data/v1/subscription-details?testSegmentData=true` to validate the subscriptions.

Where, `testSegmentData` query is used to validate the state data of the segment before enabling the NRF Growth feature.

Note

Ensure that the state data of the NRFs in Set1 is available in the NRFs of Set2. In case you are upgrading the existing set, then ensure that the state data of the NRFs in Set2 is available in the NRFs of Set1.

For more information about the query parameters, see the [REST Based NRF State Data Retrieval](#) section.

10. Enable NRF Growth Forwarding feature, if forwarding is applicable.

Note

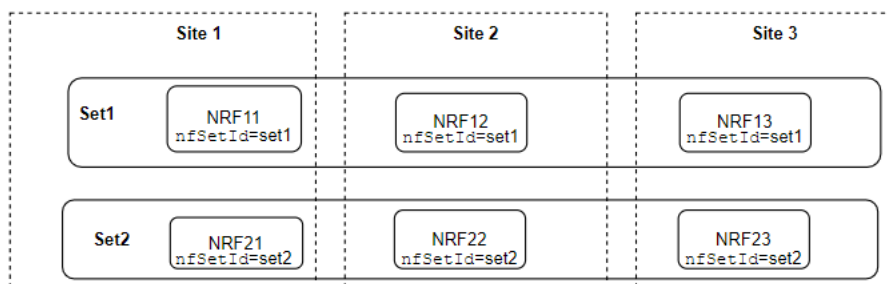
When NRF Growth feature is enabled, the existing forwarding options will not be used.

11. Enable the NRF Growth feature in all the NRFs. Enable the feature using the API `/nrf-configuration/v1/nrfGrowth/featureOptions`.
12. Ensure that the following alerts are not present in any of the sets in the network:
 - a. [OcnrfRemoteSetNrfSyncFailed](#)
 - b. [OcnrfSyncFailureFromAllNrfOfAllRemoteSets](#)
 - c. [OcnrfSyncFailureFromAllNrfOfAnyRemoteSet](#)
 - d. [OcnrfDatabaseFallbackUsed](#)

If present, wait for 30 seconds to 1 minute and retry till the alerts are cleared. If the alerts are not cleared, see alerts for resolution steps.

13. After the above configurations are complete, all service operations consider complete segment data for processing the request.
You can migrate the NFs from Set1 to Set2 or vice-versa. For more information about the steps to migrate NFs, see the [Migration of NFs](#) section.

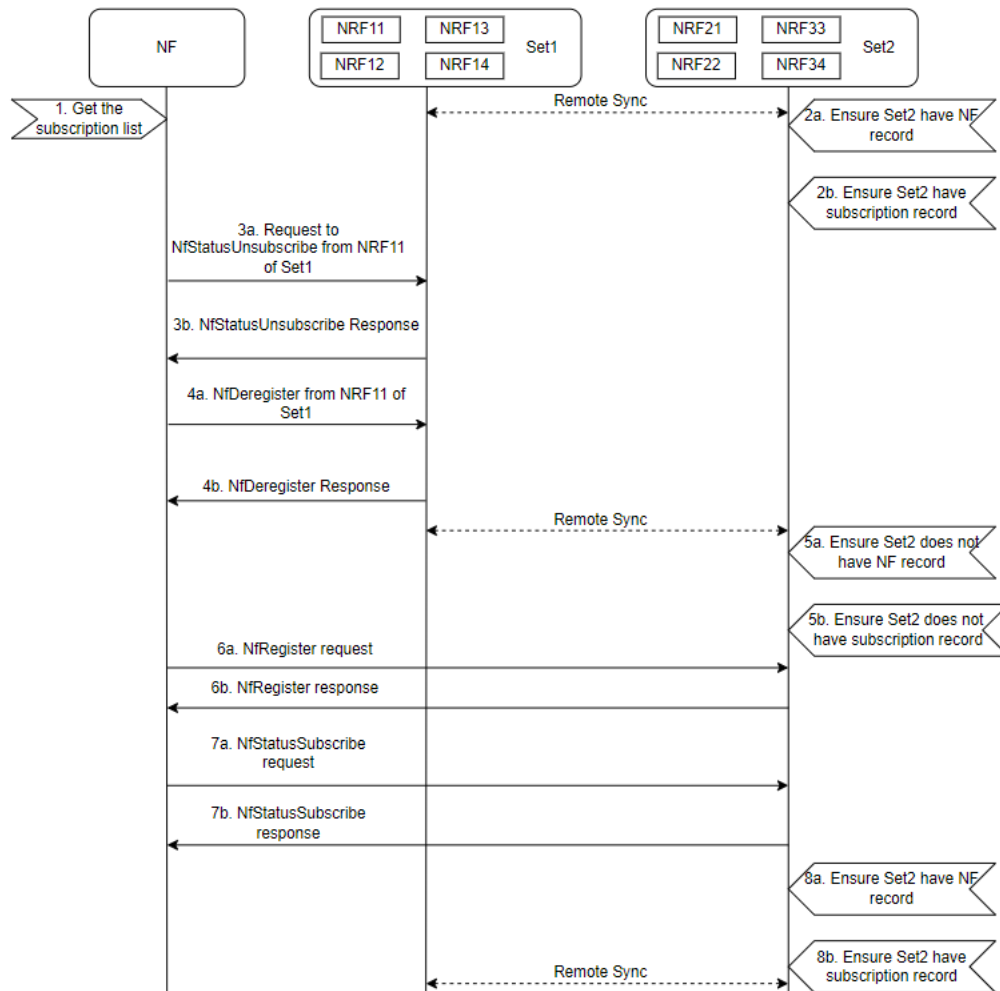
Figure 4-12 NRF Growth nfSetId Configuration



Migration of NFs

1. Make sure that the NF subscription list is available.
2. Use the following state data API at the remote NRF set to validate the NRF has record of this NF record as remote host details. If present, wait for 5-10 seconds and retry the API till the `nfInstanceId` is not present in the response.
 - a. Use `/nrf-state-data/v1/nf-details?nf-instance-id=<the nfInstanceId of the NF>` to validate the nf-instances.
 - b. Use `/nrf-state-data/v1/subscription-details?subscription-id= <subscription ID of the subscription>` to validate the subscriptions.
3. Unsubscribe the subscriptions of the NF from the NRF.
 - a. NF sends `NfStatusUnsubscribe` request to NRF.
 - b. NRF sends `NfStatusUnsubscribe` response to NF.
4. Deregister the NF from the NRF.

- a. NF sends NfDeregister request to NRF.
 - b. NRF sends NfDeregister response to NF.
5. Use the following state data API at the target NRF to validate the NRF does not have the NF record. If present, wait for 5-10 seconds and retry the API till the nfInstanceId is not present in the response.
 - a. Use /nrf-state-data/v1/nf-details?nf-instance-id=<the nfInstanceId of the NF> to validate the nf-instances.
 - b. Use /nrf-state-data/v1/subscription-details?subscription-id= <subscription ID of the subscription> to validate the subscriptions.
6. Register the NF with the NRF at the target NRF set.
 - a. NF sends NfRegister request to NRF.
 - b. NRF sends NfRegister response to NF.
7. Create the new subscription as required.
 - a. NF sends NfStatusSubscribe request to NRF.
 - b. NRF sends NfStatusSubscribe response to NF.
8. Use the following state data API at the target NRF to validate that the NF is registered and the subscription is created. The NF record is stored as local registered NF. If not present, wait for 5-10 seconds and retry the API till the nfInstanceId is present in the response.
 - a. Use /nrf-state-data/v1/nf-details?nf-instance-id=<the nfInstanceId of the NF> to validate the nf-instances.
 - b. Use /nrf-state-data/v1/subscription-details?subscription-id= <subscription ID of the subscription> to validate the subscription.

Figure 4-13 Migration of NF from one set to another

Configure

Configure the NRF Growth feature using REST API or CNC Console:

- **Configure Forwarding Options for NRF Growth feature using REST API:** Perform the configurations as described in the "Forwarding Options for NRF Growth" section of *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Configure Forwarding Options for NRF Growth feature using CNC Console:** Perform the configurations as described in the [Forwarding Options](#) section.
- **Configure NRF Growth feature using REST API:** Perform the feature configurations as described in the "NRF Growth Options" section of *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Configure NRF Growth feature using CNC Console:** Perform the feature configurations as described in [NRF Growth Options](#).

Note

The forwarding rules for nfDiscover service requests are based on following 3GPP discovery request parameters:

- target-nf-type (**Mandatory Parameter**)
- service-names (**Optional Parameter**)

The forwarding rules for access token service requests are based on the following 3GPP access token request parameter:

- scope (**Mandatory Parameter**)

Observe**Metrics**

The following metrics are added for the NRF Growth feature.

- ocnrf_cds_rx_requests_total
- ocnrf_cds_tx_responses_total
- ocnrf_cds_round_trip_time_seconds_[suffix]
- ocnrf_query_remote_cds_requests_total
- ocnrf_query_remote_cds_responses_total
- ocnrf_query_remote_cds_round_trip_time_seconds_[suffix]
- ocnrf_query_remote_cds_message_size_bytes_[suffix]
- ocnrf_cache_fallback_total
- ocnrf_db_fallback_total
- ocnrf_query_cds_requests_total
- ocnrf_query_cds_responses_total
- ocnrf_query_cds_round_trip_time_seconds_[suffix]
- ocnrf_dbmetrics_total
- ocnrf_nf_registered_count
- ocnrf_cache_sync_count_total
- ocnrf_remote_set_unavailable_total
- ocnrf_all_remote_sets_unavailable_total

For more information on the above metrics, see the [NRF Cache Data Metrics](#) section.

Alerts

Following are the NRF Growth feature specific alerts:

- [OcnrfRemoteSetNrfSyncFailed](#)
- [OcnrfSyncFailureFromAllNrfOfAnyRemoteSet](#)
- [OcnrfSyncFailureFromAllNrfOfAllRemoteSets](#)
- [OcnrfCacheDataServiceDown](#)

- [OcnrfDatabaseFallbackUsed](#)
- [OcnrfTotalNFsRegisteredAtSegmentBelowMinorThreshold](#)
- [OcnrfTotalNFsRegisteredAtSegmentBelowMajorThreshold](#)
- [OcnrfTotalNFsRegisteredAtSegmentBelowCriticalThreshold](#)

For more information on the above alerts, see the [Feature Specific Alerts](#) section.

KPIs

Following are the NRF Growth feature specific KPIs:

- Cache Sync
- Total Number of CDS Requests
- Total Number of CDS Responses
- Total Number of CDS Requests per Service Operation
- Total Number of CDS Responses per Service Operation
- CDS Latency 50%
- CDS Latency 90%
- CDS Latency 95%
- CDS Latency 99%
- Total Number of CDS Requests per Request Type
- Total Number of CDS Responses per Request Type
- Total Number of Remote CDS Requests
- Total Number of Remote CDS Responses
- Remote CDS Query Latency 50%
- Remote CDS Query Latency 90%
- Remote CDS Query Latency 95%
- Remote CDS Query Latency 99%
- Database Fallback
- CDS Cache Sync

For more information on the above metrics, see the [NRF Growth Specific KPIs](#) section.

Maintain

If you encounter alerts at system or application levels, see the [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

1. **Collect the logs:** For more information on collecting logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.15.1 Impacted Service Operations

This section explains the change in the functionality of the service operation when multiple NRF sets are deployed.

nfRegistration Service Operation

NFRegister, NFUpdate, or NFDeregister

The NF registers and heartbeats to the Primary NRF. When the *nfRegistration* service receives an NFRegister, NFUpdate, or NFDeregister request, it processes the request and if successful, it creates, updates, or deletes the nf-instances records from the cnDBTier. The nf-instances is made available and used by the service operation in the remote set as well.

The *nfRegistration* service does not query the Cache Data Service (CDS) for these service operations. It directly updates or saves the data in the local cnDBTier.

NFProfileRetrieval

When the *nfRegistration* service receives the NFProfileRetrieval request, it queries the CDS to fetch the NFProfile.

The CDS provides the NFProfile of the local NRF set by querying the cnDBTier. The CDS queries the remote NRF sets periodically and caches the data in the in-memory cache. If the growth feature is enabled, the CDS provides the NFProfile registered at the remote NRF sets by querying the in-memory cache.

The response contains the matching NFProfile either from the local NRF set or from the remote NRF set. The NFProfileRetrieval response is created by the *nfRegistration* service with the nf-instances provided by the CDS.

The responses from the *nfRegistration* service vary based on the following conditions:

- If the NFProfile is not present in the response from the CDS, a response with status code 404 NOT FOUND is sent to the consumer NF.
- If the CDS is unreachable or a non-2xx status code is received, the registration service relies on the cnDBTier to obtain the nf-instances local data and fulfill the service operation. The *nfRegistration* service fetches data from the cnDBTier and only the matching NFProfile from the local NRF set data is sent.
- If the NRF Growth feature is enabled and the remote NRF set is not reachable, CDS provides state data of the local NRF set received from cnDBTier and the last known state data of the remote set from its in-memory cache.

NFListRetrieval

When the *nfRegistration* service receives an NFListRetrieval request, it queries the CDS to get the list of nfInstanceIDs.

The CDS provides the nf-instances of the local NRF set by querying the cnDBTier. The CDS queries the remote set periodically and caches the data in the in-memory cache. If the growth feature is enabled, the CDS provides the nf-instances of the remote NRF sets by querying the in-memory cache.

The response contains the matching nf-instances from the local NRF set and the remote NRF set. The NFListRetrieval response is created by the *nfRegistration* service with the nf-instances provided by the CDS.

The responses from the *nfRegistration* service vary based on the following conditions:

- If there are no matching nf-instances in either of the sets, an empty response is sent.
- If the CDS is unreachable or a non-2xx status code is received, the registration service falls back to the cnDBTier to get the nf-instances local data and fulfill the service operation. The *nfRegistration* service fetches data from the cnDBTier and only the matching nf-instances from the local NRF set data is sent.
- If the NRF Growth feature is enabled and the remote NRF set is not reachable, CDS provides state data of the local NRF set received from cnDBTier and the last known state data of the remote set from its in-memory cache.

nfSubscription Service Operation

The NFs continue to subscribe for Producer NFs and update their subscriptions using the NRFs of the same georedundant set. The *nfSubscription* service is responsible for creating and maintaining the subscriptions in NRF. It also takes care of triggering NfStatusNotify to the consumer NFs for their subscriptions.

NfStatusSubscribe

When the *nfSubscription* service receives the NfStatusSubscribe request to create a subscription, the *nfSubscription* service checks the following constraints before creating the subscription:

- duplicate subscription based on the allowDuplicateSubscriptions parameter configuration. This check is performed across all the sets in the segment. For more information about the configuration of this parameter, see [NF Management Options](#). For more information about the functionality of this parameter for different values configured, see [Use Cases for Allow Duplicate Subscriptions](#).
- subscription limit conditions based on the subscriptionLimit parameter configuration. This check is applicable for all the subscriptions at the local NRF set. For more information about the Subscription Limit feature, see the [Subscription Limit](#) section.

If the constraints are passed, the *nfSubscription* service creates the subscription and saves it to the cnDBTier. The *nfSubscription* service queries the CDS to get the subscription already created. The CDS provides subscriptions at the local NRF set by querying the cnDBTier. The CDS queries the remote set periodically and caches the data in the in-memory cache. If the growth feature is enabled, the CDS provides the subscriptions of the remote NRF sets by querying the in-memory cache.

The responses from the *nfSubscription* service vary based on the following conditions:

- If the CDS is unreachable or a non-2xx status code is received, the *nfSubscription* service relies on the cnDBTier to get the subscription in local NRF and fulfill the service operation. The *nfSubscription* service creates subscriptions only in the local NRF.
- If the NRF Growth feature is enabled and the remote NRF set is not reachable, CDS provides subscription details of the local NRF set, and the last known information of the remote NRF set is provided.

NfStatusSubscribe(Patch)

When the *nfSubscription* service receives the NfStatusSubscribe (Patch) request to update a subscription, the *nfSubscription* service checks the following constraints before updating the subscription:

- checks if the subscription exists. This check is performed across all the sets in the segment.

- subscription limit conditions based on the `subscriptionLimit` parameter configuration. This check is applicable for all the subscriptions at the local NRF set.

If the constraints are passed, the *nfSubscription* service updates the subscription and saves it to the `cnDBTier`.

The subscription microservice queries the CDS to retrieve the subscriptions that are created at the local NRF set. The CDS provides the corresponding subscriptions created at the local NRF set by querying the `cnDBTier`. If the NRF Growth feature is enabled, the CDS provides the matching subscriptions created at the remote NRF sets by querying the in-memory cache.

The responses from the *nfSubscription* service vary based on the following conditions:

- If the CDS is unreachable or a non-2xx status code is received, the *nfSubscription* service relies on the `cnDBTier` to get the subscription in local NRF and fulfill the service operation. The *nfSubscription* service updates subscriptions only in the local NRF.
- If the NRF Growth feature is enabled and the remote NRF set is not reachable, CDS provides subscription details of the local NRF set, and the last known information of the remote NRF set is provided.

NfStatusUnsubscribe

When the *nfSubscription* service receives the `NfStatusUnsubscribe` request to delete a subscription, the *nfSubscription* service checks if the subscription exists. This check is performed across all the sets in the segment.

The subscription microservice queries the CDS to retrieve the matching subscriptions that are created at the local NRF set. The CDS provides the corresponding subscriptions created at the local NRF set by querying the `cnDBTier`. If the NRF Growth feature is enabled, the CDS provides the matching subscriptions created at the remote NRF sets by querying the in-memory cache.

If the subscription is present, it deletes the subscription from the `cnDBTier` and responds with the 200 OK status code. If the subscriptions created at the one NRF set cannot be deleted at any other NRF set and such requests are rejected. If the subscription is not present, the response with a 404 status code is sent.

The responses from the *nfSubscription* service vary based on the following conditions:

- If the CDS is unreachable or a non-2xx status code is received, the *nfSubscription* service relies on the `cnDBTier` to get the subscription in local NRF and fulfill the service operation. The *nfSubscription* service unsubscribes the subscriptions only in the local NRF.
- If the NRF Growth feature is enabled and the remote NRF set is not reachable, CDS provides subscription details of the local NRF set, and the last known information of the remote NRF set is provided.

NfStatusNotify

The *nfSubscription* service triggers notifications to consumer NFs that are subscribed to NF instance status events when the conditions specified in the subscription are met. Notifications are triggered for subscriptions created across all sets within the segment.

From release 26.1.200 onwards, the *nfSubscription* service maintains both local and remote set subscriptions in its in-memory cache. The service retrieves subscriptions matching the NF event from the cache and triggers the *NfStatusNotify* operation for all eligible subscribers.

The behavior of the *nfSubscription* service under different conditions is as follows:

- If the CDS is unreachable or returns a non-2xx response, the `nfSubscription` service uses the last known remote set subscription data available in the cache. Notifications are triggered for subscriptions from both the local set and the cached remote set data.
- If the NRF Growth feature is enabled and a remote NRF set is not reachable, CDS provides subscription details for the local NRF set and the last known subscription data for the remote NRF set, if available.

NFDiscover

When the `NFDiscover` service receives a discovery request, it looks for `Producer NFProfile` maintained at the in-memory cache in the discovery service. The discovery service cache is periodically updated by querying the CDS.

CDS updates the local cache of the discovery microservice with the latest local NRF set data. CDS sends the response with the latest local NRF set data and cached remote NRF data.

Additionally, if the NRF Growth feature is enabled CDS updates the local cache of the discovery microservice with the latest local NRF set data and cached remote NRF data.

In case the CDS is not reachable or a non-2xx status code is received, the discovery service relies on the `cnDBTier` to get local NRF set data and update its in-memory cache for the local NRF set state data. If the NRF Growth feature is enabled, the last known data of the remote NRF set is used for the discovery service operation.

NfAccessToken

When the `nfAccessToken` service receives a `nfAccessToken` request with `targetNfInstanceId`, it queries the CDS to validate if the target NF and/or requester NF is registered.

The `nfAccessToken` service queries the CDS to retrieve the `targetNfInstanceId` and `requesterNfInstanceId` that are created at the local NRF set. The CDS provides the corresponding NF instances created at the local NRF set by querying the `cnDBTier`. If the NRF Growth feature is enabled, the CDS provides the matching NF instances created at the remote NRF sets by querying the in-memory cache.

Note

The `requesterNfInstanceId` is validated as part of the [Access Token Request Authorization](#) feature.

If the CDS is unreachable or a non-2xx status code is received, the `nfAccessToken` service falls back to the `cnDBTier` to get the `NfInstanceId` local NRF set and fulfill the service operation.

4.15.2 Interaction with Existing Features

With the deployment of multiple sets of NRFs, the functionality of the following features is impacted.

NRF Forwarding Feature

When the growth feature is enabled, the service requests can be forwarded to NRF in another segment. The service requests are forwarded to NRF in another segment if the requested `Producer NfInstances` are not registered in any of the NRF sets in the segment.

For more information about configuring the forwarding options, see the [Enhanced NRF Set Based Deployment \(NRF Growth\)](#) section.

NRF Growth Forwarding

NRF Growth Forwarding is the forwarding behavior used when the Enhanced NRF Set Based Deployment (NRF Growth) feature is enabled. When NRF Growth feature is enabled, service operation messages like NfProfileRetrieval, NfDiscovery, NfAccessToken, and NfStatusSubscribe can be forwarded to an NRF in another segment if the requested Producer NF instances are not registered in any NRF set within the local segment.

NRF Growth Forwarding behavior is controlled through the REST API: `{apiRoot}/nrf-configuration/v1/nrfGrowth/nrfForwardingOptions`

For more details, see the “Forwarding Options for NRF Growth” section in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

Note

- When the Growth feature is enabled, NRF–NRF Forwarding Options configurations (API :`{apiRoot}/nrf-configuration/v1/forwardingOptions`)) are not considered.
- Ensure to migrate the configurations in this API to `{apiRoot}/nrf-configuration/v1/nrfGrowth/nrfForwardingOptions` before enabling the Growth feature.

Dynamic SLF Feature

When dynamic SLF is configured and growth feature is enabled, the dynamic selection of the SLF profiles is performed across local and remote NRF sets. In a given NRF set, the preferredSLFLocality attribute can be utilized to prefer SLFs of the local NRF set over SLFs of remote NRF set for sending SLF query. For more information about the dynamic SLF feature, see the [Subscriber Location Function](#) section.

Subscription Limit

When the growth feature is enabled, the subscription count is evaluated within each set.

Note Ensure that the total number of subscriptions in all the sets in the segment must not exceed the `globalMaxLimit` value. Configure the `globalMaxLimit` value accordingly.

For example, consider there are two sets deployed in the segment, the total subscription that is supported in the segment is 1000, and the `globalMaxLimit` of set1 is 300 and set2 is 700. In this case, NRF validates that the subscription count of set1 does not cross 300 and set2 does not cross 700.

For more information about the Subscription Limit feature, see the [Subscription Limit](#) section.

REST-Based NRF State Data Retrieval

REST-based NRF state data retrieval feature provides options for Non-Signaling APIs to access NRF state data. It allows the operator to access the NRF state data to understand and debug in the event of failures. NRF exposes the following APIs that are used to fetch the NfProfiles and NfSubscriptions at NRF across the local and remote NRF sets. When the growth feature is enabled, the API behavior is as follows:

1. `{apiRoot}/nrf-state-data/v1/nf-details`
The API returns the NfProfiles registered at the NRF and its mated sites. The response includes the NfProfiles registered at the local site, and its mated sites if the replication channel between the given site and the mate site is UP.

When the growth feature is disabled, the remote profiles can still be fetched by setting the query parameter `?testSegmentData=true`.

Refer [Enable](#) section to know the usage of this query parameter.

The NfProfiles are filtered based on the query parameters mentioned in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*. The filtered NfProfiles are included in the response.

2. `{apiRoot}/nrf-state-data/v1/subscription-details`

The API returns the NfSubscriptions created at the NRF and its mated sites. The response includes the NfSubscriptions created at the local site, and its mated sites if the replication channel between the given site and the mate site is UP.

When the growth feature is disabled, the remote subscriptions can still be fetched by setting the query parameter `?testSegmentData=true`.

Refer Enable section to know the usage of this query parameter.

The NfSubscriptions are filtered based on the query parameters mentioned in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*. The filtered NfSubscriptions are included in the response.

Kubernetes Probes

Startup Probe

The Cache Data Service startup probe proceeds when the following conditions are met:

1. Connectivity to the cnDBTier is successful.
2. The NRF State and Configuration tables are present, and configuration data is present in the cnDBTier.

Readiness Probe

The Cache Data Service readiness probe runs the container only if the following conditions are met:

1. Connectivity to the cnDBTier is successful.
2. The NRF State and Configuration tables are present, and configuration data is present in the cnDBTier.
3. One successful attempt to load the local NRF set state data into the local cache. The state data is the NfInstances and NfSubscriptions. If no NfInstances or NfSubscriptions are present in the cnDBTier, the cache will remain empty and the start-up probe is considered a success. This check is done only once when the pod comes up for the first time. Subsequent readiness probes will not check this condition.
4. If the growth feature is enabled, there will be one successful attempt to load the state data from all the remote NRF sets that are configured. If no NfInstances or NfSubscriptions are received from the remote NRF Set, that request is considered a success. If the remote set NRFs are not reachable, then after all the reattempts and reroutes, the request is considered a success.

Liveness Probe

The Liveness Probe monitors the health of the critical threads running the Cache Data Service. If any of the threads are detected to be in a deadlock state or non-running, the liveness Probe will fail.

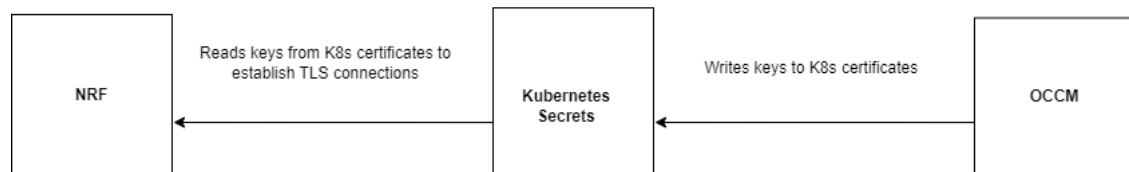
For more information about Kubernetes probes, see the [Kubernetes Probes](#) section.

4.16 Support for Automated Certificate Lifecycle Management

In NRF 23.3.x and earlier, X.509 and Transport Layer Security (TLS) certificates were managed manually. When multiple instances of NRF were deployed in a 5G network, certificate management, such as certificate creation, renewal, removal, and so on, became tedious and error-prone.

Starting with NRF 23.4.x, you can integrate NRF with Oracle Communications Cloud Native Core, Certificate Management (OCCM) to support automation of certificate lifecycle management. OCCM manages TLS certificates stored in Kubernetes secrets by integrating with Certificate Authority (CA) using the Certificate Management Protocol Version 2 (CMPv2) protocol in the Kubernetes secret. OCCM obtains and signs TLS certificates within the NRF namespace. For more information about OCCM, see *Oracle Communications Cloud Native Core, Certificate Management User Guide*.

Figure 4-14 Support for OCCM



The above diagram indicates that OCCM writes the keys to the certificates and NRF reads these keys to establish a TLS connection with other NFs.

OCCM can automatically manage the following TLS certificates:

- 5G Service Based Architecture (SBA) client TLS certificates
- 5G SBA server TLS certificates
- Message Feed TLS certificates

This feature enables NRF to monitor, create, recreate, and renew TLS certificates using OCCM, based on their validity. For information about enabling HTTPS, see "Configuring Secrets for Enabling HTTPS" in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Install Guide Considerations

- Upgrade: When NRF is deployed with OCCM, follow the specific upgrade procedure. For information about the upgrade strategy, see "Upgrade Strategy" in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
- Rollback: For more information on migrating the secrets from NRF to OCCM and removal of Kubernetes secrets from the yaml file, see "Postupgrade Task" in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Configure

There are no additional configuration changes required at NRF.

Observe Metrics

This feature uses the existing metrics:

- `oc_egressgateway_connection_failure_total`
- `oc_ingressgateway_connection_failure_total`

For more information, see [NRF Gateways Metrics](#).

Maintain

If you encounter any OCCM-specific alerts, see the "OCCM Alerts" section in *Oracle Communications Cloud Native Core, Certificate Management User Guide*.

If you encounter alerts at system or application levels, see the [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

1. Collect the logs: For more information on collecting logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. Raise a service request: See [My Oracle Support](#) for more information on how to raise a service request.

4.17 Egress Gateway Route Configuration for Different Deployments

The Egress Gateway route configuration for mTLS and non-TLS based deployments is as follows:

Table 4-18 Egress Gateway Route Configuration for Static Peers

Egress Traffic	Egress Gateway Configuration			Outgoing Message Details		
	Peer under PeerSetConfiguration	RoutesConfiguration.httpsTargetOnly	RoutesConfiguration.httpRuriOnly	3gpp-Sbi-Target-apiRoot	Scheme	Authority Header
HTTPS Outgoing Traffic (TLS)	httpsConfiguration	true	false	Target FQDN Example: <SLF FQDN>/<NotificationServer>	https	Peer FQDN Example: SCP/SEPP FQDN
HTTP Outgoing Traffic (non-TLS)	httpsConfiguration	true	true	Target FQDN Example: <SLF FQDN>/<NotificationServer>	http	Peer FQDN Example: SCP/SEPP FQDN
HTTP (non-TLS) and HTTPS (TLS) Outgoing Traffic	httpsConfiguration httpConfiguration	false	false	Target FQDN Example: <SLF FQDN>/<NotificationServer>	http/https	Peer FQDN Example: SCP/SEPP FQDN

Table 4-19 Egress Gateway Route Configuration for virtualHost Peers

Egress Traffic	Egress Gateway Configuration			Outgoing Message Details		
	Peer under PeerSetConfiguration	RoutesConfiguration.httpsTargetOnly	RoutesConfiguration.httpRuriOnly	3gpp-Sbi-Target-apiRoot	Scheme	Authority Header
HTTPS Outgoing Traffic (TLS)	httpsConfiguration	true	false	Target FQDN Example: <SLF FQDN>/<NotificationServer>	https	Resolved Peer FQDN Example: Resolved SCP/ SEPP FQDN
HTTP Outgoing Traffic (non-TLS)	httpConfiguration	false	true	Target FQDN Example: <SLF FQDN>/<NotificationServer>	http	Resolved Peer FQDN Example: Resolved SCP/ SEPP FQDN
HTTP (non-TLS) and HTTPS (TLS) Outgoing Traffic	httpsConfiguration httpConfiguration	false	false	Target FQDN Example: <SLF FQDN>/<NotificationServer>	http/https	Resolved Peer FQDN Example: Resolved SCP/ SEPP FQDN

Note

- For service-mesh based deployment, NRF Egress Gateway application container sends HTTP outgoing traffic only. The sidecar container is responsible for sending out the traffic as HTTPS traffic. Hence, for service-mesh based deployment, perform the configuration as per HTTP Outgoing Traffic (non-TLS).

Configuration for HTTPS Outgoing Traffic

For HTTPS Outgoing Traffic, perform the following configuration at NRF Egress Gateway:

- Update the **PeerConfiguration** as follows:

```
sample PeerConfiguration.json
[
  {
    "id": "peer1",
    "host": "scp-stub-service01",
    "port": "8443",
    "apiPrefix": "/",
```

```

        "healthApiPath":"/{scpApiRoot}/{apiVersion}/status"
    }
]

```

2. Update the **PeerSetConfiguration** as follows:

```

sample peerset.json
[
  {
    "id":"set0",
    "httpsConfiguration":[
      {
        "priority": 1,
        "peerIdentifier": "peer1"
      }
    ]
  }
]

```

3. Update the **RoutesConfiguration** as follows:

```

sample RoutesConfiguration.json
{
  "id":"egress_scp_proxy2",
  "uri":"http://localhost:32069/",
  "order":3,
  "metadata":{
    "httpsTargetOnly":true,
    "httpRuriOnly":false,
    "sbiRoutingEnabled":true
  },
  "predicates":[
    {
      "args":{
        "pattern":"/nudr-group-id-map/v1/nf-group-ids"
      },
      "name":"Path"
    }
  ],
  "filters":[
    {
      "name":"SbiRouting",
      "args":{
        "peerSetIdentifier":"set0",
        "customPeerSelectorEnabled":false
      }
    }
  ]
}

```

Configuration for HTTP Outgoing Traffic

For HTTP Outgoing Traffic, perform the following configuration at NRF Egress Gateway:

1. Update the **PeerConfiguration** as follows:

```
sample PeerConfiguration.json
[
  {
    "id": "peer1",
    "host": "scp-stub-service01",
    "port": "8080",
    "apiPrefix": "/",
    "healthApiPath": "/{scpApiRoot}/{apiVersion}/status"
  }
]
```

2. Update the **PeerSetConfiguration** as follows:

```
sample PeerSetConfiguration.json
[
  {
    "id": "set0",
    "httpConfiguration": [
      {
        "priority": 1,
        "peerIdentifier": "peer1"
      }
    ]
  }
]
```

3. Update the **RoutesConfiguration** as follows:

```
sample RoutesConfiguration.json
{
  "id": "egress_scp_proxy2",
  "uri": "http://localhost:32069/",
  "order": 3,
  "metadata": {
    "httpsTargetOnly": true,
    "httpRuriOnly": true,
    "sbiRoutingEnabled": true
  },
  "predicates": [
    {
      "args": {
        "pattern": "/nudr-group-id-map/v1/nf-group-ids"
      },
      "name": "Path"
    }
  ],
  "filters": [
    {
      "name": "SbiRouting",
      "args": {
        "peerSetIdentifier": "set0",
        "customPeerSelectorEnabled": false
      }
    }
  ]
}
```

```

    }
  }
}

```

Configuration for HTTP and HTTPS Outgoing Traffic

For HTTPS and HTTP Outgoing Traffic, perform the following configuration at NRF Egress Gateway:

1. Update the **PeerConfiguration** as follows:

```

sample PeerConfiguration.json
[
  {
    "id": "peer1",
    "host": "scp-stub-service01",
    "port": "8080",
    "apiPrefix": "/",
    "healthApiPath": "/{scpApiRoot}/{apiVersion}/status"
  }
  {
    "id": "peer2",
    "host": "scp-stub-service01",
    "port": "8443",
    "apiPrefix": "/",
    "healthApiPath": "/{scpApiRoot}/{apiVersion}/status"
  }
]

```

2. Update the **PeerSetConfiguration** as follows:

```

sample peerset.json
[
  {
    "id": "set0",
    "httpConfiguration": [
      {
        "priority": 1,
        "peerIdentifier": "peer1"
      }
    ]
  }
  {
    "id": "set1",
    "httpsConfiguration": [
      {
        "priority": 1,
        "peerIdentifier": "peer2"
      }
    ]
  }
]

```

3. Update the **RoutesConfiguration** as follows:

```
sample RoutesConfiguration.json
{
  "id": "egress_scp_proxy2",
  "uri": "http://localhost:32069/",
  "order": 3,
  "metadata": {
    "httpsTargetOnly": false,
    "httpRuriOnly": false,
    "sbiRoutingEnabled": true
  },
  "predicates": [
    {
      "args": {
        "pattern": "/nudr-group-id-map/v1/nf-group-ids"
      },
      "name": "Path"
    }
  ],
  "filters": [
    {
      "name": "SbiRouting",
      "args": {
        "peerSetIdentifier": "set0",
        "customPeerSelectorEnabled": false
      }
    }
  ]
}
```

4.18 Routing Egress Messages through SCP

NRF allows routing of following Egress messages through SCP or directly with an option to configure each Egress request type independently:

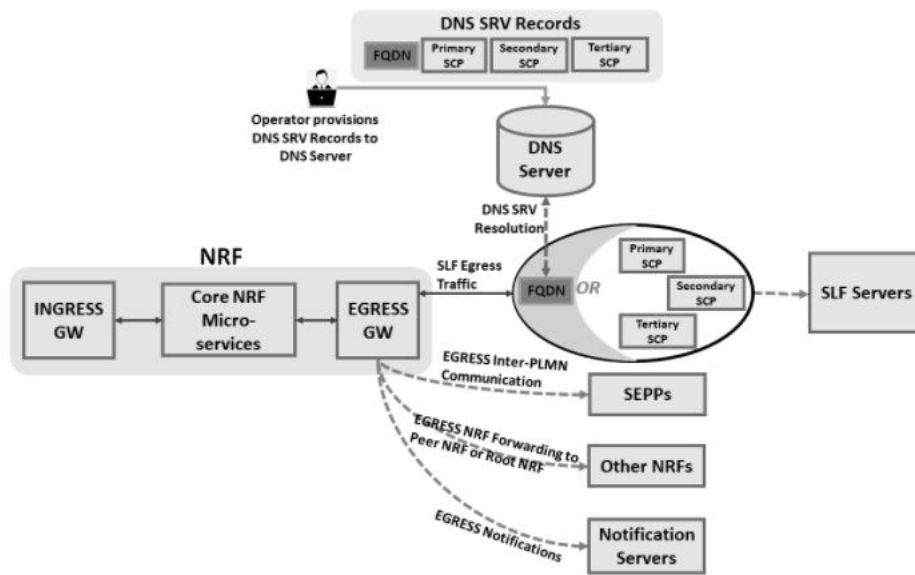
- SLF requests
- Notification requests
- NRF Forwarding requests
- Roaming requests

The above requests are routed through SCP based on the configuration in the Egress Gateway. For more information about the routes configuration, see the "Routes Configuration" section in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

NRF supports routing of the Egress requests through SCP configured with FQDN and virtual FQDN as peer instances.

Alternate route service is used for the resolution of virtual FQDN using DNS-SRV. Egress Gateway uses the virtual FQDN of peer instances to query the Alternate Route Service to get the list of alternate FQDNs, each of which has a priority assigned to them. The Egress Gateway selects the peer instances based on the priority value.

Figure 4-15 Routing Egress Messages through SCP



Managing the feature Enable

1. Open the `ocnrf_custom_values_26.1.201.yaml` file.
2. Set `enableNrfArtisanService` to **true** to enable Artisan microservice.

Note

This parameter must be enabled when dynamic SLF feature is configured.

3. Set `alternateRouteServiceEnable` to **true** to enable alternate route service. For more information on enabling alternate route service, see the "Global Parameters" section in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Note

This parameter must be enabled when alternate route service through DNS-SRV is required.

4. Save the file.
5. Run `helm install`. For more information about installation procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
6. If you are enabling this parameter after NRF deployment, run `helm upgrade`. For more information about upgrade procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Configure

Configure using REST API: Perform the following Egress Gateway configuration as described in the "Egress Gateway Configuration" section of the *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

- create or update the peerconfiguration with SCP FQDN details.
- create or update the peersetconfiguration to assign these peers.
- create or update the sbiroutingerrorcriteriasets.
- create or update the sbiroutingerroractionsets.
- create or update the routesconfiguration to provide the SCP details. For more information about the routes configuration specific to the above-mentioned requests, see the following sections:
 - [SLF Requests](#)
 - [Notifications Requests](#)
 - [NRF Forwarding Requests](#)
 - [Roaming Requests](#)
- If all the requests must be routed through SCP, then create or update the routesconfiguration as follows:

```
[
  {
    "id": "egress_scp_proxy1",
    "uri": "http://localhost:32068/",
    "order": 0,
    "metadata": {
      "httpsTargetOnly": true,
      "httpRuriOnly": true,
      "sbiRoutingEnabled": true
    },
    "predicates": [
      {
        "args": {
          "pattern": "/*"
        },
        "name": "Path"
      }
    ],
    "filters": [
      {
        "name": "SbiRouting",
        "args": {
          "peerSetIdentifier": "set0",
          "customPeerSelectorEnabled": false,
          "errorHandling": [
            {
              "errorCriteriaSet": "criteria_1",
              "actionSet": "action_1",
              "priority": 1
            },
            {
              "errorCriteriaSet": "criteria_0",
              "actionSet": "action_0",
              "priority": 2
            }
          ]
        }
      }
    ]
  }
]
```

```

    }
  ]
}
},
{
  "id": "default_route",
  "uri": "egress://request.uri",
  "order": 100,
  "filters": [
    {
      "name": "DefaultRouteRetry"
    }
  ],
  "predicates": [
    {
      "args": {
        "pattern": "/*"
      },
      "name": "Path"
    }
  ]
}
]

```

For more information about the routes configuration on different deployments, see [Egress Gateway Route Configuration for Different Deployments](#).

Maintain

If you encounter alerts at system or application levels, see the [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

- Collect the logs: For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
- Raise a service request: See [My Oracle Support](#) for more information on how to raise a service request.

4.18.1 SLF Requests

NRF supports routing of SLF queries through SCP towards SLF or UDR.

Managing SLF Requests through SCP

Configure

You can configure the SLF requests through SCP using the Egress Gateway configurations either using REST API or Console:

- **Configure using REST API:** Perform the following feature configurations as described in the "Egress Gateway Configuration" section of *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*:
 - Create or update {apiRoot}/nrf/nf-common-component/v1/egw/peerconfiguration.

- Create or update the {apiRoot}/nrf/nf-common-component/v1/egw/peerSetconfiguration to assign these peers.
- Create or update {apiRoot}/nrf/nf-common-component/v1/egw/sbiRoutingerrorCriteriaSets.
- Create or update {apiRoot}/nrf/nf-common-component/v1/egw/sbiRoutingerrorActionSets.
- Update the {apiRoot}/nrf/nf-common-component/v1/egw/routesconfiguration as mentioned below:

```
curl -v -X PUT "http://10.75.226.126:32247/nrf/nf-common-component/v1/egw/routesconfiguration" -H "Content-Type: application/json" -d @header.json
```

sample header.json:-

```
[
  {
    "id": "egress_scp_proxy1",
    "uri": "http://localhost:32068/",
    "order": 0,
    "metadata": {
      "httpsTargetOnly": true,
      "httpRuriOnly": false,
      "sbiRoutingEnabled": true
    },
    "predicates": [
      {
        "args": {
          "pattern": "/nudr-group-id-map/v1/nf-group-ids"
        },
        "name": "Path"
      }
    ],
    "filters": [
      {
        "name": "SbiRouting",
        "args": {
          "peerSetIdentifier": "set0",
          "customPeerSelectorEnabled": true,
          "errorHandling": [
            {
              "errorCriteriaSet": "criteria_1",
              "actionSet": "action_1",
              "priority": 1
            },
            {
              "errorCriteriaSet": "criteria_0",
              "actionSet": "action_0",
              "priority": 2
            }
          ]
        }
      }
    ]
  }
],
```

```

{
  "id": "default_route",
  "uri": "egress://request.uri",
  "order": 100,
  "predicates": [{
    "args": {
      "pattern": "/*"
    },
    "name": "Path"
  }]
}
]

```

- **Configure using Console:** Perform the following feature configurations as described:
 - Create or update [Peer Configuration](#).
 - Create or update the [Peer Set Configuration](#) to assign these peers.
 - Create or update [SBI Error Criteria Sets](#).
 - Create or update [SBI Error Action Sets](#).
 - Update the [Routes Configuration](#) as mentioned above.

① Note

To disable the routing of SLF queries through SCP, remove the Egress Gateway configuration from the {apiRoot}/nrf/nf-common-component/v1/egw/routesconfiguration, and retain the default_route configuration. This default_route configuration is available by default during fresh installation or upgrade.

```

{
  "id": "default_route",
  "uri": "egress://request.uri",
  "order": 100,
  "predicates": [{
    "args": {
      "pattern": "/*"
    },
    "name": "Path"
  }]
}

```

4.18.2 Notifications Requests

NRF allows you to route the notification messages through SCP based on the configuration in the Egress Gateway.

Managing Notifications Requests through SCP

This section explains the procedure to configure the feature.

Configure

You can configure the notifications through SCP using the Egress Gateway configurations either using REST API or Console:

- **Configure using REST API:** Perform the following feature configurations as described in the "Egress Gateway Configuration" section of *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*:
 - Create or update {apiRoot}/nrf/nf-common-component/v1/egw/peerconfiguration.
 - Create or update the {apiRoot}/nrf/nf-common-component/v1/egw/peerconfiguration to assign these peers.
 - Create or update {apiRoot}/nrf/nf-common-component/v1/egw/sbiroutingerrorcriteriasets.
 - Create or update {apiRoot}/nrf/nf-common-component/v1/egw/sbiroutingerroractionsets.
 - Update the {apiRoot}/nrf/nf-common-component/v1/egw/routesconfiguration as mentioned below:

```
curl -v -X PUT "http://10.75.226.126:32247/nrf/nf-common-component/v1/egw/routesconfiguration" -H "Content-Type: application/json" -d @header.json
```

sample header.json:-

```
{
  "id": "egress_scp_proxy2",
  "uri": "http://localhost:32068/",
  "order": 20,
  "filters": [
    {
      "args": {
        "errorHandling": [
          {
            "priority": 1,
            "actionSet": "action_1",
            "errorCriteriaSet": "criteria_1"
          },
          {
            "priority": 2,
            "actionSet": "action_0",
            "errorCriteriaSet": "criteria_0"
          }
        ],
        "peerSetIdentifier": "set0",
        "customPeerSelectorEnabled": false
      },
      "name": "SbiRouting"
    }
  ],
  "metadata": {
    "httpRuriOnly": false,
    "httpsTargetOnly": true,
    "sbiRoutingEnabled": true
  },
  "predicates": [
    {
      "args": {
```

```

        "header": "3gpp-Sbi-Callback",
        "regexp": "Nnrf_NFManagement_NFStatusNotify"
      },
      "name": "Header"
    }
  ],
  {
    "id": "default_route",
    "uri": "egress://request.uri",
    "order": 100,
    "predicates": [{
      "args": {
        "pattern": "/*"
      },
      "name": "Path"
    }]
  }
}

```

- **Configure using Console:** Perform the following feature configurations as described:
 - Create or update [Peer Configuration](#).
 - Create or update the [Peer Set Configuration](#) to assign these peers.
 - Create or update [SBI Error Criteria Sets](#).
 - Create or update [SBI Error Action Sets](#).
 - Update the [Routes Configuration](#) as mentioned above.

① Note

To disable the routing of notification through SCP, remove the SbiRouting filter for SCP from the {apiRoot}/nrf/nf-common-component/v1/egw/routesconfiguration, and add the default_route configuration. Following the sample default_route configuration:

```

{
  "id": "default_route",
  "uri": "egress://request.uri",
  "order": 100,
  "predicates": [{
    "args": {
      "pattern": "/*"
    },
    "name": "Path"
  }]
}

```

4.18.3 NRF Forwarding Requests

NRF allows you to route the NRF-NRF forwarding messages through SCP based on the configuration in the Egress Gateway.

Managing NRF Forwarding Requests through SCP

This section explains the procedure to configure the feature.

Configure

You can configure the forwarding through SCP using the Egress Gateway configurations either using REST API or Console:

- **Configure using REST API:** Perform the following feature configurations as described in the "Egress Gateway Configuration" section of *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*:
 - Create or update {apiRoot}/nrf/nf-common-component/v1/egw/peerconfiguration.
 - Create or update the {apiRoot}/nrf/nf-common-component/v1/egw/peerconfiguration to assign these peers.
 - Create or update {apiRoot}/nrf/nf-common-component/v1/egw/sbiroutingerrorcriteriasets.
 - Create or update {apiRoot}/nrf/nf-common-component/v1/egw/sbiroutingerroractionsets.
 - Update the {apiRoot}/nrf/nf-common-component/v1/egw/routesconfiguration as mentioned below:

```
curl -v -X PUT "http://10.75.226.126:32247/nrf/nf-common-component/v1/egw/routesconfiguration" -H "Content-Type: application/json" -d @header.json
```

sample header.json:-

```
[
  {
    "id": "egress_scp_proxy1",
    "uri": "http://localhost:32068/",
    "order": 0,
    "filters": [
      {
        "args": {
          "errorHandling": [
            {
              "priority": 1,
              "actionSet": "action_1",
              "errorCriteriaSet": "criteria_1"
            },
            {
              "priority": 2,
              "actionSet": "action_0",
              "errorCriteriaSet": "criteria_0"
            }
          ],
          "peerSetIdentifier": "set0",
          "customPeerSelectorEnabled": false
        },
        "name": "SbiRouting"
      },
      {
        "args": {
```

```

        "name": "OC-NRF-Forwarding"
      },
      "name": "RemoveRequestHeader"
    }
  ],
  "metadata": {
    "httpRuriOnly": false,
    "httpsTargetOnly": true,
    "sbiRoutingEnabled": true
  },
  "predicates": [
    {
      "args": {
        "header": "OC-NRF-Forwarding",
        "regexp": ".*"
      },
      "name": "Header"
    }
  ]
},
{
  "id": "default_route",
  "uri": "egress://request.uri",
  "order": 100,
  "filters": [
    {
      "name": "DefaultRouteRetry"
    }
  ],
  "predicates": [{
    "args": {
      "pattern": "/*"
    },
    "name": "Path"
  }]
}
]

```

- **Configure using Console:** Perform the following feature configurations as described:
 - Create or update [Peer Configuration](#).
 - Create or update the [Peer Set Configuration](#) to assign these peers.
 - Create or update [SBI Error Criteria Sets](#).
 - Create or update [SBI Error Action Sets](#).
 - Update the [Routes Configuration](#) as mentioned above.

Note

To disable the NRF-NRF forwarding messages through SCP, remove the Egress Gateway configuration from the {apiRoot}/nrf/nf-common-component/v1/egw/routesconfiguration, and retain the default_route configuration. This default_route configuration is available by default during fresh installation or upgrade. Following the sample default_route configuration:

```
{
  "id": "default_route",
  "uri": "egress://request.uri",
  "order": 100,
  "filters": [
    {
      "name": "DefaultRouteRetry"
    }
  ],
  "predicates": [{
    "args": {
      "pattern": "/*"
    },
    "name": "Path"
  }]
}
```

4.18.4 Roaming Requests

NRF allows you to route the roaming messages through SCP based on the configuration in the Egress Gateway.

Managing Roaming Requests through SCP

This section explains the procedure to configure the feature.

Configure

You can configure the roaming through SCP using the Egress Gateway configurations either using REST API or Console:

- **Configure using REST API:** Perform the following feature configurations as described in the "Egress Gateway Configuration" section of *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*:
 - Create or update {apiRoot}/nrf/nf-common-component/v1/egw/peerconfiguration.
 - Create or update the {apiRoot}/nrf/nf-common-component/v1/egw/peerconfiguration to assign these peers.
 - Create or update {apiRoot}/nrf/nf-common-component/v1/egw/sbiroutingerrorcriteriasets.
 - Create or update {apiRoot}/nrf/nf-common-component/v1/egw/sbiroutingerroractionsets.

- Update the {apiRoot}/nrf/nf-common-component/v1/egw/routesconfiguration as mentioned below:

```
curl -v -X PUT "http://10.75.226.126:32247/nrf/nf-common-component/v1/egw/routesconfiguration" -H "Content-Type: application/json" -d @header.json
```

sample header.json:-

```
[
  {
    "id": "egress_scp_proxy1",
    "uri": "http://localhost:32068/",
    "order": 0,
    "filters": [
      {
        "args": {
          "errorHandling": [
            {
              "priority": 1,
              "actionSet": "action_1",
              "errorCriteriaSet": "criteria_1"
            },
            {
              "priority": 2,
              "actionSet": "action_0",
              "errorCriteriaSet": "criteria_0"
            }
          ],
          "peerSetIdentifier": "set0",
          "customPeerSelectorEnabled": false
        },
        "name": "SbiRouting"
      },
      {
        "args": {
          "name": "OC-MCCMNC"
        },
        "name": "RemoveRequestHeader"
      }
    ],
    "metadata": {
      "httpRuriOnly": false,
      "httpsTargetOnly": true,
      "sbiRoutingEnabled": true
    },
    "predicates": [
      {
        "args": {
          "header": "OC-MCCMNC",
          "regexp": "310014"
        },
        "name": "Header"
      }
    ]
  },
  {
    "id": "default_route",
```



```

    "uri": "egress://request.uri",
    "order": 100,
    "filters": [
      {
        "name": "DefaultRouteRetry"
      }
    ],
    "predicates": [{
      "args": {
        "pattern": "/*"
      },
      "name": "Path"
    }]
  }
]

```

- **Configure using Console:** Perform the following feature configurations as described:
 - Create or update [Peer Configuration](#).
 - Create or update the [Peer Set Configuration](#) to assign these peers.
 - Create or update [SBI Error Criteria Sets](#).
 - Create or update [SBI Error Action Sets](#).
 - Update the [Routes Configuration](#) as mentioned above.

① Note

To disable the routing of roaming messages through SCP, remove the Egress Gateway configuration from the {apiRoot}/nrf/nf-common-component/v1/egw/routesconfiguration, and retain the default_route configuration. This default_route configuration is available by default during fresh installation or upgrade. Following the sample default_route configuration:

```

{
  "id": "default_route",
  "uri": "egress://request.uri",
  "order": 100,
  "filters": [
    {
      "name": "DefaultRouteRetry"
    }
  ],
  "predicates": [{
    "args": {
      "pattern": "/*"
    },
    "name": "Path"
  }]
}

```

4.19 Ingress Gateway Pod Protection

Note

NRF recommends to enable the Ingress Gateway Pod Protection Using Rate Limiting feature over the Ingress Gateway Pod Protection feature. The Ingress Gateway Pod Protection feature will be deprecated in the upcoming releases. For more information about enabling the Ingress Gateway Pod Protection Using Rate Limiting feature, see [Ingress Gateway Pod Protection Using Rate Limiting](#).

Ingress Gateway handles all the incoming traffic towards NRF. It may undergo overload conditions due to uneven distribution of traffic, network fluctuations leading to traffic bursts, or unexpected high traffic volume.

This feature protects the Ingress Gateway container from getting overloaded due to uneven traffic distribution, traffic bursts, and congestion. It ensures the protection and mitigation of container from entering an overload condition, while also facilitating necessary actions for recovery.

The pod protection is performed based on the CPU usage and the Pending Message Count of the container as explained in the [Congestion State Parameters](#). These congestion parameters are measured at various states mentioned in the [Ingress Gateway Load States](#) to detect the overload condition.

In a service mesh based deployment, all incoming connections to the pod get terminated at the sidecar container, then the sidecar container creates a new connection toward the application container. These incoming connections from the peer are managed by the sidecar and outside the purview of the application container.

Hence when the Ingress Gateway container reaches DOC or Congested level, in a service mesh based deployment, the Ingress Gateway container will only be able to stop accepting new connections from the sidecar container. Also in this state, the Ingress Gateway container will reduce the concurrency of the existing connections between the sidecar container and the Ingress Gateway container. Any new request received over a new connection may get accepted or rejected based on the sidecar connection management.

In a non service mesh based deployment, all incoming connections to the pod get terminated at the Ingress Gateway container. Hence when the Ingress Gateway container reaches DOC or Congested level, the Ingress Gateway container will stop accepting new connections. Also in this state, the Ingress Gateway container will reduce the concurrency of the existing connections between the peer and the Ingress Gateway container. Any new request received over a new connection will result in to a request timeout at the peer.

Congestion State Parameter

As part of the Pod Protection feature, every Ingress Gateway microservice pod monitors its congestion state. Following are the congestion parameters to monitor the pod state:

- CPU
The congestion state is monitored based on CPU usage to determine the congestion level. The CPU usage is monitored using the Kubernetes cgroup (cpuacct.usage) and it is measured in nanoseconds.

It is monitored periodically and calculated using the following formula and then compared against the configured CPU thresholds to determine the congestion state. For more

information about the parameters and the proposed threshold values, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

Figure 4-16 CPU Measurement

$$\frac{\text{CurrentCpuUsage} - \text{LastCpuUsage}}{\text{CurrentTime} - \text{LastSampleTime}} \times 100$$

CPUs

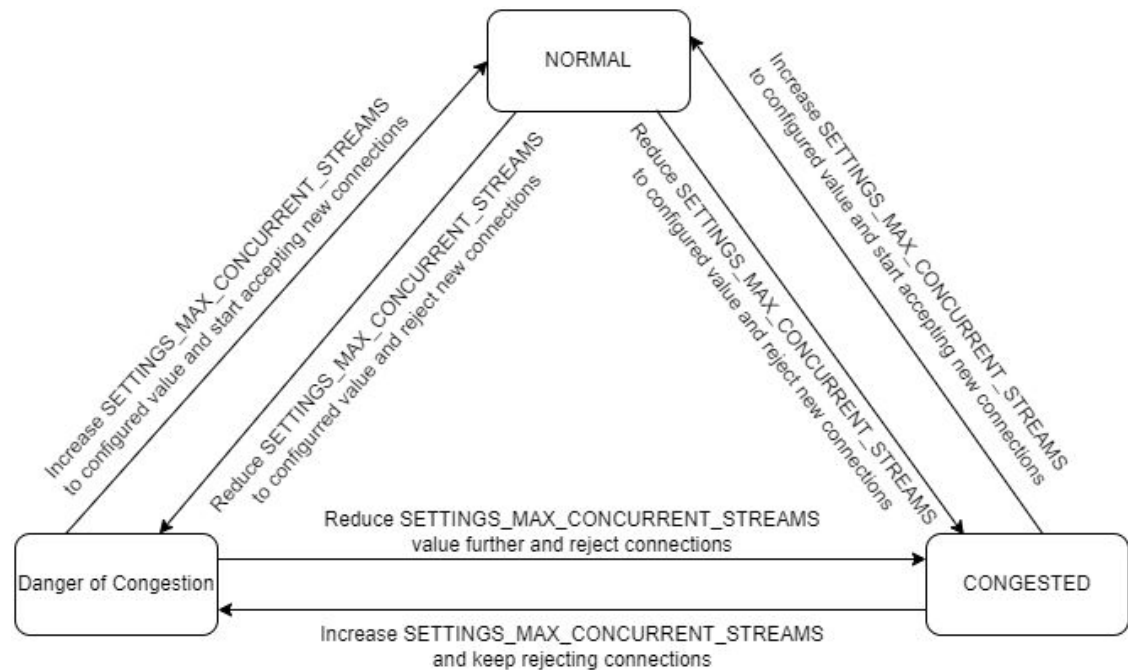
Where,

- CurrentCpuUsage is the counter reading at current periodic cycle.
- LastCpuUsage is the counter reading at previous periodic cycle.
- CurrentTime is the current time snapshot.
- LastSampleTime is the previous periodic cycle time snapshot.
- CPUs is the total number of CPUs for a given pod.
- Pending Message Count: The pending message count is the number of requests that are received by the Ingress Gateway pod from other NFs and yet to send the response. This includes all the requests triggered towards the Ingress Gateway pod. The pending message count is monitored periodically and compared against the configured thresholds to determine the congestion state.

Ingress Gateway Pod States

Following are the various states to detect overload conditions. This will protect and mitigate the pod entering into an unstable condition, and to take necessary actions to recover from this condition.

Figure 4-17 Pod Protection State Transition

**Note**

The transition can occur between any states. The threshold for these congestion parameters are preconfigured and must not be changed.

- Congested State:** This is the upper bound state where the pod is congested. This means one or more congestion parameters are above the configured thresholds for the congested state. For more information about the configuration, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*. The pod can be transitioned to the Congested state either from the Normal State or the DoC state. When the pod reaches this state, the following actions are performed:
 - new incoming HTTP2 connection requests are not accepted.
 - the pod gradually decrements the number of concurrent streams by updating `SETTINGS_MAX_CONCURRENT_STREAMS` parameter in a `SETTINGS` frame to the configured `maxConcurrentStreamsPerCon` value at a regular interval. The number of concurrent streams are decremented based on the value configured in `decrementBy` parameter. And, the regular interval is configured in the `decrementSamplingPeriod` parameter.
- Danger of Congestion (DoC) State:** This is the intermediate state where the pod is approaching a congested state. This means if one or more congestion parameters are above the configured thresholds for the DoC state. For more information about the configuration, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

When the pod reaches this state, the following actions are performed:

- any new incoming HTTP2 connection requests are not accepted.

- if the pod is transitioning from the Normal state to the DoC state, the pod gradually decrements the number of concurrent streams by updating `SETTINGS_MAX_CONCURRENT_STREAMS` parameter in a `SETTINGS` frame to the configured `maxConcurrentStreamsPerCon` value at a regular interval. The number of concurrent streams are decremented based on the value configured in `decrementBy` parameter. And, the regular interval is configured in the `decrementSamplingPeriod` parameter.
- if the pod is transitioning from the Congested state to the DoC state, the pod gradually increments the number of concurrent streams by updating `SETTINGS_MAX_CONCURRENT_STREAMS` parameter in a `SETTINGS` frame to the configured `maxConcurrentStreamsPerCon` value at a regular interval. The number of concurrent streams are incremented based on the value configured in `incrementBy` parameter. And, the regular interval is configured in the `incrementSamplingPeriod` parameter.
- **Normal State:** This is the lower bound state where the CPU usage is below the configured thresholds for DoC and Congested states. For more information about the configuration, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

When the pod reaches this state, the following actions are performed:

- the pod will continue accepting new incoming HTTP2 connection requests.
- in case the pod is transitioning from the Congested or DoC state to Normal state, the pod gradually increments the number of concurrent streams by updating `SETTINGS_MAX_CONCURRENT_STREAMS` parameter in a `SETTINGS` frame to the configured `maxConcurrentStreamsPerCon` value at a regular interval. The number of concurrent streams are incremented based on the value configured in `incrementBy` parameter. And, the regular interval is configured in the `incrementSamplingPeriod` parameter.

To avoid toggling between these states due to traffic pattern, it is required for the pod to satisfy the condition of the target state for a given period before transitioning it to target state. For example, if the pod is transitioning from DoC to Congested state, then the pod must satisfy the threshold parameters of Congested state for a given period, before moving to Congested state.

The below configurations are used to define the period till which the pod has to be in a particular state:

- `stateChangeSampleCount`
- `monitoringInterval`

Formula for calculating the period is: $(stateChangeSampleCount * monitoringInterval)$

For more information about the configuration, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

Managing Ingress Gateway Pod Protection

This section explains the procedure to enable and configure the feature.

Enable

You can enable the Pod Protection feature using the REST API or Console:

- **Enable using REST API:** Perform the following configurations
 1. Use the API path as `{apiRoot}/nf-common-component/v1/igw/podprotection`.
 2. Set `podprotection.enabled` to **true**.

3. Set `podProtection.congestionControl.enabled` to **true**.
4. Run the API using PUT method with the proposed values given in the Rest API. For more information about the configuration using REST API, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

Note

The proposed values are engineering configured values and must not be changed.

- **Enable using Console:** Perform the following configurations in [Pod Protection](#):
 1. Switch **Enabled** to enable the feature.
 2. Switch **Enabled** under **Congestion Control** section.
 3. Click **Save** to save the changes.

Configure

You can configure the feature using the Ingress Gateway configurations either using REST API or Console:

- **Configure using REST API:** Perform the following feature configurations as described in the "Ingress Gateway Configuration" section of *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Configure using Console:** Perform the feature configurations as described in [Pod Protection](#).

Observe**Metrics**

Following metrics are added in the [NRF Gateways Metrics](#) section:

- `oc_ingressgateway_pod_congestion_state`
- `oc_ingressgateway_pod_resource_stress`
- `oc_ingressgateway_pod_resource_state`
- `oc_ingressgateway_incoming_pod_connections_rejected_total`

Alerts

Following metrics are added in the [NRF Alerts](#) section:

- [OcnrlIngressGatewayPodInDangerOfCongestionState](#)
- [OcnrlIngressGatewayPodInCongestedState](#)
- [OcnrlIngressGatewayPodCpuUsageInCongestedState](#)
- [OcnrlIngressGatewayPodCpuUsageInDangerOfCongestionState](#)
- [OcnrlIngressGatewayPodPendingMessageInCongestedState](#)
- [OcnrlIngressGatewayPodPendingMessageInDangerOfCongestionState](#)

KPIs

Added the feature specific KPIs in the [Ingress Gateway Pod Protection](#) section.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information about how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.20 Network Slice Specific Metrics

The 5G Network slices are identified by Network Slice Instances (NSIs) and Single Network Slice Selection Assistance Information (SNSSAI).

A Network Function (NF) can have multiple NSIs and SNSSAIs listed under them to support multiple slices. NRF supports measuring the number of requests and responses for various service operation per network slice. This measurement is performed using the metrics mentioned in [Observe](#).

Observe

Metrics

Following are the metrics to measure the requests and responses:

- ocnrf_nfDiscover_rx_requests_perSnssai_total
- ocnrf_nfDiscover_tx_success_response_perSnssai_total
- ocnrf_nfDiscover_tx_empty_response_perSnssai_total
- ocnrf_nfDiscover_tx_failure_response_perSnssai_total
- ocnrf_nfDiscover_rx_requests_perNsi_total
- ocnrf_nfDiscover_tx_success_response_perNsi_total
- ocnrf_nfDiscover_tx_empty_response_perNsi_total
- ocnrf_nfDiscover_tx_failure_response_perNsi_total
- ocnrf_nfDiscover_tx_forwarded_requests_perSnssai_total
- ocnrf_nfDiscover_rx_success_forwarded_responses_perSnssai_total
- ocnrf_nfDiscover_rx_empty_forwarded_responses_perSnssai_total
- ocnrf_nfDiscover_rx_failure_forwarded_responses_perSnssai_total
- ocnrf_nfDiscover_tx_forwarded_requests_perNsi_total
- ocnrf_nfDiscover_rx_success_forwarded_responses_perNsi_total
- ocnrf_nfDiscover_rx_empty_forwarded_responses_perNsi_total
- ocnrf_nfDiscover_rx_failure_forwarded_responses_perNsi_total
- ocnrf_nfRegister_requests_perSnssai_total
- ocnrf_nfRegister_success_responses_perSnssai_total
- ocnrf_nfRegister_failure_responses_perSnssai_total

- ocnrf_nfRegister_requests_perNsi_total
- ocnrf_nfRegister_success_responses_perNsi_total
- ocnrf_nfRegister_failure_responses_perNsi_total
- ocnrf_nfUpdate_requests_perSnssai_total
- ocnrf_nfUpdate_success_responses_perSnssai_total
- ocnrf_nfUpdate_failure_responses_perSnssai_total
- ocnrf_nfUpdate_requests_perNsi_total
- ocnrf_nfUpdate_success_responses_perNsi_total
- ocnrf_nfUpdate_failure_responses_perNsi_total
- ocnrf_nfDeregister_requests_perSnssai_total
- ocnrf_nfDeregister_success_responses_perSnssai_total
- ocnrf_nfDeregister_failure_responses_perSnssai_total
- ocnrf_nfDeregister_requests_perNsi_total
- ocnrf_nfDeregister_success_responses_perNsi_total
- ocnrf_nfDeregister_failure_responses_perNsi_total
- ocnrf_nfHeartBeat_requests_perSnssai_total
- ocnrf_nfHeartBeat_success_responses_perSnssai_total
- ocnrf_nfHeartBeat_failure_responses_perSnssai_total
- ocnrf_nfHeartBeat_requests_perNsi_total
- ocnrf_nfHeartBeat_success_responses_perNsi_total
- ocnrf_nfHeartBeat_failure_responses_perNsi_total

For more information about the metrics, see [Network Slice Specific Metrics](#) section.

KPIs

The feature specific KPIs are added in the [Network Slice Specific KPIs](#) section.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see "Collecting Logs" section in *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.21 CCA Header Validation in NRF for Access Token Service Operation

Client Credentials assertion (CCA) is a token signed by the Consumer NF. It enables NRF to authenticate the Consumer NF which includes the signed token in Access Token service

request. CCA header contains the Consumer NF's NfInstanceId that gets checked against the certificate by the NRF. The CCA also includes a timestamp as the basis for the restriction of its lifetime.

Consumer NF sends the *3gpp-Sbi-Client-Credentials* header containing the CCA in the HTTP request and NRF performs the CCA validation. The CCA header validation is a JWT-based validation at NRF where the Consumer NF sends a JWT token as part of the header to NRF in Access Token request. The JWT token has an X5c certificate and other NF-specific information that is validated against the configuration values defined in NRF. The signature of the JWT token is validated against the CA root certificate configured at NRF.

Figure 4-18 Client Credentials JWT Token

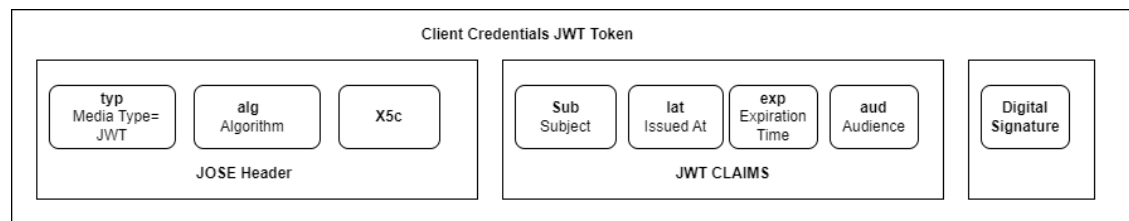


Table 4-20 JOSE header

Attribute name	Data type	P	Cardinality	Description
typ	String	M	1	The "typ" (type) Header Parameter is used to declare the media type of the JWS. Default value: JWT
alg	String	M	1	The "alg" (algorithm) Header Parameter is used to secure the JWS. Supported Algorithm types: RSA/ECDSA.
X5c	Array	M	1	The "X5c" (X.509 certificate) Header Parameter contains the X.509 public key certificate corresponding to the key used to digitally sign the JWT.

Table 4-21 JWT claims

Attribute name	Data type	P	Cardinality	Description
sub	NfInstanceId	M	1	This IE contains the NF instance ID of the NF service consumer, corresponding to the standard "Subject" claim.
iat	integer	M	1	This IE indicates the time at which the JWT was issued, corresponding to the standard "Issued At" claim. This claim may be used to determine the age of the JWT.
exp	integer	M	1	This IE contains the expiration time after which the client credentials assertion is considered to be expired, corresponding to the standard "Expiration Time" claim.

Table 4-21 (Cont.) JWT claims

Attribute name	Data type	P	Cardinality	Description
aud	array(NFType)	M	1..N	This IE contains the NF type of NRF, for which the claim is applicable, corresponding to the standard "Audience" claim.

The digitally signed client credentials assertion is further converted to the JWS compact serialization encoding as a string.

If the validation is successful, the Access Token request is processed further.

If CCA header validation fails, the Access Token request is rejected by NRF with "403 Forbidden" with the cause attribute set to "CCA_VERIFICATION_FAILURE".

Managing CCA Header validation in NRF for Access Token Service Operation

1. Create Ingress Gateway Secret. For more information about configuring secrets, see section "Configuring Secret to Enable CCA Header" in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
2. **Configure:** Configure the secret containing the CA root bundle and enable CCA header feature for AccessToken either using REST or Console:
 - **Using REST API:** Perform the feature configurations in the {apiRoot}/nrf/nf-common-component/v1/igw/ccaheader URI in "CCA Header Validation" section in Ingress Gateway as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*
 - **Using Console:** Perform the feature configurations for CCA Header Validation in Ingress Gateway as described in [CCA Header](#).

Note

Do not enable this feature using enabled attribute in the {apiRoot}/nrf/nf-common-component/v1/igw/ccaheader URI. Enable this feature only by using the enabled attribute in the ccaHeaderValidation under accesstoken_mapping id in the {apiRoot}/nrf/nf-common-component/v1/igw/routesconfiguration URI. Use the configuration as suggested in the "Routes Configuration" section in Ingress Gateway Configuration in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*. Accidental deletion of any of the routes in this configuration leads to service outage.

3. **Enable:** Enable the feature post installation or post upgrade using REST API or CNC Console.
 - **Using REST API:** Set the value of enabled attribute to *true* in the ccaHeaderValidation under accesstoken_mapping id in the {apiRoot}/nrf/nf-common-component/v1/igw/routesconfiguration URI. For more details, see the "Routes Configuration" section in Ingress Gateway Configuration in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

- **Using CNC Console:** Set the value of Enabled parameter to *true* in the [Routes Configuration](#).

Note

Enable this feature only by using the enabled attribute in the ccaHeaderValidation under accesstoken_mapping id in the {apiRoot}/nrf/nf-common-component/v1/igw/routesconfiguration URI. Use the configuration as suggested in the "Routes Configuration" section in Ingress Gateway Configuration" in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*. Accidental deletion of any of the routes in this configuration leads to service outage. Do not enable this feature using enabled attribute in the {apiRoot}/nrf/nf-common-component/v1/igw/ccaheader URI.

Observe

Metrics

Following are the CCA Header Validation in NRF for Access Token Service Operation feature specific metrics in [NRF Gateways Metrics](#) section:

- oc_ingressgateway_cca_header_request_total
- oc_ingressgateway_cca_header_response_total
- oc_ingressgateway_cca_certificate

KPIs

There are no KPIs for this feature.

Alerts

Following are the CCA Header validation in NRF for Access Token Service Operation feature specific alerts in [Feature Specific Alerts](#) section:

- [OcnrfCcaRootCertificateExpiringIn5Days](#)
- [OcnrfCcaRootCertificateExpiringIn1Day](#)
- [OcnrfCcaRootCertificateExpiringIn4Hours](#)

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts persist, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see "Collecting Logs" section in *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

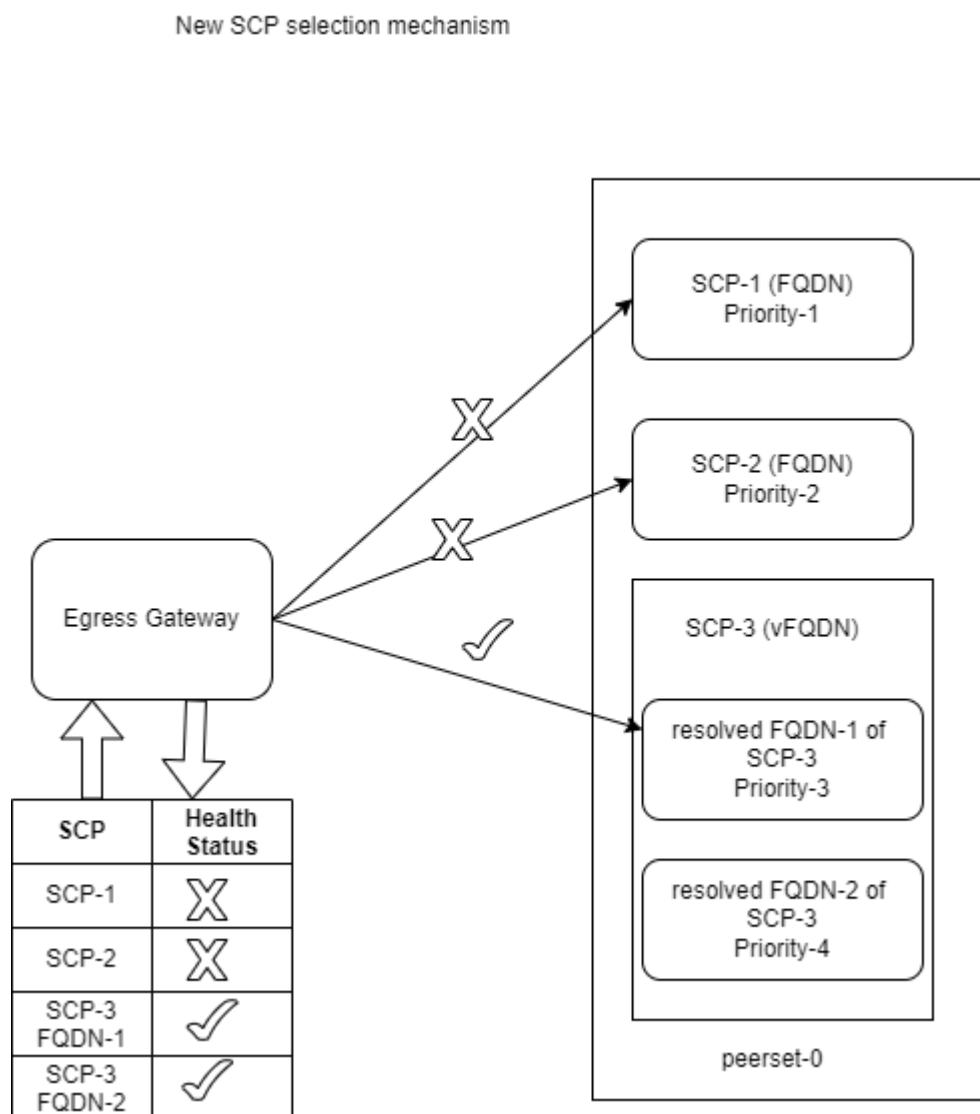
4.22 Monitoring the Availability of SCP Using SCP Health APIs

NRF determines the availability and reachability status of all SCPs irrespective of the configuration types.

This feature is an enhancement to the existing SBI routing functionality. Egress Gateway microservice interacts with SCP on their health API endpoints using HTTP2 OPTIONS method. It monitors the health of configured SCP peers to ensure that the traffic is routed directly to the healthy peers. This enhancement avoids routing or rerouting towards unhealthy peers, thus minimizing the latency time.

Egress Gateway microservice maintains the health status of all available and unavailable SCPs. It maintains the latest health of SCPs by periodically monitoring and uses this data to route egress traffic to the most preferred healthy SCP.

Figure 4-19 SCP Selection Mechanism



Once *peerconfiguration*, *peerconfiguration*, *routesconfiguration*, and *peermonitoringconfiguration* parameters are configured at Egress Gateway microservice, and all SCPs (after Alternate Route Service (ARS) resolution, if any vFQDN is configured) are marked initially as healthy. The peers attached to the associated peerconfiguration are scheduled to run health API checks and update the health status continuously.

During the installation, the value of the parameter *peermonitoringconfiguration* is set to false by default. Since, this feature is an add-on to the existing SBI Routing feature and will be activated if the *sbiouteconfig* feature is enabled. To enable this feature, perform the following:

- configure *peerconfiguration* with *healthApiPath* as `/{{scpApiRoot}}/{{apiVersion}}/status`
- configure *peerconfiguration*
- configure *routesconfiguration*
- configure *sbioutingerrorcriteriasets*
- configure *sbioutingerroractionsets*
- enable *peermonitoringconfiguration*

If SBI Routing feature is enabled before upgrading, the *healthApi* in *peerconfiguration* should be attached manually to existing configured peers. If the operator tries to enable *peermonitoringconfiguration* and the targeted peers do not have the *healthApiPath* then an appropriate error response is sent.

Managing Monitoring the Availability of SCP Using SCP Health APIs

This section explains the procedure to enable and configure the feature.

Configure

You can configure the Monitoring the Availability of SCP using the REST API or Console:

- **Configure using REST API:** Perform the following feature configurations as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*:
 - Create or update `{{apiRoot}}/nrf/nf-common-component/v1/egw/peerconfiguration`.
 - Create or update the `{{apiRoot}}/nrf/nf-common-component/v1/egw/peerconfiguration` to assign these peers.
 - Create or update `{{apiRoot}}/nrf/nf-common-component/v1/egw/sbioutingerrorcriteriasets`.
 - Create or update `{{apiRoot}}/nrf/nf-common-component/v1/egw/sbioutingerroractionsets`.
 - create or update `routesets {{apiRoot}}/nrf/nf-common-component/v1/egw/routesconfiguration` to use the above peerconfiguration.
 - enable the feature using the below *peermonitoring* configuration `{{apiRoot}}/nrf/nf-common-component/v1/egw/peermonitoringconfiguration`.

Note

Health Monitoring of the peer will start only after the feature is enabled and the corresponding peerconfiguration is used in *sbiouteconfig*.

- **Configure using Console:** Perform the following feature configurations as described:
 - create or update [Peer Configuration](#) with health status endpoint details.
 - create or update the [Peer Set Configuration](#) to assign these peers.
 - create or update [SBI Error Criteria Sets](#).
 - create or update [SBI Error Action Sets](#).
 - create or update [Routes Configuration](#) to use the above peerset.
 - enable the feature using the below [Peer Monitoring Configuration](#).

Note

Health Monitoring of the peer will start only after the feature is enabled and the corresponding peerset is used in sbirouteconfig.

Observe

Metrics

Following metrics are added in the [NRF Gateways Metrics](#) section:

- oc_egressgateway_peer_health_status
- oc_egressgateway_peer_health_ping_request_total
- oc_egressgateway_peer_health_ping_response_total
- oc_egressgateway_peer_health_status_transitions_total
- oc_egressgateway_peer_count
- oc_egressgateway_peer_available_count

Alert

Following alerts are added in the [NRF Alerts](#) section:

- [OcnrfSCPMarkedAsUnavailable](#)
- [OcnrfAllSCPsMarkedAsUnavailable](#)

KPIs

Added the feature specific KPIs in the [SCP Health Status](#) section.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts persists, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.23 Controlled Shutdown of NRF

NRF supports controlled shutdown feature to isolate NRF from the current network at a particular site. This isolation helps to perform any maintenance activities or recovery

procedures as required without uninstalling the NRF at the particular site. During this time the operations of the Ingress Gateway, Egress Gateway, and NrfAuditor microservices are paused. These services read the operational state from the database periodically. The operational state of NRF can be changed by using REST API or CNC Console at any time.

The two operational states defined for NRF are as follows:

- NORMAL
- COMPLETE_SHUTDOWN

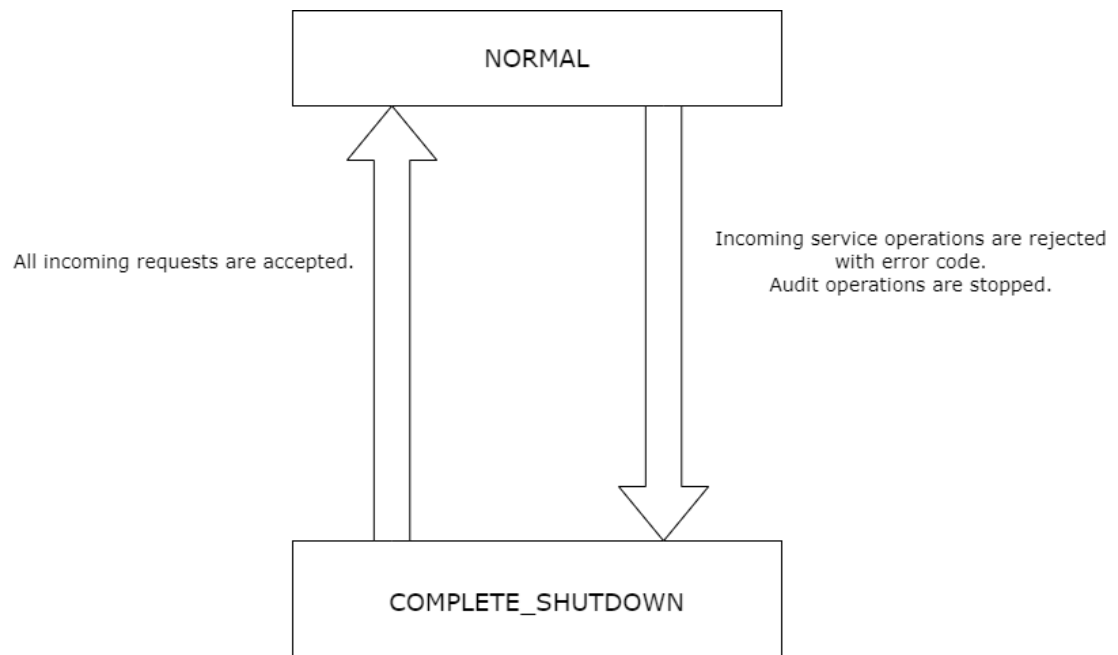
Note

- Ensure that the database is up and the NRF services must be able to connect and communicate with the database to change the operational state.
- In either state, if the database goes down, the back-end pods go to the NOT_READY state, but the Ingress Gateway microservice will continue to be in the last known operational state. When the Controlled Shutdown feature is enabled and the database is not available, all the incoming messages will be rejected with the *Service Unavailable* messages if the operational state is "NORMAL", or with a configurable error code if the operational state is COMPLETE_SHUTDOWN. However, the operators will not be able to see the operational state in CNC Console due to database unavailability.

If the controlled shutdown operational state is NORMAL, then NRF processes the message as normal.

If the controlled shutdown operational state is COMPLETE_SHUTDOWN, then NRF rejects all incoming requests with a configurable error code.

Figure 4-20 Operational State changes



The following behavior changes occur when the operational state changes:

From NORMAL to COMPLETE_SHUTDOWN

- The Ingress Gateway microservice rejects all new requests towards the services that have been configured for controlled shutdown with a configurable error code. In this case, all the inflight transactions will be gracefully handled. The controlled shutdown applies to the following services:

- nfregristration
- nfdiscovery
- nfsubscription
- nfaccess token

The error codes are configured using `controlledshutdownerrormapping` and `errorcodeprofiles` APIs.

- The NrfAuditor microservice pauses all its audit procedures, hence no notifications are generated. `0cnrfAuditOperationsPaused` alert is raised to indicate that the audit is paused.
- The Egress Gateway microservice handles all the inflight requests gracefully. Since the Ingress Gateway and NrfAuditor microservices are in a `COMPLETE_SHUTDOWN` operational state, there would be no requests from the backend services.

Note

No specific configuration for controlled shutdown needs to be applied on the routes for the Egress Gateway microservice.

- The NrfConfiguration microservice continues to process any configuration requests in the `COMPLETE_SHUTDOWN` state.
- `0cnrfOperationalStateCompleteShutdown` alert is raised to indicate the operational state of NRF is `COMPLETE_SHUTDOWN`.
- The operational state change is recorded and can be viewed using the `controlledShutdownOptions` REST API. Additionally, the history of operational state changes can be viewed using the `operationalStateHistory` REST API.

From COMPLETE_SHUTDOWN to NORMAL

- The Ingress Gateway microservice resumes processing all incoming requests.
- The Egress Gateway microservice resumes processing all outgoing requests.
- The NrfAuditor pod waits for a preconfigured waiting period before resuming its audit procedures to allow the NFs to move back to this NRF after the NRF has changed to the `NORMAL` operational state. Once the waiting period has expired, the audit procedures resume, and the `0cnrfAuditOperationsPaused` alert is cleared. The waiting period is defined as

$$(\text{defaultHbTimer} * \text{nfHeartBeatMissAllowed}) + \text{maxReplicationLatency(s)} + \text{replicationLatencyThreshold} * \text{latencyMultiplier}$$

Where,

- defaultHbTimer - defaultHbTimer configured in `nfManagementOptions.nfHeartBeatTimers` where the `nfType` is "ALL_NF_TYPE". For more information about the parameter, see "NF Management Options" in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- nfHeartBeatMissAllowed - nfHeartBeatMissAllowed configured in `nfManagementOptions.nfHeartBeatTimers` where the `nfType` is "ALL_NF_TYPE". For more information about the parameter, see "NF Management Options" in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- maxReplicationLatency - The maximum replication latency detected across all the sites. This parameter supports dynamic value.
- replicationLatencyThreshold - The replicationLatencyThreshold configured in `geoRedundancyOptions`. For more information about the parameter, see "Georedundancy Options" in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- latencyMultiplier - A preconfigured fixed offset value set as 3.
- 0cnrf0operationalStateCompleteShutdown alert is cleared to indicate that the operational state of NRF is NORMAL.
- The operational state change is recorded and can be viewed using the `controlledShutdownOptions` REST API. Additionally, the history of operational state changes can be viewed using the `operationalStateHistory` REST API.

NRF Behavior Post Fault Recovery

During the database restore procedure, along with the configuration data, the `NFProfile` data/subscription data also gets restored which may not always be the latest state data at that moment. In this state, the `NrfAuditor` microservice may act upon the `NFProfiles`/`NFsubscriptions` which are not up-to-date yet. Also, the NFs is in process of moving to the current NRF which is available now. In this state, if the audit procedure is performed, NRF suspends those NFs and send out notifications to the consumer NFs. The same is applicable for `NfSubscriptions`, where the subscriptions may get deleted due to an older `lastUpdatedTimestamp` in the backup data.

To avoid this problem, `NrfAuditor` microservice waits for a waiting period before resuming the auditing of `NFProfiles` and subscriptions as soon as it comes to Ready state from NotReady state. An alert ("0cnrfAuditOperationsPaused") is raised to indicate that the audit processes have paused, see [NRF Alerts](#) section. Once the waiting period is elapsed, the audit processes resume and the alert is cleared.

To know about the computation of the waiting period, see [Controlled Shutdown of NRF](#).

Note

The `NrfAuditor` pod goes to NotReady state whenever it loses connectivity with the database. During temporary connectivity fluctuations, the `NrfAuditor` pod may transition between Ready and NotReady states cause the cool off period to kick in for every NotReady to Ready transition. To avoid such short and frequent transitions, `NrfAuditor` microservice applies the waiting period only when the pod is in NotReady for more than 5 seconds.

Managing Controlled Shutdown of NRF

Prerequisites

The following parameters are required in the `ocnrf_custom_values_26.1.201.yaml` file to configure the feature.

- `global.enableControlledShutdown` is the flag to enable the feature. The default value is `true`. To disable the feature, set the value of the flag to `false`. Please note that the below configurations are required for the feature to work.
- `controlled shutdown filter` under `routesConfig`.

Note

The route configuration must not be modified.

For more information about the `global.enableControlledShutdown` attribute, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Configure

You can configure the Controlled Shutdown of NRF feature using the REST API or Console:

- **REST API:** Perform the following feature configurations as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
 - `{apiRoot}/nrf/nf-common-component/v1/igw/errorcodeprofiles`
 - `{apiRoot}/nrf/nf-common-component/v1/igw/controlledshutdownerrormapping`
 - `{apiRoot}/nrf-configuration/v1/controlledShutdownOptions`
 - `{apiRoot}/nrf-configuration/v1/operationalStateHistory`
- **CNC Console:**
 - You can configure error code profiles as described in the [Error Code Profile](#) section.
 - You can configure error mapping as described in the [Controlled Shutdown Error Mapping](#) section.
 - You can change only the Operational State and view the Operational State History as described in the [Controlled Shutdown](#) section.

Observe

Metrics

Following are the controlled shutdown feature specific metrics:

- `ocnrf_operational_state`
- `ocnrf_audit_status`

For more information about the metrics for the controlled shutdown of NRF see the [NRF Metrics](#) section.

Alerts

Following are the controlled shutdown feature specific alerts:

- [OcnrfOperationalStateCompleteShutdown](#)
- [OcnrfAuditOperationsPaused](#)

For more information about the alerts raised for the controlled shutdown of NRF see the [Controlled Shutdown of NRF Feature](#) section.

KPIs

Following are the controlled shutdown feature specific KPIs:

- Operational State {{ pod }}
- NRF Audit status

For more information about the KPIs in NRF see the [Controlled Shutdown of NRF](#) section.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see "Collecting Logs" section in *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.24 User-Agent Header for Outgoing Requests

NRF supports the addition of User-Agent header for outgoing messages for NFStatusNotify and SLF query requests. NRF adds the User-Agent header with the configured value to the mentioned outgoing messages.

In addition, NRF propagates the User-Agent header received in all forwarding and roaming requests.

Managing User-Agent Header for Outgoing Requests

Configure

You can configure User-Agent header value feature using the REST API or CNC Console.

- **Configure using REST API:** Provide the value for `ocnrfUserAgentHeader` in **generalOptions** configuration API. For more information about this API, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Configure using CNC Console:** Provide the value for **OCNRF User-Agent Header** on the General Options Page. For more information about the field, see [General Options](#) page.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts persist, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see "Collecting Logs" section in *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.25 Support for Kubernetes Resource

4.25.1 Node Selector

The Node Selector feature allows the Kubernetes scheduler to determine the type of nodes in which the NRF pods are scheduled, depending on the predefined node labels or constraints.

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

To see all the default labels assigned to a Kubernetes node, run the following command:

```
kubectl describe node <node_name>
```

Where,

<node_name> is the name of Kubernetes node.

For example:

```
kubectl describe node pollux-k8s-node-1
```

Sample output:

```
Name:          pollux-k8s-node-1
Roles:         <none>
Labels:        beta.kubernetes.io/arch=amd64
               kubernetes.io/hostname=pollux-k8s-node-1
               kubernetes.io/os=linux
               topology.kubernetes.io/region=RegionOne
               topology.kubernetes.io/zone=nova
```

Managing NRF Node Selector Feature

Enable

You can enable Node Selector feature using the Helm:

1. Open the `ocnrf_custom_values_26.1.201.yaml` file.
2. Set `global.nodeSelection` to **ENABLED** to enable the node selection.
For more information about the parameters, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
3. Save the file.
4. Install NRF. For more information about installation procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Configure

You can configure the node selector parameters using Helm.

- Configure the following parameters in the global, NRF microservices and Gateways sections:
 - `nodeSelection`
 - `helmBasedConfigurationNodeSelectorApiVersion`
 - `nodeSelector.nodeKey`
 - `nodeSelector.nodeValue`
- Configure the following parameters in the appinfo section:
 - `nodeSelection`
 - `helmBasedConfigurationNodeSelectorApiVersion`
 - `nodeSelector`
- Configure the following parameters in the perinfo section:
 - `nodeSelectorEnabled`
 - `helmBasedConfigurationNodeSelectorApiVersion`
 - `nodeSelectorKey`
 - `nodeSelectorValue`

For more information about the parameters, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.25.2 Kubernetes Probes

One of the key feature that Kubernetes provides is high availability. This is achieved by the smallest deployment model called Pods. The health check of these Pods are performed by Kubernetes Probes.

There are three types of probes:

- **Liveness Probe:** Indicates if the container is operating. If the container is operating, no action is taken. If not, the kubelet kills and restarts the container.
- **Readiness Probe:** Indicates whether the application running in the container is ready to accept requests. If the application is ready, services matching the pod are allowed to send traffic to it. If not, the endpoints controller removes the pod from all matching Kubernetes Services.
- **Startup Probe:** Indicates whether the application running in the container has started. If the application is started, other probes start functioning. If not, the kubelet kills and restarts the container.

Managing Kubernetes Probes Feature

Configure

You can configure Kubernetes Probes feature using the Helm:

1. Open the `ocnrf_custom_values_26.1.201.yaml` file.
2. Configure the probes for each microservices. For more information about configuration parameters, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
3. Save the file.
4. Install NRF. For more information about installation procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
5. If you are configuring these parameter after NRF deployment, upgrade NRF. For more information about upgrade procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.25.3 Pod Disruption Budget

PodDisruptionBudget (PDB) is a Kubernetes resource that allows you to achieve high availability of scalable application services when the cluster administrators perform voluntary disruptions to manage the cluster nodes.

PDB restricts the number of pods that are down simultaneously from voluntary disruptions. Defining PDB is helpful to keep the services running undisrupted when a pod is deleted accidentally or deliberately. PDB can be defined for high available and scalable NRF services.

It allows safe eviction of pods when a Kubernetes node is drained to perform maintenance on the node. It uses the `maxPdbUnavailable` parameter specified in the Helm chart to determine the maximum number of pods that can be unavailable during a voluntary disruption.

Managing Pod Disruption Budget

Enable

This feature is enabled automatically if you are deploying NRF with Release 16.

Configure

You can configure this feature using Helm. For information about configuring PDB, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Observe

There is no specific metrics and alerts required for the Support of PDB functionality.

4.25.4 Network Policies

NetworkPolicies are an application-centric construct that allows you to specify how a pod is allowed to communicate with various network entities. To control communication between the cluster's pods and services and to determine which pods and services can access one another inside the cluster, it creates pod-level rules.

Previously, NRF had the privilege to communicate with other namespaces, and pods of one namespace could communicate with others without any restriction. Now, namespace-level isolation is provided for the NRF pods, and some scope of communications is allowed between the NRF and pods outside the cluster. The network policies enforces access restrictions for all the applicable data flows except communication from Kubernetes node to pod for invoking container probe.

Managing Support for Network Policies

Enable

To use this feature, network policies need to be applied to the namespace in which NRF is deployed.

Configure

You can configure this feature using Helm. For information about configuring PDB, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Observe

There is no specific metrics and alerts required for the Network Policy feature.

4.25.5 Tolerations

Taints and tolerations are Kubernetes mechanism that allows you to ensure that pods are not placed on inappropriate nodes. Taints are added to nodes, while tolerations are defined in the pod specification. One or more taints are applied to a node, this marks that the node should not accept any pods that do not tolerate the taints.

When a taint is assigned by Kubernetes configurations, it repels all the pods except those that have a matching toleration for that taint. Tolerations are applied to pods to allow the pods to schedule onto nodes with matching taints. Tolerations allow scheduling but do not guarantee scheduling. For more information about the Kubernetes documentation.

Managing Kubernetes Tolerations

Enable

To enable the tolerations perform the following:

1. Open the `ocnrf_custom_values_26.1.201.yaml` file.
2. Set `global.tolerationsSetting` to **ENABLED** to enable toleration.
For more information about the parameters, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

3. Save the file.
4. Install NRF. For more information about installation procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Configure

You can configure the tolerations parameters using Helm.

1. Configure `global.tolerations` as per the requirement based on the taints on the node. For more information about the parameters, see the [Tolerations](#) table.
2. By default `global.tolerations` is applied to all the microservices. In case you want to modify the tolerations for a specific microservice, configure `tolerationsSetting` under the specific microservice.

For more information about the parameters, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Table 4-22 Tolerations

Parameter	Description
key	It is name of the key.
value	It is a value for the configured key.
effect	Indicates the taint effect applied for the node. The effect is defined by one of the following: • NoSchedule: – New pods that do not match the taint are not scheduled onto that node. – Existing pods on the node remain. • PreferNoSchedule: – New pods that do not match the taint might be scheduled onto that node, but the scheduler tries not to. – Existing pods on the node remain. • NoExecute: – New pods that do not match the taint cannot be scheduled onto that node. – Existing pods on the node that do not have a matching toleration are removed.
operator	Indicates the criteria to match the tolerations with the taint configuration. The value can be: • Equal: The key, value, and effect parameters must match with the taint configuration. • Exists: The key and effect parameters must match the taint configuration. The value parameter can be blank.

Observe

There are no specific metrics and alerts required for this feature.

4.25.6 Dual Stack

According to RFC 4213, Dual stack supports both versions of the Internet Protocol (IPv4 and IPv6).

Dual stack provides:

- coexistence strategy that allows hosts to reach IPv4 and IPv6 simultaneously.
- IPv4 and IPv6 allocation to the Kubernetes clusters during cluster creation. This allocation is applicable for all the Kubernetes resources unless explicitly specified during the cluster creation.

Using the dual stack mechanism, NRF communicates within services or deployments in a Kubernetes cluster using IPv4 or IPv6 or both simultaneously depending on the configured deployment mode. Previously, NRF was supporting only dual stack with IPv4 preferred deployment on a platform configured as dual stack with IPv4 preferred.

From 25.1.100, NRF also supports dual stack with IPv6 preferred deployment on a platform configured as dual stack with IPv4 preferred. This can be achieved by configuring the `ipFamilyPolicy` and `ipFamilies` based on the deployment mode for all the NRF microservices. For more information about the attributes, see [Table 4-24](#).

In a 5G network, for a dual stack based deployment, NRF microservices can be grouped as follows:

- **Edge Microservices:** The edge microservice is Ingress Gateway microservice which handles the incoming requests from other NFs. NRF supports dual stack for Ingress Gateway microservice. The Ingress Gateway microservice can accept any IP address types (IPv4 or IPv6) from other NFs.

Note

Ingress Gateway microservice establishes connection with NRF backend microservices on a single stack with IPv6 preferred.

- **Backend Microservices:** All other microservices except the Ingress Gateway microservice is considered as backend microservice. NRF supports single stack IPv4 or IPv6 for backend microservices. All the backend microservices interacts with each other using single stack.
- **Egress Gateway microservice** provide options for sending outgoing request using IPv4 or IPv6. The preferred routing mode can be configured using `global.egressRoutingMode` Helm parameter. For more information about this parameter, see the "Customizing NRF" section in the *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Note

If "Dynamic Selection of SLF" in SLF feature is invoked, the internet protocol versions (IPv4 and IPv6) configured in `routingParameter (Ipv4Address or Ipv6Address)` attribute in `{apiRoot}/nrf-configuration/v1/slfOptions` URI must match with the `global.egressRoutingMode` Helm parameter configured in Egress Gateway microservice dual stack preference.

IP Address Allocation to Pods

IP address allocation to pods depends on the IP address preference which is set in the Kubernetes cluster. Pods do not have the privilege to choose an IP address. For example, if the Kubernetes cluster has IPv4 preferred configuration, both IPv4 and IPv6 are allocated to the pod, but the primary address is IPv4.

Example of a pod with primary address as IPv4 deployed in an IPv4 preferred infrastructure:

```
Status: Running
IP: 10.xxx.xxx.xxx
IPs:
  IP: 10.xxx.xxx.xxx
  IP: fd00::1:1xxx:9xxx:bxxx:fxxx
```

IP address allocation to pods depends on the IP address preference set in the Kubernetes cluster. Pods do not have the privilege to choose an IP address. For example, if the Kubernetes cluster has IPv6 preferred configuration, both IPv4 and IPv6 are allocated to the pod, but the primary IP address is IPv6.

Example of a pod with primary address as IPv6 deployed in an IPv4 preferred infrastructure:

```
Status: Running
IP: fd00::1:1xxx:9xxx:bxxx:fxxx
IPs:
  IP: fd00::1:1xxx:9xxx:bxxx:fxxx
  IP: 10.xxx.xxx.xxx
```

IP Address Allocation to Services

IP address allocation to all the NRF services, depends on the NRF deployment mode as defined as per Supported Deployment Mode Table. When the Helm parameters are configured appropriately, NRF automatically configures IP Family Policy and IP Families attributes to the NRF services.

Table 4-23 Supported Deployment Mode

Supported Mode	Required Configurations in Helm		
	Edge Deployment Mode (global.edgeDeploymentMode)	Backend Deployment Mode (global.backEndDeploymentMode)	Egress Routing Mode (global.egressRoutingMode)
IPv4 Only	IPv4	IPv4	IPv4
IPv6 Only	IPv6	IPv6	IPv6
IPv4 over IPv6	IPv4_IPv6	IPv6	Any valid value. (Possible values are IPv4, IPv6, IPv4_IPv6, IPv6_IPv4, and None.)
IPv6 over IPv4	IPv6_IPv4	IPv6	Any valid value. (Possible values are IPv4, IPv6, IPv4_IPv6, IPv6_IPv4, and None.)
ClusterPreferred	ClusterPreferred	ClusterPreferred	None

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

You can customize the IP address allocation to services based on the above Helm parameters. Services route the traffic to the destination endpoints based on this configuration. If the Helm

parameter is set to IPv4, then IPv4 is allocated to services, and services use IPv4 pod IPs to send the traffic to endpoints.

IP Family Policy Attribute, IP Families Attribute, Pod IP and Service IP indicates the Ingress Gateway microservice whereas the Endpoint belongs to backend microservice.

IP address allocation for the edge microservice (Ingress Gateway Microservice) is configured using the `global.edgeDeploymentMode` Helm parameter.

IP address allocation for all the backend microservices are performed based on the value configured at the `global.backEndDeploymentMode` Helm parameter.

IP selection control and connections for the Egress Gateway microservice or the outgoing traffic is handled by the `global.egressRoutingMode` Helm parameter.

For more information about the above parameters, see the "Customizing NRF" section in the *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

The following table describes how IP address allocation, `ipFamilyPolicy`, and `ipFamilies` vary based on the above parameter configuration for services:

Table 4-24 IP Address Allocation

Infrastructure Preference	Backend Deployment Mode Helm Parameter	ipFamilyPolicy Attribute	ipFamilies Attribute	Pod IP	Service IP	Endpoints
IPv4 Preferred	IPv4	SingleStack	IPv4	Ipv4,IPv6	IPv4	IPv4
IPv6 Preferred	IPv4	SingleStack	IPv4	Ipv6,IPv4	IPv4	IPv4
IPv4 Preferred	IPv6	SingleStack	IPv6	Ipv4,IPv6	IPv6	IPv6
IPv6 Preferred	IPv6	SingleStack	IPv6	Ipv6,IPv4	IPv6	IPv6
IPv4 Preferred	IPv4_IPv6(IPv4 Preferred)	RequiredDualStack	IPv4 Preferred	Ipv4,IPv6	Ipv4,IPv6	IPv4
IPv6 Preferred	IPv4_IPv6(IPv4 Preferred)	RequiredDualStack	IPv4 Preferred	Ipv6,IPv4	Ipv4,IPv6	IPv4
IPv4 Preferred	IPv6_IPv4(IPv6 Preferred)	RequiredDualStack	IPv6 Preferred	Ipv4,IPv6	Ipv6,IPv4	IPv6
IPv6 Preferred	IPv6_IPv4(IPv6 Preferred)	RequiredDualStack	IPv6 Preferred	Ipv6,IPv4	Ipv6,IPv4	IPv6

Note

NRF defines all the `global.edgeDeploymentMode` and `global.backEndDeploymentMode` as `ClusterPreferred` by default. This helps NRF or other microservices to fallback to the single stack support.

Upgrade Impact

In a dual stack environment, all the NRF backend services are configured as single stack. As per Kubernetes limitation, NRF upgrade is not supported when there is a mismatch in `ipFamilies` configured between NRF backend microservices and the deployment mode `ipFamilies` configuration. In this case, NRF recommends a fresh installation to change the preferred `ipFamilies`. However, this is not applicable for the edge microservice (Ingress

Gateway microservice) as they can choose to increase the list of ipFamilies by setting it as dual stack according to the cluster preference.

Managing Dual Stack

Enable

The dual stack support is a core functionality of NRF. You do not need to enable or disable this feature.

Configure

This section lists the configuration details for this feature.

Helm

1. Customize the `ocnrf_custom_values_26.1.201.yaml` file.
2. Set `global.edgeDeploymentMode` to *clusterPreferred* to indicate the edge deployment mode.
3. Set `global.backEndDeploymentMode` to *clusterPreferred* to indicate the backend deployment mode.
4. Set `global.egressRoutingMode` to *None* to control the IP address selection and connection for the Egress Gateway microservice. For more information about the parameters, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
5. Save the file.
6. Install NRF. For more information about installation procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Observe

Metrics

The following metrics are added in the [Ingress Gateway Metrics](#) section:

- `oc_ingressgateway_incoming_ip_type`
- `oc_ingressgateway_outgoing_ip_type`

The following metrics are added in the [Egress Gateway Metrics](#) section:

- `oc_egressgateway_incoming_ip_type`
- `oc_egressgateway_outgoing_ip_type`
- `oc_egressgateway_dualstack_ip_rejected_total`

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see "Collecting Logs" section in *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.

2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.26 Pod Protection Support for NRF Subscription Microservice

The NRF subscription microservice is responsible for the following service operations:

- NfStatusSubscribe
- NfStatusUnsubscribe
- NfStatusNotify

Of the above service operations, NfStatusSubscribe and NfStatusUnsubscribe requests are received by the subscription pod through the Ingress Gateway service. The registration (nregistration) and auditor (nrfauditor) pods trigger notification events towards the subscription pod, which in turn triggers the NfStatusNotify requests to the consumer NFs.

The subscription pod currently undergo a risk of the congested condition. A congested condition is defined as a state where the pod's resource utilization (CPU and Pending Message count) is higher than the expected thresholds. This would result in higher latency, pod restarts, or traffic loss.

This situation may occur due to:

- increase of notification events received from the registration and auditor pods.
- increase of NfStatusSubscribe or NfStatusUnsubscribe events.
- a large number of NfStatusNotify events being triggered.

The Overload Control feature through Ingress Gateway only ensures the traffic through the Ingress Gateway to the subscription pods is regulated. For more information about the Overload Control feature, see [Overload Control](#).

However, in the NRF traffic call model, this traffic constitutes only 1% of the traffic to this service while 99% of the traffic is because of the NfStatusNotify events. Hence, the overload feature alone does not prevent the NRF subscription microservice pod from going into the congested state. The Pod Protection feature is introduced as a solution to address the overload situation by protecting the pod independently and continuing to provide service.

Note

Horizontal POD Autoscaling (HPA) at subscription microservice and pod protection mechanism at subscription microservice are independent features with different trigger conditions. While HPA considers microservice load, pod protection mechanism works only on the POD load. Therefore, their order of triggering cannot be predicted.

NRF monitors the congestion state for the subscription microservice pod. The congestion state is monitored by the following parameters:

- **CPU:** The CPU consumption of the Subscription microservice container is used to determine the congestion level. The CPU usage is monitored using the Kubernetes cgroup (cpuacct.usage) and it is measured in nanoseconds. It is monitored periodically and calculated using the following formula and then compared against the configured CPU thresholds to determine the congestion state.

Figure 4-21 CPU Measurement

$$\frac{\text{CurrentCpuUsage} - \text{LastCpuUsage}}{\text{CurrentTime} - \text{LastSampleTime}} \times 100$$

CPUs

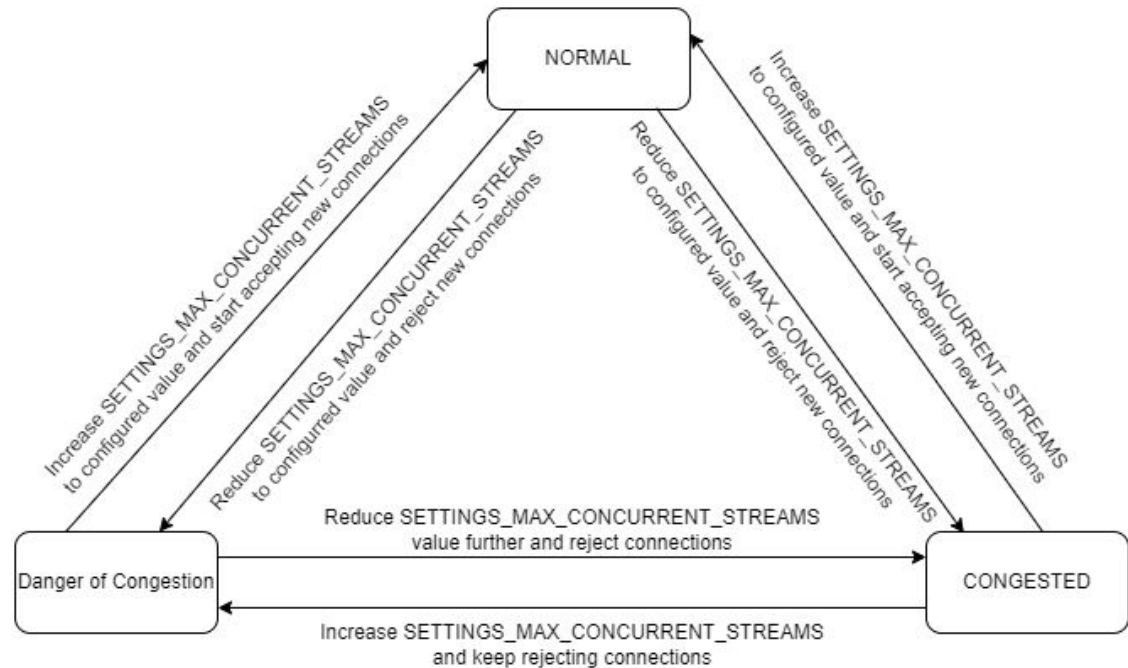
Where,

- CurrentCpuUsage is the counter reading at current periodic cycle.
- LastCpuUsage is the counter reading at previous periodic cycle.
- CurrentTime is the current time snapshot.
- LastSampleTime is the previous periodic cycle time snapshot.
- CPUs is the total number of CPUs for a given pod.
- Pending Message Count: The pending message count is the number of requests that are received by the subscription pod and yet to send the response. This includes all the requests triggered towards the Subscription pods from the registration, auditor, and Ingress Gateway microservices. The processing of the requests may include DB operations, forwarding the request to another NRF, and triggering notifications. The pending message count is monitored periodically and then compared against the configured thresholds to determine the congestion state.

Subscription Microservice Load States

Following are the different overload states to detect overload conditions. This will protect and mitigate the pod entering into an overload condition, and to take necessary actions to recover from overload.

Figure 4-22 Pod Protection State Transition

**Note**

The transition can occur between any states based on the congestion parameters. These congestion parameters are preconfigured and cannot be changed.

- Congested State:** This is the upper bound state where the pod is congested. This means one or more congestion parameters is above the configured thresholds for the congested state. For more information about the configuration using CNC Console, see [Pod Protection Options](#). The pod can be transitioned to the Congested State either from the Normal State or the DoC state.

When pod reaches this state, the following actions are performed:

- new incoming HTTP2 connection requests are not accepted.
- the pod gradually decrements the number of concurrent streams by updating `SETTINGS_MAX_CONCURRENT_STREAMS` parameter in a `SETTINGS` frame to the configured `maxConcurrentStreamsPerCon` value at a regular interval. The concurrent streams are decremented based on the value configured in `decrementBy` parameter. And, the regular interval is configured in the `decrementSamplingPeriod` parameter.

Alerts are raised when any of the subscription pods go into this state. For more information about alerts, see [NRF Alerts](#).

- Danger of Congestion (DoC) State:** This is the intermediate state where the pod is approaching a congested state. This means one or more congestion parameters, CPU or Pending Message Count, is above the configured thresholds for the DoC state. For more information about the configuration using CNC Console, see [Pod Protection Options](#).
 - When pod reaches this state, the following actions are performed:
 - * any new incoming HTTP2 connection requests are not accepted.

- * if the pod is transitioning from the Normal State to the DoC state, the pod gradually decrements the number of concurrent streams by updating SETTINGS_MAX_CONCURRENT_STREAMS parameter in a SETTINGS frame to the configured maxConcurrentStreamsPerCon value at a regular interval. The concurrent streams are decremented based on the value configured in decrementBy parameter. And, the regular interval is configured in the decrementSamplingPeriod parameter.
- * if the pod is transitioning from the Congested State to the DoC state, the pod gradually increments the number of concurrent streams by updating SETTINGS_MAX_CONCURRENT_STREAMS parameter in a SETTINGS frame to the configured maxConcurrentStreamsPerCon value at a regular interval. The concurrent streams are incremented based on the value configured in incrementBy parameter. And, the regular interval is configured in the incrementSamplingPeriod parameter.
- Normal State: This is the lower bound state where all the congestion parameters for the pod are below the configured thresholds for DoC and Congested states. For more information about the configuration using CNC Console, see [Pod Protection Options](#). When pod reaches this state, the following actions are performed:
 - the pod will continue accepting new incoming HTTP2 connection requests.
 - in case the pod is transitioning from the Congested or DoC state to Normal state, the pod gradually increments the number of concurrent streams by updating SETTINGS_MAX_CONCURRENT_STREAMS parameter in a SETTINGS frame to the configured maxConcurrentStreamsPerCon value at a regular interval. The concurrent streams are incremented based on the value configured in incrementBy parameter. And, the regular interval is configured in the incrementSamplingPeriod parameter.

To avoid toggling between these states due to traffic pattern, it is required for the pod to be in a particular state for a given period before transitioning to another state. The below configurations are used to define the period till which the pod has to be in a particular state:

- stateChangeSampleCount
- monitoringInterval

Formula for calculating the period is: (stateChangeSampleCount * monitoringInterval)

When the Subscription pods are in DoC or Congested state, it forces the client pods, registration, auditor, and Ingress Gateway to send lesser traffic towards the subscription pod. Subscription pod receives traffic in following scenarios:

- The registration pod sends a notification trigger request to the subscription pods when:
 - an NF registers itself with NRF.
 - an NF updates its registered profiles.
 - an NF deregisters itself from NRF.
- The auditor pod sends a notification trigger request to the subscription pods when:
 - the auditor marks an NF as SUSPENDED.
 - the auditor deregisters an NF when an NF is SUSPENDED state for a configurable amount of time.
- The subscription pod receives the below requests through the Ingress Gateway service when:
 - the consumer NF creates a new subscription in NRF using NFStatusSubscribe request.

- the consumer NF updates an existing Subscription in NRF using NFStatusSubscribe request.
- the consumer NF unsubscribes using NFStatusUnsubscribe request.

If the registration and auditor pods are unable to trigger a notification request to the subscription pods since they are in DoC or Congested State, It is possible that the consumer NFs will not be notified about the particular change in the consumer NfProfile. However, this is mitigated as the consumer NFs are expected to perform rediscovery of the producer NFs whenever the discovery validity time expires. This will ensure that their producer NF data will be refreshed, despite the dropped NfStatusNotify message.

The registration pod will not reject any of the incoming requests, like NfRegister, NfUpdate, NfDeregister, and NfHeartbeat even if it is unable to trigger a notification to the subscription pods for the same reason.

It is expected that the requests through the Ingress Gateway to the congested subscription pods may timeout, or get rejected.

Managing Subscription Microservice Pod Protection

This section explains the procedure to enable and configure the feature.

Enable

You can enable the Pod Protection feature using the CNC Console or REST API.

- **Enable using REST API:** Set `podProtectionOptions.enabled` to **true** and `podProtectionOptions.congestionControl.enabled` to **true** in Pod Protection Options configuration API. For more information about API path, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Enable using CNC Console:** Set Enabled to **true** for Pod Protection and Enabled to **true** for Congestion Control in Pod Protection Options page. For more information about enabling the feature using CNC Console, see the [Pod Protection Options](#) section.

Observe

Metrics

Following metrics are added in the [Pod Protection Metrics](#) section:

- `ocnrf_pod_congestion_state`
- `ocnrf_pod_cpu_congestion_state`
- `ocnrf_pod_pending_message_count_congestion_state`
- `ocnrf_incoming_connections`
- `ocnrf_max_concurrent_streams`
- `ocnrf_pod_cpu_usage`
- `ocnrf_pod_pending_message_count`
- `ocnrf_pod_incoming_connection_rejected_total`
- `ocnrf_nfNotification_trigger_total`

Alert

Following alerts are added in the [NRF Alerts](#) section:

- [OcnrfPodInDangerOfCongestionState](#)
- [OcnrfPodCpuUsageInDangerOfCongestionState](#)
- [OcnrfPodPendingMessageCountInDangerOfCongestionState](#)

- [OcnrfPodInCongestedState](#)
- [OcnrfPodCpuUsageInCongestedState](#)
- [OcnrfPodPendingMessageCountInCongestedState](#)

KPIs

Added the feature specific KPIs in the [Subscription Pod Protection](#) section.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.27 Pre and Post Install/Upgrade Validations

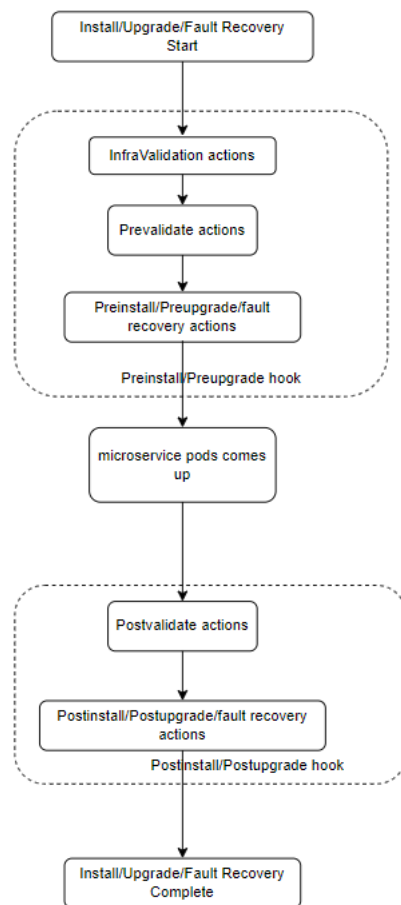
This feature applies validation checks on the infrastructure, application, databases, and its related tables before and after the installation, upgrade, or fault recovery.

When NRF is deployed, there could be inconsistencies and unexpected results if the required NRF tables or the site-specific configurations are not available. This could happen due to network issues, system issues, human error, race conditions. The feature aims to detect any inconsistency early in the system state and report the same. The validations are done during the preinstallation, postinstallation, preupgrade, and postupgrade. The infrastructure validations are performed as part of the preinstallation and preupgrade validations.

Note

Validation of database and tables during rollback procedures is not supported.

The below diagram depicts the flow where the validations occur:

Figure 4-23 Pre and Post Install/Upgrade Validations

Database and its Related Tables Validation

Each microservice is responsible for validating the database and the tables that it creates and manages.

The following tables are validated by each microservice:

- NrfConfiguration Service validates the following tables in the NRF Application database:
 - NrfSystemOptions
 - NfScreening
 - SiteIdToNrfInstanceIdMapping
 - NrfEventTransactions
- NfRegistration Service validates the following tables in the NRF Application database:
 - NfInstances
 - NfStatusMonitor
- NfSubscription service validates the following table in the NRF Application database:
 - NfSubscriptions
- NrfAuditor service validates the following table in NRF Leader Election database:
 - NrfAuditorLeaderPod

- NrfConfiguration Service validates the following tables in the NRF Network Database:
 - NfScreening_backup
 - NrfSystemOptions_backup
 - SiteIdToNrfInstanceIdMapping_backup

Note

- The common configuration database and its tables are currently not validated in the preinstallation, fault recovery, and postinstallation validation.
- The schema of the ReleaseConfig table is not currently validated in the preinstallation and postinstallation validation.

NRF Pre and Post Validations

NRF performs the following validation checks:

- [NRF Infrastructure Validation](#)
- [NRF Preinstallation Validation](#)
 - [For Fresh Installation](#)
 - [For Fault Recovery](#)
- [NRF Postinstallation Validations](#)
 - [For Fresh Installation](#)
 - [For Fault Recovery](#)
- [NRF Preupgrade Validation](#)
- [NRF Postupgrade Validation](#)

Managing Pre and Post Install/Upgrade Validations Feature

Enable

You can enable the feature using the Helm:

1. Open the `ocnrf_custom_values_26.1.201.yaml` file.
2. Set `global.appValidate.preValidateEnabled` to **true** to validate the database tables during preinstallation and preupgrade.
3. Set `global.appValidate.postValidateEnabled` to **true** to validate the database tables during postinstallation and postupgrade.
4. Set `global.appValidate.infraValidateEnabled` to **true** to validate the database tables during infrastructure validation. Configure the following `appInfo` attributes:
 - a. Configure `replicationUri` with the database monitoring service FQDN or port as per the deployment. The URI must be provided as "`http://<db monitor service name>:<db monitor service port>/db-tier/status/replication/realtime`".
 - b. Configure `dbTierVersionUri` with the database monitoring service FQDN or port to retrieve the `cnDBTier` version. The URI must be provided as "`http://<db monitor service name>:<db monitor service port>/db-tier/version`".

- c. Configure `alertmanagerUrl` with the database monitoring service FQDN or port to retrieve the `cnDBTier` version. The URI must be provided as `"http://<alert manager service name>:<alert manager service port>/cluster/alertmanager"`.
5. Set `global.appValidate.faultRecoveryMode` to **true** to install NRF in fault recovery mode.
For more information about the parameters, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
6. Save the file.
7. Install or upgrade NRF. For more information about the procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

4.27.1 NRF Infrastructure Validation

The infrastructure validations are performed as part of the preinstallation and preupgrade validations. The validation is done by the preinstallation and preupgrade hooks of the app-info service. The infrastructure validation is disabled by default.

Note

- It is highly recommended to enable it, and perform the required configuration to detect incompatibilities early. The infrastructure validation will be enabled by default from the next releases.
- Infrastructure validation is not supported during rollback procedures.

This validation is enabled by setting `global.appValidate.infraValidateEnabled` parameter to **true** in the `ocnrf_custom_values_26.1.201.yaml` file. The following checks are performed as part of the infrastructure validation before installing or upgrading NRF:

- Validate the minimum viable path from the previous NRF version to the current NRF version for an upgrade. This is validated based on the value configured in the `global.minViablePath` parameter. If this minimum viable path is not supported, NRF upgrade will not proceed.
- Validate that the installed Kubernetes version is compatible with the target NRF version being installed or upgraded. This is validated based on the value configured in the `global.minKubernetesVersion` parameter. If the Kubernetes version is not compatible, NRF installation or upgrade will not proceed.
- Validate that the installed `cnDBTier` version is compatible with the target NRF version being installed or upgraded. This is validated based on the value configured in the `global.minDbTierVersion` parameter. If the `cnDBTier` version is not compatible, NRF installation or upgrade will not proceed.
- Verify the replication status with the connected peer. This is validated based on the value configured in the `appinfo.defaultReplicationStatusOnError` parameter. If the replication is disabled or failed for all peers, NRF installation or upgrade will not proceed.
- Verify that there are no critical alerts raised in the system. If critical alerts are found, installation or upgrade will not proceed.

4.27.2 NRF Preinstallation Validation

The following sections describe the preinstallation validation performed when NRF is installed for fresh installation mode and fault recovery mode.

4.27.2.1 For Fresh Installation

The preinstallation validation is performed as part of the preinstallation hooks of each NRF microservice. It is the first set of actions performed. For more information about the list of microservices that perform validation, see [NRF Microservice Table Validation](#).

This validation is configured by setting `global.appValidate.preValidateEnabled` parameter to **true** in the `ocnrf_custom_values_26.1.201.yaml`. The following checks are performed as part of the preinstallation validation:

- Validate the presence of the database. If not present, the installation will not proceed. The database is expected to be present, before proceeding with installation.
- Validate the ReleaseConfig table does not have release information about the site being installed. If present, the installation will not proceed, as it will not be a fresh installation.
- Validate the presence of the required tables. Each microservice validates the tables that it is responsible for. If all the required tables are present, then the table schema is validated against the schema expected as per the release version. If the tables are partially present or if the schema validation fails, installation will not proceed. The tables are expected to be present when multisite georedundant NRF is deployed.

4.27.2.2 For Fault Recovery

NRF can be installed in fault recovery mode by setting `global.appValidate.faultRecoveryMode` parameter to **true** in the `ocnrf_custom_values_26.1.201.yaml`. When NRF is deployed in the fault recovery mode, with a database backup in place, the following checks are performed as part of the preinstallation validation:

- Validate the presence of the database. If not present, the installation will not proceed. The database is expected to be present, before proceeding with installation.
- Validate if the ReleaseConfig table contains release information about the site. If not present, the installation will not proceed as the table is expected to contain information from the database backup.
- Validate the presence of the required tables. Each microservice validates the tables that it is responsible for. If the tables are present, then the table schema is validated against the schema expected as per the release version. If the tables are partially present or if the schema validation fails, installation will not proceed.
- Validate the configType in the NrfSystemOptions table against the configTypes expected as per the releaseVersion of the specific site. If validation fails, installation will not proceed.
- Validate the nfScreeningRulesListType in the NfScreening table against the nfScreeningRulesListType expected as per the releaseVersion of the specific site.

Note

It is recommended that after the installation is completed in fault recovery mode, this flag has to be set to `false`. This can be done while performing future upgrades.

In case preinstallation fails, the error reason is logged in the preinstallation hook job of the particular microservice.

4.27.3 NRF Postinstallation Validations

The following sections describe the postinstallation validation performed when NRF is installed in fresh installation mode and fault recovery mode.

4.27.3.1 For Fresh Installation

The following sections describe the postinstallation validation performed when NRF is installed in fresh installation mode and fault recovery mode.

The postinstallation validation is done as part of the postinstallation hooks of each NRF microservice and is the last set of actions performed. For more information about the list of microservices that perform validation, see [NRF Microservice Validation](#).

This validation is configured by setting `global.appValidate.postValidateEnabled` parameter to **true**. The following checks are performed as part of the postinstallation validation:

- Validate if the ReleaseConfig table contains release information about the site. If not present, the installation will not proceed.
- Validate the presence of the database. If not, the installation will not proceed.
- Validate the presence of the required tables. Each microservice validates the tables that it is responsible for. If all the required tables are present, then the table schema is validated against the schema expected as per the release version. If the tables are partially present or if the schema validation fails, installation will not proceed. The tables are expected to be present when multisite georedundant NRF is deployed.
- Validate the configType in the NrfSystemOptions table against the configTypes expected as per the releaseVersion of the specific site. If validation fails, installation will not proceed.
- Validate the nfScreeningRulesListType in the NfScreening table against the nfScreeningRulesListType expected as per the releaseVersion of the specific site.

The tables are expected to be present when multisite georedundant NRF is deployed.

In case postinstallation fails, the error reason will be logged in the postinstallation hook job of the particular microservice.

4.27.3.2 For Fault Recovery

When NRF is installed in the fault recovery mode, using previously backed up database, similar actions as mentioned in [NRF in Fault Recovery Mode](#) are performed.

Note

It is recommended that after the installation is complete in fault recovery mode, this flag has to be set to `false`. This can be done while performing future upgrades.

4.27.4 NRF Preupgrade Validation

The following sections describe the preupgrade validation done as part of the preupgrade hooks of each NRF microservice and is the first set of actions performed. The following checks are performed as part of the preupgrade validation.

For more information about the list of microservices that perform validation, see [NRF Microservice Validation](#).

This validation is configured by setting `global.appValidate.preValidateEnabled` parameter to **true** in the `ocnrf_custom_values_26.1.201.yaml` file. The following checks are performed as part of the preupgrade validation:

- Validate if the ReleaseConfig table contains release information about the site. If not present, the upgrade will not proceed.
- Validate the presence of the database required to proceed with the upgrade. If not present, the upgrade will not proceed.
- Validate the presence of the required tables required to proceed with the upgrade. Each microservice validates the tables that it is responsible for. If all the tables are not present or partially present, the upgrade will not proceed.
- Validate the table schema against the schema expected as per the release version. If validation fails, upgrade will not proceed.
- Validate the configType in the NrfSystemOptions table against the configTypes expected as per the releaseVersion of the specific site. If validation fails, upgrade will not proceed.
- Validate the nfScreeningRulesListType in the NfScreening table against the nfScreeningRulesListType expected as per the releaseVersion of the specific site.

The tables are expected to be present when multisite georedundant NRF is deployed.

4.27.5 NRF Postupgrade Validation

The following sections describe the postupgrade validation done as part of the postupgrade hooks of each NRF microservice and is the last set of actions performed. The following checks are performed as part of the postupgrade validation.

For more information about the list of services that perform validation, see [NRF Microservice Validation](#).

This validation is configured by setting `global.appValidate.postValidateEnabled` parameter to **true** in the `ocnrf_custom_values_26.1.201.yaml` file. The following checks are performed as part of the postupgrade validation:

- Validate if the ReleaseConfig table contains release information about the site. If not present, the upgrade will not proceed.
- Validate the presence of the database required to proceed with the upgrade. If not present, the upgrade will not proceed.
- Validate the presence of the required tables required to proceed with the upgrade. Each microservice validates the tables that it is responsible for. If all the tables are not present or partially present, the upgrade will not proceed.
- Validate the table schema against the schema expected as per the release version. If validation fails, upgrade will not proceed.
- Validate the configType in the NrfSystemOptions table against the configTypes expected as per the releaseVersion of the specific site. If validation fails, upgrade will not proceed.
- Validate the nfScreeningRulesListType in the NfScreening table against the nfScreeningRulesListType expected as per the releaseVersion of the specific site.

The tables are expected to be present when multisite georedundant NRF is deployed.

4.28 Ignore Unknown Attribute in NFDDiscover Search Query

NRF by default rejects any nfdDiscover request (400 Bad Request) with query attributes that are not supported. As part of this feature, instead of rejecting the request, NRF allows processing the nfdDiscover request by ignoring the unsupported and unknown search query attributes. The list of query attributes that should be ignored while processing the nfdDiscover request is configured using Helm.

Enable

You can enable this feature using the Helm:

1. Open the `ocnrf_custom_values_26.1.201.yaml` file.
2. List the search query in `searchQueryIgnoreList` under `nfdiscovery` section. For more information about the parameter, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
3. Save the file.
4. Run `helm install`. For more information about the installation procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
5. If you are setting this parameter after NRF deployment, run the `Helm upgrade`. For more information about the upgrade procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

4.29 NF Authentication using TLS Certificate

This feature supports authentication of the Network Function before accessing the, NRF services. In case, authentication fails, NRF rejects the service operation requests. In this feature, NRF challenges some attributes from the TLS certificate against defined attributes.

4.29.1 XFCC Header Validation

HTTPS support is a minimum requirement for 5G NFs as defined in 3GPP TS 33.501. This feature enables extending identity validation from the Transport layer to the Application layer and provides a mechanism to validate the NF FQDN presence in Transport Layer Security (TLS) certificate as added by the Service Mesh against the NF Profile FQDN present in the request.

NRF provides configurations to dynamically enable or disable the feature. To enable the feature on Ingress Gateway in NRF deployment, see `xfccHeaderValidation` attribute in User Configurable Section of *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide* for more details.

Note

- This feature is disabled by default. The feature needs to be enabled at API Gateway and NRF. At NRF, the feature enabling or disabling can be performed using the following configuration.
- Once this feature is enabled, all of NFs must re-register with FQDN in NF Profile or NFs can send NFUpdate with FQDN. For Subscription Service Operations, Network Functions must register with NRF. The NFs that are subscribed before enabling the feature, must register with NRF for further service operations.

Managing NF Authentication using TLS Certificate**Enable**

To enable the feature on Ingress Gateway in NRF deployment:

1. Customize the `ocnrf_custom_values_26.1.201.yaml` file.
2. Set **enabled** parameter to `true` under XFCC header validation/extraction in Ingress Gateway Global Parameters section:

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

3. Save the file.
4. Run helm upgrade, if you are enabling this feature after NRF deployment. For more information about upgrade procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Configure

Configure the NF Authentication using the TLS Certificate feature using REST API or CNC Console:

- **Configure NF Authentication using TLS Certificate using REST API:** Perform the feature configurations as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*. Refer to attributes under `nfAuthenticationOptions` in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide* for more details.
- **Configure NF Authentication using TLS Certificate using CNC Console:** Perform the feature configurations as described in [NF Authentication Options](#).

Observe

For more information on NF Authentication using TLS certificate feature metrics and KPIs, see [NRF Metrics](#) and [NRF KPIs](#) sections.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.

2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.29.2 TLS SNI Header Validation

Oracle Communications Cloud Native Core, Network Repository Function (NRF) supports Server Name Identification (SNI) when acting as a client and sending TLS handshake message. The FQDN in SNI is used to identify the server for which the TLS connection is needed. When the same server is supporting multiple services, the SNI identifies which service is to be used for the TLS connection. As a part of the TLS handshake initiation process, SNI is populated in the client handshake sent by Egress Gateway depending on the routing type. There are two routing options:

- Direct Routing – Egress Gateway adds the target server's FQDN in the SNI. If the target server has only IP address, then the SNI header will not be populated in the outgoing TLS requests.
- Indirect Routing – Egress Gateways uses the FQDN of the selected Peer (For example, host of the SCP or SEPP) for populating the SNI header. If the selected peer has an IP address, SNI header is not populated in the outgoing TLS requests.

Warning

This feature should be enabled only for non-servicemesh-based deployments.

Note

When the feature is enabled, SNI header is populated at Egress Gateway only when an FQDN is available.

Managing TLS SNI Header Validation

Enable

You can enable the TLS SNI header feature in NRF deployment:

1. Open the `ocnrf_custom_values_26.1.201.yaml` file.
2. Set `egress-gateway.sniHeader.enabled` to **true** to enable TLS SNI header validation.
3. Save the file.
4. Run `helm install`. For more information about the installation procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
5. If you are setting this parameter after NRF deployment, run the `Helm upgrade`. For more information about the upgrade procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Observe

For more information on TLS SNI header validation feature metrics `oc_egressgateway_sni_error_total` see [NRF Metrics](#) section.

Maintain

In case the SNI header is not sent in the TLS 1.2 handshake, perform the following:

1. **Collect the logs:** The logs are collected during the following scenarios:
 - To ensure that the SNI header is added and the feature is running as expected, look up the SNI feature is enabled log statement at the debug level.
 - To identify when the Peer rejected the client handshake due to invalid SNI sent by Egress Gateway, look up the Unrecognized server name indication log statement at the debug level.
 - To verify if both service mesh and SNI feature are enabled, look up the Service mesh is enabled. As a result, SNI will not be populated even though it is enabled log statement at the warn level.
For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.30 Subscriber Location Function

Subscriber Location Function (SLF) feature of NRF allows you to select the network function based on the Subscription Permanent Identifier (SUPI) and Generic Public Subscription Identifier (GPSI) subscriber identities. The SLF feature supports Authentication Server Function (AUSF), Unified Data Repository (UDR), Unified Data Management (UDM), Policy Control Function (PCF), and Charging Function (CHF) nTypes for discovery query.

The discovery of producer network functions is performed as follows:

- NRF checks if SLF feature is enabled or not. If the feature is enabled:
 - Check `slfLookupConfig` contains details for `target-nf-type` in `NFDiscover` query:
 - * In case any of the `NFDiscover` search query attributes are present in configured `skipSLFLookupParameters` then the SLF lookup is not performed.
For example, if the search query attribute is `group-id-list` and the same attribute is configured in `skipSLFLookupParameters`, then NRF will not perform SLF lookup rather NRF will use the `group-id-list` present in the search query while processing of `NFDiscover` service operation.
 - * In case the configured `skipSLFLookupParameters` attribute does not match with any of the `NFDiscover` search query, then the mandatory parameter (either SUPI or GPSI) required for SLF lookup must be present in the `NFDiscover` search query.
 - * In case none of the mandatory attributes (SUPI or GPSI) are present in `NFDiscover` search query and if `NFDiscover` search query attribute is present in configured `exceptionListForMissingMandatoryParameter` attribute, then NRF does not perform SLF lookup and processes the `NFDiscover` service operation without rejecting the `NFDiscover` search query.
 - * In case both the mandatory attributes (SUPI or GPSI) are present in `NFDiscover` search query and if `NFDiscover` search query attribute is present in configured `exceptionListForMissingMandatoryParameter` attribute, NRF performs SLF lookup and drops the SUPI or GPSI and processes the `NFDiscover` service operation.

- * In case none of the mandatory attributes (SUPI or GPSI) are present in NFDDiscover search query and if NFDDiscover search query attribute is present in configured `exceptionListForMissingMandatoryParameter` attribute, then NRF will process the NFDDiscover service operation without rejecting the NFDDiscover search query.
 - * In case none of the mandatory attributes (SUPI or GPSI) are present in the NFDDiscover search query and if NFDDiscover search query attribute is not present in configured `exceptionListForMissingMandatoryParameter` attribute then NRF rejects the discovery query.
 - * In case both of the mandatory attributes (SUPI or GPSI) are present in NFDDiscover search query, then configured `preferredSubscriberIdType` is used to decide which of the mandatory attribute is used to perform the SLF query by ignoring the other attributes.
- Finds the NF Group Id by sending SLF query (that is, `Nudr_GroupIDmap` service operation) with the received Subscriber Identity (like SUPI and GPSI).
 - Generates NFDDiscover service response using the `NFGroupId` received in SLF response and other parameters. The received Subscriber Identifier is not used during NF Producer selection.
 - `accessTokenCacheEnabled` flag enables caching of the oAuth2 token for SLF communication at NRF.

Note

- `accessTokenCacheEnabled` flag is functional only when the oAuth2 token is required for SLF communication that is controlled by the `accessTokenCacheEnabled` parameter.
- Operators must enable the `accessTokenCacheEnabled` flag only after NRF deployment is successfully upgraded to 26.1.201.

NRF supports direct routing or dynamic routing of SLF queries:

- For direct routing, see [Static Selection of SLF](#).
- For dynamic routing, see [Dynamic Selection of SLF](#).

Managing Subscriber Location Function Feature

Enable

You can enable SLF feature using the REST API or CNC Console.

- **Enable using REST API:** Set `featureStatus` to **ENABLED** in **SLF Options** configuration API. For more information about API path, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Enable using CNC Console:** Set **Feature Status** to **ENABLED** on the SLF Options page. For more information about enabling the feature using CNC Console, see [SLF Options](#).

Configure

You can configure the SLF feature using the REST API or CNC Console:

- **Configure using REST API:** Perform the feature configurations as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

- **Configure using CNC Console:** Perform the feature configurations as described in [SLF Options](#).

① Note

- Atleast one of the attributes fqdn, ipv4Address, or ipv6Address must be included by the registered UDR.
- For routing, the NfService level attributes are considered first. If none of the attributes are present at NfService level, then the NfProfile level attributes are considered, not in a mix mode where some of the attributes are from NfService and some from NfProfile.
However, with [Support for Configurable Port and Routing Parameter Selection](#) feature, routing selection parameter can be picked either from NfService or NfProfile in a mix mode as per the availability.
- Of the three attributes, the endpoint is selected in the following order:
 - ipv4Address
 - ipv6Address
 - fqdn

However with the [Support for Configurable Port and Routing Parameter Selection](#) feature, the order of the attributes can be configured.

- For the cases where ports are not present, (example: ipv4Address and ipv6Address in NfProfile or FQDN from NfService/NfProfile or ipEndpoints with no port in NfService), scheme configured in the NfService is used to determine the port.
 - If NfService.scheme is set to http, port 80 is used.
 - If NfService.scheme is set to https, port 443 is used.

However with [Support for Configurable Port and Routing Parameter Selection](#) feature, the port selection can be configured.

Observe

Metrics

Following are the SLF feature specific metrics:

- ocnrf_nfDiscover_ForSLF_rx_requests_total
- ocnrf_nfDiscover_ForSLF_tx_responses_total
- ocnrf_SLF_tx_requests_total
- ocnrf_SLF_rx_responses_total
- ocnrf_slf_jetty_latency_seconds_[suffix]
- ocnrf_nfDiscover_SLFlookup_skipped_total
- ocnrf_nfDiscover_continue_mandatoryAttributes_missing_total
- ocnrf_max_slf_attempts_exhausted_total

For more information about SLF metrics, see [NRF SLF Metrics](#) section.

Alerts

Following are the SLF feature specific alerts:

- [OcnrfMaxSlfAttemptsExhausted](#)

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

1. **Collect the logs:** For more information about how to collect logs, see "Collecting Logs" section in *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information about how to raise a service request.

4.30.1 Static Selection of SLF

NRF supports static selection of SLF to perform direct routing of discovery queries. These queries are sent to Unified Data Repository (UDR) or SLF (that is, Nudr_GroupIDmap service) to retrieve the corresponding NFGroupID. In the current configuration, the SLF or UDR is selected based on the `slfHostConfig` configuration and establishes direct communication with the selected SLF or UDR. For SLF query through Service Communication Proxy (SCP), see the [SLF Requests](#) section.

SLF host configuration attribute (`slfHostConfig`) allows the user to configure the details of SLF or UDR network functions.

The `slfHostConfig` configuration consists of attributes like `apiVersion`, `scheme`, `FQDN`, `port`, `priority`. NRF allows the configuration of more than two hosts. The host with the highest priority is considered as the Primary Host. The host with the second highest priority is considered as a Secondary Host.

Note

- Refer to 3GPP TS 29.510 (release 15.5) for definition and allowed range for `slfHostConfig` attribute (`apiVersion`, `scheme`, `FQDN`, `port`, `priority`, and so on).
- Apart from priority attribute, no other attributes plays any role in primary or secondary host selection.
- Apart from primary or secondary host, other configured hosts (if any) are not used during any message processing.
- When more than one host is configured with highest priority, then two of them is picked as primary or secondary host randomly.

The SLF request is first sent to the primary SLF. In case of an error from primary SLF, the request is sent to secondary SLF based on the following configurations:

1. **rerouteOnResponseHttpStatusCodes:** This attribute is used to determine if SLF retry must be performed to an alternate SLF based on the response code received from the SLF. The alternate SLF is picked from the SLF Host Config, if `slfConfigMode` is set to `STATIC_SLF_CONFIG_MODE` or from the `slfDiscoveredCandidateList` if `slfConfigMode` is set to `DISCOVERED_SLF_CONFIG_MODE`. For primary and secondary SLF details, see `slfHostConfig` attribute.

2. **maximumHopCount**: This configuration determines the maximum number of hops (SLF or NRF) that NRF can forward in a given service request. This configuration is useful during NRF Forwarding and SLF feature interaction.

Enable the feature in Static mode

The default configuration for `slfConfigMode` is **STATIC_SLF_CONFIG_MODE**. Perform the following steps to enable the SLF feature in static mode:

1. Configure `slfHostConfig` and `slfLookupConfig` parameters. For more information on the parameters, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
2. Set `featureStatus` to **ENABLED**.

4.30.2 Dynamic Selection of SLF

NRF supports dynamic selection of SLF based on the registered SLF or UDR profiles. This configuration is defined based on the SLF Configuration Mode attribute (`slfConfigMode`). This attribute allows the user to decide whether the SLF lookup can be performed based on preconfigured `slfHostConfig` configuration or use the SLFs registered with NRF.

The dynamic selection of producer network functions is as follows.

NRF checks if the SLF feature is enabled or not. When the feature is enabled:

- If `slfConfigMode` attribute is set to **STATIC_SLF_CONFIG_MODE**, the SLF lookup is performed based on preconfigured `slfHostConfig` as described in [Static Selection of SLF](#).
- To perform SLF lookup based on the SLFs registered with NRF:
 - Set `populateSlfCandidateList` to **true**:


```
("populateSlfCandidateList": true)
```
 - Wait until at least one entry of SLF candidate is listed under `slfDiscoveredCandidateList`. Perform GET operation to check if any SLF candidate is listed in the output.
 - Change `slfConfigMode` to **DISCOVERED_SLF_CONFIG_MODE**:

```
{
  "featureStatus": "ENABLED",
  "slfLookupConfig": [{
    "nfType": "UDR"
  }],
  "slfConfigMode": "DISCOVERED_SLF_CONFIG_MODE"
}
```

Note

Setting `populateSlfCandidateList` to **true** and `slfConfigMode` to **DISCOVERED_SLF_CONFIG_MODE** must be performed in two separate requests.

Note

Upgrade NRF to enable NrfArtisan service, if not enabled during installation. For more information on enabling Artisan Microservice, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

The `slfHostConfig` must be configured before or while setting the `slfConfigMode` as `STATIC_SLF_CONFIG_MODE` when `featureStatus` is `ENABLED`.

Once the `featureStatus` is `ENABLED`, and the `slfConfigMode` is `STATIC_SLF_CONFIG_MODE`, the `slfHostConfig` cannot be empty.

If `slfConfigMode` is set to `DISCOVERED_SLF_CONFIG_MODE`, `slfHostConfig` is not considered for discovery query.

The `slfConfigMode` can be set to `DISCOVERED_SLF_CONFIG_MODE` only if there is atleast one `slfCandidate` present in the `slfDiscoveredCandidateList`. To trigger the population of `slfDiscoveredCandidateList`, set `populateSlfCandidateList` to **true**.

The `nrfArtisan` service populates the `slfDiscoveredCandidateList` by sending an `nfDiscovery` query to the `nfDiscovery` service to fetch the registered SLF or UDR `NfProfiles`. The discovery query used is:

```
/nnrf-disc/v1/nf-instances?target-nf-type=UDR&requester-nf-type=NRF&service-  
names=nudr-group-id-map&preferred-  
locality=<slfOptions.preferredSLFLocality>&limit=0
```

The `nfDiscovery` service fetches the registered SLF or UDR `NfProfiles` and apply the filtering criteria based on the discovery query parameters to get the relevant set of SLF or UDR `NfProfiles`. The UDR or SLF profiles are sorted and prioritized before adding to the discovery response. All the features that are available for discovery service operations, if enabled, are applied while processing the discovery query. For example: forwarding, emptylist and extended preferred locality features are included. The discovery response is sent to the `nrfArtisan` service which will then populate the `slfDiscoveredCandidateList`.

Note

If `nrfArtisan` service does not receive a success response from the discovery service, the `slfDiscoveredCandidateList` will contain the SLF producers that were received from the discovery service in the last successful response.

The order of the UDR or SLF profiles in the `slfDiscoveredCandidateList` list will be decided based on the sorting algorithms in `nfDiscovery` Service. The same is considered when NRF sends the SLF query to the SLF.

Refer [Preferred Locality Feature Set](#) for details on how the `NfProfiles` are sorted based on preferred-locality and extended-preferred-locality.

Prior to 22.2.x of NRF, Egress Gateway used to return 503 response for timeout exceptions (for example, No response received for SLF query or No Response received for Query sent to Forwarding NRF).

From 22.3.x onwards, Egress Gateway returns 408 response codes for timeout exceptions (REQUEST_TIMEOUT and CONNECTION_TIMEOUT), to keep the behavior in line with the HTTP standard. Hence, after upgrading to 22.3.x or a fresh install of 22.3.x, if a retry needs to be performed for the timeout scenario, 408 error code explicitly needs to be configured under SLF reroute option. Following is the configuration for SLF options:

```
{
    "rerouteOnResponseHttpStatusCodes": {
        "pattern": "^([3,5][0-9]{2})$|408$"
    }
}
```

If the SLF request failed due to non-2xx error response (except 404response)/request timeouts all SLFs (and the error codes are configured under “rerouteOnResponseHttpStatusCodes”), then

- if forwarding is enabled and the message is a candidate to forward, NRF will forward the request to the other segment NRF.
- if forwarding is disabled, NRF will reject the discovery query with the configured error code under “SLF_Not_Reachable”

If the SLF request failed due to 404 error response and 404 is configured under “rerouteOnResponseHttpStatusCodes”, then,

- NRF will retry to secondary or tertiary SLFs.
- forwarding is not performed in this case (there is an explicit code was added to have this functionality as per the SLF requirement).

Enable the feature in Dynamic mode

Prerequisite

Artisan Microservice (NrfArtisan) must be ENABLED. For more information on enabling alternate route service, see the "Global Parameters" section in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Configuring slfConfigMode to Dynamic

Perform the following steps to enable the SLF feature using registered SLF profiles:

1. Configure slfLookupConfig parameter. For more information on the parameters, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
2. Set populateSlfCandidateList to true. This will trigger the population of slfDiscoveredCandidateList.
3. Perform GET on the slfOptions to see if slfDiscoveredCandidateList has atleast one candidate. If present, go to step 4. If not, then wait till the slfDiscoveredCandidateList is populated with SLF profiles.
4. Set slfConfigMode to **DISCOVER_SLF_CONFIG_MODE** and featureStatus to **ENABLED**.

Moving from Dynamic to Static

Perform the following to switch from dynamic to static configuration:

1. Configure `slfHostConfig` parameter. For more information on the parameters, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
2. Set `slfConfigMode` to **STATIC_SLF_CONFIG_MODE**, provided `slfHostConfig` and `slfLookupConfig` are already present.
3. Set `populateSlfCandidateList` to **false**.

Moving from Static to Dynamic

Perform the following to switch from static to dynamic configuration:

1. Upgrade NRF to enable `NrfArtisan` service, if not enabled previously. Configure `enableNrfArtisanService` under **global attributes** to **true** in the `ocnrf_custom_values_26.1.201.yaml` file.
2. Set `populateSlfCandidateList` to **true**. This triggers the population of `slfDiscoveredCandidateList`.
3. Perform GET on the `slfOptions` to see if `slfDiscoveredCandidateList` has at least one candidate. If present, go to step 4. If not, then wait till the `slfDiscoveredCandidateList` is populated with SLF profiles.
4. Set `slfConfigMode` to **DISCOVER_SLF_CONFIG_MODE** and `featureStatus` to **ENABLED**.

Note

If `slfConfigMode` is set to **DISCOVERED_SLF_CONFIG_MODE**, `slfHostConfig` is not considered for discovery query.

4.30.3 Support for Configurable Port and Routing Parameter Selection

When the Dynamic Selection of SLF feature is enabled, the SLFs are selected from the `slfOptions.slfcandidateList` which is populated using the SLFs registered at NRF. While routing the SLF requests, the hosts and the port details are taken from the SLF profile from any of the below attributes:

- `NfProfile.ipv4Addresses`
- `NfProfile.ipv6Addresses`
- `NfService.IpEndpoint.ipv4Address`
- `NfService.IpEndpoint.ipv6Address`
- `nfProfile.fqdn`
- `nfService.fqdn`

NRF allows to configure the preferred routing parameter using `preferredRoutingParameter` parameter in the `{apiRoot}/nrf-configuration/v1/slfOptions` URI. This parameter is applied in case one or more of the above attributes is present in the `NfProfile` or `NfService` based on the `preferredRoutingParameter.priority` configured.

If the `preferredRoutingParameter.routingParameter` attribute is set to `IPv4`, then the host and IP address details are taken from the `NfService.IpEndpoint.ipv4Address` or the host details are taken from the `NfProfile.ipv4Addresses`.

If the `preferredRoutingParameter.routingParameter` attribute is set to IPv6, then the host and IP address details are taken from the `NfService.IpEndpoint.ipv6Address` or the host details are taken from the `NfProfile.ipv6Addresses`.

If the `preferredRoutingParameter.routingParameter` attribute is set to FQDN, then the host and FQDN details are taken from the `nfProfile.fqdn` or `nfService.fqdn`.

The port details for all the above attributes can be derived with a configurable option using `preferredPortFromIPEndpoint` attribute in `{apiRoot}/nrf-configuration/v1/slfOptions` URI. This configuration is used for port selection when any one of the below conditions are satisfied:

- IPv4Addresses or Ipv6Addresses of NfProfile is used and does not contain the port
- FQDN of NfService or NfProfile is used

If `preferredPortFromIPEndpoint` attribute in `{apiRoot}/nrf-configuration/v1/slfOptions` is set to true, then Port is taken from the `NfService.IpEndpoint.port`. If `NfService.IpEndpoint.port` is not present in the `NfProfile` then the port is determined using the `NfService.scheme`.

If `preferredPortFromIPEndpoint` attribute in `{apiRoot}/nrf-configuration/v1/slfOptions` URI is set to false, the `NfService.scheme` is used to determine the port.

If `NfService.scheme` is set to http, port 80 is used.

If `NfService.scheme` is set to https, port 443 is used.

Managing Configurable Port and Routing Parameter Selection Feature

Configure

You can configure the following parameters using the REST API or CNC Console:

- **Configure using REST API:** Perform the `preferredPortFromIPEndpoint` and `preferredRoutingParameter` feature configurations as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Configure using CNC Console:** Perform the feature configurations as described in [SLF Options](#).

4.30.4 Rerouting SLF Requests Using Alternate SCP and Alternate SLF

NRF supports routing SLF requests through SCP as per the configuration in the Egress Gateway SBI routing configuration. SLFs are selected based on Static or Dynamic SLF feature configuration.

In case an error response is received from SLF, NRF reroutes the SLF request to an alternate SLF. However, in this case, the same SCP that was used in the previous route is always used. It is possible that SCP had rerouted the SLF request to the alternate SLF in the first attempt and it failed. In the subsequent attempt if the same SCP is used, there is a possibility that this reroute might also fail. Also, NRF doesn't consider the number of SLFs that are already been attempted by SCP.

With the implementation of this feature, NRF allows you to configure maximum number of SLF attempts or an alternate SCP route to enhance the routing strategy and minimize the number of reroutes. When an error response is received, the subsequent reroutes to SLF are through alternate SCP and SLF path, improving resilience and service continuity.

NRF discovery microservice sends the Nudr_GroupIDmap request to SLF through SCP based on the Egress Gateway routes configuration.

This feature allows you to configure the maximum number of SLF attempts or an alternate SCP route to process the subsequent attempts.

This can be achieved by:

- **Limiting number of SLF attempts:** This is performed by configuring the number of SLF attempts in the maxSLFAttempts parameter. For more information, see [Maximum SLF Attempts](#).
- **Choosing an alternate SCP:** This is performed by enabling the useAlternateScp parameter. For more information, see [Use Alternate SCP](#).

① Note

If the Egress Gateway is down, then no reroute is performed and an error response is sent to the producer NF.

Maximum SLF Attempts

In a routing using SCP deployment, when the discovery service receives a non-2xx response, NRF extracts the server header to deduce the number of SLFs that have been attempted.

For example:

- If the server header is Server: UDR-UDR1-Instance-Id UDR-UDR2-Instance-Id, the number of attempts is considered as **2**.
- If the server header is Server: UDR-UDR1-Instance-Id UDR-UDR2-Instance-Id SCP-SCP1-Instance-Id, the number of attempts is considered as **2**.
- If the server header is Server: envoy, the number of attempts is considered as **1**.
- If the server header is Server: UDR-UDR1-Instance-Id, the number of attempts is considered as **1**.
- If the server header is Server: SCP-SCP1-Instance-Id, the number of attempts is considered as **1**.
- If there is no server header received or server header is empty, the number of attempts is considered as **1**.
- If the request has timed out, the number of attempts is considered as **1**.

The number of attempts to SLF is validated against the value configured for maxSLFAttempts parameter, as follows:

- If the maxSLFAttempts is not exhausted, discovery selects the next SLF to reroute the request.
- If the maxSLFAttempts is exhausted and there is no successful response, discovery sends the error response. If there is only one SLF, NRF will not reroute to the already attempted SLF and send the error response.
- If the maxSLFAttempts is exhausted and forwarding is enabled, NRF routes the discovery request to another NRF based on maximumHopCount configuration. The maximumHopCount provides the total number of SLF attempts and NRFs forwarding attempts performed. NRF tries to attempt to all available SLFs and then if maximumHopCount is left, NRF will forward the request to another NRF. When the

maxSLFAttempts parameter is configured, the operator can choose how many maximum SLF attempts can be done before forwarding the request.

For example:

In 3 SLF and 4 NRF deployments,

- If maximumHopCount is set to 5 and maxSLFAttempts is set as 0, then the number of attempts to SLF is 3 and number of attempts to NRF is 2.
- If maximumHopCount is set to 5 and maxSLFAttempts is set as 2, the following combinations are possible:
 - the number of attempts to SLF is 1 and number of attempts to NRF is 4.
 - the number of attempts to SLF is 2 and number of attempts to NRF is 3.

① Note

The value of maxSLFAttempts parameter must be less than or equal to the value configured for maximumHopCount parameter in {apiRoot}/nrf-configuration/v1/generalOptions API. For more information about the maximumHopCount parameter, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

For more information about server header propagation in service-mesh deployment, see [Adding Filters for Server Header Propagation](#).

Use Alternate SCP

In a routing using SCP deployment, when the discovery service receives a non-2xx response, NRF checks the useAlternateScp parameter value.

If useAlternateScp parameter is set to **true**, then NRF chooses an alternate SCP, if available, to reroute the in a round-robin format to reroute the request. If there is only one SCP instance, NRF reroutes the request using the same SCP irrespective of the useAlternateScp configuration.

If all the available SCPs are tired and attempts are left, then NRF revolves back to the first SCP and repeat the SCP selection based on the round-robin.

① Note

- When useAlternateScp is set to **true**, alternate SCP selection will not guaranteed if SCP Health APIs feature is enabled. Hence, it is recommended to disable SCP Health APIs feature when useAlternateScp is set to **true**. For more information about the SCP Health APIs feature, see the [Monitoring the Availability of SCP Using SCP Health APIs](#) section.
- When useAlternateScp is set to **true**, customPeerSelectorEnabled parameter in {apiRoot}/nrf/nf-common-component/v1/egw/routesconfiguration must also be set to **true**.

Managing the feature

This section explains the procedure to enable and configure the feature.

Configure

You can configure the feature either using REST API or Console:

- **Configure using REST API:** Perform the following feature configurations as described in the "Egress Gateway Configuration" section of *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*:
 - Configure the value of `maxSLFAttempts` parameter greater than **0** to limit the number of SLF attempts. The number of attempts is calculated based on the server header received in the response.
 - (Optional) Enable `useAlternateScp` in the `{apiRoot}/nrf-configuration/v1/slfOptions` to allow alternate routing using SCP.
 - Create or update the alternate SCP peer details in the `{apiRoot}/nrf/nf-common-component/v1/egw/peerconfiguration`.
 - Create or update the `{apiRoot}/nrf/nf-common-component/v1/egw/peerSetconfiguration` to assign these peers.
 - Update the `{apiRoot}/nrf/nf-common-component/v1/egw/routesconfiguration` as mentioned in the below sample:

Note

When `maxSLFAttempts` is greater than **0** or `useAlternateScp` is set to **true**, don't configure `errorHandling` under `routesconfiguration`, as NRF discovery microservice will handle the reroute.

Sample body:

```
[
  {
    "id": "egress_scp_proxy1",
    "uri": "http://localhost:32068/",
    "order": 3,
    "metadata": {
      "httpsTargetOnly": true,
      "httpRuriOnly": true,
      "sbiRoutingEnabled": true
    },
    "predicates": [
      {
        "args": {
          "pattern": "/nudr-group-id-map/v1/nf-group-ids"
        },
        "name": "Path"
      }
    ],
    "filters": [
      {
        "name": "SbiRouting",
        "args": {
          "peerSetIdentifier": "set0",
          "customPeerSelectorEnabled": true
        }
      }
    ]
  }
]
```

```

    }
  }
],
{
  "id": "default_route",
  "uri": "egress://request.uri",
  "order": 100,
  "filters": [
    {
      "name": "DefaultRouteRetry"
    }
  ],
  "predicates": [
    {
      "args": {
        "pattern": "/*"
      },
      "name": "Path"
    }
  ]
}
]

```

- **Configure using Console:** Perform the following feature configurations as described:
 - Configure the value of **Maximum SLF Attempts** parameter greater than **0** in the [SLF Options](#) to limit the number of SLF attempts.
 - (Optional) Enable **Use Alternate SCP** in the [SLF Options](#) to allow alternate routing using SCP.
 - Create or update [Peer Configuration](#).
 - Create or update the [Peer Set Configuration](#) to assign these peers.
 - Update the [Routes Configuration](#) as mentioned above.

Note

When **Maximum SLF Attempts** is greater than **0** or **Use Alternate SCP** is set to **true**, don't configure **Error Handling** under **Routes Configuration**, as NRF discovery microservice will handle the reroute.

Observe

Metrics

- Updated the dimension list for the following metrics with `slfFqdn` dimension:
 - `ocnrf_slf_tx_requests_total`
 - `ocnrf_slf_rx_responses_total`
- Updated the description of the `ocnrf_max_slf_attempts_exhausted_total` metric.

Alerts

Updated the description of the [OcnrfMaxSlfAttemptsExhausted](#) alert.

KPIs

There are no KPIs for this feature.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information about how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information about how to raise a service request.

4.30.5 Rerouting SLF Requests Based on Server Header Value

This feature extends the existing "Rerouting SLF Requests Using Alternate SCP and Alternate SLF" capability to increase retry path diversity and service continuity within the network. Previously, NRF used the server header in error responses to count how many UDR (SLF) instances had been attempted, but could not identify exactly which instances were involved. This limitation occasionally led to redundant retries to the same UDR (SLF) instance, reducing overall failover effectiveness.

With this enhancement, NRF can now extract unique identifiers for UDR (SLF) instances directly from the response's server header (for example, identifiers in formats like UDR-udr1-instanceid or SCP-scp-p.xyz.com). By comparing these identifiers to a dynamically or statically configured list of available UDR (SLF) instances, NRF can select an alternative instance that has not yet been attempted. The first part of individual entries in the server header determines whether the entry refers to a UDR or SCP instance. NRF extracts the instanceid from UDR entries, compares it against the current list of available UDRs, and excludes instances that have already been attempted from further retries. This approach minimizes redundant routing, improves efficiency, and strengthens the resilience and continuity of network services.

When an SLF query fails, NRF checks the server header and its prioritized list of SLFs to determine which SLF instances have already been attempted. For each re-attempt, NRF:

- deducts the number of attempts left based on the server header content.
- chooses the next highest-priority, SLF instance (preferably untried) from the prioritized SLF list. This list is created either using static configuration or using the Dynamic SLF feature.
- optionally selects an alternate SCP for routing, depending on configuration and availability.
- if all prioritized SLFs have been attempted and no further retries are permitted, the request is rejected or forwarded as per configuration.

Examples

The following table describes the possible scenarios, along with the interpretation where the server header values are used:

Table 4-25 Server Header Interpretation based on examples

Case #	Server Header Count	Interpretation
1	Server: SCP-scp-p.xyz.com (Where, SCP-P denotes the Primary, SCP-C denotes the Secondary SCP. These are the SCPs configured at Egress Gateway.)	There are multiple reasons for this case when the server header comes with "SCP-scp-p.xyz.com" - SCP-p tried multiple NFs, all timed out. Note: SCP would not insert server header on behalf of Server NF instance. That is, the presence of server header with Server NF instance(s) implies that the Server NF instance(s) had generated the error response. The exception case is when SCP does consider a Server NF instance(s) due to it being overloaded (Overload-Reduction-Metric: 100%) in which case SCP can include the overloaded Server NF instance(s) in the server header. - SCP-p tried UDR1. UDR1 timed out. But the NF Set contains only one instance (UDR1). - SCP-p generated the error response. SCP-p could not try UDR1 or UDR2 because TCP connections to both UDR1 and UDR2 from SCP-p are down. - SCP-p generated an error due to internal reasons (for example, SCP-p is overloaded).
2	Server: UDR-udr1-instanceid	Multiple reasons for this case: - SCP-P tried UDR1, and it returned an error. Further, SCP may have tried UDR2, which would have timed out. - SCP-P tried UDR1, and it generated an error response. SCP-P could not try UDR2 because the TCP connection to UDR2 from SCP-P is down. - SCP-P tried UDR1. UDR1 generated an error response. But the NF Set contains only one instance (UDR1).
3	Server: UDR-udr2-instanceid UDR-udr1-instanceid	Multiple reasons for this case: - SCP-P tried UDR1 and UDR2 in that order. Both generated an error response - SCP-P finds out UDR1 is overloaded (Overload-Reduction-Metric: 100%). SCP-P tried UDR2, and it returned an error.
4	Server: UDR-udr3-instanceid UDR-udr2-instanceid UDR-udr1-instanceid (3 UDRs available)	Multiple reasons for this case: - SCP-P finds out UDR1 is overloaded (Overload-Reduction-Metric: 100%). SCP-P tried UDR2, and it returned an error. Then SCP tried UDR3, and it returned an error. - SCP-P finds out both UDR1 and UDR2 are overloaded (Overload-Reduction-Metric: 100%). SCP-P tried UDR3, and it returned an error.
5	Server: SCP-scp-p.xyz.com UDR-udr2-instanceid UDR-udr1-instanceid (Only 2 UDRs available)	Multiple reasons for this case: SCP-P could not attempt either UDR1 or UDR2 because of both reporting overload (Overload-Reduction-Metric: 100%)
6	Server: SCP-scp-p.xyz.com UDR-UDR3-instanceid UDR-UDR2-instanceid UDR-UDR1-instanceid (3 UDRs available)	SCP-P could not attempt r UDR1 or UDR2 or UDR 3 because of all reporting overload (Overload-Reduction-Metric: 100%).

Table 4-25 (Cont.) Server Header Interpretation based on examples

Case #	Server Header Count	Interpretation
7	Server: SCP-scp-c.xyz.com	Multiple reasons for this case: • SCP-C tried SCP-P. SCP-P timed out. • SCP-C generated the error response (For example, SCP-P overloaded with Overload-Reduction-Metric: 100%). • SCP-C could not try SCP-P because the TCP connection to SCP-P from SCP-C is down.
8	Server: 'envoy'	• NRF sent http request to SCP-C. Either the client (NRF) side Sidecar or Aspen Mesh or the server (SCP-C) side Sidecar/Aspen Mesh generated a 503 or 504 error towards NRF. • For NRFs internal micro-services, if side-cars generated error with Server header as "envoy"; Note: • SCP-C sent http request to SCP-P. Either the client (SCP-C) side Sidecar or Aspen Mesh or the sever (SCP-P) side Sidecar/Aspen Mesh generated a 503 or 504 error towards SCP-C. SCP-C would replace the 'envoy' server header with SCP-scp-c.xyz.com towards NRF. • SCP-P sent http request to UDR. Either the client (SCP-P) side Sidecar or Aspen Mesh or the server (UDR) side Sidecar or Aspen Mesh generated a 503 or 504 error towards SCP-P. If no other alternate UDRs are available, then SCP-P would replace the server header with SCP-scp-p.xyz.com (for both 503 and 504) towards SCP-C.

Based on the above interpretations, the following use cases describe the reroutes based on server header values:.

Table 4-26 Use cases

Case	Test Parameters	Server Header	Attempts Counted from Header and Next Attempts	Reason
1a	• Prioritized SLF List at NRF: UDR1, UDR2, UDR3 • Prioritized SCP List at EGW (NRF): SCP1, SCP2 • maxSlfAttempts: 2 • useAlternateScp: true	Server: UDR-udr1-instanceid	• Attempts Counted from Header: +1 • Next Attempt: UDR2 via SCP2	NRF does not reattempt to UDR1. It selects the next highest-priority UDR (UDR2) and routes the request via SCP2 (useAlternateScp=true).

Table 4-26 (Cont.) Use cases

Case	Test Parameters	Server Header	Attempts Counted from Header and Next Attempts	Reason
1b	• Prioritized SLF List at NRF: UDR1, UDR2, UDR3 • Prioritized SCP List at EGW (NRF): SCP1, SCP2 • maxSIfAttempts: 2 • useAlternateScp: false	Server: UDR-udr1-instanceid	• Attempts Counted from Header: +1 • Next Attempt: UDR2 via SCP1	NRF does not reattempt to UDR1. It selects the next highest-priority UDR (UDR2) and routes the request via SCP1 (useAlternateScp=false)
2a	• Prioritized SLF List at NRF: UDR1, UDR2, UDR3 • Prioritized SCP List at EGW (NRF): SCP1, SCP2 • maxSIfAttempts: 3 • useAlternateScp: true	Server: SCP-scp-p.xyz.com UDR-udr2-instanceid UDR-udr1-instanceid	• Attempts Counted from Header: +2 • Next Attempt: UDR2 via SCP2	SCP could not attempt either UDR1 or UDR2 because of both reporting overload (Overload-Reduction-Metric: 100%) or one UDR returned an error or timed out, and another UDR reported overload. In this case, since NRF does not know for certain why the error response was generated. Hence, UDR1 and UDR2 may be retried again via SCP2 (useAlternateScp=true), if they were not tried and has higher priority.
2b	• Prioritized SLF List at NRF: UDR1, UDR2, UDR3 • Prioritized SCP List at EGW (NRF): SCP1, SCP2 • maxSIfAttempts: 3 • useAlternateScp: false	Server: SCP-scp-p.xyz.com UDR-udr2-instanceid UDR-udr1-instanceid	• Attempts Counted from Header: +2 • Next Attempt: UDR3 via SCP1	NRF does not reattempt to UDR1 or UDR2. It selects the next highest-priority UDR (UDR3) and routes the request via the same SCP (SCP1) (useAlternateScp=false).
3a	• Prioritized SLF List at NRF: UDR1 • Prioritized SCP List at EGW (NRF): SCP1, SCP2 • maxSIfAttempts: 2 • useAlternateScp: true	Server: SCP-scp-p.com	• Attempts Counted from Header: +1 • Next Attempt: Attempt UDR1 via SCP2	In this case, there is only one UDR instance (UDR1) which is already attempted using SCP1. NRF reattempts to UDR1 using alternate SCP (SCP2) (useAlternateScp=true).

Table 4-26 (Cont.) Use cases

Case	Test Parameters	Server Header	Attempts Counted from Header and Next Attempts	Reason
3b	• Prioritized SLF List at NRF: UDR1 • Prioritized SCP List at EGW (NRF): SCP1, SCP2 • maxSIfAttempts: 2 • useAlternateScp: false	Server:SCP-scp-p.com	• Attempts Counted from Header: +1 • Next Attempt: Attempt UDR1 via SCP1	In this case, there is only one UDR instance (UDR1), which is already attempted using SCP1. NRF reattempts to UDR1 using the same SCP (SCP1) (useAlternateScp=false).
4a	• Prioritized SLF List at NRF: UDR1, UDR2, UDR3 • Prioritized SCP List at EGW (NRF): SCP1, SCP2 • maxSIfAttempts: 2 • useAlternateScp: true	Server: SCP-scp-p.com	• Attempts Counted from Header: +1 • Next Attempt: Attempt UDR2 via SCP2	NRF does not reattempt to UDR1. It selects the next highest-priority UDR (UDR2) and routes the request via an alternate SCP (SCP2) (useAlternateScp=true).
4b	• Prioritized SLF List at NRF: UDR1, UDR2, UDR3 • Prioritized SCP List at EGW (NRF): SCP1, SCP2 • maxSIfAttempts: 2 • useAlternateScp: false	Server: SCP-scp-p.com	• Attempts Counted from Header: +1 • Next Attempt: Attempt UDR2 via SCP1	NRF does not reattempt to UDR1. It selects the next highest-priority UDR (UDR2) and routes the request via the same SCP (SCP1) (useAlternateScp=false).
5	• Prioritized SLF List at NRF: UDR1, UDR2, UDR3 • Prioritized SCP List at EGW (NRF): SCP1, SCP2 • maxSIfAttempts: 2 • useAlternateScp: true/false	Server: SCP-scp-p.xyz.com UDR-udr2-instanceid UDR-udr1-instanceid	• Attempts Counted from Header: +2 • Next Attempt: Attempts exhausted	All attempts have been exhausted. No more reattempts will be performed even though we have SLFs which are not attempted.

Table 4-26 (Cont.) Use cases

Case	Test Parameters	Server Header	Attempts Counted from Header and Next Attempts	Reason
6	- Multiple requests - Prioritized SLF List at NRF: UDR1, UDR2, UDR3 - Prioritized SCP List at EGW (NRF): SCP1, SCP2 - maxSlfAttempts: 4 - useAlternateScp: true	(Response1) Server: UDR-UDR2-Instance-Id UDR-UDR1-Instance-Id. (Response2) Server: SCP-scp-p.xyz.com	- Attempts Counted from Header for the first response: +2 - Next Attempt for the first response: Attempt UDR3 via SCP2 - Attempts Counted from Header for the second response: +1 - Next Attempt for the second response: Attempt UDR3 via SCP1	First response: NRF does not reattempt to UDR1 and UDR2. It selects the next highest-priority UDR (UDR3) and routes the request via SCP2 (useAlternateScp=true). Second Response: All UDRs have been attempted. However, since the response contained SCP, UDR3 is retried via alternate SCP (SCP1) (useAlternateScp=true).
7	- Multiple requests - Prioritized SLF List at NRF: UDR1, UDR2 - Prioritized SCP List at EGW (NRF): SCP1, SCP2 - maxSlfAttempts: 3 - useAlternateScp: true	(Response 1) Server: SCP-scp-p.xyz.com (Response 2) Server header: SCP-SCP-Secondary-FQDN UDR-UDR2-Instance-Id	- Attempts Counted from Header for the first response: +1, - Next Attempt for the first response: UDR2 via SCP2 - Attempts Counted from Header for the second response: +1 - Next Attempt for the second response: UDR1 via SCP1	NRF does not reattempt to UDR1. It selects the next highest-priority UDR (UDR2) and routes the request via an alternate SCP (SCP2) (useAlternateScp=true).
8	- Prioritized SLF List at NRF: UDR1 - Prioritized SCP List at EGW (NRF): SCP1, SCP2 - maxSlfAttempts: 2 - useAlternateScp: true/false	Server: UDR-udr1-instanceid	- Attempts Counted from Header: +1 - Next Attempt: No further attempts	NRF does not reattempt further as there is only one UDR (UDR1) prioritized on the SLF list at NRF. It does not have any alternate UDRs for reattempting, though the flag useAlternateScp is set to true.

Table 4-26 (Cont.) Use cases

Case	Test Parameters	Server Header	Attempts Counted from Header and Next Attempts	Reason
9	• Prioritized SLF List at NRF: UDR1, UDR2, UDR3 • Prioritized SCP List at EGW (NRF): SCP1, SCP2 • maxSlfAttempts: 2 • useAlternateScp: true/false	Server: SCP-scp-p.xyz.com UDR-udr2-instanceid UDR-udr1-instanceid	• Attempts Counted from Header: +2 • Next Attempt: Attempts exhausted	NRF does not communicate with the next untried UDR as the total number of attempts to be made are exhausted and it does not retry further.
10	• Prioritized SLF List at NRF: UDR1, UDR2, UDR3 • Prioritized SCP List at EGW (NRF): SCP1, SCP2 • maxSlfAttempts: 3 • useAlternateScp: true	Server: SCP-scp-p.xyz.com UDR-udr2-instanceid UDR-udr1-instanceid	• Attempts Counted from Header: +2 • Next Attempt: UDR3 via SCP1	NRF does not reattempt to UDR1 and UDR2. It selects the next highest-priority UDR (UDR3) and routes the request via an alternate SCP (SCP2) (useAlternateScp=true).
11	• Prioritized SLF List at NRF: UDR1, UDR2, UDR3 • Prioritized SCP List at EGW (NRF): SCP1, SCP2 • maxSlfAttempts: 3 • useAlternateScp: false	Server: SCP-scp-p.xyz.com UDR-udr3-instanceid UDR-udr1-instanceid	• Attempts Counted from Header: +2 • Next Attempt: UDR2 via SCP1	NRF does not reattempt to UDR1 and UDR3. It selects the next highest-priority UDR (UDR2) and routes the request via the same SCP (SCP1) (useAlternateScp=false).
12	• Prioritized SLF List at NRF: UDR1, UDR2, UDR3, UDR4 • Prioritized SCP List at EGW (NRF): SCP1, SCP2 • maxSlfAttempts: 3 • useAlternateScp: true	Server: UDR-udr3-instanceid UDR-udr1-instanceid	• Attempts Counted from Header: +2 • Next Attempt: UDR2 via SCP2	NRF does not reattempt to UDR1 and UDR3. It selects the next highest-priority UDR (UDR2) and routes the request via an alternate SCP (SCP2) (useAlternateScp=true).

Table 4-26 (Cont.) Use cases

Case	Test Parameters	Server Header	Attempts Counted from Header and Next Attempts	Reason
13	• Prioritized SLF List at NRF: UDR1, UDR2 • Prioritized SCP List at EGW (NRF): SCP1, SCP2 • maxSIfAttempts: 3 • useAlternateScp: true	Server: xyz or --Header not present-- or Server: 'envoy'	• Attempts Counted from Header: +1 • Next Attempt: UDR2 via SCP2	NRF does not reattempt to UDR1. It selects the next highest-priority UDR (UDR2) and routes the request via an alternate SCP (SCP2) (useAlternateScp=true).
14	• Prioritized SLF List at NRF: UDR1, UDR2 • Prioritized SCP List at EGW (NRF): SCP1, SCP2 • maxSIfAttempts: 2 • useAlternateScp: true	Server: SCP-scp-p.xyz.com UDR-udr1-instanceid	• Attempts Counted from Header: +1 • Next Attempt: UDR2 via SCP2	NRF does not reattempt to UDR1. It selects the next highest-priority UDR (UDR2) and routes the request via an alternate SCP (SCP2) (useAlternateScp=true).
15	• Prioritized SLF List at NRF: UDR1 • Prioritized SCP List at EGW (NRF): SCP1, SCP2 • maxSIfAttempts: 2 • useAlternateScp: true	Server: SCP-scp-p.xyz.com UDR-udr1-instanceid	• Attempts Counted from Header: +1 • Next Attempt: UDR1 via SCP2	In this case, there is only one UDR instance (UDR1), which is already attempted using SCP1. NRF reattempts to UDR1 using the alternate SCP (SCP2) (useAlternateScp=true).
16	• Unknown UDR in the header • Prioritized SLF List at NRF: UDR1, UDR2, UDR3 • Prioritized SCP List at EGW (NRF): SCP1, SCP2 • maxSIfAttempts: 3 • useAlternateScp: true	Server: UDR-udr5-instanceid UDR-udr1-instanceid	• Attempts Counted from Header: +2 • Next Attempt: UDR2 via SCP2	NRF does not reattempt to UDR1. It selects the next highest-priority UDR (UDR2) and routes the request via an alternate SCP (SCP2)(useAlternateScp=true).

Table 4-26 (Cont.) Use cases

Case	Test Parameters	Server Header	Attempts Counted from Header and Next Attempts	Reason
17	- Multiple unknown UDRs in the header Prioritized SLF List at NRF: UDR1, UDR2, UDR3 Prioritized SCP List at EGW (NRF): SCP1, SCP2 maxSlfAttempts: 3 useAlternateScp: true	Server: SCP-scp-p.xyz.com UDR-udr6-instanceid UDR-udr5-instanceid UDR-udr1-instanceid	Attempts Counted from Header: +3 Next Attempt: Attempts exhausted	NRF does not communicate with the next highest-priority UDR as the total number of attempts to be made are exhausted and it does not retry further.
18	- Unknown NF in the header Prioritized SLF List at NRF: UDR1, UDR2, UDR3 Prioritized SCP List at EGW (NRF): SCP1, SCP2 maxSlfAttempts: 3 useAlternateScp: true	Server: NRF-nrf-instanceid UDR-udr2-instanceid UDR-udr1-instanceid	Attempts Counted from Header: +2 Next Attempt: UDR3 via SCP2	NRF does not reattempt to UDR1. It selects the next highest-priority UDR (UDR3) and routes the request via SCP (SCP2) (useAlternateScp=true).
19	- SCP is present after udr entries Prioritized SLF List at NRF: UDR1, UDR2, UDR3 Prioritized SCP List at EGW (NRF): SCP1, SCP2 maxSlfAttempts: 3 useAlternateScp: true	Server: UDR-udr2-instanceid UDR-udr1-instanceid SCP-scp-p.xyz.com	Attempts Counted from Header: +2 Next Attempt: UDR2 via SCP2	NRF does not reattempt to UDR1. It selects the next highest-priority UDR (UDR2) and routes the request via SCP (SCP2) (useAlternateScp=true).

Table 4-26 (Cont.) Use cases

Case	Test Parameters	Server Header	Attempts Counted from Header and Next Attempts	Reason
20	- When there is an invalid instanceId Prioritized SLF List at NRF: UDR1, UDR2, UDR3 Prioritized SCP List at EGW (NRF): SCP1, SCP2 maxSlfAttempts: 3 useAlternateScp: true	Server: UDR-udr2-invalidInstanceId UDR-udr1-instanceId	Attempts Counted from Header: +2 Next Attempt: UDR2 via SCP2	NRF does not reattempt to UDR1. It selects the next highest-priority UDR (UDR2) and routes the request via SCP (SCP2) (useAlternateScp=true).
21	- When fqdn present instead of instanceId Prioritized SLF List at NRF: UDR1, UDR2, UDR3 Prioritized SCP List at EGW (NRF): SCP1, SCP2 maxSlfAttempts: 3 useAlternateScp: true	Server: UDR-udr2-fqdn UDR-udr1-instanceId	Attempts Counted from Header: +2 Next Attempt: UDR2 via SCP2	NRF does not reattempt to UDR1. It selects the next highest-priority UDR (UDR2) and routes the request via SCP (SCP2) (useAlternateScp=true).
22	Prioritized SLF List at NRF: UDR1, UDR2 Prioritized SCP List at EGW (NRF): SCP1, SCP2 maxSlfAttempts: 2 useAlternateScp: true	Server: SCP-scp-p.xyz.com SCP-scp-c.xyz.com	Attempts Counted from Header: +1 Next Attempt: UDR2 via SCP2	NRF does not reattempt to UDR1. It selects the next highest-priority UDR (UDR2) and routes the request via SCP (SCP2) (useAlternateScp=true).

Managing the feature

This section explains the procedure to enable and configure the feature.

Enable

You can enable the feature either using REST API or Console:

- Enable using REST API:** Set the value of serverHeaderValueBasedSLFSelection attribute to **ENABLED** in the {apiRoot}/nrf-configuration/v1/slfOptions URI. For more details, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

- **Enable using CNC Console:** Set the value of **Server Header Value Based SLF Selection** parameter to **ENABLED** in the [SLF Options](#).

Observe

Metrics

There are no new metrics added for this feature.

Alerts

There are no new alerts added for this feature.

KPIs

There are no new KPIs for this feature.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information about how to collect logs, see Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide.
2. **Raise a service request:** See [My Oracle Support](#) for more information about how to raise a service request.

4.30.6 Skip SLF Lookup

The Skip SLF Lookup feature extends the Subscriber Location Function (SLF) decision logic for NF discovery requests. The feature enables the NRF to bypass SLF lookup when the configured discovery parameter indicate that subscriber location information is not required for request processing.

When the feature is configured, the NRF evaluates the configured discovery parameter to determine whether an SLF lookup is required. If the configured skip criteria are satisfied, the NRF processes the NF discovery request without invoking the SLF. Otherwise, the NRF performs the standard SLF lookup procedure.

For information about the standard SLF lookup procedure and request processing behavior, see [Subscriber Location Function](#).

Managing the Feature

Configure

You can configure the Skip SLF Lookup feature using one of the following methods:

- **REST API:** Configure the skipSLFLookupParameters attribute in the {apiRoot}/nrf-configuration/v1/slfOptions URI. For more information, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **CNC Console:** Configure the **Skip SLF Lookup Parameter List** parameter in [SLF Options](#).

Observability

Metrics

There are no metrics added or updated for this feature.

Alerts

There are no alerts added or updated for this feature.

KPIs

There are no KPIs related to this feature.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts persist, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see "Collecting Logs" section in *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.30.7 Discovery Parameter Value Based Skip SLF Lookup

NRF supports the "Skip SLF Lookup" feature to skip the SLF lookup based on the presence of configured discovery query parameters in the incoming discovery request. The values of these discovery query parameters are not evaluated.

The "Discovery Parameter Value Based Skip SLF Lookup" feature enhances the existing "Skip SLF Lookup" feature by allowing NRF to skip the SLF lookup based on the configured values of discovery query parameters.

This feature provides an option to configure a set of values for the discovery query parameter. NRF compares the configured parameter-value combinations with the incoming discovery request.

- If all the configured parameter-value combinations match the incoming discovery request, NRF skips the SLF lookup.
- If the configured parameter-value combinations do not match the incoming discovery request, NRF performs the SLF lookup.

NRF processes the discovery request and performs skip SLF lookup as follows:

- If the value of `enableValueBasedSkipSLFLookup` parameter is set as `true`, NRF validates the discovery query parameters and its values received in the discovery request against the values configured in `valueBasedSkipSLFLookupParams` parameter to determine if the SLF lookup is to be skipped. The `valueBasedSkipSLFLookupParams` parameter comprises of `parameterName` and `parameterValue` attributes.

```
valueBasedSkipSLFLookupParams": [ {"parameterName": "dnn", "parameterValue": "abc*"}, {"parameterName": "group-id-list", "parameterValue": ".*"}]
```

Where,

- `parameterName` - indicates a valid discovery query parameter supported by NRF for which the SLF lookup is to be skipped.

Note

This feature supports only dnn based skipSLFLookup.

- `parameterValue` - indicates the value for the corresponding discovery parameter name for which the SLF lookup is skipped. This value can be configured as a regular expression.
If the `parameterValue` is a regular expression, NRF matches this value with the discovery request.
 - * If the values match, NRF skips the SLF lookup and proceeds with discovery processing.
 - * If the values do not match, NRF performs SLF lookup.
 - * If the `parameterValue` is configured as `.*`, it indicates all values. NRF skips the SLF lookup for any value received for the discovery parameter.

Note

Pattern matching is performed using Java Platform Standard Ed. 8 Documentation. For more information, about regular expressions, see <https://docs.oracle.com/javase/8/docs/api/java/util/regex/Pattern.html>.

- If the value of `enableValueBasedSkipSLFLookup` is set as `false`, NRF uses the existing "Skip SLF Lookup" feature based on the presence of the discovery query parameters configured in `skipSLFLookupParameters`. The values of these discovery query parameters are not evaluated.

Note

The "Skip SLF Lookup" feature and the "Discovery Parameter Value Based Skip SLF Lookup" feature are mutually exclusive when the `enableValueBasedSkipSLFLookup` attribute is set to `true`.

When `enableValueBasedSkipSLFLookup` is `true`, NRF evaluates only the configured `valueBasedSkipSLFLookupParams` entries.

If the configured values do not match the incoming discovery request, NRF performs the SLF lookup and does not evaluate or fall back to the `skipSLFLookupParameters` configuration, even if it is configured.

The following table describes the functionality of the feature based on the sample values configured in `valueBasedSkipSLFLookupParams` and the incoming discovery query parameters.

Table 4-27 Examples for Discovery Parameter Value Based Skip SLF Lookup

Value of <code>enableValueBasedSkipSLFLookup</code> parameter	<code>parameterName</code> and <code>parameterValue</code> configured in <code>valueBasedSkipSLFLookupParams</code>	Query Parameter name and value received in the incoming discovery requests	Result
true	<code>{"parameterName": "dnn", "parameterValue": ".*"}</code>	<code>dnn=dnn-c4, dnn=dnn-1, dnn=DnNvAl123</code>	SLF lookup is skipped for all the values (dnn-c4, dnn-1, and DnNvAl123).

Table 4-27 (Cont.) Examples for Discovery Parameter Value Based Skip SLF Lookup

Value of enableValueBasedSkipSLFLookup parameter	parameterName and parameterValue configured in valueBasedSkipSLFLookupParams	Query Parameter name and value received in the incoming discovery requests	Result
true	<code>{"parameterName": "dnn", "parameterValue": "dnn*"}</code>	dnn=dnn-c4, dnn=dnn-1, dnn=DnvAl123, dnn=DnaaAl123	SLF lookup is skipped for the following incoming requests with the values dnn-c4 and dnn-1 and but SLF lookup will be performed for the incoming requests with the values DnvAl123 and DnaaAl123.
true	<code>{"parameterName": "dnn", "parameterValue": "^dnn-c4\$"}</code>	dnn=dnn-c4, dnn=adnn-c4, dnn=dnn-1, dnn=dnnAl123, dnn=DnaaAl123	SLF lookup is skipped for the incoming request with value dnn-c4 and SLF lookup is performed for the incoming requests with the values adnn-c4, dnn-1, dnnAl123, and DnaaAl123.
true	<code>{"parameterName": "dnn", "parameterValue": "^prov[a-g\\d]{1,3}\\w{3}\$"}</code>	dnn=prova5aaa, dnn=provaa15aaa, dnn=prova5a	SLF lookup is skipped for the incoming request with value prova5aaa and SLF lookup is performed for the incoming requests with the values provaa15aaa and prova5a.
true	<code>{"parameterName": "dnn", "parameterValue": "^province1\\.mnc\\d{3}\\\\.mcc\\d{3}\\\\.gprs\$"}</code>	dnn=province1.mnc014.mcc310.gprs, dnn=province3.mnc012.mcc3150.gprs, dnn=province1.mnc0141.mcc001.gprs, dnn=province1.mnc001.mcc003.gprs	SLF lookup is skipped for the incoming request with value province1.mnc014.mcc310.gprs, province1.mnc001.mcc003.gprs and SLF lookup is performed for the incoming requests with the values province3.mnc012.mcc3150.gprs, and province1.mnc0141.mcc001.gprs
true	<code>{"parameterName": "dnn", "parameterValue": "parameterValue": ".+\\.mnc012\\.mcc345\\.gprs"}</code>	prov.mnc012.mcc345.gprs, prov2.mnc011.mcc234.gprs, prov2.mnc001.mcc233.gprs	SLF lookup is skipped for the incoming request with value prov.mnc012.mcc345.gprs and SLF lookup is performed for the incoming requests with the values prov2.mnc011.mcc234.gprs and prov2.mnc001.mcc233.gprs.
false	<code>{"parameterName": "dnn", "parameterValue": "dnn*"}</code>	dnn=dnn-c4, dnn=dnn-1, dnn=DnvAl123, dnn=DnaaAl123	Value based SLF lookup is not performed as the feature is disabled. NRF falls back to the existing skip SLF lookup feature (skipSLFLookupParameters), if it is configured.

Managing Discovery Parameter Value Based Skip SLF Lookup

Configure

You can configure the following parameters using the REST API or CNC Console:

- **Configure using REST API:** Configure the values for `valueBasedSkipSLFLookupParams` as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Configure using CNC Console:** Configure the values for **Value Based Skip SLF Lookup Parameter List** as described in [SLF Options](#).

Note

After NRF upgrade to 25.1.100, the `valueBasedSkipSLFLookupParams` is empty by default. Populate the values for `valueBasedSkipSLFLookupParams` attribute and then enable the `enableValueBasedSkipSLFLookup` parameter. The feature cannot be enabled when the `valueBasedSkipSLFLookupParams` is empty.

Enable

You can enable Discovery Parameter Value Based Skip SLF Lookup feature using the REST API or CNC Console.

- Enable using REST API: Set `enableValueBasedSkipSLFLookup` to true in SLF Options configuration API. For more information about API path, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- Enable using CNC Console: Set **Enable Value Based Skip SLF Lookup** to **true** on the SLF Options page. For more information about enabling the feature using CNC Console, see [SLF Options](#).

Observability

Metrics

The existing `ocnrf_nfDiscover_SLFlookup_skipped_total` metric is enhanced with a new dimension `SkipSLFLookupValue` for this feature.

For more information about SLF metrics, see [NRF SLF Metrics](#) section.

Alerts

There are no alerts added or updated for this feature.

KPIs

There are no KPIs related to this feature.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts persist, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see "Collecting Logs" section in *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.31 NRF Forwarding

NRF Forwarding feature forwards the service operation messages to another NRF, if NRF is not able to fulfill the required service operation.

Note

Service operations explained below with specific cases or scenarios are eligible for forwarding.

A consumer NF instance can perform the following:

- Subscribe to changes of NF instance registered in an NRF that the Consumer NF does not communicate directly with. The NF subscription message is forwarded by an intermediate (current) NRF to another NRF. Forwarding is performed only for those subscriptions created for a NF instance id identified by the `NfInstanceIdCond`.
- Retrieve the NF profiles of NF instances registered in an NRF that the Consumer NF does not communicate directly with. The NF Profile retrieval message is forwarded by an intermediate (current) NRF to another NRF.
- Discover the NF profiles of a given NF Type with certain capabilities which are registered in an NRF that the Consumer NF does not communicate directly with. The NF discover message is forwarded by an intermediate (current) NRF to another NRF. Forwarding is performed only for those discovery requests which contain the `target-nf-instance-id` in the query for which no matching Producer NFs found in the intermediate (current) NRF.
- Request OAuth 2.0 access token for the NF instance registered in an NRF to which it is not directly interacting. The OAuth 2.0 access token service request is forwarded by an intermediate (current) NRF to NRF (which may issue the token). Forwarding is performed only for those access token requests which contain the `targetNfInstanceId`.

NRF also enables the users to define the forwarding criteria for `NFDiscover` and `AccessToken` Service Requests from NRF to an intermediate (current) NRF. The user can configure the preferred NF Type, the NF Services, or both for which forwarding is applicable. This provides the flexibility to regulate the traffic between the NRFs. For enabling Forwarding Rules Feature configuration, see the [Enable Forwarding Rules](#) section.

Managing NRF Forwarding Feature

Enable

The Forwarding feature is a core functionality of NRF. You need not enable or disable this feature.

If you are enabling NRF Growth feature, then perform the configuration as described in [Configure Forwarding Options for NRF Growth](#).

Enable Forwarding Rules

You can enable the Forwarding Rules feature using REST API or CNC Console.

- **Enable using REST API:** Set `featureStatus` to `ENABLED` in **Forwarding Options** configuration API. For more information about API path, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

- **Enable using CNC Console:** Set **Feature Status** to **ENABLED** on the Forwarding Options page. For more information about enabling the feature using CNC Console, see [Forwarding Options](#).

Note

- Before enabling forwardingRulesFeatureConfig, ensure that corresponding configurations are completed.
- The featureStatus flag under forwardingRulesFeatureConfig can be **ENABLED**, only if discoveryStatus or accessTokenStatus attributes are already **ENABLED**.
- Once featureStatus flag under forwardingRulesFeatureConfig is **ENABLED**, both discoveryStatus and accessTokenStatus attributes cannot be **DISABLED**.

Configure

Configure the NRF Forwarding feature using REST API or CNC Console:

- **Configure NRF Forwarding feature using REST API:** Perform the feature configurations as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Configure NRF Forwarding feature using CNC Console:** Perform the feature configurations as described in [Forwarding Options](#).

Note

The forwarding rules for nfDiscover service requests are based on following 3GPP discovery request parameters:

- target-nf-type (**Mandatory Parameter**)
- service-names (**Optional Parameter**)

The forwarding rules for access token service requests are based on the following 3GPP access token request parameter:

- scope (**Mandatory Parameter**)

Configure Forwarding Options for NRF Growth

Configure the NRF Forwarding Options for NRF Growth using REST API or CNC Console:

- **Configure NRF Forwarding Options for NRF Growth feature using REST API:** Perform the feature configurations as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Configure NRF Forwarding Options for NRF Growth feature using CNC Console:** Perform the feature configurations as described in [Forwarding Options](#).

Note

The forwarding rules for nfDiscover service requests are based on following 3GPP discovery request parameters:

- target-nf-type (**Mandatory Parameter**)
- service-names (**Optional Parameter**)

The forwarding rules for access token service requests are based on the following 3GPP access token request parameter:

- scope (**Mandatory Parameter**)

NRF Host configuration attribute (nrfHostConfig) allows the user to configure the details of another NRF to which the service operation messages are forwarded.

Note

For NRF-NRF Forwarding feature to work, nrfHostConfig attribute must be configured in both NRFs with each other values.

For example: NRF1 is forwarding requests towards NRF2, then nrfHostConfig configuration attribute of NRF1 shall have NRF2 details and similarly nrfHostConfig configuration attribute of NRF2 shall have NRF1 details. These configurations are used while handling different service operations of NRF.

The nrfHostConfig configuration consists of attributes like apiVersion, scheme, FQDN, port, priority, and so on. NRF allows to configure maximum of four host details. However, the host with the highest priority is considered as the Primary host.

Note

- Refer 3GPP TS 29.510 (release 15.5) for definition and allowed range for NfHostConfig attributes (apiVersion, scheme, FQDN, port, priority, and so on).
- Apart from priority attribute, no other attributes plays any role in the host selection.
- Apart from Primary, three more hosts (if configured) can be used as alternate NRF.
- When more than one host is configured with same priority, the order of NRF host selection between the same priority is random.

In the NRF Forwarding feature, a request is first forwarded to Primary NRF. In case of error, the request is forwarded to alternate NRFs based on the following configurations:

- nrfRerouteOnResponseHttpStatusCodes: This configuration is used to determine if the service operation message can be forwarded to alternate NRF or not. After receiving a response from the primary NRF, if the response status code from the primary NRF matches with this configuration, then NRF reroutes the request to the alternate NRF. Refer nrfHostConfig attribute for host NRF details.
Prior to 22.2.x of NRF, Egress Gateway used to return 503 response for timeout exceptions (for example, No response received for SLF query or No Response received for Query sent to Forwarding NRF).

From 22.3.x onwards, Egress Gateway returns 408 response codes for timeout exceptions (REQUEST_TIMEOUT and CONNECTION_TIMEOUT), to keep the behavior in line with the HTTP standard. Hence, after upgrading to 22.3.x or a fresh install of 22.3.x, if a retry needs to be performed for the timeout scenario, 408 error code explicitly needs to be configured under forwarding reroute option. Following is the configuration for forwarding options:

```
{
    "nrfRerouteOnResponseHttpStatusCodes": {
        "pattern": "^[3,5][0-9]{2}$|408$"
    }
}
```

- **maximumHopCount:** This configuration determines maximum number of hops (SLF or NRF) that NRF can forward in a given service request. This configuration useful during NRF Forwarding and SLF feature interaction.

Observe

Following are the NRF Forwarding feature specific metrics filters:

- ocnrf_forward_accessToken_tx_requests_total
- ocnrf_forward_accessToken_rx_responses_total
- ocnrf_forward_nfProfileRetrieval_tx_requests_total
- ocnrf_forward_nfProfileRetrieval_rx_responses_total
- ocnrf_forward_nfStatusSubscribe_tx_requests_total
- ocnrf_forward_nfStatusSubscribe_rx_responses_total
- ocnrf_forward_nfDiscover_tx_requests_total
- ocnrf_forward_nfDiscover_rx_responses_total
- ocnrf_forward_jetty_latency_seconds_[suffix]
- ocnrf_forward_nfDiscover_barred_total
- ocnrf_forward_accessToken_barred_total
- ocnrf_forward_nfStatusSubscribe_barred_total
- ocnrf_forward_profileRetrieval_barred_total

For more information on NRF Forwarding feature metrics and KPIs, see [NRF Forwarding Metrics](#), and [NRF KPIs](#) sections.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persist, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see "Collecting Logs" section in *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.32 NRF Georedundancy

NRF supports georedundancy to ensure high availability and redundancy. It offers a two, three, or four-sites georedundancy to ensure service availability when one of the NRF site is down. When NRF is deployed as georedundant site, all the sites work in an active state and the same data is available at all the sites.

The NFs send service requests to its primary NRF. When the primary NRF site is unavailable, the NFs redirect the service requests to the alternate site NRF. In this case, NFs get the same information from alternate NRF, and each site maintains and uses its set of configurations.

The NRF's state data gets replicated between the georedundant sites using DBTier's replication service.

Following are the prerequisites for georedundancy:

- Each site configures the remote NRF sites that it is georedundant with.
- Once the georedundancy feature is enabled on a site, it cannot be disabled.
- Georedundant sites must be time synchronized.
- Georedundant sites must be reachable from NFs or Peers on all the sites.
- NFs are required to configure primary and alternate NRFs so that when one site is down, the alternate NRF can provide the required service operations.
- At any given instance, NFs communicate with only one NRF, that is, NFs register services and maintain heartbeats with only one NRF. The data is replicated across the georedundant NRFs, thereby allowing the NFs to seamlessly move between the NRFs in case of failure.
- Ensure that site is isolated before performing georeplication.

Managing NRF Georedundancy Feature

Prerequisites

1. cnDBTier is installed and configured for each site. The DB replication channels between the sites are up. For more information about cnDBTier installation, see
2. Configure MySQL Database, Users, and Secrets. For the configuration procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Preconfigurations for Georedundancy Feature

The following are the preconfigurations that must be performed before enabling georedundancy feature.

- **Preconfigurations using Helm:**
 1. Before performing upgrade, update the Database Monitor service host and port in the below attributes as per the deployment in appInfo parameter section.

```
The attribute indicates to monitor the database status
watchMySQL: true
#The URI used by the appinfo service to retrieve the replication
channel status from the CN DB Tier. The service name used is the db-
monitor service.The URI should be provided as "http://<db monitor
service name>:<db monitor service port>/db-tier/status/replication/
realtime"
```

```

replicationUri: "http://mysql-cluster-db-monitor-svc.occne-
infra:8080/db-tier/status/replication/realtime"
#The URI used by the appinfo service to retrieve the database status
from the CN DB Tier. This is for future usage. The service name used is
the db-monitor service. It is recommended to configure these URI
correctly to avoid continuous error log in App-info.The URI should be
provided as "http://<db monitor service name>:<db monitor service
port>/db-tier/status/local"
dbStatusUri: "http://mysql-cluster-db-monitor-svc.occne-infra:8080/db-
tier/status/local"
#The URI used by the appinfo service to retrieve the realtime
database status from the CN DB Tier. This is for future usage.It is
recommended to configure these URI correctly to avoid continuous error
log in App-info.The service name used is the db-monitor service.The URI
should be provided as "http://<db monitor service name>:<db monitor
service port>/db-tier/status/local"
realtimeDbStatusUri: "http://mysql-cluster-db-monitor-svc.occne-
infra:8080/db-tier/status/cluster/local/realtime"
#The URI used by the appinfo service to retrieve the dbTier version
from the CN DB Tier. [This url is supported from CN DBTier 22.4.0].The
service name used is the db-monitor service.The URI should be provided
as "http://<db monitor service name>:<db monitor service port>/db-tier/
version"
dbTierVersionUri: "http://mysql-cluster-db-monitor-svc.occne-
infra:8080/db-tier/version"
#The URI used by the appinfo service to retrieve alerts from alert
manager. The service name used is the alert manager service name of the
CNE.The URI should be provided as "http://<alert manager service
name>:<alert manager service port>/<cluster name>/alertmanager".
alertmanagerUrl: "http://occne-prom-alertmanager.occne-infra:80/
cluster/alertmanager"

```

2. Run `helm upgrade` to apply the above configuration.
3. Verify if the appinfo service is able to fetch the database replication status by querying the following API:

Resource Method : GET

Resource URI: <appinfo-svc>:<appinfo-port>/status/category/
replicationstatus

Where,

<appinfo-svc> is the appinfo service name.

<appinfo-port> is the port of appinfo service.

Sample response:

```

[
  {
    "localSiteName": "nrf1",
    "remoteSiteName": "nrf2",
    "replicationStatus": "UP",
    "secondsBehindRemote": 0,
    "replicationGroupDelay": [
      {

```

```

        "replchannel_group_id": "1",
        "secondsBehindRemote": 0
    }
  ]
}
]

```

Recheck the configuration if the sample response is not received. If the sample response is not received, appinfo is not querying the Database Monitor service correctly.

4. This step must be done only after verifying that appinfo is able to fetch the status correctly. If the above configuration is not correct, NRF services will receive incorrect information about the database replication channel status and hence will assume replication channel status as DOWN.
Configure the NRF microservice to query appinfo for the replication status using the **Georedundancy Options** API or CNC Console:

```

Resource Method : PUT
Resource URI: <configuration-svc>:<configuration-port>/nrf-
configuration/v1/geoRedundancyOptions
{
  "replicationStatusUri": "http://<appinfo-svc>:<appinfo-port>/status/
category/replicationstatus"
}

```

Where,

<configuration-svc> is the nrfconfiguration service name.

<configuration-port> is the port of nrfconfiguration service.

<appinfo-svc> is the appinfo service name.

<appinfo-port> is the port of appinfo service.

Perform the configurations in CNC Console as described in [Georedundancy Options](#).

5. Verify that the 0cnrfDbReplicationStatusInactive and 0cnrfReplicationStatusMonitoringInactive alerts are not raised on the alert dashboard.
- **Preconfigurations using REST API:**
 1. Deploy NRF as per the installation procedure provided in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
 2. Enable the Georedundancy feature using the CNC Console or REST API:
Following is the sample configuration at Site Chicago which is georedundant with Sites Atlantic (siteName: Atlantic, NrflInstanceId: 723da493-528f-4bed-871a-2376295c0020) and Pacific (siteName: Pacific, NrflInstanceId: cfa780dc-c8ed-11eb-b8bc-0242ac130003)

```

# Resource URI: {apiRoot}/nrf-configuration/v1/geoRedundancyOptions
# Method: GET
# Content Type: application/json
{
  "useRemoteDataWhenReplDown": false,
  "featureStatus": "ENABLED",

```

```

"monitorNrfServiceStatusInterval": "5s",
"monitorDBReplicationStatusInterval": "5s",
"replicationDownTimeTolerance": "10s",
"replicationUpTimeTolerance": "10s",
"replicationLatencyThreshold": "20s",
"replicationStatusUri": "http://<appinfo-svc>:<appinfo-port>/status/
category/replicationstatus",
"siteNameToNrfInstanceIdMappingList":
  [{"siteName": "atlantic",
    "nrfInstanceId": "723da493-528f-4bed-871a-2376295c0020"},
   {"siteName": "pacific",
    "nrfInstanceId": "cfa780dc-c8ed-11eb-b8bc-0242ac130003"}
  ]
}

```

NRF considers NfProfiles, registered across georedundant sites, for all its service operations. However, if NRF detects that the replication status with its mated sites is down, it will consider NfProfiles registered at local site only. If NfProfiles that are registered across georedundant sites must be considered for certain service operations (for example, service operations that result into DB Update), set the `useRemoteDataWhenRepLDown` attribute to **true**.

This attribute is applicable only for the NfHeartBeat, NfUpdate (Patch), NfDeregister, NfStatusSubscribe (Patch), and NfStatusUnSubscribe service operations. It ensures that during the NRF site down scenario, if the NF is moving to its mated NRFs, NF need not reregister or resubscribe again. However, if this attribute is set to false and NF is switching to mated site, then the NF receives a 404 response and:

- for NfUpdate (Patch), NfDeregister, and NfHeartBeat operations, the NF is expected to register again with the NRF using NfRegister service operations.
- for NfStatusSubscribe (Patch) and NfStatusUnSubscribe, the NF is expected to subscribe again with the NRF using NfStatusSubscribe service operation.

Note

This attribute is not applicable for NfDiscovery, NfAccessToken, NfProfileRetrieval, and NfListRetrieval service operations.

• **Preconfigurations using CNC Console:**

1. Configure **Replication Status Uri** to "http://<appinfo-svc>:<appinfo-port>/status/category/replicationstatus"
2. Configure **Site Name To NRF InstanceId Mapping List** group with the NRF Instance Id and the corresponding database Site Name of the remote site(s) with which the given NRF is georedundant.

Note

Configure these mandatory attributes before enabling the Georedundancy feature. If these attributes are not configured during deployment or using the CNC Console postdeployment, georedundancy cannot be enabled, and NRF at the site acts as a standalone NRF.

Enable

After performing the above mentioned preconfigurations, enable the NRF georedundancy feature using the REST API or CNC Console.

- **Enable using REST API:** Set **featureStatus** to **ENABLED** in **Georedundancy Options** configuration API. For more information about API path, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Enable using CNC Console:** Set **Feature Status** to **ENABLED** on the Georedundancy Options page. For more information about enabling the feature using CNC Console, see [Georedundancy Options](#).

Configure

You can configure the georedundancy feature using REST API or CNC Console:

- **Configure Georedundancy using REST API:** Perform the feature configurations as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Configure Georedundancy using CNC Console:** Perform the feature configurations as described in [Georedundancy Options](#).

Fetching the Database Replication Channel Status Using appinfo Microservice

NRF microservices require the database replication channel status for various NRF service operations. The Database Monitor service exposes APIs which provides the database replication channel status. The following NRF microservice query this API:

- Nfregistration
- Nfsubscription
- NfDiscover
- nrfAuditor
- NfAccessToken
- NrfConfiguration
- NrfArtisan

Currently, all pods of the above services perform the REST API query towards the Database Monitor service periodically, and maintains the status in memory. When NRF is scaled to handle high traffic rate, the number of pods querying the Database Monitor service is very high. But, the Database Monitor service is not designed to handle high traffic rate.

Observe

Following are the georedundancy feature specific metrics:

- ocnrf_dbreplication_status
- ocnrf_dbreplication_down_time_seconds
- ocnrf_nf_switch_over_total
- ocnrf_nfSubscriptions_switch_over_total
- ocnrf_stale_nf_deleted_total
- ocnrf_stale_nfSubscriptions_deleted_total
- ocnrf_reported_dbreplication_status

For more information on georedundancy metrics and KPIs, see [Georedundancy Metrics](#) and [NRF KPIs](#) sections.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.32.1 NRF Last Known Response

When an NRF detects that the replication channel with its georedundant NRF(s) is down, it stops considering the NFs registered in the georedundant NRF(s) for any service operations. Due to unavailability of the replication channel, the latest status of the NFs registered in the georedundant NRF(s) will not get replicated. In this state the last replicated NfProfiles may be stale, hence NRF does not consider these profiles for any service operations.

During platform maintenance, network issues, or for any other reason, if the replication channels goes down, given that usually, the NFs do not register, deregister or change their profiles very often, it is acceptable for NRF to use the last known NfProfiles of remote NRFs for any service operations.

As part of this feature, `overrideReplicationCheck` Helm configurable parameter is provided to control the behavior when replication channels are down. The parameter is applicable for the following NRF microservices only:

- `nfregistration`
- `nfaccess token`
- `nfdiscovery`
- `nrfartisan`
- `nrfcachedata`

Note

`overrideReplicationCheck` is a global parameter. This is a reference variable. The value of this parameter is applicable for the above-mentioned microservices.

Enable

You can enable Last Known Response using the Helm.

Note

Perform the following steps only after Geo Redundancy Feature is enabled as described in [Georedundancy Options](#).

1. Open the `ocnrf_custom_values_26.1.201.yaml` file.

2. Set `global.overrideReplicationCheck` to **true** to enable the Last Known Response feature.

Note

`global.overrideReplicationCheck` is a reference variable.

For more information about the parameters, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

3. Save the file.
4. Run `helm upgrade`. For more information about upgrade procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

NRF behavior When the Feature is Disabled

Following are the different scenarios that explain the behavior of each NRF microservices when this feature is disabled:

- **Replication is Up**
 - **NF Register Microservice:**
 - * **NfRegister, NfUpdate, NfHeartbeat, and NfDeregister Processing:**
The service operations will be successful, irrespective of which site the NF was originally registered at the local site.
 - * **NfListRetrieval and NfProfileRetrieval Processing:**
The NRF will consider:
 - * The NFs registered and heartbeating at the local site.
 - * The NFs registered and heartbeating at the remote sites, which replicated from its Georedundant mate NRFs.
 - **NF Subscription Microservice:**
 - * **NF StatusSubscribe (POST and PATCH) and NF StatusUnsubscribe Processing:**
The service operations will be successful, irrespective of which site the Nfsubscription was originally created at the local site.
 - **NF Discover and NF AccessToken Microservice:**
The NRF will consider:
 - * The NFs registered and heartbeating at the local site.
 - * The NFs registered and heartbeating at the remote sites, which replicated from its Georedundant mate NRFs.
 - **NrfArtisan Microservice:**
The SLFs registered at both local site and remote sites are used for discovering UDRs for performing SLF query, when `slfConfigMode` is set to `DISCOVERED_SLF_CONFIG_MODE`.
 - **NrfAuditor Microservice:**
 - * NRF will audit the NfProfiles and subscriptions of the local site.

When NRF discovers any of its registered profiles has missed heartbeats, it will be marked as **SUSPENDED**. The NF will thereafter not be included in the `nfDiscovery` or `nfAccessToken` response. The Consumer NFs that have subscribed for the change are notified about the change.

- * When NRF discovers any of its subscriptions have crossed the validity period, it deletes the subscription.
- * NRF will also audit the remote site NRFs `NfProfiles` and `Subscriptions`. If NRF discovers any of the registered Profiles at the remote site has missed heartbeats, it will be marked as **PROBABLE_SUSPENDED** (internal state). The NF will thereafter not be included in the `nfDiscovery` or `nfAccessToken` response. The NF will eventually be marked as **SUSPENDED**, if the NF continues to miss its heartbeat for a configurable period. The Consumer NFs that have subscribed for the change are not notified. When NRF receives a profile Retrieval request for a `NfProfile` which is in **PROBABLE_SUSPENDED** state, it shall return the profile in the response with the status set to **UNDISCOVERABLE**.
- * When NRF discovers any of the subscriptions at the remote site have crossed the validity period, it marks the subscription as **SUSPENDED**.

Note

`global.overrideReplicationCheck` attribute is not configurable for `NrfAuditor` microservice. Refer the behavior for `nrfAuditor` when replication channel status is UP or DOWN.

- **Replication is Down**

- **NF Register Microservice:**

- * **NfRegister, NfUpdate, NfHeartbeat, and NfDeregister Processing:**

- * The `NfProfiles` will be processed if the NF is registered at the local site.
 - * If the NF is registered at the remote site, then the `NfProfile` will be processed only if `geoRedundancyOptions.useRemoteDataWhenRepLDown` is **true**. Else, the request will be rejected with 404 Not Found.

- * **NfListRetrieval and NfProfileRetrieval Processing:**

- * The NRF will consider the NFs registered and heartbeating with the local site.
 - * The NRF will not consider the NFs that are registered with remote NRF site with which the replication is down.

- **NF Subscription Microservice:**

- * **NF StatusSubscribe (POST and PATCH) and NF StatusUnsubscribe Processing:**

- * Only NF subscriptions at the local site will be processed.
 - * If the `Nfsubscription` created at remote site, then the `Nfsubscription` will be processed only if `geoRedundancyOptions.useRemoteDataWhenRepLDown` is **true**. Else, the request will be rejected with 404 Not Found.

- **NF Discover and NF AccessToken Microservice:**

The NRF will consider:

- * The NFs registered and heartbeating at the local site.

- * NRF will not consider the NFs registered and heartbeating at the remote sites with which the replication is down.
- **NrfArtisan Microservice:**
 - * When slfConfigMode is set to DISCOVERED_SLF_CONFIG_MODE, NRF will consider
 - * The SLFs registered and heartbeating at the local site.
 - * The SLFs registered with remote site NRFs with which the replication is down will not be considered.
- **NrfAuditor Microservice:**
 - * NRF will audit the NfProfiles and subscriptions of the local site. When NRF discovers any of its registered profiles has missed heartbeats, it will be marked as PROBABLE_SUSPENDED (internal state). The NF will thereafter not be included in the nfDiscovery or nfAccessToken response. The Consumer NFs that have subscribed for the change shall not be notified of the change.

When NRF discovers any of its subscriptions have crossed the validity period, it shall mark the Subscription as SUSPENDED (internal state).
 - * NRF will not audit the remote site NRFs NfProfiles and Subscriptions.

NRF behavior When the Feature is Enabled, replication is UP or Down

- **NF Register Microservice:**
 - **NfRegister, NfUpdate, NfHeartbeat, and NfDeregister Processing:**
 - * The profiles will be processed for the NFs registered at the local site or at the remote sites, irrespective of the value of the geoRedundancyOptions.useRemoteDataWhenRepLDown parameter.
 - **NfListRetrieval and NfProfileRetrieval Processing:**

The NRF will consider:

 - * The NFs registered and heartbeating at the local site.
 - * The NFs registered and heartbeating at the remote sites (last known status) which replicated from its Georedundant mate NRFs.
- **NF Subscription Microservice:**
 - **NF StatusSubscribe (POST and PATCH) and NF StatusUnsubscribe Processing:**
 - * Only NF subscriptions at the local site will be processed.
 - * If the Nfsubscription created at remote site, then the Nfsubscription will be processed only if geoRedundancyOptions.useRemoteDataWhenRepLDown is **true**. Else, the request will be rejected with 404 Not Found.
- **NF Discover and NF AccessToken Microservice:**

The NRF will consider:

 - The NFs registered and heartbeating at the local site.
 - The NFs registered and heartbeating at the remote sites (last known status) which replicated from its Georedundant mate NRFs.
- **NrfArtisan Microservice:**

The SLFs registered at both local site and remote sites (last known status) are used for discovering UDRs for performing SLF query, when slfConfigMode is set to DISCOVERED_SLF_CONFIG_MODE.

- **NrfAuditor Microservice:**
 - If the replication channel status is up,
 - * NRF will audit the NfProfiles and subscriptions of the local site. When NRF discovers any of its registered profiles has missed heartbeats, it will be marked as SUSPENDED. The NF will thereafter not be included in the nfDiscovery or nfAccessToken response. The Consumer NFs that have subscribed for the change are notified about the change.
 - When NRF discovers any of its subscriptions have crossed the validity period, it deletes the subscription.
 - * NRF will also audit the remote site NRFs NfProfiles and Subscriptions. If NRF discovers any of the registered Profiles at the remote site has missed heartbeats, it will be marked as PROBABLE_SUSPENDED (internal state). The NF will thereafter not be included in the nfDiscovery or nfAccessToken response. The Consumer NFs that have subscribed for the change are not notified.
 - * When NRF discovers any of the subscriptions at the remote site have crossed the validity period, it marks the subscription as SUSPENDED.
 - If the replication channel status is down,
 - * NRF will audit the NfProfiles and subscriptions of the local site. When NRF discovers any of its registered profiles has missed heartbeats, it will be marked as PROBABLE_SUSPENDED (internal state). The NF will thereafter not be included in the nfDiscovery or nfAccessToken response. The Consumer NFs that have subscribed for the change shall not be notified of the change.
 - * When NRF discovers any of its subscriptions have crossed the validity period, it shall mark the Subscription as SUSPENDED (internal state).
 - * NRF will not audit the remote site NRFs NfProfiles and Subscriptions.

Note

global.overrideReplicationCheck attribute is not configurable for NrfAuditor microservice. Refer the behavior for nrfAuditor when replication channel status is UP or DOWN.

In addition to the Last Known Response behavior described above, replication failure can affect the contents of NfStatusNotify messages generated for NF subscriptions.

NF_PROFILE_CHANGED Notification Behavior During Replication Failure

For NF_PROFILE_CHANGED notifications, the contents of the NfStatusNotify message depend on the following configuration parameters:

- `nfManagementOptions.nrfSupportForProfileChangesInNotification`
- `geoRedundancyOptions.useRemoteDataWhenReplDown`

The `nrfSupportForProfileChangesInNotification` parameter controls whether NRF sends only the `profileChanges` attribute or the complete NFProfile in an NF_PROFILE_CHANGED notification.

The `useRemoteDataWhenReplDown` parameter controls NRF behavior when the replication channel with a geo-redundant NRF is down.

- When the Replication Status is UP

When the replication status is UP, NRF triggers `NfStatusNotify` messages for matching subscribed NFs.

For `NF_PROFILE_CHANGED` notifications:

- If `nrfSupportForProfileChangesInNotification` is set to `true`, NRF sends the `profileChanges` attribute in the notification.
- If `nrfSupportForProfileChangesInNotification` is set to `false`, NRF sends the complete `NFProfile` in the notification.
- When the Replication Status is DOWN
When the replication status is DOWN, NRF triggers `NfStatusNotify` messages for matching subscribed NFs.
For `NF_PROFILE_CHANGED` notifications:
 - If `geoRedundancyOptions.useRemoteDataWhenReplDown` is set to `false`, NRF follows the configured value of `nrfSupportForProfileChangesInNotification`:
 - * If `nrfSupportForProfileChangesInNotification` is set to `true`, NRF sends the `profileChanges` attribute.
 - * If `nrfSupportForProfileChangesInNotification` is set to `false`, NRF sends the complete `NFProfile`.
 - If `geoRedundancyOptions.useRemoteDataWhenReplDown` is set to `true`, NRF sends the complete `NFProfile` in the notification irrespective of the value configured for `nrfSupportForProfileChangesInNotification`.

This behavior applies only to `NF_PROFILE_CHANGED` notifications.

4.33 NF Heartbeat Enhancement

This feature allows the operator to configure minimum, maximum, default heartbeat timers and the maximum number of consecutive heartbeats that the NF is allowed to skip. Further, these values can be customized per NF type.

According to 3GPP 29.510, every NF registered with NRF keeps its operative status alive by sending NF heartbeat requests periodically. The NF can optionally send the `heartbeatTimer` value when it registers its `NFProfile` or when it wants to update its registered `NFProfile`.

NRF may modify the value of the `heartbeatTimer` based on its configuration and return the new value to the NF on successful registration. The NF will thereafter use the `heartbeatTimer` as received in the registration response as its heartbeat interval.

In case the configuration changes at the NRF for the `heartbeatTimer`, the changed value must be communicated to the NF in the response of the next periodic NF heartbeat request or when it next sends an `NFUpdate` request to the NRF.

NRF monitors the operative status of all the NFs registered with it, and when it detects that an NF has missed updating its `NFProfile` or sending a heartbeat for the `heartbeatTimer` interval, NRF must mark the `NFProfile` as `SUSPENDED`. The `NFProfile` and its services may no longer be discoverable by the other NFs through the `NfDiscovery` service. The NRF notifies the subscribed NFs of the change in status of the `NFProfile`.

Managing NF Heartbeat Enhancement

Enable

The NF heartbeat is a core functionality of NRF. You do not need to enable or disable this feature.

Configure

Configure the NF Heartbeat Enhancement using REST API or CNC Console:

- **Configure NF Heartbeat using REST API:** Perform the feature configurations as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Configure NF Heartbeat using CNC Console:** Perform the feature configurations as described in [NF Management Options](#).

Observe

For more information on heartbeat metrics and KPIs, see [NRF Metrics](#) and [NRF KPIs](#) sections.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.34 Service mesh for intra-NF communication

Oracle NRF leverages the Istio or Envoy service mesh (Aspen Service Mesh) for all internal and external communication. The service mesh integration provides inter-NF communication and allows API gateway co-working with service mesh. The service mesh integration supports the services by deploying a special sidecar proxy in the environment to intercept all network communication between microservices. For more information on configuring ASM, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

4.35 NF Screening

The incoming service requests from 5G Network Functions (NFs) must be screening before allowing access to Nnrf_NfManagement service operations to ensure security.

NF Screening feature screens the incoming service requests based on certain attributes in the NfProfile against a set of screening rules configured at NRF. NRF processes the incoming service requests, only if the screening is successful, and allows to invoke Nnrf_NfManagement service operations.

NRF supports the following NF screening rules list type. For more information about the screening rules applicable to different attributes in NfProfile, see [Table 4-30](#).

Table 4-28 Screening Rules List Type

Screening Rule List	Description
"NF_FQDN"	Screening List type for NF FQDN. This screening rule type is applicable for fqdn of a NfProfile in NF_Register and NF_Update service operations.

Table 4-28 (Cont.) Screening Rules List Type

Screening Rule List	Description
"NF_IP_ENDPOINT"	Screening list type for IP Endpoint. This screening rule type is applicable for <code>ipv4address</code> , <code>ipv6address</code> attributes at <code>NfProfile</code> level and <code>ipEndPoint</code> attribute at <code>nfServices</code> level for <code>NF_Register</code> and <code>NF_Update</code> service operations.
"CALLBACK_URI"	Screening list type for callback URIs in <code>NF Service</code> and <code>nfStatusNotificationUri</code> in <code>SubscriptionData</code> . This is also applicable for <code>nfStatusNotificationUri</code> attribute of <code>SubscriptionData</code> for <code>NFStatusSubscribe</code> service operation. This screening rule type is applicable for <code>defaultNotificationSubscription</code> attribute at <code>nfServices</code> level for <code>NF_Register</code> and <code>NF_Update</code> service operations.
"PLMN_ID"	Screening list type for PLMN ID. This screening rule type is applicable for <code>plmnList</code> attribute at <code>NfProfile</code> level for <code>NF_Register</code> and <code>NF_Update</code> service operations.
"NF_TYPE_REGISTER"	Screening list type for allowed NF Types to register. NRF supports 3GPP TS 29510 Release 15 and specific Release 16 NF Types. For more information on the supported NF Types list, see "Supported NF Types" section. This screening rule type is applicable for <code>nfTypeList</code> attribute at <code>NfProfile</code> level for <code>NF_Register</code> and <code>NF_Update</code> service operations.

When a service request is received, NRF performs screening of the service request for each of the above mentioned screening rules list type, as follows:

- Checks if the global screening option is Enabled or Disabled.
You can configure the **`nfScreeningOptions.featureStatus`** parameter as "ENABLED" using REST or Console.

Note

By default, the NF Screening feature is disabled globally.

- If it is Enabled, NRF checks if the attribute in the `NfProfile` is configured under `BLOCKLIST` or `ALLOWLIST`. For more information about these attributes, see [Table 4-29](#).
You can configure **`nfScreeningType`** parameter as `BLOCKLIST` or `ALLOWLIST` for the specific screening rule configuration. For more information about the screening rules applicable to different attributes in `NfProfile`, see [Table 4-30](#).

Table 4-29 NF Screening Type

NfScreeningType	Description
BLOCKLIST	If the attribute is configured as Blocklist and the attribute in the request matches with the configured value, the service request is not processed further. For example, <code>nfFqdn</code> is configured as Blocklist, then the service request with <code>fqdn</code> present in the <code>NfProfile</code> is not processed further.
ALLOWLIST	If the attribute is configured as Allowlist and the attribute in the request matches with the configured value, then the service request is processed further. For example, <code>nfIpEndPointList</code> is configured as Allowlist, then the service request with <code>ipv4Addresses</code> present in the <code>NfProfile</code> is processed further.

- Based on the **`nfScreeningType`** parameter configuration, NRF checks screening rules, per `NfType` and global screening rules data level. Depending on the configuration, the service request is processed. For more information about the configuration, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

The following table describes the screening rules applicable to different attributes in `NfProfile`.

Table 4-30 Screening rules applicable to NfProfile attributes

Management Service Operation	Screening Rules List	Attribute in NfProfile	Attribute in REST
NF_Subscribe	CALLBACK_URI	SubscriptionData.nfStatusNotificationUri	nfCallBackUriList
NF_Register, NF_Update	CALLBACK_URI	NfService.defaultNotificationSubscriptions	nfCallBackUriList
NF_Register, NF_Update	NF_FQDN	NfProfile.fqdn	nfFqdn
NF_Register, NF_Update	NF_IP_ENDPOINT	- NfProfile.ipv4Addresses - NfProfile.ipv6Addresses - NfService.ipEndPoints	nflpEndPointList
NF_Register, NF_Update	PLMN_ID	NfProfile.plmnList	plmnList
NF_Register, NF_Update	NF_TYPE_REGISTER	NfProfile.nfType	nfTypeList

Managing NF Screening Feature

Enable

You can enable the NF Screening feature using the CNC Console or REST API.

- **Enable using REST API:** Set featureStatus to ENABLED in **NF Screening Options** configuration API. For more information about API path, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Enable using CNC Console:** Set **Feature Status** to **ENABLED** on the NF Screening Options page. For more information about enabling the feature using CNC Console, see [NF Screening Options](#).

Configure

You can configure the NF Screening feature using REST API or CNC Console:

- **Configure using REST API:** Perform the feature configurations as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Configure using CNC Console:** Perform the feature configurations as described in [NF Screening Options](#).

Observe

Following are the NF Screening feature specific metrics:

- ocnrf_nfScreening_nfFqdn_requestFailed_total
- ocnrf_nfScreening_nfFqdn_requestRejected_total
- ocnrf_nfScreening_nflpEndPoint_requestFailed_total
- ocnrf_nfScreening_nflpEndPoint_requestRejected_total
- ocnrf_nfScreening_callbackUri_requestFailed_total
- ocnrf_nfScreening_callbackUri_requestRejected_total
- ocnrf_nfScreening_plmnId_requestFailed_total
- ocnrf_nfScreening_plmnId_requestRejected_total

- ocnrf_nfScreening_nfTypeRegister_requestFailed_total
- ocnrf_nfScreening_nfTypeRegister_requestRejected_total
- ocnrf_nfScreening_notApplied_InternalError_total

For more information about NF Screening metrics and KPIs, see [NF Screening Metrics](#) and [NRF KPIs](#) sections.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts persists, perform the following:

1. **Collect the logs:** For more information about how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information about how to raise a service request.

4.36 REST Based NRF State Data Retrieval

REST based NRF state data retrieval feature provides options for Non-Signaling APIs to access NRF state data. It helps the operator to access the NRF state data to understand and debug in the event of failures.

This feature provides various queries which can help to get data as per the requirement.

Managing REST Based NRF State Data Retrieval Feature

Configure

You can configure the REST Based NRF State Data Retrieval feature using REST API. For more information on state data retrieval, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.37 Key-ID for Access Token

Key-ID (kid) feature is about to add "kid" header in Access Token Response generated by NRF. As per RFC 7515 section 4.1.4, the use of Key-ID (kid) is to indicate which key was used to secure JSON Web Signature (JWS).

Note

You must perform [OCNRF Access Token Service Operation](#) configuration before configuring Key-ID for Access Token. For details about Kubernetes Secret configuration approaches for the private key and public certificate used for access token signing (including use of defaultK8SecretDetails versus Key-ID-specific Secret details), see [OCNRF Access Token Service Operation](#).

Each NRF and NF producer(s) will have multiple keys with algorithm indexed with "kid" configured. NRF REST based configuration provides options to configure different key-ids and corresponding NRF private keys and public certificates along with corresponding oauth signing algorithms. One of the configured key-ids, can be set as current Key-ID. While generating the oauth access token, NRF uses the keys, algorithm and certificates corresponding to current Key-ID.

NRF configuration provides "addkeyIDInAccessToken" attribute which tells to add Key-ID as header in Access Token Response or not. If value is true, then currentKeyID value will be added in "kid" header in AccessToken Response. If value is false, then "kid" header will not be added in AccessToken Response.

See *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide* for more information on how to check AccessToken Signing Key Status.

Managing Key-ID for Access Token Feature**Enable**

You can enable the Key-ID for Access Token feature using the CNC Console or REST API.

Enable the Key-ID for Access Token feature using REST API as follows:

1. Use the API path as {apiRoot}/nrf-configuration/v1/nfAccessTokenOptions.
2. Content type must be application/json.
3. Run the PUT REST method using the following JSON:

```
{
  "addkeyIDInAccessToken": true
}
```

Enable the Key-ID for Access Token feature using CNC Console as follows:

1. From the left navigation menu, navigate to **NRF** and then select **NF Access Token Options**. The **NF Access Token Options** page is displayed.
2. Click **Edit** from the top right side to edit or update **NF Access Token Options** parameter. The page is enabled for modification.
3. Select the **Add KeyID in AccessToken** under **Token Signing Details** section as **True** from the drop-down menu.
4. Click **Save** to save the **NF Access Token Options**.

Configure

You can configure the Key-ID for Access Token Feature using REST API or CNC Console:

- **Configure Key-ID for Access Token using REST API:** Perform the feature configurations as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Configure Key-ID for Access Token using CNC Console:** Perform the feature configurations as described in [NF Access Token Options](#).

Observe

Metrics

For more information on Key-ID for Access Token metrics, see the [NF Access token Metrics](#) section.

KPIs

For more information on Key-ID for Access Token KPIs, see the [NRF KPIs](#) section.

Alerts

Following are the KeyID feature specific alerts:

- [OcnrfAccessTokenCurrentKeyIdNotConfigured](#)
- [OcnrfAccessTokenCurrentKeyIdInvalidDetails](#)
- [OcnrfAccessTokenCurrentKeyIdNotConfigured](#)
- [OcnrfOauthCurrentKeyDataHealthStatus](#)
- [OcnrfOauthNonCurrentKeyDataHealthStatus](#)
- [OcnrfOauthCurrentCertificateExpiringIn1Week](#)
- [OcnrfOauthNonCurrentCertificateExpiringIn1Week](#)
- [OcnrfOauthCurrentCertificateExpiringIn30days](#)
- [OcnrfOauthNonCurrentCertificateExpiringIn30days](#)

For more information about the alerts raised for the feature, see the [KeyID for AccessToken Feature](#) section.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.38 NRF Access Token Service Usage Details

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

The Nnrf_AccessToken service operation is defined as follows:

- Access Token Request (Nnrf_AccessToken_Get)

Note

This procedure is specific to the NRF Access Token service operation. NRF general configurations, database, and database-specific secret creation are not part of this procedure.

Procedure to use NRF Access Token Service Operation

This procedure provides step-by-step details to use 3GPP defined access token service operation supported by NRF.

1. Create NRF private key and public certificate

This step explains the need to create the NRF private keys and public certificates.

Private keys are used by NRF to sign the Access Token generated. It is available only with NRF.

Public certificates are used by producer NFs to validate the access token generated by NRF. So, public certificates are available with producer network functions. NRF does not need the public certificate while signing the access token.

The expiry time of the certificate is required to set appropriate validity time in the AccessTokenClaim.

Note

For more details about the validity time of AccessTokenClaim, see "oauthTokenExpiryTime".

Two types of signing algorithms are supported by NRF. For both types different keys and certificates required to be generated:

- ES256: ECDSA digital signature with SHA-256 hash algorithm
- RS256: RSA digital signature with SHA-256 hash algorithm

Anyone or both of the algorithm files can be generated depending upon the usage of hash algorithms. Depending upon NRF rest based configuration-specific keys and certificates are used to sign the Access Token.

Note

The creation process for private keys, certificates, and passwords is at the discretion of the user or operator.

Sample keys and certificates:

After running this step, the private keys and public certificates of NRF (generated files depends upon algorithms chosen by operator or user) are created. There can be multiple such pairs of private keys and public certificates which will eventually be configured in NRF with different KeyIds.

For example:

ES256 based keys and certificates:

- ecdsa_private_key.pem

- `ecdsa_certificate.crt`

RS256 based keys and certificates:

- `rsa_private_key.pem`
- `rsa_certificate.crt`

Note

- Unencrypted key and certificates are only supported.
- For RSA, the supported versions are PKCS1 and PKCS8.
- For ECDSA, the supported version is PKCS8.

2. Namespace creation for Secrets

This step explains the need to create Kubernetes namespace in which Kubernetes secrets are created for NRF private keys and public certificates. For creating namespace, see the "Verifying and Creating NRF Namespace" section in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Note

- Different namespaces or the same namespace can be used for NRF private keys and public certificates.
- It can be the same namespace as for NRF deployment.
- Appropriate RBAC permission needs to be associated with the ServiceAccount, if the namespace is other than NRF's namespace.

3. Secret creation for NRF private keys and public certificates

This step explains commands to create the Kubernetes secret(s) in which NRF private keys and public certificates can be kept safely. For configuring secrets, see the "Configuring Secret for Enabling Access Token Service" section in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Note

The same secret can be used which is already there for NRF private keys.

A sample command is provided in the "Configuring Kubernetes Secret for Accessing NRF Database" section in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide* to create or update the secret. In case, there is a need to create or update multiple secrets for each entity, then the same section can be followed.

4. Perform NRF REST based configuration with outcome details of Steps 1 to 3

This step explains the NRF REST based configuration to use the NRF private keys, public certificates, secret(s), and secret namespace(s).

NRF REST based configuration provides options to configure different key-ids and corresponding NRF private keys and public certificates along with corresponding oauth signing algorithms. One of the configured key-ids, can be set as the current key-id.

While generating the OAuth access token, NRF uses the keys, algorithm, and certificates corresponding to the current key-id.

Note

For each Key-ID, NRF references the private key and public certificate used for access token signing from Kubernetes Secrets using the configured `k8SecretName`, `k8SecretNamespace`, and `fileName` (for both private key and certificate). You can use either of the following approaches:

- Approach 1: Use a common Kubernetes Secret for all Key-IDs
If the private keys/certificates for all Key-IDs are stored in a single Kubernetes Secret:
 - Configure only `defaultK8SecretDetails` with the common `k8SecretName` and `k8SecretNamespace`.
 - For each Key-ID, under the private key and certificate sections, configure only `fileName`. Do not configure `k8SecretName` or `k8SecretNamespace` for the Key-ID. NRF uses `defaultK8SecretDetails` for the Secret name and namespace.
- Approach 2: Use a dedicated Kubernetes Secret for each Key-ID
If each Key-ID uses a separate Kubernetes Secret:
 - For each Key-ID, configure `k8SecretName`, `k8SecretNamespace`, and `fileName` under the private key and certificate sections.
 - If `k8SecretName` and `k8SecretNamespace` are configured for a Key-ID, NRF ignores `defaultK8SecretDetails` even if it is configured.

For more information on NF Access Token options configuration using REST APIs, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

4.39 Access Token Request Authorization

NRF follows and supports the 3GPP TS 29.510 based verification for Access Token Authorization requests for specific NF producer based on the allowed NFType, PLMN present in the NFProfiles. Extension to this requirement is to include screening for Access Token requests based on NFType.

NRF plays a major role as an OAuth2.0 Authorization server in 5G Service based architecture. When an NF service Consumer needs to access the services of an NF producer of a particular NFType and NFInstanceId, it obtains an OAuth2 access token from the NRF. NRF performs the required authorization, and if the authorization is successful, a token is issued with the requested claims. NRF provides an option to the user to specify the authorization of the Producer-Consumer NF Types along with the producer NF's services.

The operator can configure the mapping of the Requester NFType, Target NFType, and the allowed services of the Target NF. Access Token request received based on the configuration and is further processed the request only if the authorization is successful. Allowed Services can be configured as a single wild card '*' which denotes all the Target NFs services are allowed for the consumer NF. The operator can also configure the HTTP status code and error description that can be used in the Error Response sent by the NRF when the Access Token request is rejected.

Note

When Access Token Authorization feature is enabled, it is expected that the requester and the target NFs are registered in NRF for the validation. So if the targetNfType is not specifically mentioned in the request, the targetNfType is extracted from the registered profile in the database using the targetNfInstanceId. Similarly if the requesterNfInstanceId is present in the request, the requesterNfType is extracted from the registered profile in the database.

Access Token configurable attribute "logicalOperatorForScope" is used while authorizing the services in the Access Token Request's scope against the allowed services in the configuration. If the logicalOperatorForScope is set to "OR", at least one of the services in the scope will be present in the allowed services. If it is set to "AND", all the services in the scope will be present in the allowed services.

The authFeatureConfig attribute under nfAccessTokenOptions provides the support required to use NRF Access Token Request Authorization Feature. For more details, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

When authFeatureConfig attribute is ENABLED, the nfType validation is performed as follows:

- targetNfType and requesterNfType is matched with the nfTypes used for accessToken generation. This configuration overrides the nfType validation against the allowedNfTypes in nfProfile or nfServices.
- If the above mentioned validation is not met, then:
 - requesterNfType from the accessToken request is validated against the allowedNfTypes present in the producer NF's nfServices, if present.
 - requesterNfType from the accessToken request is validated against the allowedNfTypes from the producer nfProfile, if allowedNfTypes is not present in the nfServices.

Managing Access Token Request Authorization Feature

Enable

You can enable the Access Token Request Authorization Feature using the REST API or CNC Console.

- **Enable using REST API:** Set featureStatus to ENABLED in **NF AccessToken Options** configuration API. For more information about API path, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Enable using CNC Console:** Set **Feature Status** to **ENABLED** on the NF Access Token Options page. For more information about enabling the feature using CNC Console, see [NF Access Token Options](#).

Configure

You can configure the Access Token Request Authorization feature using REST API or CNC Console:

- **Configure using REST API:** Perform the feature configurations as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
With nfAccessTokenOptions API, authFeatureConfig attribute provides the support required to use NRF Access Token Request Authorization Feature. For more details, see

Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide.

- **Configure using CNC Console:** Perform the feature configurations as described in [NF Access Token Options](#).

Observe

Following are the Access Token ReSquest Authorization feature specific metrics:

- ocnrf_accessToken_rx_requests_total
- ocnrf_accessToken_tx_responses_total

For more information on Access Token Request Authorization metrics and KPIs, see [NF Access token Metrics](#) and [NRF KPIs](#) sections.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.40 Preferred Locality Feature Set

Preferred Locality Feature Set comprises of the following features:

- Preferred Locality
- Extended Preferred Locality with Location or Location Sets
- Limiting the Number of Producers Based on NF Set Ids

For more information about these features and their processing, see the following sections.

- [Preferred Locality](#)
- [Extended Preferred Locality](#)
- [Discovery Processing for Extended Preferred Locality Feature](#)
- [Configuring Extended Preferred Locality](#)

4.40.1 Preferred Locality

When the consumer NF sends the discovery query along with an additional attribute "**preferred-locality**", the **Preferred Locality** feature is applied. By default, such discovery queries are processed as follows:

1. NRF searches and collects all the NFs profiles matching the search criteria sent in the discovery query except the "**preferred-locality**" attribute.
2. NF profiles collected in the above step are arranged as per "**preferred-locality**". Here, the NFs matching the "**preferred-locality**" are arranged as per the increasing order of their priority and the NF profiles that do not have "**preferred-locality**" are then placed in the increasing order of post-processed priority value. Here, post-processed priority value means adding the highest NF priority of the NFs that are matching with the "**preferred-**

locality" to the priority value of non-preferred NF profiles with an additional increment offset value of 1.

For example: If the highest NF priority value of **"preferred-locality"** is 10 and the priority value of non-preferred NF profile is 5, then after post processing the priority value of non-preferred NF profile will be 16 (where, 10 is the highest priority value of NF profile with **"preferred-locality"**, 5 is the priority of non-preferred NF and 1 is the offset value).

For service-name based discovery query, if there is single service in the NF profile after discovery processing, service level priority is updated.

For service-name based discovery query, if there are multiple services in the NF profile with same service name after discovery processing, along with priority value update at NF profile, service level priority is also updated.

Managing Preferred Locality feature

Enable

Enabling the **Preferred Locality** feature: This feature is enabled by default as per 3GPP TS29.510. There is no option to enable or disable it explicitly.

Observe

There are no specific metrics and alerts for this feature.

For the entire list of NRF metrics and alerts, see [NRF Metrics](#) and [NRF Alerts](#) section.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.40.2 Extended Preferred Locality

The limitation with the default **"Preferred Locality"** feature is that, it does not provide a mechanism to select matching producers from more than one **"preferred-locality"** because **"preferred-locality"** attribute allows to provide only one location in the discovery query.

To overcome this limitation, the **"Extended Preferred Locality"** feature is implemented where a preferred locality triplet, that is, collection of primary, secondary and tertiary preferred locality is associated with the given **"preferred-locality"** and **"target-nf-type"**. The "Primary Preferred Locality", "Secondary Preferred Locality", and "Tertiary Preferred Locality" in "Preferred Locality Triplet" can be configured with single location or a location set. That is, the **"Location"** attribute under **"Target Preferred Locations"** can be an individual **"Location"** or a **"Location Set Name"** configured under the **"Location Sets"**. You can configure a maximum of 255 location sets, and each location set can have upto 10 locations.

Managing Extended Preferred Locality and Limiting the Number of Producers Based on NF Set Ids

Enable

For enabling the features, see below:

- **Enable using REST API:** Set **featureStatus** to **ENABLED** in **NF Discovery Options** configuration API. For more information about the API path, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Enable using CNC Console:** Set **Feature Status** to **ENABLED** on the NF Discovery Options page. For more information about enabling the feature using CNC Console, see [NF Discovery Options](#).

Configure

You can configure the Extended Preferred Locality feature using REST API or CNC Console:

- **Configure using REST API:** Perform the feature configurations in the `{apiRoot}/nrf-configuration/v1/nfDiscoveryOptions` as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Configure using CNC Console:** Perform the feature configurations as described in [NF Discovery Options](#).

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.40.2.1 Discovery Processing for Extended Preferred Locality Feature

Discovery query is processed with respect to Extended Preferred Locality Feature is as follows:

1. NRF filters out all of the NFs profiles matching the search criteria sent in the discovery request except the "preferred-locality" query parameter.
2. NFProfiles filtered in the above step are then arranged matching the locality attribute as per the configuration for "**Primary Preferred Locality**", "**Secondary Preferred Locality**", "**Tertiary Preferred Locality**" in "Preferred Locality Triplet". The NFs profiles that are not matching with the "**preferred-locality**" query parameter are kept in a different group.
3. NFProfiles in each "Preferred Locality Triplet" will be arranged based on their priority. For NFProfiles having the same priority, load will be used for for arranging the NFProfiles. If load values are also same, then the NFProfiles will be arranged in a random order.
4. Additionally, priorities of NFProfiles falling in the groups of secondary, tertiary, and remaining non-matching locations are updated based upon a similar way of post-processed priority as defined in the "Preferred Locality" feature.

Note

When the "**Extended Preferred Locality**" feature is enabled and in case, if any of the required configurations are not matched with the respective discovery query parameters, NRF will apply the "**Preferred Locality**" feature.

5. Locations or a set of locations can be defined in "Preferred Locality Triplet" for the discovery search query.

4.40.2.2 Configuring Extended Preferred Locality

According to 3GPP TS 29.510 V15.5.0, consumer NFs can send discovery query with **preferred-locality**, along with **requester-nf-type**, **target-nf-type**, and **nf-services**.

Note

Only "**preferred-locality**", "**target-nf-type**", and "**nf-services**" attributes are considered for this feature, other attributes in the search query are not applicable.

1. Configure the location types as per the network deployment. Location types can be configured using `locationTypes` attribute.
For Example: Category-S, Category-N, and so on.

Sample location types attribute value:

```
"locationTypes": ["Category-S", "Category-N", "Category-x"]
```

Note

- Maximum 25 location types can be configured.
- `locationTypes` can have minimum 3 characters and maximum 36 characters. It can have only alphanumeric and special characters '-' and '_'. It cannot start and end with special characters.
- Duplicate location types are not allowed to be configured in this attribute.
- `locationTypes` are case sensitive it means Category-x and Category-X are different.

2. Configure NF types (along with different services) under `locationTypeMapping` attribute. This attribute allows the operator to create mapping between different `nfType` (along with `nfServices`) and the `locationTypes`. (Location types is already configured by following Step 1 above).
For Example: PCF is the NF type, `am_policy`, `bdt_policy` are NF services and Category-x is the location type.

Sample output:

```
"locationTypeMapping": [{
  "nfType": "PCF",
  "nfServices": ["am_policy", "bdt_policy"],
  "locationType": "Category-x"
}],
```

Note

- Configure **nfType** attribute to map it with the "**target-nf-type**" attribute in incoming discovery query.
- **nfServices** attribute of this configuration is used when "**service-names**" query parameter is present in discovery query. Different **nfServices** along with **nfType** can be mapped with different location types.
- In case, if **nfServices** is not required to be mapped with any particular location type, then configure the value of **nfServices** as '*'. This indicates that **locationType** mapped all NF services of that "**target-nf-type**".
- '*' value record for "**target-nf-type**" is used when no configuration is found corresponding to **service-names** attribute of discovery query.
- If "**service-names**" attribute is unavailable in the discovery query, then '*' value is used for **locationType** selection.
- "**service-names**" of discovery search query can be subset of configured **nfServices** attribute.
For Example:
 - If **sm_policy** is the only **service-names** present in discovery query and configured value for **nfServices** are **sm_policy**, **bdt_policy**. Then this configuration is used for **locationType** selection.
 - If **am_policy**, **nudr_policy** are the **service-names** present in discovery query and configured value for **nfServices** are **am_policy**, **nudr_policy**, **xyz_policy**. Then this configuration is used for **locationType** selection.
- Same **nfServices** cannot be mapped to different location type.
For example:
One **locationType** say **Category-N** is already mapped to **nfServices** with value '**sm_policy**' with **nfType** as '**PCF**', then **sm_policy** (individual or with group of NF services) cannot be mapped to another location type for '**PCF**'.
- In case, the **service-names** attribute of search query has multiple **nfServices** but in configured **nfServices** attribute (individual or with group of NF services) are mapped to different **locationType** then '*' value record for **target-nf-type** is used for location type selection.
- Maximum 100 **locationTypeMapping** values can be configured.

Sample locationTypeMapping attribute value

```
"locationTypeMapping": [{
  "nfType": "PCF",
  "nfServices": ["am_policy", "bdt_policy"],
  "locationType": "Category-x"
},
{
  "nfType": "PCF",
  "nfServices": ["sm_policy"],
  "locationType": "Category-N"
},
{
```

```

        "nfType": "PCF",
        "nfServices": ["*"],
        "locationType": "Category-S"
    },
    {
        "nfType": "AMF",
        "nfServices": ["*"],
        "locationType": "Category-S"
    }
]

```

3. Configure the preferredLocationDetails corresponding to locationType selected and preferred-locality. The preferredLocation attribute defines the preferred-locality (derived from discovery search query) and locationType selected from the locationTypeMapping attribute maps to a preferredLocationDetails.

Note

- Maximum 650 preferredLocationDetails values can be configured.
- Different priorities can be configured for preferred locations.
- preferredLocation attribute for this configuration is mapped to preferred-locality (derived from discovery search query).
- targetLocationType attribute for this configuration is mapped to locationType selected from locationTypeMapping attribute.
- Corresponding to preferredLocation and targetLocationType attributes, targetPreferredLocations can be configured. targetPreferredLocations are defined by operator.
- targetPreferredLocations attribute can have upto 3 target preferred locations.
- priority is assigned to targetPreferredLocations. There cannot be same priority to different targetPreferredLocations.
- targetPreferredLocations can be same as preferredLocation attribute value.
- In case the location attribute in targetPreferredLocations is a set of location, then configure the locationSets attribute:
 - Maximum of 255 locationSets can be configured.
 - Length of the location name can be in the range of 5 to 100 characters.
 - Maximum of 10 locations can be configured.

Sample preferredLocationDetails attribute value

```

"preferredLocationDetails": [{
    "preferredLocation": "Azusa",
    "targetLocationType": "Category-x",
    "maxNFProfilesFromFirstMatchLoc": 0,
    "targetPreferredLocations": [{
        "priority": 1,
        "location": "Azusa"
    }]
}]

```

```

        }, {
            "priority": 2,
            "location": "Vista"
        }, {
            "priority": 3,
            "location": "Ohio"
        }
    ]
}, {
    {
        "preferredLocation": "Azusa",
        "targetLocationType": "Category-y",
        "maxNFProfilesFromFirstMatchLoc": 0,
        "targetPreferredLocations": [{
            "priority": 1,
            "location": "RKL"
        }, {
            "priority": 2,
            "location": "CSP"
        }, {
            "priority": 3,
            "location": "West-Region-Edge-Set01"
        }
    ]
}
],
"locationSets": [
    {
        "locationSetName" : "West-Region-Edge-Set01",
        "locations": ["LA", "SF0"]
    }
]
]]

```

4.40.2.3 Limiting the Number of Producers Based on NF Set Ids

"Limiting the Number of Producers Based on NF Set Ids" feature is a supplement to the **"Extended Preferred Locality"** feature.

In the **Extended Preferred Locality** feature, if there are more number of producers that are matching in each location (primary, secondary, tertiary), then NRF potentially returns all the matching producer NFs. For Example, If each location is having 10 matching producer, NRF ends up in sending 30 producers in discovery response. This results in returning all the 30 producers in a message being too long which ends up in not using the network resources efficiently.

To enhance the producer selection, NRF supports to limit the number of producers by using `nfSetIdList` as follows:

- After NF profile selection is done based on the extended preferred locality logic, from the first matching location, only a limited number of NF profile will get selected based on the configuration attribute **"Maximum number of NF Profiles from First Matching Location."** The first matching location is the location where the first set of matching producers are found from the Preferred Locality Triplet.
- From the remaining locations, only those producers will be shortlisted whose `nfSetIdList` matches with the NF Set Ids of the first matching location's producers (after limiting feature is applied). As these producers can be used as alternate producers during failover scenarios.

In case of the following scenarios, NRF fallbacks to the "**Extended Preferred Locality**" feature from the "**Limiting the Number of Producers Based on NF Set Ids**" feature.

- if the value of the **Maximum number of NF Profiles from First Matching Location** attribute is configured as 0.
- if any one of the NF profiles from the first matching location after limiting the profiles, does not have the `nfSetIdList` attribute (that is the profiles are registered without NF Set Ids).

Note

- It is recommended to enable this feature only if NFs are registered with the `nfSetIdList` attribute.
- In upgrade scenarios, if an extended preferred locality is configured, then for each preferred locality attribute the value of **Maximum number of NF Profiles from First Matching Location** attribute will become 0, which disables the feature by default.

Managing Limiting the Number of Producers Based on NF Set Ids

Enable

For enabling the features, see below:

- **Enable using REST API:** Enabling **Limiting the Number of Producers Based on NF Set Ids** feature: Set the value of the `maxNFProfilesFromFirstMatchLoc` field to a value greater than 0 in `{apiRoot}/nrf-configuration/v1/nfDiscoveryOptions` configuration API. For more information about the API path, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Enable using CNC Console:** Enabling **Limiting the Number of Producers Based on NF Set Ids** feature: Set the value of **Maximum number of NF Profiles from First Matching Location** attribute to a number greater than 0 under **Preferred Location Details** on the NF Discovery Options page. For more information about enabling the feature using CNC Console, see [NF Discovery Options](#).

Note

Extended Preferred Locality feature should be enabled prior enabling the Limiting the Number of Producers Based on NF Set Ids feature.

Configure

You can configure the Limiting the Number of Producers Based on NF Set Ids features using REST API or CNC Console:

- **Configure using REST API:** Perform the feature configurations in the `{apiRoot}/nrf-configuration/v1/nfDiscoveryOptions` URI as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Configure using CNC Console:** Perform the feature configurations as described in [NF Discovery Options](#).

Observe

The following metrics are added for the **Limiting the Number of Producers Based on NF Set Ids** feature:

- ocnrf_nfDiscover_limiting_profile_count_for_nfSet_total
- ocnrf_nfDiscover_limiting_profiles_not_applied_for_nfSet_total

For more information on metrics, see [NRF Metrics](#) section.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.40.2.3.1 Discovery Processing for Limiting Number of Producers Based on NF Set Ids

Discovery query is processed with respect to Limiting the Number of Producers Based on NF Set Ids feature is as follows:

1. Perform the same steps with the discovery processing as mentioned in [Discovery Processing for Extended Preferred Locality Feature](#).
2. When the attribute **Maximum number of NF Profiles from First Matching Location** is configured to a value greater than 0, NRF allows the consumer NF to select the top "n" number of producers from the first preferred locality. And from the remaining preferred localities, only those producers are selected that have matching nfsetIdList of the top "n" producers selected from the first preferred locality.

4.40.2.3.2 Configuring Limiting Number of Producers Based on NF Set Ids

This section describes about Configuring Limiting Number of Producers Based on NF Set Ids feature.

1. Perform the same steps with the configuration as mentioned in [Configuring Extended Preferred Locality](#).
2. Configure the maxNFProfilesFromFirstMatchLoc attribute in the preferredLocationDetails to limit the number of producers based on NF Set Ids from the first matching location in a preferred locality triplet. If the value of maxNFProfilesFromFirstMatchLoc attribute is greater than 0, then the feature is enabled. Sample output:"maxNFProfilesFromFirstMatchLoc":0, indicates feature is disabled.

```
"preferredLocationDetails": [{
    "preferredLocation": "Azusa",
    "targetLocationType": "Category-x",
    "maxNFProfilesFromFirstMatchLoc":0,
    "targetPreferredLocations": [{
        "priority": 1,
        "location": "Azusa"
    }], {
```

```

        "priority": 2,
        "location": "Vista"
    }, {
        "priority": 3,
        "location": "Ohio"
    }
  ],
  {
    "preferredLocation": "Azusa",
    "targetLocationType": "Category-y",
    "maxNFProfilesFromFirstMatchLoc": 0,
    "targetPreferredLocations": [{
      "priority": 1,
      "location": "RKL"
    }, {
      "priority": 2,
      "location": "CSP"
    }, {
      "priority": 3,
      "location": "West-Region-Edge-Set01"
    }
  ]
},
"locationSets": [
  {
    "locationSetName" : "West-Region-Edge-Set01",
    "locations": ["LA", "SF0"]
  }
]

```

4.40.3 NFService Priority Update

This feature is an extension of the existing functionality of the Preferred Locality Feature Set. For more details, see [Preferred Locality](#) and [Extended Preferred Locality](#).

With this feature, NRF now updates the NFService level priority along with the NFProfile level priority while processing the discovery query. NRF updates the following:

- NFProfile level priority considering the lowest NFProfile level priority of NFProfiles
- NFService level priority considering the lowest NFService level priority of all NFServices

Impact on Preferred Locality feature

For the **Preferred Locality** feature, there can be two groups of NFProfiles. One group contains NFProfiles with locality attribute matching preferred-locality attribute query parameter and another group with the rest of the NFProfiles with non-matching preferred-locality query parameter.

With this NF Service priority feature, NFProfile level priority is updated for the second group using the Lowest NFProfile Level Priority value of the first group. Similarly, NFService level priority is updated for the second group using the Lowest NFService Level Priority value among all the NFServices present in the first group.

Priority Value Calculation:

- NFProfile Level Priority = Actual NFProfile Level Priority Value + Lowest NFProfile Level Priority of the first group + Offset Value (that is, 1)

- $\text{NFService Level Priority} = \text{Actual NFService Level Priority Value} + \text{Lowest NFService Level Priority among all the NFServices present in the first group} + \text{Offset Value (that is, 1)}$

Impact on Extended Preferred Locality feature

For the **Extended Preferred Locality** feature, there can be multiple groups of NFProfiles depending on the Extended Preferred locality feature configuration. The first group contains NFProfiles with locality attribute configured with the first matching location/location set. And subsequent group(s) can be present depending upon the configured locations and the matching NFProfiles.

With NF Service priority feature, NFProfile level priority is updated from the second group onwards using the Lowest NFProfile Level Priority of the previous group. Similarly, NFService level priority is updated from the second group onwards using the Lowest NFService Level Priority among all the NFServices of its previous group.

Priority Value Calculation:

- $\text{NFProfile Level Priority} = \text{Actual NFProfile Level Priority Value} + \text{Lowest NFProfile Level Priority of the previous group} + \text{Offset Value (that is, 1)}$
- $\text{NFService Level Priority} = \text{Actual NFService Level Priority Value} + \text{Lowest NFService Level Priority among all the NFServices present in the previous group} + \text{Offset Value (that is, 1)}$

In case, priority or load is not present in a NFService/NFProfile, then the values are considered as below:

- For NFProfile level, if priority or load values are not present, then the configured defaultPriority and defaultLoad values are considered respectively. Similarly, for NFService level, if priority or load values are not present, then the NFProfile level priority or load values are considered respectively. However, if priority or load values are not present in NFProfile as well, then the configured defaultPriority and defaultLoad values are considered respectively.
For more information about these parameters, see [General Options](#) section.
- In case, priority or load attributes are not present in the registered NFProfile or its NFServices, then the final calculated value is set based on the configured defaultPriorityAssignment and defaultLoadAssignment flags respectively.
For more information about these parameters, see [General Options](#) section.

This feature can be enabled or disabled using the servicePriorityUpdateFeatureStatus flag in the `{apiRoot}/nrf-configuration/v1/nfDiscoveryOptions` API or **Service Priority Update Feature Status** flag in the NF Discovery Options page in the CNC Console.

Managing NFService Priority Update

Enable

To enable the features, see below:

- **Enable using REST API:** Set the value of the servicePriorityUpdateFeatureStatus to ENABLED in the `{apiRoot}/nrf-configuration/v1/nfDiscoveryOptions` configuration API. For more information about the API, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Enable using CNC Console:** Set the value of the **Service Priority Update Feature Status** to **ENABLED** on the **NF Discovery Options** page. For more information about enabling the feature using CNC Console, see [NF Discovery Options](#).

Configure

You can configure the NFService Priority Update feature using REST API or CNC Console:

- **Configure using REST API:** Perform the feature configurations as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

Sample configuration:

```
"profilesCountInDiscoveryResponse": 3,  
"discoveryResultLoadThreshold": 0,  
"servicePriorityUpdateFeatureStatus": "ENABLED"
```

- **Configure using CNC Console:** Perform the feature configurations as described in [NF Discovery Options](#).

Observability

Metrics

There are no new metrics added to this feature.

Alerts

There are no alerts added or updated for this feature.

KPIs

There are no new KPIs related to this feature.

Maintain

If you encounter alerts at system or application levels, see the [NRF Alerts](#) section for the resolution steps.

In case the alerts still persist, perform the following:

1. **Collect the logs:** For more information on collecting logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.40.3.1 Discovery Processing in NFService Priority Update with preferred-locality

NRF receives the discovery request with the preferred-locality query parameter. It checks the status of **servicePriorityUpdateFeatureStatus** feature flag. If this feature flag is enabled, perform the following steps:

1. Filter out the NF Profiles matching the preferred-locality attribute of NFDISCOVER service operation query.
 - With preferred locality feature, the NF Profiles can be filtered into two groups:
 - the matching location group
 - the non-matching location group
 - With the Extended Preferred Locality feature enabled, the NF Profiles can be filtered into four groups:
 - the first matching location group
 - the second matching location group

- the third matching location group
 - the non-matching location group
- 2. Order the NF Profiles based on both priority and load values of NFService level and/or NF Profile level depending on the scenarios where Extended Preferred Locality feature is enabled or disabled.
- 3. Modify and Set the priority for both NFService and NFProfile level, based on the offset calculation logic. For more information, regarding the priority value calculation and offset calculation logic see the priority value calculation in [NFService Priority Update](#).
- 4. NRF continues with the rest of the discovery flow.

If the feature is disabled, NRF continues with the existing flow skipping the above steps.

4.40.3.2 Configuring NFService Priority Update

If the value of the `servicePriorityUpdateFeatureStatus` is ENABLED, NRF updates the NFService level priority along with the NFProfile level priority. NRF updates the NFProfile level priority considering the lowest NFProfile level priority of NFProfiles based upon specific preferred locality features and NFService level priority considering the lowest NFService level priority of NFServices based upon specific preferred locality features.

By default, the value of this `servicePriorityUpdateFeatureStatus` is DISABLED.

Enable this feature in the `{apiRoot}/nrf-configuration/v1/nfDiscoveryOptions` API.

```
"servicePriorityUpdateFeatureStatus": "ENABLED"
```

4.41 Roaming Support

NRF supports the 3GPP defined inter-PLMN routing for NRF specific service operations like NFDDiscover, AccessToken, NFStatusSubscribe, NFStatusUnSubscribe, and NFStatusNotify. To serve 5G subscribers roaming in a non-home network also known as visited or serving networks, consumer network functions in visited or serving networks need to access the NF Profiles located in the home network of 5G subscribers.

In this process, the consumer NFs sends the NRF specific service operations towards NRF which is in visited or serving network. Then, the visited or serving NRF routes these service operations towards the home NRF through SEPPs in visited or serving and home networks. NFDDiscover, AccessToken, NFStatus Subscribe, and NFStatus UnSubscribe service operations are routed from visited or serving NRF to home NRF. NFStatusNotify service operation is initiated by the home network NRF towards consumer NFs residing in visited or serving network for inter-PLMN specific subscriptions.

Note

XFCC specific validations are not supported for inter-PLMN service operations.

3GPP specific attributes defined for different service operations plays a deciding role during inter-PLMN message routing.

There are two important terminology used in roaming mechanism:

- vNRF - visited or serving NRF when subscribers are roaming in non-home network.
- hNRF - NRF in home network of the subscribers.

Table 4-31 3GPP Attributes

Attribute Name	Service Operation	Details
requester-plmn-list	NFDiscover	If the requester-plmn-list matches with NRF PLMN list, it means that the NRF will function as vNRF. If the requester-plmn-list not matches with NRF PLMN list, it means that the NRF will function as hNRF.
target-plmn-list	NFDiscover	When an NRF is vNRF, the target-plmn-list becomes a mandatory attribute to decide the target PLMN. In case the NRF is hNRF, this value can be optional but if it is present, then the value matches with hNRF PLMN.
requesterPlmnList	AccessToken	If the requesterPlmnList matches with the NRF PLMN list, it means that the NRF will function as vNRF. If the requesterPlmnList does not match with the NRF PLMN list, it means that the NRF will function as hNRF.
requesterPlmn	AccessToken	If the requesterPlmn matches with the NRF PLMN list, it means that the NRF will function as vNRF. If the requesterPlmn does not match with the NRF PLMN list, it means that the NRF will function as hNRF. In case both the requesterPlmnList and requesterPlmn attributes are present, then combined PLMN values are used.
targetPlmn	AccessToken	When an NRF is vNRF, the targetPlmn is considered to decide the target PLMN. In case the NRF is hNRF, this value must match with the hNRF PLMN.
nfType	AccessToken	When an NRF is hNRF, then this value is used for NRF NfAccessToken Authorization Feature. But in case this value is not present, then the user-agent header is used. User-Agent header is present with 3GPP defined nfType. In case this header is not present, see userAgentMandatory attribute for more details.
reqPlmnList	NFStatusSubscribe	If the reqPlmnList matches with the NRF PLMN list, it means that the NRF will function as vNRF. If the reqPlmnList does not match with the NRF PLMN list, it means that the NRF will function as hNRF.

Table 4-31 (Cont.) 3GPP Attributes

Attribute Name	Service Operation	Details
nfStatusNotificationURI	NFStatusSubscribe	In case reqPlmnList attribute is not present in Subscription data, then NRF will check that nfStatusNotificationURI is in inter-PLMN format which is 5gc.mnc(\d\d\d).mcc(\d\d\d).3gppnetwork.org format. Sample: 5gc.mnc310.mcc314.3gppnetwork.org In case nfStatusNotificationURI is in this format, then this is used to find the role of NRF. However, if reqPlmnList is present, then this attribute have to be in inter-PLMN format. This will help when hNRF generate the notification towards visited or serving network.
plmnId	NFStatusSubscribe	When an NRF is vNRF, then the plmnId is considered to decide the target PLMN. In case the NRF is hNRF, this value can be optional but if it is present, then the value shall match with the hNRF PLMN.
subscriptionId	NFStatusSubscribe, NFStatusUnSubscribe	subscriptionId also plays an important role during roaming cases. Subscription Id generated by hNRF will have 'roam' keyword prefixed in beginning of subscriptionId. It helps to identify the inter-PLMN request for subsequent service operations NFStatusSubscribe - Update and NFStatusUnSubscribe.

Enable

You can enable the Roaming Options feature using REST API or CNC Console.

- **Enable using REST API:** Set featureStatus to ENABLED in **Roaming Options** configuration API. For more information about API path, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Enable using CNC Console:** Set **Feature Status** to **ENABLED** on the Roaming Options page. For more information about enabling the feature using CNC Console, see [Roaming Options](#).

Note

Before enabling the featureStatus attribute, ensure that the corresponding configurations are completed.

Configure

You can configure the Roaming Options using REST API or CNC Console:

- **Configure NRF Roaming Options using REST API:** Perform the feature configurations as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

- Create or update {apiRoot}/nrf/nf-common-component/v1/egw/peerconfiguration. Update host with SEPP host.

```
curl -v -X PUT "http://10.75.226.126:30747/nrf/nf-common-
component/v1/egw/peerconfiguration" -H "Content-Type: application/
json" -d @peer.json
```

peer.json sample:-

```
[
  {
    "id": "peer1",
    "host": "sepp-stub-service",
    "port": "8080",
    "apiPrefix": "/",
  }
]
```

- Create or update the {apiRoot}/nrf/nf-common-component/v1/egw/peerconfiguration to assign these peers.
- Create or update {apiRoot}/nrf/nf-common-component/v1/egw/sbiroutingerrorcriteriasets.
- Create or update {apiRoot}/nrf/nf-common-component/v1/egw/sbiroutingerroractionsets.
- Update the {apiRoot}/nrf/nf-common-component/v1/egw/routesconfiguration as mentioned below:

```
curl -v -X PUT "http://10.75.226.126:32247/nrf/nf-common-
component/v1/egw/routesconfiguration" -H "Content-Type: application/
json" -d @header.json
```

sample header.json:-

```
[
  {
    "id": "egress_sepp_proxy1",
    "uri": "http://localhost:32068/",
    "order": 0,
    "sbiRoutingConfiguration": {
      "enabled": true,
      "peerSetIdentifier": "set0"
    },
    "httpRuriOnly": true,
    "httpsTargetOnly": true,
    "predicates": [{
      "args": {
        "header": "OC-MCCMNC",
        "regexp": "310014"
      },
      "name": "Header"
    }],
    "filters": [{
      "name": "SbiRouting"
    }, {
      "args": {
        "retries": "3",

```



```

        "methods": "GET, POST, PUT, DELETE, PATCH",
        "statuses": "BAD_REQUEST, INTERNAL_SERVER_ERROR,
BAD_GATEWAY, NOT_FOUND, GATEWAY_TIMEOUT",
        "exceptions":
"java.util.concurrent.TimeoutException, java.net.ConnectException, java.ne
t.UnknownHostException"
    },
    "name": "SBIReroute"
  }, {
    "args": {
      "name": "OC-MCCMNC"
    },
    "name": "RemoveRequestHeader"
  }],
  "metadata": {
  }
},
{
  "id": "default_route", "uri": "egress://
request.uri", "order": 100, "predicates": [{"args": {"pattern": "/"
**"}}, {"name": "Path"}]}
]

```

For more information about the routes configuration on different deployments, see [Egress Gateway Route Configuration for Different Deployments](#).

- **Configure NRF Roaming Options using CNC Console:** Perform the feature configurations as described in [Roaming Options](#).

Observe

Following are the NRF Roaming Options specific metrics filters:

- ocnrf_roaming_nfStatusSubscribe_rx_requests_total
- ocnrf_roaming_nfStatusSubscribe_tx_responses_total
- ocnrf_roaming_nfStatusSubscribe_tx_requests_total
- ocnrf_roaming_nfStatusSubscribe_rx_responses_total
- ocnrf_roaming_nfStatusSubscribe_rx_requests_total
- ocnrf_roaming_nfStatusSubscribe_tx_responses_total
- ocnrf_roaming_nfStatusSubscribe_tx_requests_total
- ocnrf_roaming_nfStatusSubscribe_rx_responses_total
- ocnrf_roaming_nfStatusUnSubscribe_rx_requests_total
- ocnrf_roaming_nfStatusUnSubscribe_tx_responses_total
- ocnrf_roaming_nfStatusUnSubscribe_tx_requests_total
- ocnrf_roaming_nfStatusUnSubscribe_rx_responses_total
- ocnrf_roaming_nfDiscover_rx_requests_total
- ocnrf_roaming_nfDiscover_tx_responses_total
- ocnrf_roaming_nfDiscover_tx_requests_total
- ocnrf_roaming_nfDiscover_rx_responses_total
- ocnrf_roaming_accessToken_rx_requests_total

- ocnrf_roaming_accessToken_tx_responses_total
- ocnrf_roaming_accessToken_tx_requests_total
- ocnrf_roaming_accessToken_rx_responses_total
- ocnrf_roaming_nfStatusNotify_tx_requests_total
- ocnrf_roaming_nfStatusNotify_rx_responses_total
- ocnrf_roaming_jetty_latency_seconds_[suffix]

For more information on NRF Roaming Options metrics and KPIs, see [Roaming Support Metrics](#), and [NRF KPIs](#) sections.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.42 EmptyList in Discovery Response

NRF checks the NFStatus of the target-nf-type in the NRF state data. It identifies whether the current status of the matching NFProfile is SUSPENDED.

If the NFStatus of all matching profiles is SUSPENDED, then NRF modifies the NFStatus of these profiles as "REGISTERED". The modified NFStatus is sent in the discovery response with a shorter validity period so that a call can be established. Upon expiry of the validityPeriod, the Requester NF must rediscover the target NF.

Note

Change in the NFStatus of target-nf-type to REGISTERED is not stored in the database.

In case forwarding is ENABLED for a discovery request, NRF forwards the request to identify if there are any matching profiles in another region:

- If matching profiles are found, then that profile is sent in the discovery response.
- If the NFStatus of all the matching profiles are in SUSPENDED state, then these profiles are sent in the discovery response as REGISTERED with a shorter validity period.

Note

Once the profile moves from SUSPENDED state to NOT AVAILABLE state (after 7 days), NRF will start choosing the NFProfile containing backupInfoAmfFailure instead of the NFProfile containing backupInfoAmfRemoval.

Table 4-32 Discovering NF Profiles for AMF with Guami

Scenario	Profile A that contains match with the guami attribute.	Profile B that contains match with the backupInfoAmfFailure attribute	Profile C that contains match with the backupInfoAmfRemoval attribute	Expected Discovery Response	Notes
-	<pre>{ "guami": { "plmnId": { "mcc": "594", "mnc": "75" }, "amfId": "947d18" } }</pre>	<pre>{ "backupInfoAmfFailure": [{ "plmnId": { "mcc": "594", "mnc": "75" }, "amfId": "947d18" }] }</pre>	<pre>{ "backupInfoAmfRemoval": [{ "plmnId": { "mcc": "594", "mnc": "75" }, "amfId": "947d18" }] }</pre>	-	-
1	REGISTERED	NA	NA	Profile A	Profile A is registered and matches the guami.
2	SUSPENDED PROBABLE_SUSPENDED	REGISTERED	NA	Profile B	Profile B acts as the alternative to SUSPENDED Profile A

Table 4-32 (Cont.) Discovering NF Profiles for AMF with Guami

Scenario	Profile A that contains match with the guami attribute.	Profile B that contains match with the backupInfoAmfFailure attribute	Profile C that contains match with the backupInfoAmfRemoval attribute	Expected Discovery Response	Notes
3	SUSPENDED (and NOT AVAILABLE) PROBABLE_SUSPENDED	SUSPENDED PROBABLE_SUSPENDED UNDISCOVERABLE DEREGISTERED NOT AVAILABLE	REGISTERED	Profile C	There is no alternate REGISTERED profile for the SUSPENDED Profile matching the backupInfoAmfFailure. Hence the alternate for NOT AVAILABLE Profiles is Profile B.
4	SUSPENDED (and NOT AVAILABLE) PROBABLE_SUSPENDED	SUSPENDED PROBABLE_SUSPENDED UNDISCOVERABLE DEREGISTERED NOT AVAILABLE	SUSPENDED PROBABLE_SUSPENDED UNDISCOVERABLE DEREGISTERED NOT AVAILABLE	Profile A	No Alternate REGISTERED Profiles for SUSPENDED and NOT AVAILABLE profile are present. Hence empty response feature is applied and Profile A is selected.
5	UNDISCOVERABLE DEREGISTERED NOT AVAILABLE	NA	REGISTERED	Profile C	Profile C is the alternate to NOT AVAILABLE profiles.

Table 4-32 (Cont.) Discovering NF Profiles for AMF with Guami

Scenario	Profile A that contains match with the guami attribute.	Profile B that contains match with the backupInfoAmfFailure attribute	Profile C that contains match with the backupInfoAmfRemoval attribute	Expected Discovery Response	Notes
6	UNDISCOVERABLE DEREGISTERED NOT AVAILABLE	NA	SUSPENDED PROBABLE_SUSPENDED	Profile C	There are no REGISTERED profiles or alternates for it. Empty response feature is applied on Profile C.
7	UNDISCOVERABLE DEREGISTERED NOT AVAILABLE	NA	UNDISCOVERABLE DEREGISTERED NOT AVAILABLE	NO Profile	There are no alternate REGISTERED profiles for SUSPENDED or NOT AVAILABLE profiles. Empty List feature can't be applied to Profile A or Profile C as they are not in suspended state. Hence no profile is sent in discovery response.
8	Few: SUSPENDED Few: DEREGISTERED or UNDISCOVERABLE	REGISTERED	SUSPENDED or PROBABLE_SUSPENDED or DEREGISTERED or NOT AVAILABLE or UNDISCOVERABLE	Profile B	Profile B acts as the alternative to SUSPENDED Profile A

Table 4-32 (Cont.) Discovering NF Profiles for AMF with Guami

Scenario	Profile A that contains match with the guami attribute.	Profile B that contains match with the backupInfoAmfFailure attribute	Profile C that contains match with the backupInfoAmfRemoval attribute	Expected Discovery Response	Notes
9	Few: SUSPENDED Few: DEREGISTERED or UNDISCOVERABLE	SUSPENDED or PROBABLE_SUSPENDED or DEREGISTERED or NOT AVAILABLE or UNDISCOVERABLE	REGISTERED	Profile C	There is no alternate REGISTERED Profile for SUSPENDED profiles. Profile C is REGISTERED alternate for NOT AVAILABLE Hence Considering Profile C.
10	Few: SUSPENDED Few: DEREGISTERED or UNDISCOVERABLE	SUSPENDED PROBABLE_SUSPENDED	SUSPENDED or PROBABLE_SUSPENDED or DEREGISTERED or NOT AVAILABLE or UNDISCOVERABLE	Profile A	There are no REGISTERED alternates for any state. Hence empty response feature is applied on Profile A.

Managing EmptyList Feature

Enable

You can enable EmptyList feature using the REST API or CNC Console.

- **Enable using REST API:** Set emptyListFeatureStatus to ENABLED in **nfDiscovery Options** configuration API. Also, set featureStatus to ENABLED to configure EmptyList for a particular nfType. For more information about API path, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Enable using CNC Console:** Set **Feature Status** to **ENABLED** for Empty Discovery Response. Also, set **Feature Status** to **ENABLED** to configure EmptyList for a particular nfType. For more information about enabling the feature using CNC Console, see [NF Discovery Options](#).

Observe

Metrics

[ocnrf_nfDiscover_emptyList_total](#) metric is added for the EmptyList feature.

Alert

[OcnrfNFDISCOVERYEmptyListObservedNotification](#) alert is added for the EmptyList feature.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.43 Overload Control

Overload occurs when 100% of the planned capacity is exhausted. It can be due to uneven distribution of traffic towards a given NRF service instance, network fluctuations leading to traffic bursts, or unexpected high traffic volume at any given point of time.

The Overload Control feature protects the system from getting overloaded due to unexpected surges in traffic, traffic failures, or high latency and maintains the overall health of NRF. The system needs to not only detect overload conditions but also protect against the same. Further, it needs to mitigate against and avoid the system from entering into an overload condition by taking necessary actions for recovering from overload. Using Ingress Gateway and Perf-Info microservices, NRF provides options to control network congestion and handle the overload scenarios.

NRF provides the following means for overload management:

- It provides a predefined set of threshold load levels.
- It monitors various overload indicators such as CPU utilization, pending message count, and failure message count.
- In case the threshold load level is breached for any overload indicator, enforce load shedding to protect the service.

The overload indicator for each service is monitored by the Overload Manager module in Perf-Info service. It performs overload calculations based on the following indicators:

- **CPU Utilization:** Perf-Info monitors the CPU utilization of each service by querying Prometheus for the metric 'cgroup_cpu_nanoseconds'.
- **Pending Message Count:** Ingress Gateway microservice monitors and maintains the number of messages pending to be processed by Ingress Gateway for each service. Perf-Info queries the Ingress Gateway microservice periodically to get the pending message count.
- **Failure Message Count:** Ingress Gateway microservice monitors the number of requests returning failure responses for each service. Perf-Info queries Ingress Gateway microservice periodically to get the failure message count.

Note

NRF has deprecated memory-based overload control as it is already covered by pending message count overload control.

The overload level is configured for the following NRF microservices:

- Registration
- Discovery
- AccessToken

Overload control is triggered if the threshold for one or more indicator is reached.

Perf-Info calculates the overload levels based on the values reported for each overload indicator and the configured thresholds for the overload indicator. If one or more overload indicators have breached their thresholds, the highest overload level is considered. For example, if the CPU utilization of the discovery microservice has crossed L2 threshold, and its pending message count has crossed L3 threshold, then the overload level is L3. The overload level is communicated to Ingress Gateway periodically to enforce load shedding. A configurable value is available for sampling interval as `ocPolicyMapping.samplingPeriod` based on which Ingress Gateway calculates the rate per service in the current sampling period and applies appropriate discard policies and actions in the subsequent sampling period.

The Ingress Gateway Overload Controller monitors all the service requests received against the overload control configuration. If the feature is enabled, Ingress Gateway computes the percentage of the service requests that should be discarded by using the rate of incoming requests per service for a configurable sampling period.

When Perf-Info reports that the service is in an overload state, Ingress Gateway matches the service requests to the configured service name and the configured discard policy for a particular service, and takes the appropriate action.

Note

When the percentage-based overload control discard policy is enabled, the number of requests to be dropped in the current sampling period is computed based on the configured percentage of requests that should be discarded and the "rate of requests outgoing of Ingress Gateway" in the previous sampling period for the service. Once the number of requests to be dropped in the current sampling period is computed, the Ingress Gateway does not drop all the new traffic to meet the discard count. Instead, Ingress Gateway decides if a request is to be discarded or not in a random way. If the random function returns the value as *true*, the request is discarded in the current sampling period with the discard action "RejectWithErrorCode". In a sampling period, the requests are discarded in a distributed way. The percentage dropped is not precisely the configured percentage because the number of requests to be dropped in the current sampling period is calculated based on the number of requests sent to the NRF discovery microservice in the previous sampling period and not based on the total requests received at Ingress Gateway.

Pod Level Traffic Rejections

Currently, NRF uses percentage-based discard for overload control. NRF rejects the traffic (configured percentage) with an error code when overload thresholds are breached.

Depending on the number of requests to be rejected, a token is fetched from a cache shared across all Ingress Gateway pods.

This approach has certain accuracy limitations, particularly in environments with:

- Higher number of minimum token request values
- Large number of Ingress Gateway pods
- Uneven traffic distribution across Ingress Gateway pods
- Low Transactions Per Second (TPS) traffic pattern

From Release 25.1.200 onwards, NRF rejects the incoming requests at pod level for percentage-based overload control by removing the dependency on cache-based coordination across pods. When the overload control level is breached, the number of requests to be rejected is calculated based on the requests received at each Ingress Gateway pod. This ensures a more accurate and consistent request rejection even in scenarios with low Transactions Per Second (TPS) and uneven traffic distribution.

Managing Overload Control Feature

Enable

You can enable Overload Control and Pod Level Traffic Rejections feature using the following Helm configuration:

1. Open the `ocnrf_custom_values_26.1.201.yaml` file.
2. Check the value of `global.performanceServiceEnable` parameter to true in `ocnrf_custom_values_26.1.201.yaml` file.
3. Check the value of `perf-info.overloadManager.enabled` parameter to true in `ocnrf_custom_values_26.1.201.yaml` file.
4. Check the value of `ingress-gateway.overloadControlLocalDiscardEnable` parameter is true in `ocnrf_custom_values_26.1.201.yaml` file for the pod level traffic rejections.
5. Configure the Prometheus URI in `perf-info.configmapPerformance.prometheus` in `ocnrf_custom_values_26.1.201.yaml` file.
6. Save the `ocnrf_custom_values_26.1.201.yaml` file.
7. Ensure that the autoscaling and apps apiGroups are configured under service account. For more information on configuration, see "Creating Service Account, Role and Role Binding Resources" section in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
8. Run `helm upgrade`, if you are enabling this feature after NRF deployment. For more information on upgrade procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Configure

- **Configure using REST API:** The Overload Control feature related configurations are performed at Ingress Gateway and Perf-Info. The following REST APIs must be configured for this feature:
 - `{apiRoot}/nrf/nf-common-component/v1/perfinfo/overloadLevelThreshold`
 - `{apiRoot}/nrf/nf-common-component/v1/igw/errorcodeprofiles`
 - `{apiRoot}/nrf/nf-common-component/v1/igw/ocdiscardpolicies`
 - `{apiRoot}/nrf/nf-common-component/v1/igw/ocpolicymapping`
 - `{apiRoot}/nrf/nf-common-component/v1/igw/errorcodeserieslist`

- {apiRoot}/nrf/nf-common-component/v1/igw/routesconfiguration

For more information about APIs, see "Common Services REST APIs" section in the *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*

- **Configure using CNC Console:** Perform the following configurations:
 - Create or update [Error Code Profile](#).
 - Create or update the [Overload Control Discard Policy](#).
 - Create or update [Overload Control Policy Mapping](#).
 - Create or update [Error Code Series](#).
 - Update the [Routes Configuration](#) as mentioned above.

Disable

1. Use {apiRoot}/nrf/nf-common-component/v1/igw/ocpolicymapping API and set enabled to **false** as follows:

```
{
  "enabled": false,
  "mappings": [
    {
      "svcName": "ocnrf-nfdiscovery",
      "policyName": "nfdiscoveryPolicy"
    },
    {
      "svcName": "ocnrf-nfaccessesstoken",
      "policyName": "nfaccessesstokenPolicy"
    },
    {
      "svcName": "ocnrf-nfregistration",
      "policyName": "nfregistrationPolicy"
    }
  ],
  "samplingPeriod": 200
}
```

2. Open the ocnrf_custom_values_26.1.201.yaml file.
3. Set perf-info.overloadManager.enabled parameter to false in ocnrf_custom_values_26.1.201.yaml file.
4. (Optional) Set global.performanceServiceEnable parameter to false in ocnrf_custom_values_26.1.201.yaml file.

Note

Perform this step only if you want to disable complete Perf-Info service.

5. Save the ocnrf_custom_values_26.1.201.yaml file.
6. Run `helm upgrade`, if you are disabling this feature after NRF deployment. For more information on upgrade procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Observe

Metrics

The following metrics are added for the Overload Control feature:

- `load_level`
- `service_resource_stress`
- `service_resource_overload_level`

For more information about the metric, see [Overload Control](#).

Alert

The following alerts are added for the Overload Control feature:

- [OcnrfOverloadThresholdBreachedL1](#)
- [OcnrfOverloadThresholdBreachedL2](#)
- [OcnrfOverloadThresholdBreachedL3](#)
- [OcnrfOverloadThresholdBreachedL4](#)

KPIs

There are no KPIs for this feature.

For more information on the entire list of KPIs, see [NRF KPIs](#).

Identifying Kubernetes Tag for Overload Control

The following procedure explains how to identify the tags for different Kubernetes version:

1. Log in to Prometheus.
2. Enter `cgroup_cpu_nanoseconds` query in Prometheus as shown:

Figure 4-24 Prometheus Search



3. In the response, search for the tags that contain the values for name of the container, NRF deployment namespace, and name of the NRF services:

Figure 4-25 Tag Search

```
cgroup_cpu_nanoseconds{app_kubernetes_io_component="Nrf_NFDiscovery", app_kubernetes_io_instance="nrf-perf1", app_kubernetes_io_managed_by="helm", app_kubernetes_io_name="nfdiscovery", app_kubernetes_io_part_of="ocnrf",
app_kubernetes_io_version="nfdiscovery-22.4.0.0.0", application="ocnrf", container="nfdiscovery", endpoint="oc-metrics", engine="nfdiscovery-22.4.0", helm_chart="nfdiscovery-22.4.0", instance="10.233.100.211:9090", job="ocnrf-nfdiscovery-ef-cnc-podmonitor",
microservice="nrf-perf1-nfdiscovery", mktgVersion="22.4.0.0.0", namespace="nrf-perf", pod="nrf-perf1-nfdiscovery-5b9d9b58-7c92r", pod_template_hash="5b9d9b58", security Istio IstioMode="istio", service Istio IstioCanonicalName="nfdiscovery",
service Istio IstioCanonicalRevision="nfdiscovery-22.4.0.0.0", vendors="Oracle"}
```

4. Use the tags from the response to configure the following parameters under Perf-Info microservice:
 - `tagNamespace`
 - `tagContainerName`
 - `tagServiceName`

For example, in the [Figure 4-25](#) image, namespace is the tag that contain the value for NRF deployment namespace. You need to set namespace as the value for `tagNamespace`

parameter in Perf-Info microservice. For more information on the parameters, see Perf-Info section in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.44 DNS NAPTR Update

In the 5G core networks, AMFs are added or removed dynamically for scalability or planned maintenance. NRF supports updating the Name Authority Pointer (NAPTR) record in Domain Name System (DNS) during Access and Mobility Functions (AMF) registration, update, and deregistration. The AMFs available within an AMF set is provisioned within NAPTR records in the DNS.

Note

- NRF considers the priority of the peer only for peer selection.
- This feature can be used in a NRF deployment where service-mesh is NOT present.

Enable

You must enable Artisan microservice for DNS NAPTR Update as follows:

1. Open the `ocnrf_custom_values_26.1.201.yaml` file.
2. Set `enableNrfArtisanService` to **true** to enable Artisan microservice.
3. Save the file.
4. Run Helm install. For more information about installation procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
5. If you are enabling this parameter after NRF deployment, run helm upgrade. For more information about upgrade procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
6. Set the DNS configuration as described in the "DNS NAPTR Configuration in Alternate Route Service" section of *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
7. After enabling Artisan microservice, enable DNS NAPTR Update Options using the REST API or CNC Console:

- **Enable using REST API:** Set `featureStatus` to `ENABLED` in `dnsNAPTRUpdateOptions` configuration API. For more information about API path, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Enable using CNC Console:** Set **Feature Status** to **ENABLED** on the DNS NAPTR Update Options page. For more information about enabling the feature using CNC Console, see [DNS NAPTR Update Options](#) Options.

Configure

You can configure DNS NAPTR Update options feature using the REST API or CNC Console.

- **Configure using REST API:** Perform the feature configurations as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Enable using CNC Console:** Perform the feature configurations as described in [DNS NAPTR Update Options](#) Options.

Observe

Metrics

Following metrics are added in the [DNS NAPTR Update Metrics](#) section:

- `ocnrf_dns_naptr_tx_requests_total`
- `ocnrf_dns_naptr_rx_responses_total`
- `ocnrf_dns_naptr_audit_tx_requests_total`
- `ocnrf_dns_naptr_audit_rx_responses_total`
- `ocnrf_dns_naptr_failure_rx_responses`
- `ocnrf_dns_naptr_round_trip_time_seconds_[suffix]`
- `ocnrf_dns_naptr_nfRegistration_tx_requests_total`
- `ocnrf_dns_naptr_nfRegistration_rx_responses_total`
- `ocnrf_dns_naptr_nrfAuditor_tx_requests_total`
- `ocnrf_dns_naptr_nrfAuditor_rx_responses_total`
- `ocnrf_dns_naptr_trigger_rx_requests_total`
- `ocnrf_dns_naptr_trigger_tx_responses_total`
- `oc_alternate_route_upstream_dns_request_timeout_total`

Alert

Following alerts are added for the DNS NAPTR Update feature:

- [OcnrfDnsNaptrFailureResponseStatus](#)
- [OcnrfAlternateRouteUpstreamDnsRetryExhausted](#)

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information about how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.

2. **Raise a service request:** See [My Oracle Support](#) for more information about how to raise a service request.

4.45 Notification Retry

NRF supports notification retry mechanism in case of the following scenarios in sending NfStatusNotify message. Based on the configured Notification Retry Profile, the NRF attempts to re-send the NfStatusNotify message on failures until the retry attempt is exhausted.

Following are the scenarios where retry can be performed:

- 4xx, 5xx Response Codes from notification callback server of the NF
- Connection Timeout between NRF Egress Gateway and notification callback server of the NF
- Request Timeout at NRF Egress Gateway

To enable notification request retry, the NRF Subscription microservice sends the NfStatusNotify message to the Egress Gateway. Upon failure of the request, Egress Gateway retries towards the notification callback server of the NF depending on the configuration. The retries will happen depending upon the response codes, exception list or timeout configuration in the nfManagementOptions.

Note

This is applicable only when direct routing is used for routing notification messages.

Managing Notification Retry Feature

Enable

You can enable the Notification Retry feature using the CNC Console or REST API.

- **Enable using REST API:** Set requestRetryDetails.featureStatus to **ENABLED** in NF Management Options configuration API. For more information about API path, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Enable using CNC Console:** Set **Feature Status** to **ENABLED** under **Notification Retry** section on the NF Management Options page. For more information about enabling the feature using CNC Console, see the [NF Management Options](#) section.

Configuring DefaultRouteRetry in Egress Gateway

After NRF upgrade from 23.3.x to 23.4.0, to enable notification retry feature, DefaultRouteRetry filter must be added to the Egress Gateway default route configuration.

Note

- The value of `nfsubscription.jetty.request.idleTimeout` parameter must be greater than total request timeout value (`totalRequestTimeout = ((retryCount+1) * requestTimeout) + 1000`) if notification retry feature is enabled. For more information about the parameter, see the "NF Subscription Microservice (nfsubscription)" section in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
- If attempts are done due to request timeouts, then it is possible that the backend services may timeout before all the attempts are completed. In order to avoid this, the backend `requestTimeout` attributes must be configured considering the total number of Egress reroutes and the Egress Gateway `requestTimeout`. The discovery `requestTimeout` values are configured using `nfdiscovery.jetty.request.timeout` parameter.

Following is the sample command to configure `DefaultRouteRetry`:

```
curl -X PUT "http://ocnrf-nrfconfiguration:8080/nrf/nf-common-component/v1/egw/routesconfiguration" -H 'Content-Type:application/json' -d '
[{
  "id": "default_route",
  "uri": "egress://request.uri",
  "order": 100,
  "filters": [{
    "name": "DefaultRouteRetry"
  }],
  "predicates": [{
    "args": {
      "pattern": "/*"
    },
    "name": "Path"
  }]
}]'
```

This updates the hostname and port of the `ocnrf-nrfconfiguration` and reflects the details to access the NRF configuration.

Note

To disable the notification retry, remove the DefaultRouteRetry filter from the {apiRoot}/nrf/nf-common-component/v1/egw/routesconfiguration, and retain the default_route configuration. This default_route configuration is available by default during fresh installation or upgrade. Following is the sample default route configuration:

```
{
  "id": "default_route",
  "uri": "egress://request.uri",
  "order": 100,
  "predicates": [{
    "args": {
      "pattern": "/*"
    },
    "name": "Path"
  }]
}
```

Configure

You can configure Notification Retry feature using the REST API or CNC Console.

- **Configure using REST API:** Perform the feature configurations as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Enable using CNC Console:** Perform the feature configurations as described in the [NF Management Options](#) section.

Observe**Metrics**

Following dimensions are added for ocnrf_nfStatusNotify_rx_responses_total metric in the [NRF NF Metrics](#) section:

- NotificationHostPort
- NumberOfRetriesAttempted

Alert

Following alerts are added for the Notification Retry feature:

- [OcnrfNotificationRetryExhausted](#)
- [OcnrfNotificationFailureOtherThanRetryExhausted](#)

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.

2. **Raise a service request:** See [My Oracle Support](#) for more information about how to raise a service request.

4.46 NRF Message Feed

NRF supports copying of both request and response HTTP messages routed through Ingress and Egress Gateways, to a Data Director.

Data Director receives the messages from Gateways with a correlation-id and feeds the data securely to an external monitoring system.

The correlation-id in the messages is used as a unique identifier for every transaction. If the request does not have the correlation-id, the Gateway generates the correlation-id and then passes it to Data Director.

Upon receiving an Ingress Gateway requests containing a correlation-Id, the NRF microservices includes this correlation-Id in following Egress Gateway requests that may be generated by the NRF based on the Ingress Gateway transaction:

- Inter-PLMN
- SLF
- Forwarding
- Notification

The communication between the Gateways and the Data Director is encrypted using TLS. Also, the Gateways authenticate itself to Data Director using Simple Authentication and Security Layer (SASL). For more information on configuring SASL, see [Configuring SASL](#).

Note

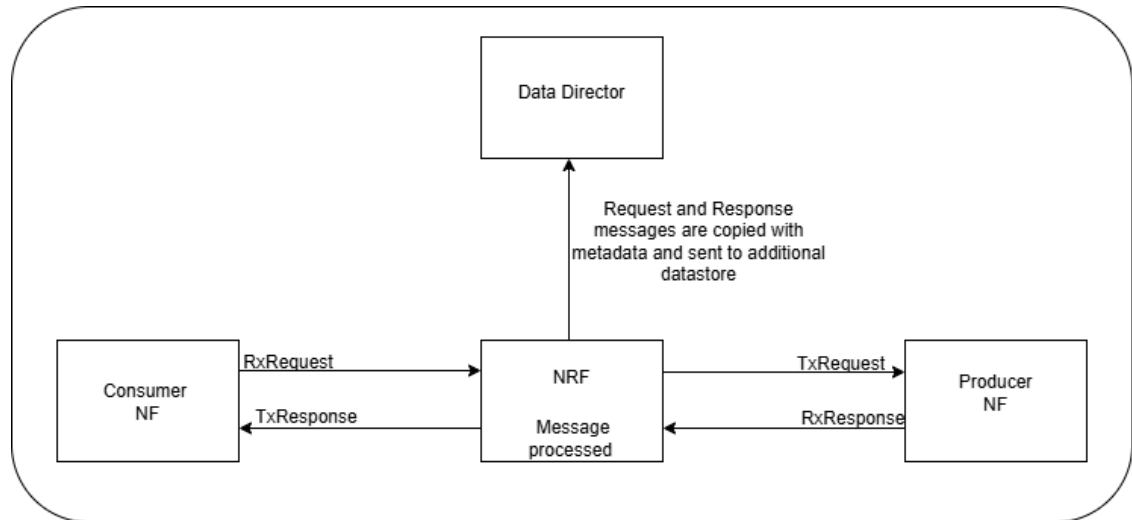
- NRF does not copy the following messages to Data Director:
 - NRF Discovery for SLF (Artisan to Discovery query for filling SLF Candidate List)
 - NRF Getting AccessToken for SLF (Egress Gateway Microservice to AccessToken for fetching Token for SLF request)
- This feature can be used in a NRF deployment where service-mesh is NOT present.

Additional Metadata Sent from NRF to Data Director

From release 25.1.200 onwards, along with the existing attributes, the following additional attributes about the message are also copied as part of the metadata list:

- source-ip
- destination-ip
- source-port
- destination-port
- pod-instance-id

Figure 4-26 Sending Metadata from NRF to Data Director



Request Messages:

- **RxRequest:** NRF receives a request sent by an external entity, such request is handled first by the Ingress Gateway microservice, it creates a message with additional metadata which is communicated to Data Director and the request is forwarded to a specific NRF backend microservice.
- **TxRequest:** NRF transmits a request to communicate an external entity, such request is sent by NRF backend microservice to Egress Gateway microservice, it creates a message with additional metadata which is communicated to Data Director and then forwards such requests to the specific address.

Response Messages:

- **RxResponse:** NRF receives a response from an external entity, such response is handled by Egress Gateway microservice, it creates a message with additional metadata which is communicated to Data Director and then it forwards the response.
- **TxResponse:** NRF transmits a response to an external entity, such response is sent by an NRF microservice to Ingress Gateway microservice, it creates a message with additional metadata which is communicated to Data Director and then sends back the response to the external entity which initiated the communication.

The following table defines the attributes of the message copy feed template:

Table 4-33 OracleNfFeed

Attribute	Data Type	Description
version	String	NRF Producer data model version.
metadata-list	MetaData	The metadata added by NRF is used by Data Director for filtering, aggregation, and routing.
header-list	Http2Header	The http2 message header.
5g-sbi-message	Http2Body	The http2 message body. Supported formats: • JSON • gzip data (content-encoding:gzip)

The following are the descriptions of the attributes that are copied to the Data Director as part of metadata:

Table 4-34 Attributes Copied to Data Director

Attribute name	Data type	Description	Source of data
correlation-id	String	This is a mandatory parameter. This is a unique identifier for the message (both request and response). The possibilities to populate this field in the metadata is as follows: - If the x-request-id header is present in the message, then the correlation-id will be filled with the x-request-id header value. - If this header is not present, then the following processing is done: - At Ingress Gateway Microservice: As soon as the message is received and the x-request-id header is not present, then Ingress Gateway generates a UUID, and set correlation-id to this UUID. Copy the message towards Data Director with correlation-id in metadata, but no x-request-id header. After copying the message to Data Director, this x-request-id header is added by Ingress Gateway to the incoming request. For response coming from the NRF backend microservice, Ingress Gateway microservice again picks the same UUID as set in the request from its context and set in the metadata. For response, it does not matter if the x-request-id header is present or not, as Ingress Gateway microservice already has it in its request context which is re-used while processing the corresponding response. - At Egress Gateway Microservice: After receiving a request from the NRFbackend microservice, if the x-request-id header is not present, Egress Gateway	x-request-id header or autogenerate.

Table 4-34 (Cont.) Attributes Copied to Data Director

Attribute name	Data type	Description	Source of data
		microservice first generates a UUID and set correlation-id metadata to this UUID, and also add the x-request-id header to the request message. Then it should copy the message to Data Director and then send it out on the wire. In the response received from outside NF, Egress Gateway microservice reuses the UUID it generated during the request and set it to correlation-id of response metadata. Egress Gateway microservice need not check or add the x-request-id header in the response.	
consumer-id	String	This is an optional parameter. 5G NF Instance ID of the NF originated the received message. For Ingress Gateway microservice, this is peer-nf-id For Egress Gateway microservice, this is self-nf-id For Notifications at Egress Gateway, this is peer-nf-id	peer-nf-id for Ingress Gateway is the NF-Instance ID extracted from the user-agent header if available in the request. User-Agent: <NF Type>-<NF Instance ID> <NF FQDN> self-nf-id will be extracted from Helm configurations (nfInstanceId).
producer-id	String	This is an optional parameter. 5G NF Instance ID of the next destination NF.	self-nf-id will be extracted from Helm configurations (nfInstanceId). Note: Egress Gateway doesn't populate producer-id.
consumer-fqdn	String	This is an optional parameter. It is the FQDN of the originating NF. For Ingress Gateway, this is peer-nf-fqdn. For Egress Gateway, this is self-nf-fqdn. For Notifications at Egress Gateway, this is peer-nf-fqdn.	peer-nf-fqdn for Ingress Gateway is the NF-FQDN extracted from user-agent header. User-Agent: <NF Type>-<NF Instance ID> <NF FQDN> self-nf-fqdn will be extracted from Helm configurations (nfFqdn). peer-nf-fqdn for Egress Gateway is extracted from 3gpp-sbi-target-apiroot header.

Table 4-34 (Cont.) Attributes Copied to Data Director

Attribute name	Data type	Description	Source of data
producer-fqdn	String	This is an optional parameter. FQDN of the destination NF For Egress Gateway, this is peer-nf-fqdn For Ingress Gateway, this is self-nf-fqdn For Notifications at Egress Gateway, this is self-nf-fqdn	peer-nf-fqdn is extracted from 3gpp-sbi-target-apiroot header. self-nf-fqdn will be extracted from Helm configurations (nfFqdn).
source-ip	String	This is an optional parameter. The IP address of the source NF that has sent the message.	NA
destination-ip	String	This is an optional parameter. The IP address of the target NF to which the message has to be sent.	NA
source-port	String	This is an optional parameter. The port of the source NF that receives response from the target NF. TCP port of the NF on the source IP address.	NA
destination-port	String	This is an optional parameter. The port of the target NF that sends response to the source NF. TCP port of the NF on the destination IP address.	NA
timestamp	String	This is a mandatory parameter. Identifies the timestamp when the message arrives at the producer. The timestamp format would be long and in nanoseconds.	The time at which the message is created with nanoseconds precision. Example: 1656499195571109210 nanoseconds
message-direction	String	This is a mandatory parameter. The direction of the message. This can be either incoming or outgoing.	Parameter to indicate whether a message is an ingress to or egress from NF. It can be indicated by putting the traffic feed trigger point name. • RxRequest (Ingress Request) • TxRequest (Egress Request) • RxResponse (Egress Response) • TxResponse (Ingress Response)
feed-source	FeedSource	This is a mandatory parameter. Information about the NF details. Note: The details are given in the following table Table 4-35 .	The details are given in the following table Table 4-35 .

Table 4-35 FeedSource

Attribute name	Data type	Description	Source of data
nf-type	String	This is a mandatory parameter. Identifies a type of producer NF.	The information from the Helm configuration from the parameter <code>global.nfTypeMsgCpy</code> . If the NFs haven't configured this, then unknown would be attached as a value.
nf-instance-id	String	This is an optional Parameter. Identifies a producer NF Instance.	The information from Helm configuration from the parameter <code>global.nfTypeMsgCpy</code> .
nf-fqdn	String	This is an optional Parameter. Identifies a producer NF FQDN.	The information from Helm configuration from the parameter <code>global.nfFqdn</code> .
pod-instance-id	String	This is an optional parameter. Identifies a producer NF's pod. This is the unique identifier or name assigned to the pod.	NA

Sample JSON file with message feed details for TxResponse transaction:

```
{
  "version": "1.0.0",
  "header-list": {
    "status": "201",
    "date": "Tue, 22 Apr 2025 01:56:52 GMT",
    "location": "http://nrf-18199363-ingressgateway:80/nrf-
instances/17380efd-6b77-4c9a-8ed9-f820371d842b",
    "content-type": "application/json",
    "nettylatency": "1745287012718",
    "requestmethod": "PUT"
  },
  "metadata-list": {
    "correlation-id": "7967c76c-15fb-4c3c-b324-c9f408698930",
    "producer-id": "6faf1bbc-6e4a-4454-a507-a14ef8e1bc5c",
    "producer-fqdn": "NRF-d5g.oracle.com",
    "timestamp": "1745287012820818431",
    "message-direction": "TxResponse",
    "source-ip": "xxx.xxx.xxx.xxx",
    "source-port": "8081",
    "destination-ip": "xxx.xxx.xxx.xxx",
    "destination-port": "51244",
    "feed-source": {
      "nf-type": "NRF",
      "nf-instance-id": "6faf1bbc-6e4a-4454-a507-a14ef8e1bc5c",
      "nf-fqdn": "NRF-d5g.oracle.com",
      "pod-instance-id": "nrf-18199363-ingressgateway-55bdb779c-clvwg"
    }
  },
  "5g-sbi-message": {
    "nfInstanceId": "17380efd-6b77-4c9a-8ed9-f820371d842b",
    "nfType": "AMF",
  }
}
```

```

"nfStatus": "REGISTERED",
"heartBeatTimer": 30,
"plmnList": [
  {
    "mcc": "310",
    "mnc": "14"
  }
],
"sNssais": [
  {
    "sd": "4ebaaa",
    "sst": 124
  },
  {
    "sd": "dc8aaa",
    "sst": 54
  },
  {
    "sd": "f46aaa",
    "sst": 73
  }
],
"nsiList": [
  "slice-1",
  "slice-2"
],
"fqdn": "AMF.d5g.oracle.com",
"interPlmnFqdn": "AMF-d5g.oracle.com",
"ipv4Addresses": [
  "xxx.xxx.xxx.xxx",
  "xxx.xxx.xxx.xxx",
  "xxx.xxx.xxx.xxx",

  "xxx.xxx.xxx.xxx"
],
"ipv6Addresses": [
  "2001:0db8:85a3:0000:0000:8a2e:0370:7334"
],
"capacity": 2000,
"load": 10,
"locality": "US East",
"amfInfo": {
  "amfSetId": "1ab",
  "amfRegionId": "23",
  "guamiList": [
    {
      "plmnId": {
        "mcc": "594",
        "mnc": "75"
      },
      "amfId": "947d18"
    },
    {
      "plmnId": {
        "mcc": "602",
        "mnc": "42"
      }
    }
  ]
}

```



```

    },
    "amfId": "5f3259"
  },
  {
    "plmnId": {
      "mcc": "135",
      "mnc": "19"
    },
    "amfId": "f37f1a"
  },
  {
    "plmnId": {
      "mcc": "817",
      "mnc": "80"
    },
    "amfId": "f7a026"
  }
],
"tailList": [
  {
    "plmnId": {
      "mcc": "641",
      "mnc": "72"
    },
    "tac": "ccc0"
  },
  {
    "plmnId": {
      "mcc": "594",
      "mnc": "45"
    },
    "tac": "77db"
  }
]
},
"nfServices": [
  {
    "serviceInstanceId": "fe137ab7-740a-46ee-aa5c-951806d77b0d",
    "serviceName": "namf-mt",
    "versions": [
      {
        "apiVersionInUri": "v1",
        "apiFullVersion": "1.0.0",
        "expiry": "2018-12-03T18:55:08.871Z"
      }
    ],
    "scheme": "http",
    "nfServiceStatus": "REGISTERED",
    "fqdn": "AMF.d5g.oracle.com",
    "interPlmnFqdn": "AMF-d5g.oracle.com",
    "apiPrefix": "",
    "defaultNotificationSubscriptions": [
      {
        "notificationType": "LOCATION_NOTIFICATION",
        "callbackUri": "http://somehost.oracle.com/callback-
uri"
      }
    ]
  }
]

```

```

        },
        {
            "notificationType": "N1_MESSAGES",
            "callbackUri": "http://somehost.oracle.com/callback-
uri",
            "n1MessageClass": "SM"
        },
        {
            "notificationType": "N2_INFORMATION",
            "callbackUri": "http://somehost.oracle.com/callback-
uri",
            "n2InformationClass": "NRPPa"
        }
    ],
    "allowedPlmns": [
        {
            "mcc": "904",
            "mnc": "47"
        },
        {
            "mcc": "743",
            "mnc": "47"
        },
        {
            "mcc": "222",
            "mnc": "23"
        },
        {
            "mcc": "521",
            "mnc": "11"
        }
    ],
    "allowedNfTypes": [
        "NRF",
        "AMF",
        "AUSF",
        "BSF",
        "UDM",
        "UDR",
        "PCF"
    ],
    "allowedNfDomains": [
        "oracle.com",
        "xyz.com"
    ],
    "allowedNssais": [
        {
            "sd": "dbaaaa",
            "sst": 14
        },
        {
            "sd": "3caaa9",
            "sst": 153
        },
        {
            "sd": "5faaad",

```

```
        "sst": 132
      }
    ],
    "capacity": 500,
    "load": 0,
    "supportedFeatures": "80000000"
  }
]
},
```

Managing Data

The messages are managed according to the type of content.

The following table describes the behavior of different content type:

Table 4-36 Managing Data

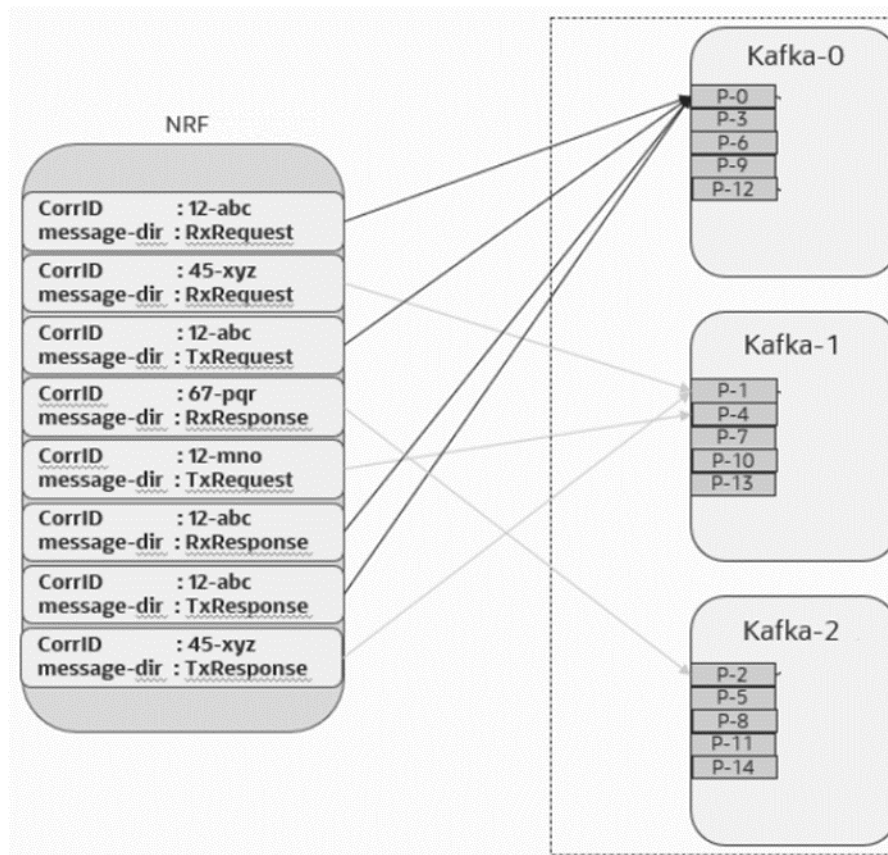
Content-Type	Content-Encoding	Behavior
• application/json • application/problem+json • application/json-patch+json • application/3gppHal+json	NA	The payload is converted into a JSON object and attached to the message copy feed payload as a JSON node.

Writing Messages of the Same Transaction in the Same Kafka Partition

From release 25.1.200 onwards, while sending messages to Data Director, NRF supports copying the request and response messages of same transaction to the same Kafka partition. This reduces the latency used to process the same transaction data. This feature uses correlation-id (unique-identifier) metadata as message key for the correlation of the messages for a transaction.

The following diagram represents the enhancement of selecting the same Kafka partition for the messages of the same transaction type:

Figure 4-27 Same Kafka Partition for Writing the Messages of the Same Transaction Type



Data Director uses the correlation-id received from the Gateways to group the messages belonging to the same transaction. Data Director feeds all these messages to the same Kafka partition instead of multiple partitions.

Managing the feature

Managing NRF Message Feed Feature

Enable

You can enable Message Feed and the feature using the Helm:

1. Open the `ocnrf_custom_values_26.1.201.yaml` file.
2. Set `ingress-gateway.messageCopy.enabled` to **true** to enable message copying at the Ingress Gateway. For more information on enabling the parameter, see the "Ingress Gateway Parameters" section in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
3. Set `egress-gateway.messageCopy.enabled` to **true** to enable message copying at the Egress Gateway. For more information on enabling the parameter, see the "Egress Gateway Parameters" section in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
4. Set `ingress-gateway.messageCopy.keybasedKafkaProducer` to **true** to enable copying messages of the given transaction to the same Kafka partition in Ingress Gateway. For more information on enabling the parameter, see the "Ingress Gateway Parameters"

section in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

5. Set `egress-gateway.messageCopy.keybasedKafkaProducer` to **true** to enable copying messages of the given transaction to the same Kafka partition in Egress Gateway. For more information on enabling the parameter, see the "Egress Gateway Parameters" section in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
6. Save the file.
7. Install NRF. For more information about installation procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
8. If you are enabling this parameter after NRF deployment, upgrade NRF. For more information about upgrade procedure, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

Note

Enabling the Message Feed feature on both the Ingress and Egress Gateways may affect pod capacity, depending on your usage model and configuration.

Configure

There is no configuration to be performed using the REST API or CNC Console.

Configuring SASL

1. Generate your SSL Certificates.

Note

Creation process for private keys, certificates and passwords is based on discretion of user or operator.

2. Before copying the certificates into the secret, add the DD Root certificates contents into the CA certificate (**caroot.cer**) generated for NRF as follows:

Note

Make sure you have added 8 hyphens "-" between 2 certificates.

```
-----BEGIN CERTIFICATE-----
<existing caroot-certificate content>
-----END CERTIFICATE-----
-----
-----BEGIN CERTIFICATE-----
<DD caroot-certificate content>
-----END CERTIFICATE-----
```

3. Create secrets for both Ingress and Egress Gateway for authentication with Data Director. To create a secret you need to store the password in a text file and using same file need to create a new secret. Run the following command to create secret:

```
kubectl create secret generic ocingress-secret --from-
file=ssl_ecdsa_private_key.pem --from-file=rsa_private_key_pkcs1.pem --
from-file=ssl_truststore.txt --from-file=ssl_keystore.txt --from-
file=caroot.cer --from-file=ssl_rsa_certificate.crt --from-
file=ssl_ecdsa_certificate.crt --from-file=sasl.txt -n <namespace>
```

```
kubectl create secret generic ocegress-secret --from-
file=ssl_ecdsa_private_key.pem --from-file=ssl_rsa_private_key.pem --from-
file=ssl_truststore.txt --from-file=ssl_keystore.txt --from-
file=ssl_cabundle.crt --from-file=ssl_rsa_certificate.crt --from-
file=ssl_ecdsa_certificate.crt --from-file=sasl.txt -n <namespace>
```

For more information on creating secrets, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

4. Configure the SSL section as described in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
5. Configure the message copy feature as described in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
6. Configure the **SASL_SSL** port in the **kafka.bootstrapAddress** attribute.

Observe

Metrics

Following metrics are added in the [NRF Gateways Metrics](#) section:

- oc_ingressgateway_msgcopy_requests_total
- oc_ingressgateway_msgcopy_responses_total
- oc_ingressgateway_dd_unreachable
- oc_egressgateway_msgcopy_requests_total
- oc_egressgateway_msgcopy_responses_total
- oc_egressgateway_dd_unreachable

Alerts

Following alerts are added in the [NRF Alerts](#) section:

- [OcnrIngressGatewayDDUnreachable](#)
- [OcnrEgressGatewayDDUnreachable](#)

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.47 Subscription Limit

In 5G architecture, Network Functions (NFs) subscribe to be notified for a change in the producer NF Profile in a network using the NFStatusSubscribe service Operation. This subscription is managed by NRF Management microservice and maintained in the database for a particular period. A notification is triggered when there is change in the producer NF Profile to the Consumer NFs by the NRF subscription microservice.

If the number of subscriptions created is very high, it may trigger a huge number of notification requests. This might lead to the overload of the NRF subscription microservice.

NRF restricts the number of allowed subscriptions to avoid overload condition at NRF subscription microservice. NRF regulates the maximum number of allowed subscriptions in the database using a configurable Global Subscription Limit. In case of georedundant NRF, the limit is applied across all the mated sites.

Note

The subscription limit must be configured with the same across all georedundant site.

NRF evaluates the global subscription limit condition every time an NF tries to create a new subscription or update an existing subscription. If the limit is breached, new subscriptions are not created or renewed, and the subscription requests are rejected with configured error code. Upon the global subscription limit is breached as well as approaching the breach threshold, specific alerts are raised based on the threshold level.

For more details about the supported maximum number of active subscriptions, see [NRF Supported Services](#).

Note

The subscription limit behavior varies when the Growth feature is enabled. For more information, see [Interaction with Existing Features](#).

Managing NRF Subscription Limit Feature

Prerequisites

Following are the prerequisites to enable the feature:

Replication link between all the georedundant sites must be up. The 0cnrfdBReplicationStatusInactive alert indicates if the replication link is inactive. If this alert is raised in any of the sites, wait till it is cleared.

Enable

You can enable the Subscription Limit feature using the CNC Console or REST API.

- **Enable using REST API:** Set `subscriptionLimit.featureStatus` to **ENABLED** in NF Management Options configuration API. For more information about API path, see *Oracle Communications Cloud Native Core Network Repository Function REST Specification Guide*.

- **Enable using CNC Console:** Set **Feature Status** to **ENABLED** under **Subscription Limit** section on the NF Management Options page. For more information about enabling the feature using CNC Console, see the [NF Management Options](#) section.

Configure

You can configure Subscription Limit feature using the REST API or CNC Console.

- **Configure using REST API:** Perform the feature configurations as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- **Enable using CNC Console:** Perform the feature configurations as described in the [NF Management Options](#) section.

Observe

Metrics

Following dimension is added in the [NRF Metrics](#) section:

- RejectionReason=SubscriptionLimitExceeded dimension is added for ocnrf_nfStatusSubscribe_tx_responses_total metric.

Following metrics are added for the Subscription Limit feature:

- ocnrf_nfset_active_subscriptions
- ocnrf_nfset_limit_level

Alerts

Following alerts are added for the Subscription Limit feature:

- [OcnrfSubscriptionGlobalCountWarnThresholdBreached](#)
- [OcnrfSubscriptionGlobalCountMinorThresholdBreached](#)
- [OcnrfSubscriptionGlobalCountMajorThresholdBreached](#)
- [OcnrfSubscriptionGlobalCountCriticalThresholdBreached](#)

KPIs

Following KPIs are added for the Subscription Limit feature:

- [Global Subscription Limit Level](#)
- [Subscription Limit Breached](#)

Maintain

If you encounter alerts at system or application levels, see [NRF Alerts](#) section for resolution steps.

In case the alerts still persists, perform the following:

1. **Collect the logs:** For more information on how to collect logs, see *Oracle Communications Cloud Native Core, Network Repository Function Troubleshooting Guide*.
2. **Raise a service request:** See [My Oracle Support](#) for more information on how to raise a service request.

4.48 Automated Test Suite Support

NRF provides Automated Test Suite (ATS) for validating the functionalities. ATS allows you to run NRF test cases using an automated testing tool, and then compares the actual results with the expected or predicted results. In this process, there is no intervention from the user. For more information on installing and configuring ATS, see *Oracle Communications Cloud Native Core, Automated Test Suite User Guide*.

4.49 NRF Capacity

For NRF target TPS, its corresponding call model, detailed resource requirements, and threshold configurations see *Oracle Communications Cloud Native Core, Network Repository Function Benchmarking Guide*.

Note

The performance and capacity of the NRF system may vary based on the call model, Feature or Interface configuration, and underlying CNE and hardware environment.

Support for 106.6K Ingress TPS with Management 3.4K, Discovery 103.2K TPS, SLF: 91.19K TPS , Notification 4560 TPS and Forwarding 15% in Growth Mode: NRF supports processing up to 106.6K Transactions Per Second (TPS) in a growth environment configured with two sets, with each set accommodating upto 51.6K Discovery TPS and 45.5K SLF TPS utilization for enabling greater performance and scalability.

For more information, see the "Benchmark Testing" section in *Oracle Communications Cloud Native Core, Network Repository Function Benchmarking Guide*.

5

Configuring NRF using CNC Console

This chapter describes how to configure different services in NRF using Oracle Communications Cloud Native Configuration Console (CNC Console).

5.1 Support for Multiple Cluster Deployment

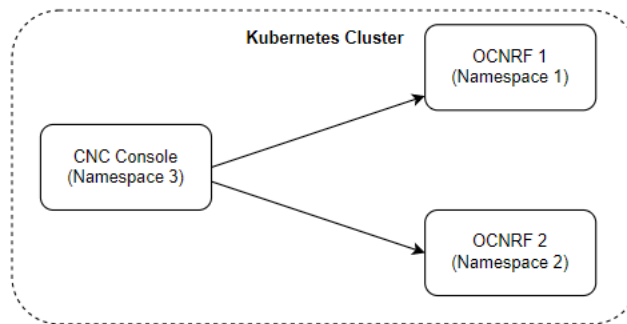
The CNC Console supports both single and multiple cluster deployments.

In a single cluster deployment, the CNC Console can manage NFs and Oracle Communications Cloud Native Core, Cloud Native Environment (CNE) common services deployed in the local Kubernetes clusters.

In a multiple instances deployment, the CNC Console can manage multiple NRF instances and CNE common services deployed within a Kubernetes cluster. For more information about single and multiple cluster deployments, see *Oracle Communications Cloud Native Configuration Console Installation, Upgrade, and Fault Recovery Guide*.

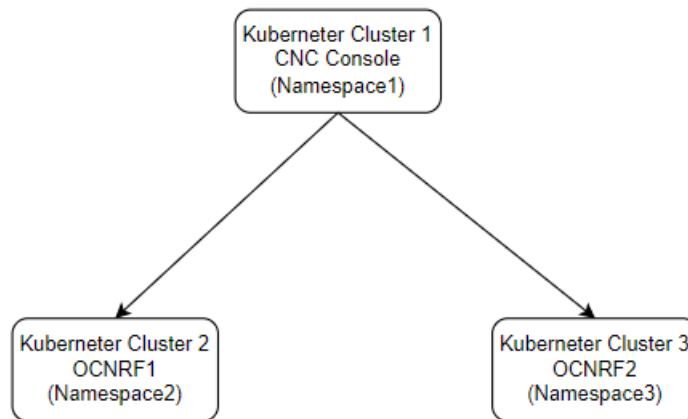
The following image represents a Kubernetes cluster with one instance of CNC Console and two instances of NRF. The single instance of the CNC Console is configuring two instances of NRF with different namespaces.

Figure 5-1 Support for Multiple Instance Deployment



With the support of multicluster deployment, NRF deployed in multiple Kubernetes clusters can be accessed using CNC Console. In a multicluster deployment, the CNC Console can manage NRF and CNE common services deployed in the remote Kubernetes clusters.

The following image represents multiple Kubernetes clusters with one CNC Console and two NRF deployments. The single instance of the CNC Console is configuring two instances of NRF with different namespaces deployed in different clusters.

Figure 5-2 Support for Multicloud Deployment

5.2 CNC Console Interface

This section provides an overview of the CNC Console, which includes an interface to configure NRF features.

You use NRF integrated with the CNC Console after logging in to the CNC Console application. To log in to the CNC Console, you need to make the following updates to the hosts file available at the **C:\Windows\System32\drivers\etc** location.

1. In the Windows system, user needs to open the hosts file in the notepad as an Administrator and append the following set of lines at the end:

```
<CNCC Node IP> cncc-iam-ingress-gateway.cncc.svc.cluster.local
<CNCC Node IP> cncc-core-ingress-gateway.cncc.svc.cluster.local
```

For example:

```
10.75.212.88 cncc-iam-ingress-gateway.cncc.svc.cluster.local
10.75.212.88 cncc-core-ingress-gateway.cncc.svc.cluster.local
```

Note

The IP Address in the above lines may change when deployment cluster changes.

2. Save and close the hosts file.
Before logging into CNC Console, create a CNC user and password. Log in to the CNC console application using the same credentials. For information on creating a CNC Console user and password, see *Oracle Communications Cloud Native Configuration Console Installation, Upgrade, and Fault Recovery Guide*.

CNC Console Log in

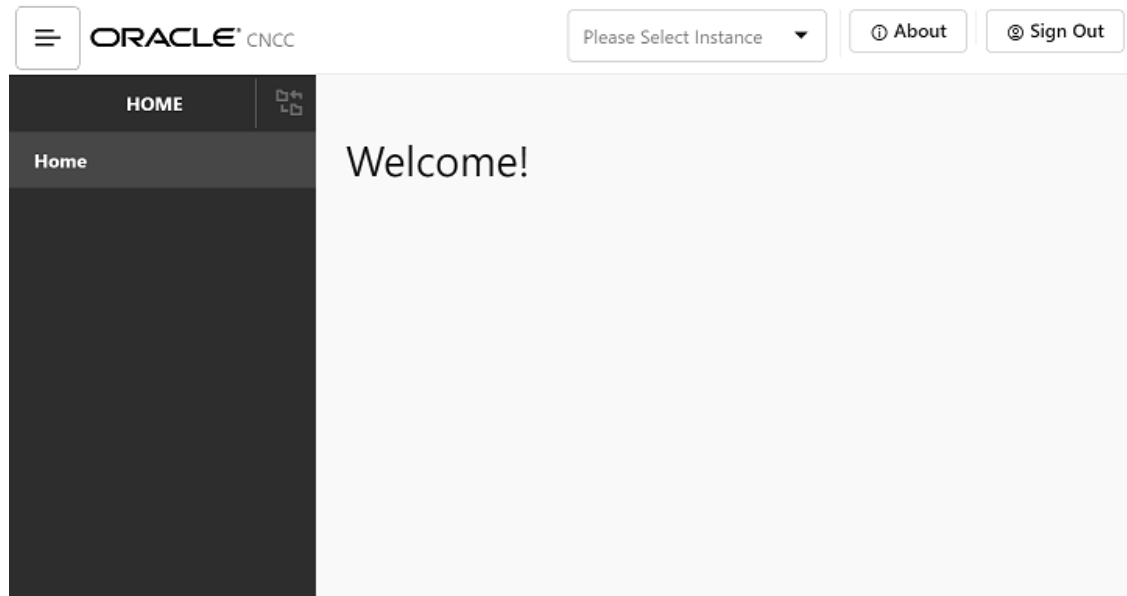
Following is the procedure to log in to CNC Console:

1. Open any browser.
2. Enter the URL: ***http://<host name>:<port number>***.

where, *host name* is cncc-iam-ingress-ip and *port number* is cncc-iam-ingressport.

3. Enter valid credentials.
4. Click **Log in**. The CNC Console interface is displayed.

Figure 5-3 CNC Console



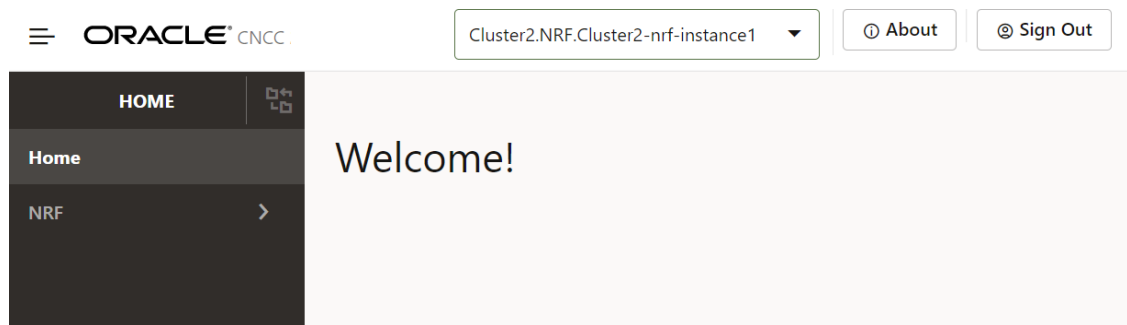
Select the required NF instance from the **Please Select Instance** drop-down list. The left pane displays the selected network function.

5.3 NRF Configuration

This section describes how to configure different features and services using CNC Console.

On selecting NRF instance from the drop-down list, the following screen appears:

Figure 5-4 NRF Welcome Screen



5.3.1 cnDBTier APIs

1. From the left navigation menu, navigate to **NRF** and then click **cnDBTier** tab.
The **cnDBTier** page is displayed.

5.3.1.1 Backup List

1. Click the **Backup List** to view the list of completed backups along with backup ID, backup size, and backup creation timestamp.
The **Backup List** page is displayed.

Note

The parameters listed in the below table are read-only.

Table 5-1 Backup List

Fields	Description
Site Name	This attribute displays the name of the current site to which NRF is connected.
Backup Details	This attribute displays the following information like backup id, backup size, and backup creation timestamp.
Backup Id	This attribute displays the ID of the stored backup.
Backup Size (bytes)	This attribute displays the size of the stored backup.
Creation TimeStamp	This attribute displays the time recorded when the backup was stored.

5.3.1.2 cnDBTier Backup Status

1. From the left navigation menu, navigate to **NRF** and then click **cnDBTier**.
The **cnDBTier** page is displayed.
2. Click **cnDBTier Backup Status** to view the cnDBTier backup status.
The **cnDBTier Backup Status** page is displayed.

Note

The parameters listed in the below table are read-only.

Table 5-2 cnDBTier Backup Status

Attribute	Description
Current Timestamp	This attribute displays the current system time.
Is Backup In Progress	This attribute displays the current cnDBTier backup status.
Next Backup Scheduled Timestamp	This attribute displays the time for the next scheduled backup.

5.3.1.3 cnDBTier Health

1. From the left navigation menu, navigate to **NRF** and then click **cnDBTier**.
The **cnDBTier** page is displayed.
2. Click **cnDBTier Health** to view the health status of the microservices like replication, backup manager, monitor services, and NDB services.
The **cnDBTier Health** page is displayed.
 - Click the **Backup Manager Health Status** to view the health status of the backup manager.
The **Backup Manager Health Status** page is displayed.

Note

The parameters listed in the below table are read-only.

Table 5-3 Backup Manager Health Status

Fields	Description
Service Name	This attribute displays the service name of the backup manager microservice.
Service Status	This attribute displays the service status of the backup manager microservice. Possible values are UP and DOWN.
DB Connection Status	This attribute displays the database connection status of the backup manager microservice. Possible values are UP and DOWN.
Overall Backup Manager Service Health	This attribute displays the overall health status of the backup manager microservice. Possible values are UP and DOWN.
Backup Executor Health Status	This attribute displays the following information like node id and DB connection status of the backup executor. – Node Id: This attribute displays the id of the node. – DB Connection Status: This attribute displays the backup executor database connection status with the nodes. Possible values are UP and DOWN.

- Click the **Monitor Health Status** to view the health status of the services.
The **Monitor Health Status** page is displayed.

Note

The parameters listed in the below table are read-only.

Table 5-4 Monitor Health Status details

Attribute	Description
Service Name	This attribute displays the service name of the monitor microservice.
DB Connection Status	This attribute displays the database connection status of the monitor microservice. Possible values are UP and DOWN.
Metric Scrape Status	This attribute displays the status of the metric scrape, that is if the metrics are fetched or not. If the metrics are fetched then the service is up and vice versa. Possible values are UP and DOWN.
Overall Monitor Service Health	This attribute displays the overall health status of the monitor microservice. Possible values are UP and DOWN.

- Click the **NDB Health Status** to view the health status of the network database. The **NDB Health Status** page is displayed.

Note

The parameters listed in the below table are read-only.

Table 5-5 NDB Health Status details

Attribute	Description
Local Site Name	This attribute displays the name of the current site. For example, site 1, site 2.
NDB Health Status Details	This attribute displays the health status of the network database like name of the NDB service, status of the service, health status of PVC.
Service Name	This attribute displays the service name. For example, ndbmgmd-0, ndbmttd-0, ndbmyappsqld-1, ndbmysqld-2.
Service Status	This attribute displays the status of the service. Possible values are UP and DOWN.

- Click the **Replication Health Status** to view the health status of the replication sites. The **Replication Health Status** page is displayed.

Note

The parameters listed in the below table are read-only.

Table 5-6 Replication Health Status details

Attribute	Description
Local Site Name	This attribute displays the name of the current site (site 1, site 2).
Health Status Details	This attribute displays the health status details of the local site like replication service name, replication service status, database connection status of the replication service, and the overall health status of the replication microservices. The number of rows in this table varies depending on the type of deployment (for example, two-site, three-site deployments).
Service Name	This attribute displays the name of the available replication service.
Service Status	This attribute displays the status of the available replication service. Possible values are UP and DOWN.
DB Connection Status	This attribute displays the database connection status of the replication microservice. Possible values are UP and DOWN.
Overall Replication Service Health	This attribute displays the overall health status of the replication microservice. Possible values are UP and DOWN.

5.3.1.4 cnDBTier Version

1. From the left navigation menu, navigate to **NRF** and then click **cnDBTier**. The **cnDBTier** page is displayed.
2. Click **cnDBTier Version** to view the version. The **cnDBTier Version** page is displayed.

Note

The parameters listed in the below table are read-only.

Table 5-7 cnDBTier Version Attributes

Attribute	Description
cnDBTier Version	This attribute displays the cnDBTier version.
NDB Version	This attribute displays the network database (NDB) version.

5.3.1.5 Database Statistics Report

1. From the left navigation menu, navigate to **NRF** and then click **cnDBTier**. The **cnDBTier** page is displayed.
2. Click **Database Statistics Report** to view the available databases. The **Database Statistics Report** page is displayed.

Note

The parameters listed in the below table are read-only.

Table 5-8 Database Statistics Report

Fields	Description
Database Count	This attribute displays the number of available database.
Database Tables Count	This attribute displays the available database names and their table count.
Database Name	This attribute displays the database name.
Table Count	This attribute displays the table count for each database.
Database Table Rows Count	This attribute displays the table rows present in each table.
Database Name	This attribute displays the database name.

- a. Click **View** available next to the database name to view the **View Database Table Rows Count** screen.
The **View Database Table Rows Count** page is displayed.

Table 5-9 View Database Table Rows Count

Fields	Description
Database Name	This attribute displays the database name.
Tables	This attribute displays the table names and the corresponding rows in each table.
Table Name	This attribute displays the table name.
Row Count	This attribute displays the table rows present in each table.

5.3.1.6 Georeplication Recovery

Perform the following procedure to mark cnDBTier cluster as failed, execute georeplication recovery, and monitor their status:

1. From the left navigation menu, navigate to **NRF** and then click **cnDBTier**.
2. Click **Georeplication Recovery** to access the Georeplication Recovery Status of the cnDBTier cluster. This includes options such as Update Cluster As Failed, Start Georeplication Recovery, and Georeplication Recovery Status.
 - Click **Update Cluster As Failed** to mark the cnDBTier cluster as **FAILED**.
The **Update Cluster As Failed** page is displayed.

Table 5-10 Update Cluster As Failed

Fields	Description
Cluster Names	This field displays a list of cnDBTier clusters that can be marked as failed.

Table 5-10 (Cont.) Update Cluster As Failed

Fields	Description
Failed Cluster Names	This field displays a cnDBTier cluster that is marked as failed.

Click **Update Cluster**. The selected cnDBTier cluster name is updated in the **Failed Cluster Names** field.

- Click **Start Georeplication Recovery** to start the georeplication recovery process for a failed site.
The **Start Georeplication Recovery** page is displayed.

Table 5-11 Start Georeplication Recovery

Attribute	Description
Failed Cluster Name	This field displays a list of all the cnDBTier clusters that have been marked as failed.
Backup Cluster Name (Optional)	This field displays a list of all the healthy cnDBTier clusters. If no cnDBTier cluster is selected, the system uses the first available healthy cnDBTier cluster for the backup.

Click **Start Georeplication Recovery** to initiate georeplication recovery.

- Click **Georeplication Recovery Status** to view the status of georeplication recovery for cnDBTier clusters.
The **Georeplication Recovery Status** page is displayed.

Table 5-12 Georeplication Recovery Status

Attribute	Description
Local Cluster Name	This field displays the name of the local cnDBTier cluster.
Georeplication Recover Status Details	This field displays the details of the georeplication recovery status of cnDBTier clusters.
Cluster Name	This field displays the cnDBTier clusters by name.
Georeplication Recovery Status	This field displays the current georeplication recovery status of the corresponding cnDBTier cluster. For more information about the georeplication recovery status, see <i>Oracle Communications Cloud Native Core, cnDBTier User Guide</i> .

5.3.1.7 Georeplication Status

- From the left navigation menu, navigate to **NRF** and then click **cnDBTier**.
The **cnDBTier** page is displayed.
- Click **Georeplication Status** to view the local site and remote site name to which NRF is connected.
The **Georeplication Status** page is displayed.

Note

The parameters listed in the below table are read-only.

Table 5-13 Georeplication Status

Attribute	Description
Local Site Name	This attribute displays the local site name to which NRF is connected. Note: The number of local site names may vary depending on the type of georeplication used in NRF.
Remote Site Name	This attribute displays the remote site name. Note: The number of remote site names may vary depending on the type of georeplication used in NRF.
Replication Status	This attribute displays the replication status with corresponding sites. Note: The number of replication statuses may vary depending on the type of georeplication used in NRF.
Seconds Behind Remote Site	This attribute displays the number of seconds that the last record read by the local site is behind the latest record written by the remote site for all the replication groups. Note: The number of replication statuses may vary depending on the type of georeplication used in NRF.

- a. Click **View** option in the **Actions** menu, to view the **View Georeplication Status** screen.
The **Georeplication Status** page is displayed.

Table 5-14 Georeplication Status

Attribute	Description
Replication Group Delay	This attribute displays the seconds behind the remote site for individual replication groups.
Replication Channel Group Id	This attribute displays the ID of the replication channel group.



- b. Click on the  option to view the **Replication Group Delay** attributes.
The **Replication Group Delay** page is displayed.

Table 5-15 View Replication Group Delay

Attribute	Description
Channel Details	This attribute displays the channel details such as Remote Replication IP and Role.
Remote Replication IP	This attribute displays the IP of the remote replication channel.
Role	This attribute displays the role of the replication channel IP.

5.3.1.8 Georeplication Recovery Across All Sites

Perform the following procedure to retrieve the georeplication status across all configured sites, offering a consolidated view of the overall replication health:

1. From the left navigation menu, navigate to **NRF** and then click **cnDBTier**.
2. Click **Georeplication Status Across All Sites** to access the georeplication status across all configured sites in the cnDBTier cluster.
The **Georeplication Status Across All Sites** page is displayed.

Table 5-16 Georeplication Status Across All Sites

Fields	Description
Site Name	This field displays the primary site for which the georeplication status is being reported.
Remote Site Name	This field displays the remote site involved in replication with the local site.
Site To Mate Site Replication Status	This field displays the overall georeplication status with all the groups.
Replication Details Per Group ID	This field displays the list of replication-group-specific details with the site name and the remote site name.

3. Click on the  option to view the **View Georeplication Status Across All Sites** attributes.
The **View Georeplication Status Across All Sites** page is displayed.

Table 5-17 View Replication Details Per Group ID

Attribute	Description
Replication Group ID	This field displays the unique identifier assigned to the replication group.
Replication Channel Group Status	This field displays the replication status for the specific replication group.
All SQL Status Details	This field displays the detailed SQL and replication state information for all SQL nodes for the specified replication group.

4. Click on the  option to view the **View All SQL Status Details** attributes.
The **View All SQL Status Details** page is displayed.

Table 5-18 View All SQL Status Details

Attribute	Description
SQL Node	This field displays the SQL node whose replication metrics are being reported.
Source Host	This field displays the remote host from which the SQL node pulls replication data.
External IP	This field displays the external endpoint through which the SQL node is accessible within the site.

Table 5-18 (Cont.) View All SQL Status Details

Attribute	Description
Replica I/O Running Status	This field displays whether the replication I/O thread is currently active or not. Possible values: Yes or No.
Replica SQL Running Status	This field displays whether the SQL thread responsible for applying replicated changes is running or not. Possible values: Yes or No.
Server ID	This field displays the unique server identifier used in the replication topology.
Role	This field displays the role of the SQL node within the replication setup (for example, ACTIVE or STANDBY).
Last Error Code	This field displays the most recent SQL thread error code encountered during replication.
Last Error Message	This field displays the most recent error message reported by the SQL thread.
Last I/O Error Code	This field displays the most recent I/O thread error code encountered during replication.
Last I/O Error Message	This field displays the most recent error message reported by the I/O thread.
Last SQL Error Code	This field displays the most recent SQL execution error code encountered while applying replicated transactions.
Last SQL Error Message	This field displays the last SQL execution error message reported.
SQL Remaining Delay	This field displays the replication lag or delay (if any) between the source site and this SQL node. Unit: seconds.

5.3.1.9 Local Cluster Status

1. From the left navigation menu, navigate to **NRF** and then click **cnDBTier**. The **cnDBTier** page is displayed.
2. Click **Local Cluster Status** to view the local cluster status for the current site. The **Local Cluster Status** page is displayed.

Note

The parameters listed in the below table are read-only.

Table 5-19 Local Cluster Status

Attribute	Description
Cluster Name	This attribute displays the name of the current site to which NRF is connected.
Cluster Status	This attribute displays the local cluster status for the current site.

5.3.1.10 On Demand Backup

1. From the left navigation menu, navigate to **NRF** and then click **cnDBTier**.

The **cnDBTier** page is displayed.

2. Click the **On Demand Backup** to create a new backup and view the status of initiated on-demand backups.

The **On Demand Backup** page is displayed.

Note

The parameters listed in the below table are read-only.

Table 5-20 On Demand Backup Details

Fields	Description
Site Name	This attribute displays the name of the current site to which NRF is connected.
DR Status	This attribute displays the disaster recovery status .
Backup Id	This attribute displays the ID of the stored backup.
Backup Status	This attribute displays the status of backup.
Remote Transfer Status	The attribute displays the status of remote transfer.
Initiate Backup	The attribute displays whether the backup is initiated or not. Note: You can read and write this API.

- Click **Edit**. The **Edit** option On Demand Backup page appears.

Note

The **Edit** mode is available only for Initiate Backup.

- Use the Toggle option to Initiate the backup and click **Save**. A confirmation message "Save successfully" appears.
- Click **Cancel** to navigate back to the On Demand Backup page.
- Click **Refresh** to reload the On Demand Backup page.

5.3.1.11 Replication HeartBeat Status

1. From the left navigation menu, navigate to **NRF** and then click **cnDBTier**. The **cnDBTier** page is displayed.
2. Click **Replication HeartBeat Status** to view the connectivity between local site and remote site name to which NRF is connected. The **Replication HeartBeat Status** page is displayed.

Note

The parameters listed in the below table are read-only.

Table 5-21 Replication HeartBeat Status Details

Fields	Description
Site Name	This attribute displays the name of the current site to which NRF is connected.
HeartBeat Details	This attribute displays the following information like remote site name, heartbeat status, heartbeat lag, and replication channel group id.
Remote Site Name	This attribute displays the remote site name.
Heartbeat Status	This attribute displays the connectivity status with corresponding sites.
Heartbeat Lag	This attribute displays the lag or latency in seconds it took to synchronize between sites.
Replication Channel Group Id	This attribute displays the ID of the replication channel group.

5.3.1.12 IP Family Preference for Replication Channel

- From the left navigation menu, navigate to **cnDBTier** and then click **IP Preference for Replication Channel**.
The **IP Preference for Replication Channel** page is displayed.
- Click **Actions** to view the IP preference set for the sites.
 - The **Edit IP Preference for Replication Channel** page is displayed.

Table 5-22 IP Preference for Replication Channel

Fields	Description
Local Site Name	This attribute displays the name of the current site to which NRF is connected.
Remote Site Name	This attribute displays the remote site name.
Preferred Family	This attribute displays the current site's preferred IP family type. IPV4- Indicates the IP Type selected is IPV4. IPV6- Indicates the IP Type selected is IPV6.
Status	This attribute displays the status of the Ip family switchover. Values are RUNNING/IN-PROGRESS.

5.3.1.13 Gracefully Stop and Start Georeplication

- From the left navigation menu, navigate to **cnDBTier** and then click **Gracefully Stop and Start Georeplication**.
The **Gracefully Stop and Start Georeplication** page is displayed.
- Click **Stop Georeplication** from the left navigation menu to stop the georeplication between the sites.
The **Edit Gracefully Stop Georeplication** page is displayed.

Table 5-23 Stop Georeplication

Fields	Description
Site Name	This attribute displays the name of the current NRF site.
Remote Site Name	This attribute displays the list of the remote NRF site names.
Replication Channel Group Ids	This attribute displays the list of replication group ids of the current site.
Georeplication Details	This attribute displays the details of the georeplication sites and their status.

Table 5-24 Georeplication Details

Fields	Description
Site Name	This attribute displays the name of the current NRF site.
Remote Site Names	This attribute displays the name of the remote NRF site.
Replication Channel Group Id	This attribute displays the replication group id.
Replication Status	This attribute displays the status of the georeplication between sites. • UP- Indicates the georeplication between the sites is up. • DOWN- Indicates the georeplication between the sites is down.
Switch Over Status	This attribute displays the switch-over status of the georeplication between sites. • SWITCH_OVER_ENABLED- Indicates the switch-over status of the georeplication between the sites is up. • SWITCH_OVER_DISABLED- Indicates the switch-over status of the georeplication between the sites is disabled.

3. Click **Stop Georeplication** to stop the replication between the sites.

Start Georeplication

1. From the left navigation menu, navigate to **cnDBTier** and then click **Gracefully Stop and Start Georeplication**.
The **Gracefully Stop and Start Georeplication** page is displayed.
2. Click **Start Georeplication** from the left navigation menu to start the georeplication between the sites.

The **Start Georeplication** page is displayed.

Table 5-25 Start Georeplication

Fields	Description
Site Name	This attribute displays the name of the current site to which NRF is connected.
Remote Site Name	This attribute displays the list of the remote site name.
Replication Channel Group Ids	This attribute displays the list of replication group ids of the current site.
Georeplication Details	This attribute displays the details of the georeplication sites and their status.

Table 5-26 Georeplication Details

Fields	Description
Site Name	This attribute displays the name of the current site to which NRF is connected.
Remote Site Names	This attribute displays the name of the remote site.
Replication Channel Group Id	This attribute displays the replication group id.
Replication Status	This attribute displays the status of the georeplication between sites. • UP- Indicates the georeplication between the sites is up. • DOWN- Indicates the georeplication between the sites is down.
Switch Over Status	This attribute displays the switch-over status of the georeplication between sites. • SWITCH_OVER_ENABLED- Indicates the switch-over status of the georeplication between the sites is up. • SWITCH_OVER_DISABLED- Indicates the switch-over status of the georeplication between the sites is disabled.

3. Click **Start Georeplication** to start the replication between the sites.

5.3.2 General Options

Perform the following procedure to configure the **General Options**:

1. From the left navigation menu, navigate to **NRF** and then click **General Options**. The **General Options** page is displayed.
2. Click **Edit** from the top right side to edit or update **General Options** parameter. The page is enabled for modification.
3. Configure **General Options** fields as described in the following table:

Table 5-27 General Options

Field Name	Description
Default Load Assignment	If NFProfile does not have Load attribute, Default Load value is set in NF Load attribute of NFProfile while sending the NFDiscover response and NFProfile sent in NFNotify operation. If the value of the Service Priority Update Feature Status feature flag is enabled in NF Discovery Options and if NFService/NFProfile does not have any value for the Load attribute, the Default Load value is set in NF Service and NF Profile load attribute while sending the NFDiscover response. For more information, about the inheritance logic, see NFService Priority Update .

Table 5-27 (Cont.) General Options

Field Name	Description
Default Priority Assignment	If NFProfile does not have Priority attribute, Default Priority value is set in NF Load attribute of NFProfile while sending the NFDDiscover response and NFProfile sent in NFNotify operation. If the value of the Service Priority Update Feature Status feature flag is enabled in NF Discovery Options and if NService/NFProfile does not have any value for the Priority attribute, the Default Priority value is set in NF Service and NF Profile Priority attribute while sending the NFDDiscover response. For more information, about the inheritance logic, see NService Priority Update.
Default Load	If the value of this attribute is set to true, then defaultLoad value is set in NF load attribute of NFProfile. This value is sent in NFDDiscover response and NFProfile sent in NFNotify operation, in case NFProfile does not have load attribute.
Default Priority	This attribute is default value of NF Priority and will be used if NFProfile does not have priority attribute set by NF.
Enable 29510 v15.3.0	functions as per 3GPP 29510 v15.3 specification, if this flag is set to true. If it is set to true, then NRF will compliant to 3GPP 29510 v15.3. If it is set to false, NRF will compliant to 3GPP 29510 v15.2.
Enable 29510 v15.5.0	NRF functions as per 3GPP 29510 v15.5 specification, if this flag is set to true. If it is set to false, NRF functions as per 3GPP 29510 v15.2 or v15.3 specification (depends on enableF3 flag).
Maximum Hop Count	Maximum number of Nodes (SLF/NRF's) that NRF can communicate, to service a request. Note: The value of this parameter must be greater than or equal to the value configured for the Maximum SLF Attempts parameter in the SLF Options.
OCNRF Scheme	NRF Host's Scheme
OCNRF Host	ocnrfHost needs to be NRF's External Routable FQDN (for example, ocnrf.oracle.com) or External Routable IpAddress
OCNRF Port	NRF Host's Port
NRF PLMN List	This value will have at least one PLMN supported by NRF and this value is set before using NRF.
Add 3GPP SBI Correlation Info Header	This attribute indicates whether the 3gpp-Sbi-Correlation-Info can be added to the request. If this flag is set to ENABLED, then 3gpp-Sbi-Correlation-Info header is added.

Table 5-27 (Cont.) General Options

Field Name	Description
OCNRF User-Agent Header	This attribute indicates the value of the User-Agent header that is added to the outgoing requests for SLF query and NFStatusNotify. The recommended value starts with NRF followed by - <operator specific string/value>. Few examples, NRF-<NrfInstanceId>, For example: NRF-4947a69a-f61b-4bc1-b9da-47c9c5d14b64 NRF-<NRF FQDN>, For example: NRF-nrf05.testnetwork.org NRF-<NrfInstanceId> <NRF FQDN>, For example: NRF-4947a69a-f61b-4bc1-b9da-47c9c5d14b64 nrf05.testnetwork.org Note: a. The length of the value can be 1-300 characters. b. String containing only blank spaces is not supported. However, it supports blank spaces in between. c. The feature is disabled for an empty string. d. 3GPP validation is not performed for the configured value.

For more information on parameters, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

4. Click **Add** provided under **NRF PLMN List** section to add MCC and MNC.
5. Enter **MCC** and **MNC** values in the field:

Table 5-28 Add NRF PLMN List

Field Name	Description
MCC	Enter the MCC value.
MNC	Enter the MNC value.

6. Click **Save** on **Add NRF PLMN List** page.
7. Click **Save** on **Edit General Options** page to save **General Options**.

For more information on parameter values, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

Note

Use the **Edit** or **Delete** icons available in the next column of the PLMN to update or delete the **NRF PLMN List** information.

5.3.3 NF Management Options

Perform the following procedure to configure the **NF Management Options**:

1. From the left navigation menu, navigate to **NRF** and then click **NF Management Options**. The **NF Management Options** page is displayed.
2. Click **Edit** from the top right side to edit or update **NF Management Options** parameter. The page is enabled for modification.
3. Configure **NF Management Options** fields as described in the following table:

Table 5-29 NF Management Options

Field Name	Description
NF Notify Load Threshold	NRF generates the notification trigger when the difference between the last notified load value and the current reported load value is equal or greater than the configured value of <code>nfNotifyLoadThreshold</code> attribute. Note: • NRF generates the notification trigger if the <code>nfProfile</code> level load is added or removed. • This feature applies to <code>nfProfile</code> level load only. NRF triggers a notification for every change in the service level load. • This feature is applicable with <code>NfHeartBeat</code> and <code>NfUpdate</code> (partial and full) service operation.
NRF Support For Profile Changes In Response	When this flag is set to true and the <code>nfprofile</code> contains <code>nfProfileChangesSupportInd</code> set to true, NRF will send only the changes in the Profile in the response. When this value is set to false, the complete profile will be sent in the response.
Default Subscription Validity Time	If the validity time attribute is not received in <code>SubscriptionData</code> during <code>NFStatusSubscribe</code>, this default value will be used for calculation of validity time (current time + default duration). If the validity time attribute is received in <code>SubscriptionData</code> during <code>NFStatusSubscribe</code>, this is minimum value will be used for validation and limit purpose. It means if value provided is less than (current time + minimum possible range value), then minimum range value will be considered as validity time for subscription and similarly in case validity time is more than (current time + maximum possible range value), then maximum range value will be considered as validity time for subscription.
NRF Support For Profile Changes In Notification	NRF sends <code>profileChanges</code> attribute instead of <code>NFProfile</code> in Notification, if this flag is enabled.
NF Profile Suspend Duration	Indicates the duration for which the NF is suspended, before it is deleted from NRF database. The value is in <code>pHqMrS</code> format. Where <code>p,q,r</code> are integers and <code>H,M,S</code> or <code>h,m,s</code> denote hours, minutes and seconds respectively.
Enable Compression For Subscription To CDS	This attribute is used to enable or disable the Gzip compression for communication between the subscription microservice and CDS. If the value is true, Gzip compression is enabled for communication between the subscription microservice and CDS. If the value is false, Gzip compression is disabled for communication between the subscription microservice and CDS.

Table 5-29 (Cont.) NF Management Options

Field Name	Description
Accept Additional Attributes	NRF preserves additional attributes that are not defined by 3GPP in NFProfile/NFService based on this attribute value.
Allow Duplicate Subscriptions	This attribute specifies if NRF allows creation of duplicate subscriptions. - If this value is set as true, for every subscription request, NRF will create a new Subscription without checking if there is already a subscription request present. For more use cases, see Use Cases for Allow Duplicate Subscriptions. - If this value is set as false, for every subscription create request, all the attributes of the subscription data JSON Object, except the validityTime attribute, is checked against all the existing subscriptions to see if there is an exact match: - If a duplicate subscription is found, NRF returns "201 Created along with the existing SubscriptionId and the existing validityTime". By this NRF will be accepting the subscription create request, but will not create a duplicate subscription. - If a duplicate subscription is not found, NRF creates the subscription and returns "201 Created with the new SubscriptionId". Note: If the value of Allow Duplicate Subscriptions is set as false, NRF would check for duplicate subscription by matching the current subscription request with every subscription present in NRF. Hence, this causes a performance degradation of around 50% during NFStatusSubscribe and NFStatusNotify service operation.
NF Heartbeat Timers	This attribute is used to configure the heartbeat related information of the NF. It allows to configure the heartbeat information per NFType. By default, the nfHeartbeatTimer information for ALL_NF_TYPE is present.
Notification Retry	This attribute is used to configure the Notification Retry feature.
Subscription Limit	This attribute is used to configure the Subscription Limit feature.
NF Profile Limit	This attribute is used to configure the NF Profile Size Limit feature.

- Click **Add** provided under **NF Heartbeat Timers** section to add the Heartbeat Timers parameters.
- Enter the values for heartbeat timers as described in the *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

Table 5-30 Add NF Heartbeat Timers

Attribute	Description
NF Type	Enter the supported NFType. All nftypes supported in 29.510 Rel 15.5.
Minimum Heartbeat Timer	The minimum HeartbeatTimer allowed for the NF.
Maximum Heartbeat Timer	The maximum HeartbeatTimer allowed for the NF.
Default Heartbeat Timer	This default heartBeatTimer value to be used when the network functions does not provide the heartBeatTimer value in NFProfile.
Number of Heartbeats NF type can miss	The allowed number of missed HeartBeat(s) after which the NFProfile is marked as suspended.

6. Click **Save** on **Add NF Heartbeat Timers** page.
7. Configure **Notification Retry** parameters as described in the following table:

Table 5-31 Notification Retry

Attribute	Description
Feature Status	This flag enables or disables the <i>NfStatusNotify</i> service operation request. Note: If any attribute is null in request body, then the previously saved values are retained and considered. If Feature Status value is ENABLED, Error Response Code List and Exception Response List cannot be simultaneously null, either of the list must be present. However, if Feature Status value is DISABLED, both Error Response Code List and Exception Response List can be simultaneously empty. Feature Status value cannot be ENABLED, if both Error Response Code List and Exception Response List are null.
Retry Count	The number of retries that happens at Egress Gateway upon the following scenarios: • 4xx, 5xx Response Error Codes: In case of the error response from the notification callback server, http status codes are matched with the statuses. • Connection Failure/Timeout: In case of connection failure/timeout, error occurred at Egress Gateway is matched with the Exception Response List. • Request Timeout: In case of request timeout, error occurred at Egress Gateway is matched with the Exception Response List.
Request Timeout	This configuration decides the request timeout if response from notification callback server is not received. Note: The value here corresponds in milliseconds. This value is used only if <code>java.util.concurrent.TimeoutException</code> is configured in Exception Response List attribute.
Error Response Code List	This configuration is the list of HTTP error codes that are authorized for retry. In case of the 4xx, 5xx Response Error Codes from the notification callback server, the HTTP status codes from error response are matched with this configuration.

Table 5-31 (Cont.) Notification Retry

Attribute	Description
Exception Response List	This configuration is the list of exceptions that are authorized for retry. Below is the set of possible exceptions: - java.net.UnknownHostException: Exception is raised when the address of a host could not be determined, or host address is invalid - javax.net.ssl.SSLHandshakeException: Exception is raised when the client and server could not negotiate the desired level of security. - java.nio.channels.ClosedChannelException: Exception is raised when an attempt is made to invoke or complete an I/O operation upon channel that is closed, or at least closed to that operation - java.net.ConnectException: Exception is raised when an error occurred while attempting to connect a socket to a remote address and port - java.util.concurrent.RejectedExecutionException: Exception is raised when a task cannot be accepted by the executor - java.util.concurrent.TimeoutException: Exception is raised when the NFStatusNotify request is timed out - java.net.SocketTimeoutException: Exception is raised when a timeout has occurred on a socket read or accept. This occurs in case of connection is not established within time.

8. Configure **Subscription Limit** parameters as described in the following table:

Table 5-32 Subscription Limit

Attribute	Description
Feature Status	This attribute is used to enable or disable the Subscription Limit feature.
Global Max Limit	This attribute is used to set the maximum number of subscriptions allowed for the NRF. Note: The value of this attribute must be same across all georedundant site.
Reject Subscription Renewal When Limit Breached	This flag is used to indicate whether Subscription Renewal is allowed when the Global Subscription limit is breached.
Limit Thresholds	This attribute is used to configure the subscription limit thresholds for which alerts are raised. Note: Duplicate level name is not allowed in limitThresholds.
Error Responses	Indicates the error response that are generated when a subscription request is rejected.

- Click **Add** provided under **Error Responses** section to add the error response details. The **Add Error Responses** page is displayed.
- Enter the values for error response configuration as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- Click **Save** on **Add Error Responses** page.
- Click **Add** provided under **Limit Thresholds** section to add the limit thresholds details. The **Add Limit Thresholds** page is displayed.
- Enter the values for limit thresholds configuration as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- Click **Save** on **Add Limit Thresholds** page.

15. Configure **NF Profile Limit** parameters as described in the following table:

Table 5-33 NF Profile Limit

Attribute	Description
Feature Status	This attribute is used to enable or disable the NF Profile Size Limit feature.
NF Profile Size Limits	This attribute is used to set the maximum size for the NF Profile.
Error Responses	This attribute provides the error response that are generated when a NF Profile exceeds the maximum defined size.

16. Click **Add** provided under **NF Profile Size Limits** section to add the NF Profile limit details. The **Add NF Profile Size Limits** page is displayed.

Table 5-34 NF Profile Size Limits

Attribute	Description
NF Type	This attribute indicates the NF type for which the profile size should be limited.
Max Size	This attribute indicates the maximum allowed size of NF Profile being registered or updated in bytes. If the value is set as 0, then there is no restriction in the maximum size of the NF Profile. NRF allows the NF Profiles as received from the Consumer NF to the database.

17. Click **Save** on **Add NF Profile Size Limits** page.
18. Enter the values for NF Profile size limits configuration as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
19. Click **Add** provided under **Error Responses** section to add the error response details. The **Add Error Responses** page is displayed.
20. Enter the values for error response configuration as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
21. Click **Save** on **Edit NF Management Options** page to save **NF Management Options**.

For more information on parameter values, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

Note

Use the **Edit** or **Delete** icons available in the next column of the heartbeat timer to update or delete the **NF Heartbeat Timers** information.

5.3.4 NF Discovery Options

Perform the following procedure to configure the **NF Discovery Options**:

- From the left navigation menu, navigate to **NRF** and then click **NF Discovery Options**. The **NF Discovery Options** page is displayed.
- Click **Edit** from the top right side to edit or update **NF Discovery Options** parameter.

The page is enabled for modification.

3. Configure **NF Discovery Options** fields as described in the following table:

Table 5-35 NF Discovery Options

Field Name	Description
Discovery Result Load Threshold	NFDiscover response contains NF profiles with load attribute value less than or equal to this configured value. In case there are no profiles matching this criteria, the profiles with load greater than the configured value are included in the response. If service-names attribute is present in the discovery query and the NF profile has only one NF service instance and that NF service load value is non-null, then that load value is considered. Otherwise, the NF profile load value is considered, if its non-null. If the considered load value is non-null and has value greater than the load threshold value, then that NF Profile gets filtered out. Value 0 indicates this feature is disabled. Increment or decrement the Discovery Result Load Threshold parameter using the arrow keys.
Profile Count In Discovery Response	This value restricts NF profile count in NFDiscover response. If value of this attribute is 0, it means this functionality is disabled. In that case all of the NF profiles after the discovery filtering will be returned in NFDiscover response. Increment or decrement the Profiles Count In Discovery Response parameter using the arrow keys. Note: If Limit attribute is present in SearchData URI, then this attribute is not used.
Discovery Validity Period	This attribute mentions the validity period of a discovery request for a specific target-nf-type after which requester NF must perform discovery again to get the latest values. By default, the validityPeriod information for ALL_NF_TYPE is present.
Empty Discovery Response	This attribute defines the configuration for EmptyList feature.
Extended Preferred Locality	This attribute is used for Extended Preferred Locality feature.
Enable Compression For Discovery To CDS	This attribute is used to enable or disable the Gzip compression for communication between the discovery microservice and CDS. If the value is true, Gzip compression is enabled for communication between the discovery microservice and CDS. If the value is false, Gzip compression is disabled for communication between the discovery microservice and CDS.

Table 5-35 (Cont.) NF Discovery Options

Field Name	Description
Service Priority Update Feature Status	This attribute determines if the NFService Priority Update feature is enabled or disabled. If this feature flag is ENABLED, NRF updates the NFService level priority along with the NFProfile level priority while processing the discovery query. If this feature flag is DISABLED, NRF does not update the NFService level priority along with the NFProfile level priority while processing the discovery query.

4. Select the **Service Priority Update Feature Status** value as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
5. Click **Add** provided under **Discovery Validity Period** section to add the validity information.

Table 5-36 Add Discovery Validity Period

Attribute	Description
NF Type	Enter the supported NFType. All nfTypes supported in 29.510 Rel 15.5.
Validity Period	Specify the validity period of a discovery request of a specific target-nf-type after which requester NF must perform discovery again to get the latest values. The value is in pHqMrS format.
Empty List Validity Period	This attribute mentions the validity period for an empty list response of a discovery request of a specific target-nf-type. This value is sent as <code>validityPeriod</code> in the discovery response when NRF is generating empty response, irrespective of <code>emptyListFeatureStatus</code> is ENABLED or DISABLED. In case the specific nfType is not configured, then <code>emptyListValidityPeriod</code> configured for <code>ALL_NF_TYPE</code> is considered in the discovery response. Upon expiry of the <code>emptyListValidityPeriod</code>, Producer NF must send the discovery request again. The value is in pHqMrS format, where p, q, r are integers and H, M, S or h, m, s denotes hours, minutes, and seconds respectively.

6. Click **Save** on **Add Discovery Validity Period** page.
7. Click **Add** provided under **Empty List Configuration** section to the nfTypes for which EmptyList must be configured.
8. Configure the **NF Type** and **Feature Status** per nfType on the **Add Empty List Configuration** page.
9. Click **Save** on **Add Empty List Configuration** page.
10. Select the **Feature Status** and **Location Types** values provided under **Extended Preferred Locality** section as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

11. Click **Add** provided under **Location Type Mapping** section to add the location information.
12. Enter the location type mapping values as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

Table 5-37 Add Location Type Mapping

Attribute	Description
NF Type	NF type of particular Network Function. This value is derived from target-nf-type of Discovery Search query.
NF Services	NF Services belonging to Network Function
Location Type	Location Type to which NF is mapped

13. Click **Save**.
14. Click **Add** provided under **Preferred Location Details** section to add the preferred location information.
15. Provide the configuration for Preferred location details as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

Table 5-38 Add Preferred Location Details

Attribute	Description
Preferred Location	This value is matched with preferredLocation from consumer NF in Discovery Search Query.
Target Location Type	This value is derived from mapped locationType attribute value of LocationTypeMapping table.
Maximum number of NF Profiles from First Matching Location	This value is configured to define the maximum number of NF profiles that can be selected from the first matching location from the Target Preferred Locations.
Target Preferred Locations	Preferred Locations decided by operator for particular preferredLocation and targetLocationType.

- a. Click **Add** provided under **Target Preferred Locations** section to add the target preferred location information:

Table 5-39 Add Target Preferred Locations

Attribute	Description
Priority	Set the priority using the arrows
Location	Enter the target location or location set

- b. In case **Location** is a set of locations, configure **Location Sets**. Click **Add** provided under **Location Sets** section to add the location information:

Table 5-40 Location Sets

Attribute	Description
Location Set Name	An identifier to distinguish among other locations. It must be alphanumeric and allowed special characters are - and _. Note: It is recommended to append Set as a keyword for every <code>locationSetName</code> specifying group of locations, for easy identification between a single location and group of locations. The length of the location name can be in the range of 5 to 100 characters.
Locations	Set of unique locations, where location is of type string, and n is predefined maximum locations per location set. A maximum of 10 locations can be configured.

- c. Click **Save** to save the location set.
- d. Click **Save** on **Add Target Preferred Locations** page to save the target preferred location.
16. Click **Save** on **Add Preferred Location Details** page to save the preferred location.
17. Click **Save** on **Edit NF Discovery Options** page to save **NF Discovery Options**.

Note

Use the **Edit** or **Delete** icons displayed on the next column of the specific entry to update or delete the **Discovery Validity Period**, **Location Type Mapping**, and **Preferred Location Details** information.

5.3.5 NF Access Token Options

Perform the following procedure to configure the **NF Access Token Options**:

1. From the left navigation menu, navigate to **NRF** and then click **NF Access Token**.
2. Click **AccessToken Options** under **NF AccessToken**.
The **NF AccessToken Options** page is displayed.
3. Click **Edit** from the top right side to edit or update **NF AccessToken Options** parameter.
The page is enabled for modification.
4. Configure **AccessToken Options** fields as described in the following table:

Table 5-41 AccessToken Options

Field Name	Description
Audience Type	Select the value for the AudienceType in AccessTokenClaim. NRF considers this value only if targetNfType and targetNfInstanceId both are not received in AccessTokenRequest. NF_INSTANCE_ID: NF Instance Id(s) in audience IE of AccessTokenClaim NF_TYPE: NF Type in audience IE of AccessTokenClaim

Table 5-41 (Cont.) AccessToken Options

Field Name	Description
Authorize Requester NF	This attribute validates the requester NF is registered with NRF or not. If the value is ENABLED, NRF issues the access token only to the registered requester NFs. Additionally, it checks if NFtype and requesterPlmn (if present) in the Access Token Request is same as in NF profile registered with NRF. If the value is set as DISABLED, NRF does not perform any of the above validation and issues token to non-registered NFs as well. Note: For this functionality to work, set the value of Feature status in Access token authorization feature as DISABLED.
Logical Operator For Scope	Select the value to decide whether values in scope will have relationship AND or OR. If value is AND, while looking for producer network function profiles, token will be issued for profiles matching all the services-names present in scope. If value is OR, token will be issued for profiles matching any of the services-names present in scope.
OAuth Token Expiry Time	Set the OAuth token expiry time. Note: In case NRF signed certificate expiry duration is less than this attribute, then certificate expiry duration is used in Access Token Expiry Time.
Access token authorization feature	The attribute contains the parameters required to enable and configure NfAccessToken Authorization Feature.
Token Signing Details	This attribute allows user to configure all of the details required to sign the token generated by NRF.
Access token authorization error responses	This attribute allows user to update details for different error conditions.

5. Select **Feature status** provided under **Access token authorization feature** section.
6. Click **Add** provided under **Access token authorization feature rules configuration** section to add the rules.
7. Enter the values for rules configuration as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

Note

The fields **Feature status**, **Access token authorization feature rules configuration** and **Add Access token authorization error responses** can be independently configured in any order. However, when the **Feature status** is ENABLED, the **Access token authorization feature rules configuration** must be preconfigured or be present in the current request.

Table 5-42 AuthConfig

Attribute	Description
Target NF Type	Enter the attribute to define the NF Type of the target NF.
Requester NF Type	Enter the attribute to define the NF Type of the requester NF that is authorized to access the target NF Type and its services.

Table 5-42 (Cont.) AuthConfig

Attribute	Description
Service Names	Enter the attribute to define the NF services that is authorized to be accessed by the requester NF type. The value "*" indicates that all the services are authorized to be accessed the requester NF Type. If "*" is to be used, the services contain only a single entry in the list with this value.

8. Click **Save** on **Add Access token authorization feature rules configuration** page.
9. Enter the **Token Signing Details** as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
10. Enter the **Default K8s Secret Details** as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
11. Click **Add** provided under **Key Details List** section to add the Key IDs details.
12. Enter the values for rules configuration as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

Table 5-43 OauthKeyDetails

Attribute	Description
Key ID	Unique value in list of keys. Key Details are known by this value.
Algorithm	Algorithm value will be used to sign the oauth token.
Private Key	Enter the NRF Private key details: • K8s Secret Name • K8s Secret NameSpace • File Name
Certificate	Enter the NRF Public certificate details. • K8s Secret Name • K8s Secret NameSpace • File Name

13. Click **Save** on **Add Key Details List** page.
14. Click **Add** provided under **Access token authorization error responses** section to add the error response details.
15. Enter the values for rules configuration as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
16. Click **Save** on **Add Access token authorization error responses** page.
17. Click **Save** to save the NF AccessToken Options.

Note

Use the **Edit** or **Delete** icons available in the next column of the specific entry to update or delete the **Access token authorization feature rules configuration**, **Token Signing Details**, **Key Details List** and **Access token authorization error responses** information.

5.3.5.1 Access Token Signing Data Status

This screen displays the status of Access Token signing data. The data is fetched from [NF Access Token Options](#).

Figure 5-5 Access Token Signing Data Status

Access Token Signing Data Status Refresh Help

Data Time Stamp: 2021-05-11T08:41:27.087Z

AccessToken Signing Keys Count: 2

▼ Access Token Signing Data

Key ID ↑↓	
EcdsaKid	View
RsaKid	View

5.3.6 Forwarding Options

Perform the following procedure to configure the **Forwarding Options**:

1. From the left navigation menu, navigate to **NRF** and then click **Forwarding Options**. The **Forwarding Options** page is displayed.
2. Click **Edit** from the top right side to edit or update **Forwarding Options** parameter. The page is enabled for modification.
3. Configure **Forwarding Options** fields as described in the following table:

Table 5-44 Forwarding Options

Field Name	Description
NF Profile Retrieval Status	This attribute controls the forwarding of NFProfileRetrieval service operation messages.
Subscription Status	This attribute controls the forwarding of NFStatusSubscribe, NFStatusUnsubscribe service operation messages. Note: NFStatusSubscribe forwarding is supported only if Subscription Condition is NfInstanceIdCond in the NFStatusSubscribe request.

Table 5-44 (Cont.) Forwarding Options

Field Name	Description
Discovery Status	This attribute controls the forwarding of NFDDiscover service operation messages.
AccessToken Status	This attribute controls the forwarding of AccessToken service operation messages.
NRF Host Config	This is used to configure Primary and alternate NRF Details which is used for forwarding various requests. Note: The value of this attribute can be FQDN, IPv4 or IPv6.
NRF Reroute On Response HTTP Status Codes	This configuration is used to determine if the service operation message needs to be forwarded to alternate NRF.
Forwarding Rules Feature Config	This attribute provides details for Forwarding Rules feature configuration.
Error Responses	This attribute defines the error responses which may be sent during NRF Forwarding scenarios.

4. Click **Add** provided under **NRF Host Config** section to add the host information. The **Add NRF Host Config** page is displayed.
5. Enter the values for rules configuration as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

Table 5-45 NfConfig

Field Name	Description
Scheme	URI schema supported by NF
Host	Host of NF
Port	Port of NF
apiPrefix	ApiPrefix
Priority	Priority of NF
NF Instance ID	NF Instance Id of NF

- a. Click **Add** provided under **API Versions** section.
- b. Enter **API Full Version** and **API Version In Uri** values.
- c. Click **Save** on **Add API Versions** page.
6. Click **Save** on **Add NRF Host Config** page.
7. Select the **Feature Status** value provided under **Forwarding Rules Feature Config** section to set the feature configuration.
This flag can be **ENABLED** only if **Discovery Status** or **AccessToken Status** attributes are **ENABLED**.

Note

Once **Feature Status** flag is **ENABLED** for **Forwarding Rules Feature Config**, both **Discovery Status** and **AccessToken Status** forwarding cannot be disabled.

8. Click **Add** provided under **Forwarding Rules Feature Config** section to add the Forwarding Rules feature configuration.
The **Add Forwarding Rules Config** page is displayed.

Enter the values for rules configuration as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

Table 5-46 Add Forwarding Rules Config

Field Name	Description
Target NF Type	This attribute defines target NF type in a forwarding rule.
Service Names Match Type	This attribute provides details on how the service names are evaluated, based on the defined constraints. Exact: Service Names in incoming request must be present in the configured service names. Anyone: Service Names in incoming request must match with any one of the configured service names. Note: If serviceNames is a wildcard attribute, then this attribute can be skipped.
Service Names	List of services allowed for target NF type.

9. Click **Save** on **Add Forwarding Rules Config** page.
10. Click **Add** provided under **Error Responses** section to add the error response details. The **Add Error Responses** page is displayed.
11. Enter the values for rules configuration as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
12. Click **Save** on **Add Error Responses** page.
13. Click **Save** to save the **Forwarding Options**.

Note

Use the **Edit** or **Delete** icons available in the next column of the specific entry to update or delete the **NRF Host Config**, **Forwarding Rules Feature Config**, and **Error Responses** information.

5.3.7 SLF Options

Perform the following procedure to configure the **SLF Options**:

1. From the left navigation menu, navigate to **NRF** and then click **SLF Options**. The **SLF Options** page is displayed.
2. Click **Edit** from the top right side to edit or update **SLF Options** parameter. The page is enabled for modification.
3. Configure **SLF Options** fields as described in the following table:

Table 5-47 SLF Options

Field Name	Description
Feature Status	Enables or disables the SLF Feature. - If the GroupId is already present in Search Query and the value of featureStatus is also ENABLED. NRF uses the Group Id received and not communicate to SLF or UDR. - Additionally, if the Subscriber Id is present in Search Query, it is ignored and not be used to perform discovery search in NRF.
UseOAuthToken	This attribute is used while performing the SLF query to SLF or UDR to query the Access Token service to get OAuth access token details. If the value of this attribute is true, the SLF function of NRF accesses the Access Token service. If the value of this attribute is false, the SLF function does not access the Access Token service and performs the SLF query without OAuth Access Token. Note: This attribute is considered only if the oauth2Required attribute is not configured in the registered UDRs. For more information about oauth2Required attribute, see 3GPP 29.510 v16.
Cache AccessToken	When this attribute is true, NRF will cache the OAuth2 token for SLF communication and use it until the token is expired. When this attribute is false, for each SLF query NRF generates a new OAuth2 token. Note: Operator must set this field to true after NRF is upgraded from previous version and the upgrade process is complete and successful.
Preferred Port from IPEndPoint	This attribute is used only when the dynamic SLF feature is enabled. While routing the SLF requests, the hosts and the port details are taken from the attribute in the SLF profile depending on the <code>slfOptions.preferredRoutingParameter.routingParameter</code> paramater. If the attribute in the <code>slfProfile</code> does not contain "port", then the port can be taken from the <code>NfService.ipEndpoints</code> attribute of the SLF profile based on the value of Preferred Port from IPEndPoint. If Preferred Port from IPEndPoint attribute is set to ENABLED, the port is picked from the <code>NfService.ipEndpoints</code>. If no port is present in the <code>NfService.ipEndpoints</code>, then NRF will use the <code>NfService.scheme</code> to determine the port. If Preferred Port from IPEndPoint is set to DISABLED, the <code>NfService.scheme</code> is used to determine the port. If <code>NfService.scheme</code> is set to <code>http</code>, port 80 is used. If <code>NfService.scheme</code> is set to <code>https</code>, port 443 is used. Note: For port selection, the first <code>ipEndpoints</code> configured with only port (without <code>IPv4Addresses/IPv6Addresses</code>) is used as port for routing.
Preferred Routing Parameter	This attribute indicates the priority of the parameters <code>Fqdn</code>, <code>Ipv4Address</code>, and <code>Ipv6Address</code> are used for routing SLF requests. If the most preferred attribute is not present in the <code>NfProfile</code>, then the next available preferred attribute is selected for routing. Note: The highest preference is given for the routing parameter to which the lowest priority value is set.

Table 5-47 (Cont.) SLF Options

Field Name	Description
SLF Configuration Mode	This attribute decides whether the SLF lookup can be performed based on preconfigured SLF Host Config configuration or SLF or UDR registered at the NRF. STATIC_SLF_CONFIG_MODE: If this value is set, the SLF lookup is performed based on preconfigured SLF Host Config. DISCOVERED_SLF_CONFIG_MODE: If this value is set, the SLF lookup is performed based on SLF or UDR registered with NRF. Note: The SLF Host Config must be configured before or while setting the SLF Configuration Mode as STATIC_SLF_CONFIG_MODE when Feature Status is ENABLED. Once the Feature Status is ENABLED, and the SLF Configuration Mode is set to STATIC_SLF_CONFIG_MODE, the SLF Host Config cannot be empty. If SLF Configuration Mode is set to DISCOVERED_SLF_CONFIG_MODE, SLF Host Config is not considered for discovery query. The SLF Configuration Mode can be set to DISCOVERED_SLF_CONFIG_MODE only if there is atleast one slfCandidate present in the SLF Discovered Candidate List. To trigger the population of SLF Discovered Candidate List, Populate SLF Discovered Candidate List must be set to true.
Maximum SLF Attempts	Indicates the maximum SLF attempts that can be made when the SLF request fails. When this parameter is configured to the value greater than 0, the number of attempts is calculated based on the server header received in the response. To enable the "Rerouting SLF Requests Using Alternate SCP and Alternate SLF" feature, set the value of Maximum SLF Attempts parameter to a value greater than 0. Note: The value of this parameter must be less than or equal to the value configured for Maximum Hop Count parameter in General Options.
Use Alternate SCP	Indicates whether the reroute for the SLF query can be performed using alternate SCP. If the value is set to true, the alternate SCP that is configured under the Egress Gateway route configuration is used for routing the SLF query. If the value is set to false the alternate SCP is not used for routing. Note: - When Use Alternate SCP is set to true, alternate SCP selection will not guaranteed if SCP Health APIs feature is enabled. Hence, it is recommended to disable SCP Health APIs feature when Use Alternate SCP is set to true. - When Use Alternate SCP is set to true, Custom Peer Selector Enabled parameter in Routes Configuration must also be set to true.

Table 5-47 (Cont.) SLF Options

Field Name	Description
Server Header Value Based SLF Selection	Indicates if the Rerouting SLF Requests Based on Server Header Value feature is enabled or disabled. When set to ENABLED, the NRF uses the server header information received in the response to determine the next SLF to be attempted. This helps to select only SLF instances that have not been previously attempted for subsequent retries. Note: The Maximum SLF Attempts parameter must be set to a value greater than 0 to enable the Rerouting SLF Requests Based on Server Header Value feature.
Preferred SLF Locality	Indicates the preferred locality for SLF or UDR. When this attribute is configured, the SLF or UDR profile belonging to this locality is given the highest priority.
SLF Lookup Configuration	This attribute defines details for SLF lookup. Different exception lists, preferredSubscriberIdType, and SLF lookup skip can be configured per NFType. While enabling the SLF feature, this attribute is configured before or while enabling the feature.
SLF Host Config	This is used to configure Primary and Secondary SLF details which are used for forwarding various requests. It allows to configure details of SLF like apiVersions, scheme, host, port, and so on. The only supported value for apiVersionInUri is v1. Hence the apiVersions attribute must have at least one data record with apiVersionInUri attribute values set as v1. This configuration allows you to configure more than two SLF details. SLF with highest priority is considered as Primary SLF for forwarding messages. SLF with second highest priority is considered as Secondary SLF for forwarding. If supportedNfTypeList is set, then operator must set this attribute. This is because this value will be used to contact the network function hosting the SLF. To reset this attribute, send an empty array, for example: "slfHostConfig": [] If this attribute is already set, then there is no need to provide the value again. Note: The value of the Host attribute in SLF Host Config parameter can be FQDN, IPv4, or IPv6. This attribute is used only if SLF Configuration Mode is set to STATIC_SLF_CONFIG_MODE.
Reroute On Response HTTP Status Codes	This attribute is used after getting a response from primary SLF (SLF Config with the highest priority), if the response code from primary SLF is present or matches this configuration, then NRF reroutes the SLF query to secondary SLF (SLF Config with second highest priority).
Populate SLF Discovered Candidate List	This attribute triggers the creation of the SLF Discovered Candidate List when set to true. Note: If SLF Configuration Mode is set to DISCOVERED_SLF_CONFIG_MODE, this attribute cannot be set back to false.

Table 5-47 (Cont.) SLF Options

Field Name	Description
SLF Discovered Candidate List	This attribute contains the list of SLF or UDR profiles registered with the NRF which is used to send the SLF query when the SLF feature is enabled and SLF Configuration Mode is set to DISCOVERED_SLF_CONFIG_MODE . Note: Do not modify this parameter value. Consider it as a read-only parameter.
Error Responses	This attribute defines the error responses which may be sent during SLF processing. This attribute will allow to update the error response code and error response description for preloaded error conditions.

4. Configure **Preferred Port from IPEndPoint** and **Preferred Routing Parameter** option.
5. Click **Add** provided under **Preferred Routing Parameter** section to add the routing parameter details.
The **Preferred Routing Parameter** page is displayed.
6. Enter the values for **Preferred Routing Parameter** as described.

Table 5-48 Preferred Routing Parameter

Parameter	Description	Details
Priority	Indicates the priority for the routing parameter. Note: No duplicate priority values are allowed.	Data Type: integer Constraints: 1, 2, 3 Default Value: NA
Routing Parameter	Indicates the routing parameter assigned for the specific priority. Note: Routing parameter value should be either Ipv4Address, Ipv6Address or Fqdn.	Data Type: string Constraints: Ipv4Address, Ipv6Address, Fqdn Default Value: NA

7. Click **Save** on **Preferred Routing Parameter** page.
8. Click **Add** SLF lookup configuration under **SLF Lookup Configuration** section.
9. Enter the values for SLF lookup configuration as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

Table 5-49 SLF Lookup Configuration

Field	Description
NF Type	NF Type for which SLF need to be supported.
Preferred Subscriber Id Type	This attribute is only used to pick one Subscriber Identifier if more than one subscriber identifiers (SUPI, GPSI) are present in the NFDiscover service operation message.

Table 5-49 (Cont.) SLF Lookup Configuration

Field	Description
Exception List For Missing Mandatory Parameter	This attribute indicates if the mandatory attributes (SUPI or GPSI) are present in the discovery query and if any of the discovery query parameter matches with the value configured in this attribute, NRF continues to perform SLF Lookup. If the mandatory attributes (SUPI or GPSI) are not present in the discovery query parameters and if NFDDiscover search query attribute is not present in the configured Exception List For Missing Mandatory Parameter attribute then the discovery query is rejected. If any of the discovery query parameter matches with the value configured in this attribute, NRF will not reject the request and continues to process the discovery request based on the other query parameters.
Skip SLF Lookup Parameter List	If the discovery query parameter matches with any of the values configured in this attribute, SLF lookup is to be skipped. In this case, NRF ignores the SUPI or GPSI if present in the discovery search query and processes the discovery query based on the remaining query attributes. Note: - NRF does not check if the mandatory parameters (SUPI or GPSI) are present in the discovery query if any of its parameters matches with this attribute. - If SUPI or GPSI is configured in Skip SLF Lookup Parameter List, NRF will not skip SLF lookup for the discovery request. - If the Enable Value Based Skip SLF Lookup parameter is set as true, NRF ignores the Skip SLF Lookup Parameter List parameter and proceeds with the value based skip SLF lookup.
Value Based Skip SLF Lookup Parameters	This attribute configures the discovery parameter name and their corresponding values for which SLF lookup is to be skipped. The entries in the Value Based Skip SLF Lookup Parameters are used only when Enable Value Based Skip SLF Lookup flag is set to true. Note: - NRF does not check if the mandatory parameters (SUPI or GPSI) are present in the discovery query if any of its parameters matches with this attribute. - If SUPI or GPSI is configured in Value Based Skip SLF Lookup Parameters, NRF will not skip SLF lookup for the discovery request.

Table 5-49 (Cont.) SLF Lookup Configuration

Field	Description
Enable Value Based Skip SLF Lookup	This attribute is used to enable or disable the Discovery Parameter Value Based Skip SLFLookup feature. If the value of Enable Value Based Skip SLF Lookup parameter is set as true, NRF validates the discovery query parameters and the values received in the discovery request against the values configured in Value Based Skip SLF Lookup Parameters parameter to determine if the SLF lookup is to be skipped. If the value of Enable Value Based Skip SLF Lookup parameter is set as false, NRF falls back to the existing skip SLF lookup feature (Skip SLF Lookup Parameter List) based on the list of discovery parameters configured.

Table 5-50 Value Based Skip SLF Lookup Parameters List

Field	Description
Skip Parameter Name	This parameter is a valid discovery query parameter supported by NRF for which the SLF lookup is to be skipped. Note: In 25.1.100, Discovery Parameter Value Based Skip SLF Lookup feature supports only dnn based skipSlfLookup.
Skip Parameter Value	This is the value for the corresponding discovery parameter name for which the SLF lookup is skipped and this value can be configured as a regular expression. .* indicates all and NRF skips the SLF lookup for any discovery parameter value. Note: - The Parameter Value string cannot be empty or null. - Maximum length of string is 200 characters.

10. Click **Save** on **Add SLF Lookup Configuration** page.
11. In **Edit** mode, click **Add** HTTP status code information under **Reroute On Response HTTP Status Codes** section.
12. Enter the values for HTTP status codes as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
13. Click **Add** provided under **SLF Host Config** section to add the host information.
14. Enter the values for SLF Host configuration as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
15. Click **Save** on **Add SLF Host Config** page.
16. Set the value to *true* for **Populate SLF Discovered Candidate List** from the drop-down list to create the **SLF Discovered Candidate List**.
17. Click **Add** provided under **Error Responses** section to add the error response details. The **Add Error Responses** page is displayed.
18. Enter the values for **Error Responses** as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
19. Click **Save** on **Add Error Responses** page.
20. Click **Save** to save the SLF Options.

Note

Use the **Edit** or **Delete** icons available in the next column of the specific entry to update or delete the **SLF Lookup Configuration**, **Reroute On Response HTTP Status Codes**, **SLF Host Config**, and **Error Responses**.

5.3.8 Roaming Options

Perform the following procedure to configure the **Roaming Options**:

1. From the left navigation menu, navigate to **NRF** and then click **Roaming Options**. The **Roaming Options** page is displayed.
2. Click **Edit** from the top right side to edit or update **Roaming Options** parameter. The page is enabled for modification.
3. Configure **Roaming Options** fields as described in the following table:

Table 5-51 Roaming Options

Field Name	Description
Feature Status	Flag to control roaming feature. If value is ENABLED, roaming specific routing occurs. If value is DISABLED, roaming specific routing not occurs.
Generic InterPlmn FQDN	Generic FQDN required to be added in Inter-PLMN headers request. Every NRF, whether it is vNRF or hNRF, adds the genericInterPlmnFqdn in the header. This helps to detect the loop. This is a mandatory attribute. Note: It is mandatory to configure this FQDN value in inter-PLMN format. Example: nrf.5gc.mnc012.mcc345.pub.3gppnetwork.org
User Agent Mandatory	This flag regulates the consideration to relax or reject the request, if the user-agent is not present in the request at home NRF for Access Token Request Validation feature processing. Note: User-agent header is only applicable when the nfType attribute of the access token request is not present at home NRF.
Notification API Version	Required as part of 3gpp-Sbi-Callback header input which specifies the version of Notification Server. This is a mandatory attribute for Roaming feature. Example: v1
3GPP API Root Scheme	This attribute defines the scheme which is used while constructing the 3GPP API root header.
Error Responses	This attribute defines the error responses which may be sent during NRF Roaming traffic processing. This attribute allows the user to configure the error response code and error response description for preloaded error conditions.

4. Click **Add** under **Error Responses** section to add the error response details. The **Add Error Responses** page is displayed.

5. Enter the values for **Error Responses** as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
6. Click **Save** on **Add Error Responses** page.
7. Click **Save** to save the **Roaming Options**.

Note

Use the **Edit** or **Delete** icons available in the next column of the specific entry to update or delete the **Error Responses** information.

5.3.9 Georedundancy Options

Perform the following procedure to configure the **Georedundancy Options**:

1. From the left navigation menu, navigate to **NRF** and then click **Georedundancy Options**. The **Georedundancy Options** page is displayed.
2. Click **Edit** from the top right side to edit or update **Georedundancy Options** parameter. The page is enabled for modification.
3. Configure **Georedundancy Options** fields as described in the following table:

Table 5-52 Georedundancy Options

Field Name	Description
Feature Status	Enables or disables the georedundancy feature in OCNRF.
Replication DownTime Tolerance	This attribute specifies the minimum time the reported replication status shall remain as INACTIVE before OCNRF considers the replication status as INACTIVE.
Replication UpTime Tolerance	This attribute specifies the minimum time the reported replication status shall remain as ACTIVE before OCNRF considers the replication status as ACTIVE.
Replication Latency Threshold	This attribute defines the maximum allowed replication latency beyond which the replication channel shall be considered INACTIVE.
Replication Latency	The default replication Latency of the replication channel.
Replication Status Uri	The URI that is used to query the DB replication status.
Use Remote Data When Replication Down	This attribute specifies whether the remote NRF records are considered for NRF service operations when the DB replication is down. This attribute impacts only the following service requests: • NFRegister • NFUpdate • NFHeartbeat • NFDeregister • NFStatusSubscribe (POST and PATCH) • NFStatusUnsubscribe If the value of Use Remote Data When Replication Down is true, the remote site records will be considered when the replication is down. If the value of Use Remote Data When Replication Down is false, the remote site records are not used for processing.

Table 5-52 (Cont.) Georedundancy Options

Field Name	Description
Monitor NRF Service Status Interval	This attribute defines the time interval for monitoring the aggregated Nf_Management service status (combined status of nfRegistration, nfSubscription and nrfAuditor service).
Monitor DB Replication Status Interval	This attribute defines the time interval for monitoring the DB replication status.
Site Name To NRF InstanceId Mapping List	It contains an array of SiteNameToNrfInstanceIdMapping.

- Enter the values for rules configuration as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- Click **Add** provided under **Site Name To NRF InstanceId Mapping List** section to add the site ID details.

Table 5-53 Add Site Name To NRF InstanceId Mapping List

Attribute name	Description
Site Name	Represents site name
NRF Instance Id	Represents nrfInstanceId of NRF

- Click **Save** on **Add Site Name To NRF InstanceId Mapping List** page.
- Click **Save**.

5.3.10 NF Authentication Options

Perform the following procedure to configure the **NF Authentication Options**:

- From the left navigation menu, navigate to **NRF** and then click **NF Authentication Options**.
The **NF Authentication Options** page is displayed.
- Click **Edit** from the top right side to edit or update **NF Authentication Options** parameter.
The page is enabled for modification.
- Configure **NF Authentication Options** fields as described in the following table:

Table 5-54 NF Authentication Options

Field Name	Description
NF Registration Status	This attribute controls the authentication of consumer NF for NFRegister, NFUpdate and NFDeregister service operations. If value of this attribute is ENABLED, then identity of consumer NF is validated. If value of this attribute is DISABLED, then validation is not performed for consumer NF.
NF Subscription Status	This attribute controls the authentication of consumer NF for NFStatusSubscribe and NFStatusUnsubscribe service operations. If value of this attribute is ENABLED, then identity of consumer NF is validated and NRF allows the subscription only if the NF is registered with NRF. If value of this attribute is DISABLED, then validation is not performed for consumer NF.

Table 5-54 (Cont.) NF Authentication Options

Field Name	Description
NF Discovery Status	This attribute controls the authentication of consumer NF for NFDISCOVER service operation. If value of this attribute is ENABLED, then identity of consumer NF is validated. If value of this attribute is DISABLED, then validation is not performed for consumer NF. In case NF identity is not present in discovery request messages then validation is performed as per checkIfNfisRegistered attribute.
Access Token Status	This attribute controls the authentication of consumer NF for AccessToken service operation. If value of this attribute is ENABLED, then identity of consumer NF is validated. If value of this attribute is DISABLED, then validation is not performed for consumer NF.
NF Profile Retrieval Status	This attribute controls the authentication of consumer NF for NF Profile Retrieval service operation. If value of this attribute is ENABLED, then identity of consumer NF is validated. If value of this attribute is DISABLED, then validation is not performed for consumer NF.
NF List Retrieval Status	This attribute controls the authentication of consumer NF for NF List Retrieval service operation. If value of this attribute is ENABLED, then identity of consumer NF is validated. If value of this attribute is DISABLED, then validation is not performed for consumer NF.
Check if NF is registered	This attribute controls the mechanism if there is need to check if NF is registered or not with NRF. If value of this attribute is ENABLED, then validation is performed. If value of this attribute is DISABLED, then validation is not performed for consumer NF. discovery request does not contain requester-nf-instance-fqdn and value of nfDiscoveryAuthenticationStatus is ENABLED.
errorResponses	This attribute defines the error responses which may be sent for NF Authentication scenarios. This attribute will allow to update the response code, error response description, retryAfter and redirectUrl for preloaded error conditions.

- Click **Add** provided under **Error Responses** section to add the error response details.
- Enter the values for rules configuration as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
- Click **Save** on **Add Error Responses** page.
- Click **Save** to save the NF Authentication Options.

 Note

Use the **Edit** or **Delete** icons available in the next column of the specific entry to update or delete the **Error Responses**.

5.3.11 Logging Level Options

Perform the following procedure to configure the **Logging Level Options**:

- From the left navigation menu, navigate to **NRF** and then click **Logging Level Options**. The **Logging Level Options** page is displayed.
- Click **Edit** from the top right side to edit or update **Logging Level Options** parameter. The page is enabled for modification.

3. Select the **Service Type** from the drop-down list to select anyone of the following NF Service type.
 - a. **nfAccessToken**
 - b. **nfDiscovery**
 - c. **nfRegistration**
 - d. **nfSubscription**
 - e. **nrfAuditor**
 - f. **nrfConfiguration**
 - g. **nrfArtisan**
 - h. **nrfCacheData**
 - i. **ingressGateway**
 - j. **egressGateway**
 - k. **appInfo**
 - l. **perfinfo**
 - m. **alternateroute**

For more information, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

Table 5-55 Logging Level Options

Attribute	Description
nfAccessToken	Specifies the log level options for nfAccessToken microservice
nfDiscovery	Specifies the log level options for nfDiscovery microservice
nfRegistration	Specifies the log level options for nfRegistration microservice
nfSubscription	Specifies the log level options for nfSubscription microservice
nrfAuditor	Specifies the log level options for nrfAuditor microservice
nrfConfiguration	Specifies the log level options for nrfConfiguration microservice
nrfArtisan	Specifies the log level options for nrfArtisan microservice
nrfCacheData	Specifies the log level options for Cache Data Service
ingressGateway	Specifies the log level options for Ingress Gateway
egressGateway	Specifies the log level options for Egress Gateway
appInfo	Specifies the log level options for app info
perfinfo	Specifies the log level options for Perf Info
alternateroute	Specifies the log level options for alternate-route service

4. Select the **Application Log Level** from the dropdown menu to set the constraints of the log. Possible values are:
 - **TRACE**
 - **DEBUG**

- INFO
- WARN
- ERROR

Note

The value for the **Application Log Level** field is the mandatory value, and the package log level is the optional value.

5. Select the appropriate **Log Rate Control Log Level** option from the drop-down menu, in the **Log Rate Control** section.

Table 5-56 Log Rate Control Options

Log Level	Description
ALL	No filtering; logs everything (not common for BurstFilter).
DEBUG	Filters logs at DEBUG and above.
ERROR	Applies burst filtering to error messages and above.
FATAL	Only filters fatal errors.
INFO	Filters logs at INFO, WARN, ERROR, and FATAL.
OFF	Disables the logLevel.
TRACE	Filters everything, including the most detailed logs.
WARN	Applies filtering to warnings and above.

6. Set the value of **Rate**. This value indicates the number of log messages that are throttled per second.

Note

The **Log Rate Control** and **Rate** parameters are displayed only for NRF microservices.

7. Set the status of **Additional Error Logging** as **ENABLED** from the drop-down menu to add the additional attributes in the ERROR log.

Note

This attribute is available only for the following microservices:

- nfregristration
- nfsubscription
- nfdiscovery
- nfaccessesstoken
- nrfconfiguration
- nrfauditor
- nrfcachedata
- nrfartisan
- ingressGateway
- egressGateway
- alternateroute

8. Set the status of **Log Subscriber Info** as **ENABLED** from the drop-down menu to add the subscriberId details in the ERROR log.

Note

This attribute is available only for the following microservices:

- nfregristration
- nfsubscription
- nfdiscovery
- nfaccessesstoken
- nrfconfiguration
- nrfauditor
- nrfcachedata
- nrfartisan
- ingressGateway
- egressGateway
- alternateroute

9. Click **Add** provided under **Package Log Level** section to specify the name of the package and its log level.

Note

This section is only applicable when Oracle Engineering is trying to isolate an issue and requests one or more package names be added and logs collected after the reproduction of an issue.

- a. Select the **Package Name** in the **Package Log Level** section. Possible values are:
 - **root**
 - **cache**

Note

cache is for nfDiscovery microservice only.

- b. From the **Log Level** drop-down list, select the log level for the package. Possible values are:
 - **TRACE**
 - **DEBUG**
 - **INFO**
 - **WARN**
 - **ERROR**
 - c. Click **Save** on **Add Package Log Level** page.
The package log level information for the selected service is saved.
10. Click **Save** to save the **Logging Level Options**.

Note

Use the **Edit** or **Delete** icons available in the next column of the specific entry to update or delete the **Package Log Level**.

5.3.12 NF Screening Options

Perform the following procedure to configure the **NF Screening Options**:

1. From the left navigation menu, navigate to **NRF** and then click **NF Screening Options**.
The **NF Screening Options** page is displayed.
2. Click **Edit** from the top right side to edit or update **NF Screening Options** parameter.
The page is enabled for modification.
3. Configure the values for the attributes as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*:
 - a. Enter the **Response Code** value in the field.
 - b. Select the **Feature Status** from the drop-down list.
4. Click **Save**.

5.3.12.1 Screening Rules

NF Screening supports the functionality to screen the service requests received from 5G Network Functions (NFs) before allowing access to NRF services. In this feature, NRF screens the incoming service operations from NFs on the basis of some attributes against set of rules configured at NRF. NRF processes the required services only if screening is successful. This feature provides extra security by restricting the NF that can use the service of NRF.

Using the screening lists, operator can decide which NF can access the services provided by NRF by configuring attributes based on the requirement.

5.3.12.1.1 CALLBACK URI

Screening list type for callback URIs in NF Service and nfStatusNotificationUri in SubscriptionData.

NRF screens the callback URI present in the request before allowing access to management service. Host present in callback URI (FQDN+port or IP+port) must be used for screening. In CALLBACK URI, the attributes that can be modified are FQDN, Port and IP address.

5.3.12.1.1.1 Configuring Callback URI Parameters

Perform the following procedure to configure the **CALLBACK URI**:

1. From the left navigation menu, navigate to **NRF** and then click **Screening Rules**. Under **Screening Rules**, click **CALLBACK URI**. The **CALLBACK URI** page is displayed.
2. Click **Edit** from the top right side to edit or update a CALLBACK URI parameter. The page is enabled for modification.
3. Set the values for the fields as follows:
 - a. Select **Status** from drop-down list.
 - b. Select the required **NF Screening Type** from drop-down list.
 - c. Choose the **Failure Action** for specific *Rules Data* from drop-down list. For more information on NF Types, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
 - d. Click **Add** provided under **NF Callback URIs** section based on the requirement for each *Rules Data* to add NF Callback URIs.
 - e. Enter the parameter values in **Add NF Callback URIs** page as described in the following table:

Table 5-57 Add NF Callback URIs

Attribute Name	Description
FQDN	Exact FQDN to be matched. This is conditional, at least one attribute is present.
Pattern	Regular Expression for FQDN. This is conditional, at least one attribute is present.
IPv4 Address	Enter the IPv4 address to be matched.
IPv4 Address Range	Enter the range of IPv4 addresses.
IPv6 Address	Enter the IPv6 address to be matched.
IPv6 Address Range	Enter the range of IPv6 addresses.
Ports	Enter the Ports. If this attribute is not configured then it will not be considered for validation
Port Ranges	Enter the range of ports. If this attribute is not configured then it will not be considered for validation

For more information on parameter values and description, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

- f. Click **Save** on **Add NF Callback URIs** page to save the **NF Callback URIs** details.
4. Click **Save**.

Note

Use the **Edit** or **Delete** icons available in the next column of the specific entry to update or delete the **NF Callback URIs**.

5.3.12.1.2 NF FQDN

NRF screens the Fully Qualified Domain Name (FQDN) present in the request before allowing access to management service.

In NF FQDN, the attributes that can be modified are pattern, fqdn in NFProfile and fqdn in NFService.

5.3.12.1.2.1 Configuring NF FQDN Parameters

Perform the following procedure to configure the **NF FQDN**:

1. From the left navigation menu, navigate to **NRF** and then click **Screening Rules**. Under **Screening Rules**, click **NF FQDN**.
The **NF FQDN** page is displayed.
2. Click **Edit** from the top right side to edit or update the NF FQDN parameter.
The page is enabled for modification.
3. Set the values for the fields as follows:
 - a. Select **Status** from drop-down list.
 - b. Select the required **NF Screening Type** from drop-down list.
 - c. Choose the **Failure Action** for specific *Rules Data* from drop-down list.
 - d. Enter the **Pattern** and **FQDN** values under **NF FQDN** section based on the requirement for each *Rules Data*.
4. Click **Save**.

Note

Repeat the above steps for all the **Rules Data**.

5.3.12.1.3 NF IP Endpoint

NRF screens the IP endpoint(s) present in the request before allowing access to management service.

5.3.12.1.3.1 Configuring NF IP Endpoint Parameters

Perform the following procedure to configure the **NF IP Endpoint**:

1. From the left navigation menu, navigate to **NRF** and then click **Screening Rules**. Under **Screening Rules**, click **NF IP Endpoint**.
The **NF IP Endpoint** page is displayed.

2. Click **Edit** from the top right side to edit or update NF IP Endpoint parameters. The page is enabled for modification.
3. Set the values for the fields as follows:
 - a. Select **Status** from drop-down list.
 - b. Select the required **NF Screening Type** from drop-down list.
 - c. Choose the **Failure Action** for specific *Rules Data* from drop-down list.
 - d. Click **Add** provided under **NF IP Endpoint** section based on the requirement for each *Rules Data* to add NF IP Endpoint.
 - e. Enter the parameter values in **Add NF IP Endpoint** page as described in the following table:

Table 5-58 Add NF IP Endpoint

Attribute Name	Description
IPv4 Address	IPv4 address to be matched. See NOTE below
IPv4 Address Range	Range of IPv4 addresses. See NOTE below
IPv6 Address	IPv6 address to be matched. See NOTE below
IPv6 Address Range	Range of IPv6 addresses. See NOTE below
port	If this attribute is not configured then it will not be considered for validation
portRange	If this attribute is not configured then it will not be considered for validation

For more information on parameter values and description, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

- f. Click **Save** on **Add NF IP Endpoint** page to save the **NF IP Endpoint** details.
4. Click **Save**.

Note

Use the **Edit** or **Delete** icons available in the next column of the specific entry to update or delete the **NF IP Endpoint**.

5.3.12.1.4 NF Type Register

NRF screens the NF type present in the incoming service request.

5.3.12.1.4.1 Configuring NF IP Type Register Parameters

Perform the following procedure to configure the **NF IP Type Register**:

1. From the left navigation menu, navigate to **NRF** and then click **Screening Rules**. Under **Screening Rules**, click **NF IP Type Register**. The **NF IP Type Register** page is displayed.
2. Click **Edit** from the top right side to edit or update a NF IP Type Register parameters. The page is enabled for modification.
3. Set the values for the fields as follows:

- a. Select **Status** from drop-down list.
 - b. Select the required **NF Screening Type** from drop-down list.
 - c. Select the **Failure Action** from drop-down list for *Global Screening Rules Data*.
 - d. Enter the NF Type in the **NF Type List** field for *Global Screening Rules Data*.
4. Click **Save**.

5.3.12.1.5 PLMN ID Parameters

NRF screens the PLMN ID present in the request before allowing access to management service.

5.3.12.1.5.1 Configuring PLMN ID Parameters

Perform the following procedure to configure the **PLMN ID**:

1. From the left navigation menu, navigate to **NRF** and then click **Screening Rules**. Under **Screening Rules**, click **PLMN ID**.
The **PLMN ID** page is displayed.
2. Click **Edit** from the top right side to edit or update a PLMN ID parameters.
The page is enabled for modification.
3. Set the values for the fields as follows:
 - a. Select **Status** from drop-down list.
 - b. Select the required **NF Screening Type** from drop-down list.
 - c. Choose the **Failure Action** for specific *Rules Data* from drop-down list.
 - d. Click **Add** provided under **PLMN List** section based on the requirement for each *Rules Data* to add PLMN List.
 - e. Enter the **MCC** and **MNC** parameter values in **Add PLMN List** page.
For more information on parameter values and description, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
 - f. Click **Save** on **Add PLMN List** page to save the **PLMN List** details.
4. Click **Save**.

Note

Use the **Edit** or **Delete** icons available in the next column of the specific entry to update or delete the **PLMN List**.

5.3.13 DNS NAPTR Update Options

Perform the following procedure to configure the **DNS NAPTR Update Options**:

1. From the left navigation menu, navigate to **NRF** and then click **DNS NAPTR Update Options**.
2. Click **DNS NAPTR Update Options** under **DNS NAPTR Update**.
The **DNS NAPTR Update Options** page is displayed.

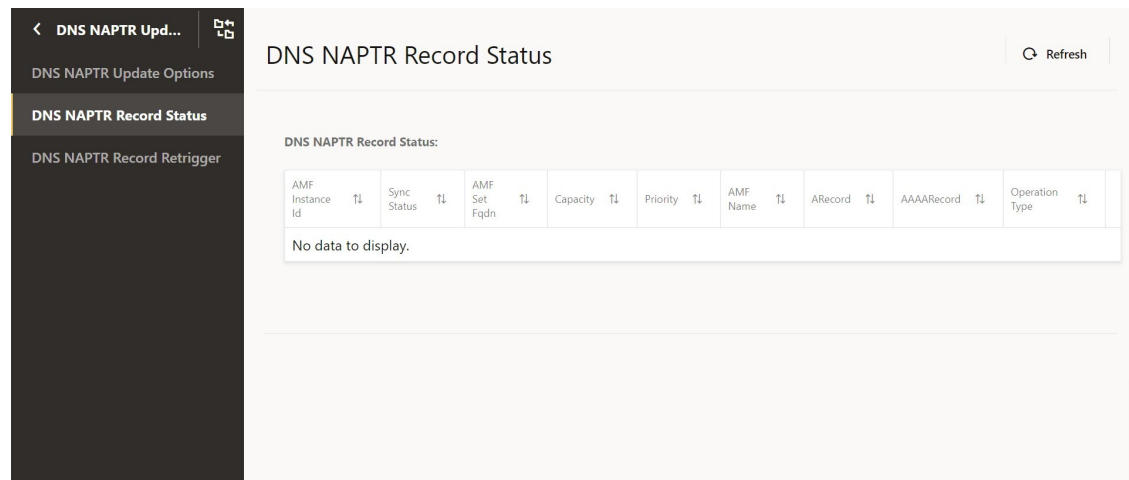
- Click **Edit** from the top right side to edit or update **DNS NAPTR Update Options** parameter.
The page is enabled for modification.
- Configure **DNS NAPTR Update Options** fields as described in the following table:

Table 5-59 DNS NAPTR Update Options

Field Name	Description
Feature Status	Enables or disables the DNS NATPR update. If the value of this attribute is ENABLED, then NRF performs DNS NAPTR update during AMF NFRegister, NFUpdate, and NFDeregister requests. If the value of this attribute is DISABLED, then NRF does not perform any DNS NAPTR update during AMF NFRegister, NFUpdate, and NFDeregister requests.
Max Retry Count	This attribute defines the maximum number of retries when a DNS NAPTR update fails.
Default Priority	The value of this attribute is considered as NF priority in case NFProfile does not have a priority attribute.
Default Capacity	The value of this attribute is considered as NF capacity in case NFProfile does not have the capacity attribute.

5.3.13.1 DNS NAPTR Record Status

This screen displays the status of DNS NAPTR record.

Figure 5-6 DNS NAPTR Record Status

Click on **View** icon to view the status of specific DNS NAPTR Record.

5.3.13.2 DNS NAPTR Record Retrigger

Perform the following procedure to retrigger NFInstanceIds using **DNS NAPTR Record Retrigger** option.

- From the left navigation menu, navigate to **DNS NAPTR Record Retrigger**.
The **DNS NAPTR Record Retrigger** page is displayed.

2. Click **Edit** from the top right side to edit or update **DNS NAPTR Record Retrigger** parameter.
The page is enabled for modification.
3. Enter the NFInstanceIds in **Retrigger NAPTR Update Records** field.
4. Click **Save**.

5.3.14 Pod Protection Options

Perform the following procedure to configure the **Pod Protection Options**:

1. From the left navigation menu, navigate to **NRF** and then click **Pod Protection Options**.
The NF Subscription Pod Protection Options page is displayed.
2. Click **Edit** from the top right side to edit or update Pod Protection Options.
The page is enabled for modification.
3. Set the value to `true` for **Enabled** option from the drop-down to enable the Pod Protection Options.
4. Set the value to `true` from the drop-down for **Enabled** option under Congestion Control section to enable the congestion control.
5. Click **Save** to save the Pod Protection Options.

Table 5-60 Pod Protection Options

Attribute	Description	Details
Enabled	This attribute indicates if the Pod Protection feature is enabled or disabled.	DataType: Boolean Constraints: true, false Default Value: false
Monitoring Interval	This attribute indicates the periodicity at which the overload state is monitored. Unit: Milliseconds Note: Do not modify this parameter value. Consider it as a read-only parameter.	DataType: Integer Constraints: NA Default Value: 1200
Congestion Control	This attribute allows the congestion control configuration. For more information about congestion control parameters, see Table 5-61 .	DataType: Object Constraints: NA Default Value: NA

Table 5-61 CongestionControlConfig

Attribute	Description	Details
Enabled	This attribute allows the configuration of pod protection attributes for the nfSubscription pods. Note: This must be set to true for Pod Protection feature.	DataType: Boolean Constraints: true, false Default Value: false

Table 5-61 (Cont.) CongestionControlConfig

Attribute	Description	Details
Action Sampling Period	This attribute indicates the interval at which the configured action must be considered. The actions are configured under entryAction.action attribute. The interval is calculated as (actionSamplingPeriod * monitoringInterval). Note: Do not modify this parameter value. Consider it as a read-only parameter.	DataType: Integer Constraints: NA Default Value: 2
State Change Sample Count	This attribute indicates the number of times the pod must be in the particular congestion state before transitioning to that state. For example, if the current state is normal, and the new state is DoC, then NRF moves the pod to DoC only if the state is reported for 10 times in 1 second (stateChangeSampleCount * monitoringInterval). Note: Do not modify this parameter value. Consider it as a read-only parameter.	DataType: Integer Constraints: NA Default Value: 2
States	This attribute indicates the congestion states, the thresholds, and corresponding actions. For more information about congestion states, see Table 5-62.	DataType: Object Constraints: NA Default Value: NA

Table 5-62 CongestionStates

Attribute	Description	Details
Name	The name of the congestion state. - Normal: The pod is not in overload state. - Danger of Congestion (Doc): The pod is about to go into the congested state. Actions configured in the entryAction is performed. - Congested state: The pod is in congested state. Actions configured in the entryAction is performed. Note: Do not modify this parameter value. Consider it as a read-only parameter.	DataType: String Constraints: Normal, Doc, Congested Default Value: NA
Weight	The weight of the congestion state. The weight indicates the criticality of the congestion state. The lower the value, the lower the criticality. Note: Do not modify this parameter value. Consider it as a read-only parameter.	DataType: Integer Constraints: NA Default Value: Normal= 0, DoC= 1, and Congested= 2
Entry Action	This attribute indicates the actions for the congestion state. For more information about the entry action configuration, see Table 5-63. Note: Do not modify this parameter value. Consider it as a read-only parameter.	DataType: List Constraints: NA Default Value: NA

Table 5-62 (Cont.) CongestionStates

Attribute	Description	Details
Resource Threshold	This attribute indicates the resource thresholds for the given congestion state. This configuration is mandatory for the 'DoC' and 'Congested' states. For more information about the threshold for each resources, see Table 5-64. Note: Do not modify this parameter value. Consider it as a read-only parameter.	DataType: Object Constraints: NA Default Value: NA

Table 5-63 EntryActionConfig

Attribute	Description	Details
Action	This attribute indicates the action for the congestion state. - AcceptIncomingConnections: The action indicates whether the incoming new connection is accepted or rejected based on the overload state. - MaxConcurrentStreamsUpdate: The action indicates whether to increase or decrease the max concurrent stream for all incoming connections till the maxConcurrentStreamsPerCon is reached.	DataType: String Constraints: MaxConcurrentStreamsUpdate, AcceptIncomingConnections Default Value: NA
Arguments	This attribute indicates the actions for the congestion state. For more information about the arguments, see Table 5-65.	DataType: Map <String, Object> Constraints: NA Default Value: NA

Table 5-64 ResourceThreshold

Attribute	Description	Details
CPU	The CPU threshold is expressed in percentage. Note: Do not modify this parameter value. Consider it as a read-only parameter.	DataType: Integer Constraints: NA Default Value: For DoC, the default CPU is 60. For Congested, the default CPU is 75.
Pending Message Count	The number of messages pending to be processed, expressed in absolute value. Note: Do not modify this parameter value. Consider it as a read-only parameter.	DataType: Integer Constraints: NA Default Value: For DoC, the default count is 100. For Congested, the default count is 150.

Table 5-65 Possible Arguments

Attribute	Description	Details
Accept	The attribute indicates if the incoming connection should be accepted or not. Applicable when the action is Accept Incoming Connections . True: The incoming connection is accepted. False: The incoming connection is rejected.	DataType: Boolean Constraints: true, false Default Value: NA
Increment By	The attribute indicates the factor by which the current concurrent streams value will be incremented till it reaches <code>maxConcurrentStreamsPerCon</code> . Note: This is preconfigured for Normal and DoC state.	DataType: Integer Constraints: NA Default Value: 30
Decrement By	The attribute indicates the factor by which the current concurrent streams value will be decremented till it reaches <code>maxConcurrentStreamsPerCon</code> . Note: This is preconfigured for DoC and Congested state.	DataType: Integer Constraints: NA Default Value: 30
Max Concurrent Streams Per Connection	The attribute indicates the maximum number of concurrent streams per connection.	DataType: Integer Constraints: NA Default Value: For Normal, the default value is 100. For DoC, the default count is 50. For Congested, the default count is 10.
Decrement By Action Sampling Period	The attribute indicates the time interval at which the <code>decrementBy</code> is applied to reach Max Concurrent Streams Per Connection . If not provided, the Action Sampling Period is used. Note: This is preconfigured for DoC and Congested state.	DataType: Integer Constraints: NA Default Value: 1
Increment By Action Sampling Period	The attribute indicates the time interval at which the <code>incrementBy</code> is applied to reach Max Concurrent Streams Per Connection . If not provided, the Action Sampling Period is used. Note: This is preconfigured for DoC and Congested state.	DataType: Integer Constraints: NA Default Value: 30

5.3.15 Controlled Shutdown

Perform the following procedure to configure the **Controlled Shutdown**:

1. From the left navigation menu, navigate to **NRF** and then click **Controlled Shutdown**. The **Controlled Shutdown Options** page is displayed.
2. Click Edit from the top right side to edit or update **Operational State** parameter. The page is enabled for modification.
3. Configure **Operational State** field as described in the following table:

Table 5-66 Operational State

Field Name	Description
Operational State	Determines the value of the current operational state. Allowed values are NORMAL, COMPLETE_SHUTDOWN.

- Click on **Operational State History** field to view the last 5 operational state changes.

Table 5-67 Operational State History

Field Name	Description
Operational State History	Provides the list of the last five operational state changes.

5.3.16 NRF Growth Options

Perform the following steps to configure the NRF Growth feature.

- From the left navigation menu, navigate to **NRF** and then click the **Growth Feature**.
- Select **Feature Options** under **Growth Feature** in the left navigation menu.
The **Feature Options** page is displayed.
- Click **Edit** from the top right side to edit or update Growth Feature Options.
The page is enabled for modification.

Table 5-68 Feature Options

Attribute	Description	Details
Feature Status	This is an optional parameter. This attribute is used to enable or disable the NRF Growth feature. featureStatus value cannot be ENABLED , if nfSetId is null and nrfHostConfig is not configured. If the value of this attribute is set as ENABLED , then the state data from multiple sets is used for processing service requests.	Data Type: String Constraints: NA Default Value: DISABLED Range: ENABLED or DISABLED
Enable Compression For CDS to CDS	This is an optional parameter. This attribute is used to enable or disable the Gzip compression for communication between the local CDS microservice and the remote CDS microservice. If the value is true, Gzip compression is enabled for communication between the local CDS microservice and the remote CDS microservice. If the value is false, compression is disabled for communication between the local CDS microservice and the remote CDS microservice.	Data Type: Boolean Constraints: NA Default Value: false Range: true, false

Table 5-68 (Cont.) Feature Options

Attribute	Description	Details
NF Set ID	This is a mandatory parameter. This attribute indicates the NRF set ID to which the NRF belongs. The value of this is the same for all the georedundant sites. The value for this attribute is set as per 3GPP TS 29.571 v16.7.0.	Data Type: String Constraints: maximum length is 255. Default Value: null Range: NA
NRF Host Config	This is a mandatory parameter. This attribute is used to configure the NRF host details of the remote NRF set. See Table 5-69 for details.	Data Type: Array Constraints: NA Default Value: NA Range: NA
NRF Reroute Profile	The attribute indicates the number of reroutes to be performed when the NRF of a remote NRF set is unreachable. See Table 5-71 for details.	Data Type: Array Constraints: NA Default Value: NA Range: NA

Table 5-69 NRF Host Config

Attribute	Description	Details
Host Config Mode	This is a mandatory parameter. The attribute defines the mode in which the configurations are used. STATIC_MODE: When this value is set, the NRF hosts configured in the <code>staticNrfConfigList</code> is used. Note: <code>STATIC_MODE</code> is the only mode supported in this release.	Data Type: String Constraints: NA Default Value: <code>STATIC_MODE</code> Range: NA
Static NrfConfig List	This is a mandatory parameter. This attribute is used to configure the host details of the NRFs from the remote NRF set. The attribute must have at least two entries to enable the feature. One of the entries must contain the details of the local NRF Set. See Table 5-70 for details. Note: A maximum of three NRF sets can be configured. In each NRF set, a maximum of four hosts per set are allowed.	Data Type: Array Constraints: NA Default Value: NA Range: NA

Table 5-70 Static NrfConfig List

Attribute	Description	Details
NF Set ID	This is a mandatory parameter. This attribute represents the unique ID of the NRF set. The value of this is the same for all the georedundant sites. The value for this attribute is set as per 3GPP TS 29.571 v16.7.0.	Data Type: String Constraints: maximum length is 255. Default Value: NA Range: NA
Nrf Host ConfigList	This is a mandatory parameter. This attribute is used to configure the NRF host details of the remote NRF set(s). See, the NfConfig table in <i>Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide</i> for details.	Data Type: Array Constraints: NA Default Value: NA Range: NA

Table 5-71 NRF Reroute Profile

Attribute	Description	Details
Reroute Attempts	This is an optional parameter. This attribute indicates the number of alternate NRF reroutes when the retry attempts are exhausted.	Data Type: Integer Constraints: NA Default Value: 1 Range: 0-3
Http Status Code List	This is an optional parameter. This attribute indicates the HTTP status codes to which retry and reroute must be attempted.	Data Type: Array Constraints: NA Default Value: "pattern": "[3,5][0-9]{2}\$" Range: NA

4. Set the value to **ENABLED** for the **Feature Status** option from the drop-down to enable the Growth feature.
5. Configure **NRF Host Config** details. Enter the values for host configuration as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
 - a. Click **Add** provided to add a NF set ID.
 - b. Click **Save** on the **Add NF Set ID** page.
6. Configure the reroute profile. Enter the values for reroute configuration as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

5.3.16.1 Forwarding Options

In case you want to enable Forwarding Options for the NRF Growth feature, perform the following configurations:

Note

When the NRF Growth feature is enabled, **NRF-NRF Forwarding Options** configurations is not considered. For more information about the forwarding options, see the "[Forwarding Options](#)" section.

1. From the left navigation menu, navigate to **NRF** and then click the **Growth Feature**.
2. Select **Forwarding Options** under **Growth Feature** in the left navigation menu. The **Forwarding Options** page is displayed.
3. Click **Edit** from the top right side to edit or update the **Forwarding Options** parameter. The page is enabled for modification.
4. Configure **Forwarding Options** fields as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
5. Configure **NRF Host Config** details. Enter the values for host configuration as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
 - a. Click **Add** provided to add a segment ID.
 - b. Click **Save** on the **Add Segment ID** page.
6. Select the **Feature Status** value provided under the **Forwarding Rules Feature Config** section to set the feature configuration. This flag can be **ENABLED** only if Discovery Status or AccessToken Status attributes are **ENABLED**.
7. Click **Add** provided under the **Forwarding Rules Feature Config** section to add the Forwarding Rules feature configuration. The **Add Forwarding Rules Config** page is displayed.
 - a. Enter the values for rules configuration as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
 - b. Click **Save** on the **Add Forwarding Rules Config** page.
8. Click **Add** provided under the Error Responses section to add the error response details. The **Add Error Responses page** is displayed.
 - a. Enter the values for rules configuration as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
 - b. Click **Save** on the **Add Error Responses** page.
9. Click **Save** to save the **Forwarding Options**.

5.3.17 Ingress Gateway

This section describes the Ingress Gateway configurations.

5.3.17.1 CCA Header

This configuration is used to update the CCA header configuration. By default, configurableErrorCodes will have value as provided in the feature configuration, if the configuration is disabled then default values are considered from Helm file.

Perform the following configurations:

1. From the left navigation menu, navigate to **Ingress Gateway** option to configure the Ingress Gateway APIs.
2. Click the **CCA Header** option under **Ingress Gateway** to configure the CCA header.
3. The **CCA header** page is displayed with default values.
4. Click **Edit** to edit the default configuration.
The **Edit CCA header** page is displayed.
5. Configure the fields in the **Edit CCA header** page as mentioned in [Table 5-72](#).
6. Click **Save** on the **Edit CCA header** page to save the details. Click **Cancel** to discard your progress and go back to **CCA header** page.

Note

- Use **Refresh** icon to refresh the configuration.

Table 5-72 CCA Header Validation Configuration

Field Name	Description	Details
Enabled	Indicates if the CCA validation feature flag is enabled or disabled. Note: • Do not modify this parameter value. This value should be always false. Consider it as a read-only parameter. • Enable this feature post installation or upgrade only by using the Enabled parameter in Metadata under Access Token Id to true in the Routes Configuration section. Use the configuration as suggested in the "Routes Configuration" section in Ingress Gateway Configuration" in <i>Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide</i>. Accidental deletion of any of the routes in this configuration leads to service outage.	Data Type: boolean Constraints: true, false Default Value: false Presence: M
Min Expiry Time	Indicates the buffer or additional time that is added to the current time to check it with the certificate expiry time.	Data Type: integer Constraints: NA Default Value: 0 Presence: M
Max Token Age	Indicates the maximum token age allowed. Note: It skips the check if the value is 0.	Data Type: integer Constraints: 0 - 86400 seconds Default Value: 0 Recommended Value: 60 for NRF. Presence: M
Role	Indicates the CCA token validator role to match the audience claim in the header. Note: Do not modify this parameter value. Consider it as a read-only parameter.	Data Type: string Constraints: NA Default Value: NRF Presence: M

Table 5-72 (Cont.) CCA Header Validation Configuration

Field Name	Description	Details
Sub Key	Indicates if the certificate extension name to be read in the public key certificate received in CCA request for consumer NFs Instance Id. For NRF this value should be NF Instance Id. Note: Do not modify this parameter value. Consider it as a read-only parameter.	Data Type: string Constraints: NA Default Value: subjectAltName Presence: M
Validation Rule	Indicates the CCA validation rule. - strict: If "Issued At"+"Maximum Token Age Allowed "> current time, then the NRF validation rules are applied. - relaxed: "Issued At" validation is not mandatory. Validation rules are applied to Producer NF. For NRF, this value is always strict.	Data Type: string Constraints: strict, relaxed Default Value: strict Presence: M
K8 Secret Name	Indicates the name of the Kubernetes secret in which the CA bundle is present. Note: After fresh installation, these attributes must be configured with appropriate values as per the system requirement as these values are sample ones. Example k8SecretName: ocingress-secret	Data Type: string Constraints: NA Default Value: NA Presence: M
K8 NameSpace	Indicates the Kubernetes namespace in which CA bundle is present. Note: changens value is updated with NRF secret for CCA header. Note: After fresh installation, these attributes must be configured with appropriate values as per the system requirement as these values are sample ones. Example k8NameSpace: ocingress-ns	Data Type: string Constraints: NA Default Value: NA Presence: M
File Name	Indicates the name of the CA bundle file used for CCA. This is the file generated by certificate and key generation steps. Note: After fresh installation, these attributes can be configured with appropriate values as per the system requirement as these values are sample ones. Example: fileName: caroot.cer	Data Type: string Constraints: NA Default Value: NA Presence: M

For more information about the configuration parameters, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

5.3.17.2 Controlled Shutdown Error Mapping

This configuration is used for mapping between the routes and the error code profile that is used when the Ingress Gateway rejects incoming requests.

Perform the following configurations:

1. From the left navigation menu, navigate to **Ingress Gateway** option to configure the Ingress Gateway APIs.

- Click **Controlled Shutdown Error Mapping** option under **Ingress Gateway**.
The **Controlled Shutdown Error Mapping** page is displayed.
- Click **Edit** to edit the configuration.
The **Edit Controlled Shutdown Error Mapping** page is displayed.
- Click **Add** in the **Route Error Profile List** section.
The **Add Route Error Profile List** page is displayed.
- Configure the fields in the **Add Route Error Profile List** page as mentioned in [Table 5-73](#).
- Click **Save** on the **Edit Controlled Shutdown Error Mapping** page to save the details.
Click **Cancel** to discard your progress and go back to **Controlled Shutdown Error Mapping** page.

Note

- Use the **Edit** or **Delete** icon available in the next column of the specific entry to update or delete the error profile information.
- Use **Refresh** icon to refresh the error profile information.

Table 5-73 Controlled Shutdown Error Mapping

Field Name	Description	Details
Route ID	The route id that is configured in routes configuration.	DataType: string Constraints: NA Possible values: <subscription_mapping, accesstoken_mapping, registration_mapping, disc_mapping> The possible values should match with the routeld of the routes configuration. Default Value: NA
Error Profile Name	The error profile name that is used to fetch the error from errorcodeprofiles.	DataType: string Constraints: NA Default Value: shutdownerror503

For more information about the configuration parameters, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

5.3.17.3 Copy Header on Gateway Error

Perform the following procedure to configure the **Copy Header on Gateway Error**:

- From the left navigation menu, navigate to **Ingress Gateway** option to configure the Ingress Gateway APIs.
- Click **Copy Header on Gateway Error** option under **Ingress Gateway**.
The **Copy Header on Gateway Error** page is displayed with default values for a few fields.
- Click **Edit** to modify the attributes in the **Copy Header on Gateway Error** page.
The **Edit Copy Header on Gateway Error** page is displayed.
- Use the toggle option to **Enabled** to turn on the feature.

5. Add the required Request Header Names in the **Request Header Names** field.
6. Click **Save** on the **Edit Copy Header on Gateway Error** page to save the details.
7. Click **Cancel** to discard your progress and go back to **Copy Header on Gateway Error** page.

5.3.17.4 Error Code Profile

This configuration is used to update the errorcodeprofiles that is used in Overload Control, Controlled Shutdown feature for populating details in error responses when a request is discarded.

Perform the following configurations:

1. From the left navigation menu, navigate to **Ingress Gateway** option to configure the Ingress Gateway APIs.
2. Click **Error Code Profiles** option under **Ingress Gateway**.
The **Error Code Profiles** page is displayed with default values for few fields.
3. Click **Add** to add the profiles.
The **Create Error Code Profiles** page is displayed.
4. Configure the fields in the **Create Error Code Profiles** page as mentioned in [Table 5-74](#).
5. Click **Save** on the **Create Error Code Profiles** page to save the details. Click **Cancel** to discard your progress and go back to **Error Code Profiles** page.

Note

- Use the **Edit** icon available in the next column of the specific entry to update the route error profile information.
- Use **Refresh** icon to refresh the route error profile information.

Table 5-74 Error Code Profile Configuration

Field Name	Description	Details
Name	Indicate the error name.	Data Type: string Constraints: NA Default Value: NA Presence: M
Error Code	Error Code field in an errorScenario determines the HttpStatusCode that needs to be populated in ProblemDetails (HttpStatus field) response from Ingress Gateway when the exception occurred at Ingress Gateway matches the configured errorScenario's exceptionType field.	Data Type: integer Constraints: NA Default Value: NA Presence: M
Error Cause	Error Cause field in an errorScenario determines the error cause that needs to be populated in ProblemDetails (Cause field) response from Ingress Gateway when the exception occurred at Ingress Gateway matches the configured errorScenario's exceptionType parameter.	Data Type: integer Constraints: NA Default Value: NA Presence: O

Table 5-74 (Cont.) Error Code Profile Configuration

Field Name	Description	Details
Error Title	Error Title field in an errorScenario determines the title that needs to be populated in ProblemDetails (Title field) response from Ingress Gateway when the exception occurred at Ingress Gateway matches the configured errorScenario's exceptionType parameter.	Data Type: integer Constraints: NA Default Value: NA Presence: O
Redirect URL	Redirect URL field in an errorScenario determines the redirection URL, this value is populated in LOCATION header while sending response from Ingress Gateway. The header is populated only when the exception occurred at Ingress Gateway matches the configured errorScenario's exceptionType parameter, the errorCode configured for the particular errorScenario lies in 3xx error series and the redirectUrl field for the particular errorScenario is configured appropriately.	Data Type: integer Constraints: NA Default Value: NA Presence: O
Retry After	Retry After field in an errorScenario determines the value in seconds or particular date after which the service should be retried, this value is populated in Retry-After header while sending response from Ingress Gateway. The header is populated only when the exception occurred at Ingress Gateway matches the configured errorScenario's exceptionType parameter, the errorCode configured for the particular errorScenario lies in 3xx error series and the retry-after field for the particular errorScenario is configured appropriately in seconds.	Data Type: integer Constraints: NA Default Value: NA Presence: O
Error Description	Error Description field in an errorScenario determines the description that needs to be populated in ProblemDetails (Detail field) response from Ingress Gateway when the exception occurred at Ingress Gateway matches the configured errorScenario's exceptionType field.	Data Type: integer Constraints: NA Default Value: NA Presence: O

For more information about the configuration parameters, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

5.3.17.5 Overload Control Policy Mapping

This configuration is used to update service names and corresponding policy names for the service that is mapped to "ocDiscardPolicies" based on "policyName" and enable or disable the Overload Control feature and the sampling period in overload control. The Overload Control feature is disabled by default, and the sampling period is 200. To enable the feature, invoke REST API and update the enabled flag to true.

Perform the following configurations:

1. From the left navigation menu, navigate to **Ingress Gateway** option to configure the Ingress Gateway APIs.
2. Click the **Overload Control Policy Mapping** option under **Ingress Gateway** to configure peers.

The **Overload Control Policy Mapping** page is displayed.

3. Click **Add** to add the configuration.

The **Create Overload Control Policy Mapping** page is displayed.

4. Configure the fields in the **Create Overload Control Policy Mapping** page as mentioned in [Table 5-75](#).
5. Click **Add** in the **Mappings** section.
The **Add Mappings** page is displayed.
6. Configure the fields under the **Add Mappings** page as mentioned in [Table 5-76](#).
7. Click **Save** on the **Add Mappings** page to save the details. Click **Cancel** to discard your progress and go back to **Create Overload Control Policy Mapping** page.
8. Click **Save** on the **Create Overload Control Policy Mapping** page to save the details. Click **Cancel** to discard your progress and go back to **Overload Control Policy Mapping** page.

Note

- Use the **Edit** icon available in the next column of the specific entry to update the policy mapping information.
- Use **Refresh** icon to refresh the policy mapping information.

Table 5-75 Policy Mapping Configuration

Field Name	Description	Details
Enabled	To enable or disable Overload Control feature.	Data Type: boolean Constraints: NA Default Value: NA Presence: M
Sampling Period	Time frame for each cycle of Overload Control per service. Its value is in milliseconds.	Data Type: integer Constraints: NA Default Value: NA Presence: M

Table 5-76 Mappings

Field Name	Description	Details
Service Name	The service entry to determine a mapping between service and discard policy name per service. Service Name must be added in the following format:<deployment-name>-<servicename> Note: servicename is fixed and cannot be changed.	Data Type: string Constraints: NA Default Value: NA Presence: M
Policy Name	The discard policy entry to determine a mapping between service and discard policy name per service.	Data Type: string Constraints: NA Default Value: NA Presence: M

For more information about the configuration parameters, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

5.3.17.6 Overload Control Discard Policy

This configuration is used to update discard policies that are used in overload control to select the appropriate policy from the configured list based on the load level of a particular service. By default, `ocdiscardpolicies` is null.

Perform the following configurations:

1. From the left navigation menu, navigate to **Ingress Gateway** option to configure the Ingress Gateway APIs.
2. Click the **Overload Control Discard Policy** option under **Ingress Gateway** to configure peers.
The **Overload Control Discard Policy** page is displayed.
3. Click **Add** to add the configuration.
The **Create Overload Control Discard Policy** page is displayed.
4. Configure the fields in the **Create Overload Control Discard Policy** page as mentioned in [Table 5-77](#).
5. Click **Add** in the **Policies** section.
The **Add Policies** page is displayed.
6. Configure the fields under the **Add Policies** page as mentioned in [Table 5-78](#).
7. Click **Save** on the **Add Policies** page to save the details. Click **Cancel** to discard your progress and go back to **Create Overload Control Discard Policy** page.
8. Click **Save** on the **Create Overload Control Discard Policy** page to save the details. Click **Cancel** to discard your progress and go back to **Overload Control Discard Policy** page.

① Note

- Use the **Edit** icon available in the next column of the specific entry to update the policy information.
- Use **Refresh** icon to refresh the policy information.

Table 5-77 Discard Policy Configuration

Attribute Name	Description	Details
Name	Name of the discarded policy. Note: name must be the value configured in <code>policyName</code> under <code>ocpolicymapping</code> .	Data Type: string Constraints: NA Default Value: NA Presence: M
Scheme	Discarded policy scheme based on percentage.	Data Type: string Constraints: NA Default Value: NA Presence: M

Table 5-78 Policies

Attribute Name	Description	Details
Value	Value of priority above which requests are considered as potential candidates for drop. Percentage of requests to drop in the current sampling period over the calculated rate in the previous sampling period.	Data Type: string Constraints: NA Default Value: NA Presence: M
Action	Defines the action to be taken on selected requests rejection based on error code.	Data Type: string The value can be: RejectWithErrorCode Constraints: NA Default Value: NA Presence: M
Level	Defines the overload level.	Data Type: string Constraints: NA Default Value: NA Presence: M
Error Code Profile	Define the error code profiles.	Data Type: string Constraints: NA Default Value: NA Presence: M

For more information about the configuration parameters, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

5.3.17.7 Error Code Series

This configuration is used to map errorCodeSeries id and the corresponding errorCodeSeries configuration. By default this configuration is null.

Perform the following configurations:

1. From the left navigation menu, navigate to **Ingress Gateway** option to configure the Ingress Gateway APIs.
2. Click **Error Code Series** option under **Ingress Gateway**.
The **Error Code Series** page is displayed.
3. Click **Add** to add the error code series.
The **Create Error Code Series** page is displayed.
4. Configure the fields in the **Create Error Code Series** page as mentioned in [Table 5-79](#).
5. Click **Add** in the **Error Code Series** section.
The **Add Error Code Series** page is displayed.
6. Configure the fields in the **Add Error Code Series** page as mentioned in [Table 5-80](#).
7. Click **Save** on the **Add Error Code Series** page to save the details. Click **Cancel** to discard your progress and go back to **Create Error Code Series** page.
8. Click **Save** on the **Create Error Code Series** page to save the details. Click **Cancel** to discard your progress and go back to **Error Code Series** page.

Note

- Use the **Edit** icon or **Delete** available in the next column of the specific entry to update or delete the error code series information.
- Use **Refresh** icon to refresh the error code series information.

Table 5-79 Error Code Series

Field Name	Description	Details
ID	Indicates the error code identifier.	Data Type: string Constraints: NA Default Value: NA Presence: M
Exception List	Lists the configurable exception or error for an error scenario in Ingress Gateway. The only supported values are: ConnectionTimeout, RequestTimeout, UnknownHostException, ConnectException, RejectedExecutionException, InternalError and NotFoundException, ClosedChannelException, BlackListIpException	Data Type: string Constraints: NA Default Value: NA Presence: M
Error Code Series	Lists the error codes for a specific service. Note: "ErrorCodeSeries" is configured only if a set of error responses with specific error codes is expected in server header. If it is not configured then all the error responses will have server header.	Data Type: string Constraints: NA Default Value: NA Presence: M

Table 5-80 Error Code Series Configuration

Field Name	Description	Details
Error Set	Possible values for "errorSet" attribute: 5xx, 4xx, 3xx, 2xx, 1xx	Data Type: string Constraints: NA Default Value: NA Presence: M
Error Codes	Possible values include all error codes in the respective HttpSeries value assigned for "errorSet". Note: Use single value of "-1" if all error codes in that HttpSeries are to be considered.	Data Type: Array Constraints: NA Default Value: NA Presence: M

For more information about the configuration parameters, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

5.3.17.8 Routes Configuration

This configuration is used to configure the route ID , order of evaluation, error handling, enabling CCA header feature for a route and server header in Ingress Gateway.

Perform the following configurations:

1. From the left navigation menu, navigate to **Ingress Gateway** option to configure the Ingress Gateway APIs.
2. Click **Routes Configuration** option under **Ingress Gateway**.
The **Routes Configuration** page is displayed.
3. Click **Add** to add the configuration.
The **Create Routes Configuration** page is displayed.
4. Configure the fields in the **Create Routes Configuration** page as mentioned in [Table 5-81](#).
5. Click **Save** on the **Create Routes Configuration** page to save the details. Click **Cancel** to discard your progress and go back to **Routes Configuration** page.

Table 5-81 Routes Configuration

Attribute Name	Description	Details
ID	Value of "id" attribute defines a specific service for route configuration. This attribute can have the following values: registration_mapping, subscription_mapping, disc_mapping, and accesstoken_mapping Note: Do not modify this parameter value. The default values are pre-populated as above. Consider it as a read-only parameter.	Data Type: String Constraints: NA Default Value: NA Presence: M
URI	Indicates the value of the "uri" attribute defines the uri for a specific service for route configuration. This attribute can have the following values: http://ocnrf-nfregistration:8080 , http://ocnrf-nfsubscription:8080 , http://ocnrf-nfdiscovery:8080 , http://ocnrf-nrfcachedata:8080 , and http://ocnrf-nfaccessstoken:8080 Note: Do not modify this parameter value. The default values are pre-populated as above. Consider it as a read-only parameter.	Data Type: String Constraints: NA Default Value: NA Presence: M
Order	This value indicates the order in which the incoming request should be mapped to the routes configured. Note: Do not modify this parameter value. The default values are pre-populated. Consider it as a read-only parameter.	Data Type: Integer Constraints: NA Default Value: NA Presence: M
Failure Req Count ErrorCode Series Id	Indicates the ID that is used to map the service with the error code ID defined in errorcodeserieslist.	Data Type: String Constraints: NA Default Value: NA Presence: O
Filters	This is an array that contains the applicable shutdown states and its name. Note: Do not modify this parameter value. Consider it as a read-only parameter.	Data Type: Array[Table 5-82 .] Constraints: NA Default Value: NA Presence: O

Table 5-81 (Cont.) Routes Configuration

Attribute Name	Description	Details
Metadata	This attribute is used to enable or disable the CCA header validation feature. Note: This is applicable only for Access Token Routes Id (accesstoken_mapping). This should not be configured for any of the other routes in Routes configuration. Use the mandatory configuration as suggested in the "Routes Configuration" section in Ingress Gateway Configuration" in <i>Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide</i> . Deletion of any of the routes in this configuration leads to service outage.	Data Type: Array[Table 5-83.] Constraints: NA Default Value: NA Presence: O
Predicates	This is an array that contains the path of the specific route and its name. Note: Do not modify this parameter value. Consider it as a read-only parameter.	Data Type: Array[Table 5-84.] Constraints: NA Default Value: NA Presence: M
Server Header Details	This attribute is used to enable or disable the server header feature at route-level. For more information see Server Header Details . Note: If server header is enabled at Routes Configuration, the configuration details like nfType and nfInstanceId are retrieved from the Global level. If errorCodeSeriesId is not configured at Route level, errorCodeSeriesId configured at Global level will be used as a fallback when serverHeaderDetails at RouteLevel is set as true.	Data Type: Array[Server Header Details.] Constraints: NA Default Value: NA Presence: O

Table 5-82 Filters

Attribute Name	Description	Details
Args	Indicates if the routes have any specific shutdown state and the name. Note: Do not modify this parameter value. Consider it as a read-only parameter.	Data Type: object Constraints: NA Default Value: NA Presence: M
Applicable Shutdown States	Indicates the shutdown state defined for the specific route. Note: Do not modify this parameter value. Consider it as a read-only parameter.	Data Type: string Constraints: NA Default Value: COMPLETE_SHUTDOWN Presence: M
Name	Indicates the name of the shutdown state defined for the specific route. Note: Do not modify this parameter value. Consider it as a read-only parameter.	Data Type: string Constraints: NA Default Value: ControlledShutdownFilter Presence: M

Table 5-83 Metadata

Attribute Name	Description	Details
Enabled	Indicates if the CCA header validation feature is enabled or disabled. If the value is true, CCA header validation is available for the route. If the value is false, CCA header validation is not performed for the route.	Data Type: boolean Constraints: true, false Default Value: false Presence: M

Table 5-84 Predicates

Attribute Name	Description	Details
Args	This is an object that contains the name and the path that the incoming service can match with.	Data Type: object Constraints: NA Default Value: NA Presence: M
Pattern	Indicates the path that the incoming service can match with the specified route. Note: Do not modify this parameter value. Consider it as a read-only parameter.	Data Type: string Constraints: NA Default Value: NA Presence: M
Name	Indicates the name of the path that the incoming service wants to match with. Note: Do not modify this parameter value. Consider it as a read-only parameter.	Data Type: string Constraints: NA Default Value: NA Presence: M

Table 5-85 Server Header Details

Attribute Name	Description	Details
Enabled	This attribute is used for enabling or disabling the server header feature at route-level. If the value is true, NRF adds the server header in the error responses. If the value is false, NRF does not add the server header in the error responses.	Data Type: boolean Constraints: true, false Default Value: false Presence: M
Error Code Series Id	Indicates the error list IDs. This attribute is compared with the <code>errorCodeSeriesList.Id</code> . If this attribute matches with the <code>id</code> attribute of <code>errorCodeSeriesList</code> , NRF adds the server header in the error responses. For more information about <code>errorCodeSeriesList</code> , see Error Code Series .	Data Type: string Constraints: This value should be one of the id attribute values configured in the Table 5-79 Default Value: NA Presence: M

5.3.17.9 Pod Protection

This configuration is used to configure the pod protection for Ingress Gateway pod.

Perform the following configurations:

1. From the left navigation menu, navigate to **Ingress Gateway** option to configure the Ingress Gateway APIs.
2. Click the **Pod Protection** option under **Ingress Gateway**.
The **Pod Protection** page is displayed.
3. Click **Edit** to edit the configuration.
The **Edit Pod Protection** page is displayed.
4. Configure the fields in the **Edit Pod Protection** page as mentioned in [Table 5-86](#).
5. Configure the fields under the **Congestion Control Configuration** section as mentioned in [Table 5-87](#).
6. Click **Add** in the **States** section to configure different states for Pod Protection.
The **Add States** page is displayed.
7. Configure the fields in the **Add States** page as mentioned in [Table 5-88](#).
8. Configure the fields in the **Congestion Control Threshold** section in the **Add States** page as mentioned in [Table 5-90](#).
9. Click **Add** in the **Error Action** section the **Add States** page.
The **Add Error Action** page is displayed.
10. Configure the fields in the **Add Error Action** page as mentioned in [Table 5-89](#).
11. Click **Add** in the **Entry Action** section the **Add Error Action** page.
The **Add Entry Action** page is displayed.
12. Configure the fields in the **Add Entry Action** page as mentioned in [Table 5-91](#).
13. Click **Save** on the **Add Error Action** page to save the details. Click **Cancel** to discard your progress and go back to **Error Action** page.
14. Click **Save** on the **Add States** page to save the details. Click **Cancel** to discard your progress and go back to **Edit Pod Protection** page.
15. Click **Save** on the **Edit Pod Protection** page to save the details. Click **Cancel** to discard your progress and go back to **Pod Protection** page.

Note

- Use the **Edit** icon available in the next column of the specific entry to update or delete the states information.
- Use **Refresh** icon to refresh the states information.

Table 5-86 Pod Protection Options

Field Name	Description	Details
Enabled	This attribute indicates if the Pod Protection feature is enabled or disabled.	Data Type: Boolean Constraints: true, false Default Value: false

Table 5-86 (Cont.) Pod Protection Options

Field Name	Description	Details
Monitoring Interval	This attribute indicates the periodicity at which the overload state is monitored. Unit: Milliseconds Note: The proposed value for this attribute is 1200.	Data Type: Integer Constraints: NA Default Value: 1200

Table 5-87 Congestion Control Configurations

Field Name	Description	Details
Enabled	This attribute allows the configuration of pod protection attributes for the Ingress Gateway pods. Note: This must be set to <code>true</code> for Pod Protection feature.	Data Type: boolean Constraints: true, false Default Value: false
Action Sampling Period	This attribute indicates the interval at which the configured action must be considered. The actions are configured under <code>entryAction.action</code> attribute. The interval is calculated as $(\text{actionSamplingPeriod} * \text{monitoringInterval})$. Note: The proposed value for this attribute is 3.	Data Type: integer Constraints: NA Default Value: NA
State Change Sample Count	This attribute indicates the number of times the pod must be in the particular congestion state before transitioning to another state. For example, if the current state is normal, and the new state is DoC, then NRF moves the pod to DoC only if the state is reported for 10 times in 1 second ($\text{stateChangeSampleCount} * \text{monitoringInterval}$). Note: The proposed value for this attribute is 10.	Data Type: integer Constraints: NA Default Value: NA

Table 5-88 States

Field Name	Description	Details
Name	The name of the congestion state. - Normal: The pod is not in overload state. - Danger of Congestion (Doc): The pod is about to go into the congested state. Actions configured in the <code>entryAction</code> is performed. - Congested state: The pod is in congested state. Actions configured in the <code>entryAction</code> is performed.	Data Type: string Constraints: Normal, Doc, Congested Default Value: NA

Table 5-88 (Cont.) States

Field Name	Description	Details
Weight	The weight of the congestion state. The weight indicates the critical of the congestion state. The lower the value, the lower the criticality. Note: The proposed value for this attribute is for Normal is 0, DoC is 1, and Congested is 2.	Data Type: integer Constraints: NA Default Value: NA

Table 5-89 Entry Action

Field Name	Description	Details
Action	This attribute indicates the action for the congestion state. - AcceptIncomingConnections: The action indicates whether the incoming new connection is accepted or rejected based on the overload state. - MaxConcurrentStreamsUpdate: The action indicates whether to increase or decrease the max concurrent stream for all incoming connections till the maxConcurrentStreamsPerCon is reached.	Data Type: string Constraints: MaxConcurrentStreamsUpdate, AcceptIncomingConnections Default Value: NA

Table 5-90 Resource Threshold

Field Name	Description	Details
CPU	The CPU threshold is expressed in percentage. Note: The recommended value for this attribute is for DoC is 75 and for Congested is 85.	Data Type: integer Constraints: NA Default Value: NA
Pending Message	The number of pending messages to be processed, expressed in absolute count. Note: The recommended value for this attribute is for DoC is 1500 and for Congested is 2000.	Data Type: integer Constraints: NA Default Value: NA

Table 5-91 Possible Arguments

Field Name	Description	Details
Accept	The attribute indicates if the incoming connection should be accepted or not. Applicable when the action is AcceptIncomingConnections. true: The incoming connection is accepted. false: The incoming connection is rejected. The proposed value for Normal state is true, and for DoC and Congested state is false.	Data Type: boolean Constraints: true, false Default Value: NA

Table 5-91 (Cont.) Possible Arguments

Field Name	Description	Details
Increment by	The attribute indicates the factor by which the current concurrent streams value will be incremented till it reaches <code>maxConcurrentStreamsPerCon</code> . Note: The proposed value for this attribute is 30 for Normal and DoC state.	Data Type: integer Constraints: NA Default Value: NA
Decrement by	The attribute indicates the factor by which the current concurrent streams value will be decremented till it reaches <code>maxConcurrentStreamsPerCon</code> . Note: The proposed value for this attribute is 30 for DoC and Congested state.	Data Type: integer Constraints: NA Default Value: NA
Max Concurrent Streams Per Con	The attribute indicates the maximum number of concurrent streams per connection allowed. Note: The proposed value for this attribute is for Normal is 100, DoC is 10, and Congested is 1.	Data Type: integer Constraints: NA Default Value: NA
Decrement by Action Sampling Period	The attribute indicates the time interval at which the <code>decrementBy</code> is applied to reach <code>maxConcurrentStreamsPerCon</code> . If not provided, the <code>actionSamplingPeriod</code> is used. Note: The proposed value for this attribute is 1 for DoC and Congested state. Unit is seconds.	Data Type: integer Constraints: NA Default Value: NA
Increment by Action Sampling Period	The attribute indicates the time interval at which the <code>incrementBy</code> is applied to reach <code>maxConcurrentStreamsPerCon</code> . If not provided, the <code>actionSamplingPeriod</code> is used. Note: The proposed value for this attribute is 3 for Normal and DoC state. Unit is seconds.	Data Type: integer Constraints: NA Default Value: NA

For more information about the configuration parameters, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

5.3.17.10 Server Header Details

Perform the following procedure to configure the Server Header Details:

1. From the left navigation menu, navigate to **Ingress Gateway** option to configure the Ingress Gateway APIs.
2. Click **Server Header Details** option under **Ingress Gateway**.
The **Server Header Details** page is displayed with default values for a few fields.
3. Click **Edit** to modify the attributes in the **Server Header Details** page.
The **Edit Server Header Details** page is displayed.

Table 5-92 Server Header Details

Attribute Name	Description	Details
Enabled	Indicates if the server header feature is enabled or disabled. If this value is set to true, NRF adds the server header in the error responses. If this value is set to false, NRF does not add the server header in the error responses.	Data Type: Boolean Constraints: true, false Default Value: false Presence: M
Configuration	Indicates the configuration type of the network function, such as NF Type and NF Instance Id. For more information about these attributes, see Table 5-93 .	Data Type: Array[Table 5-93] Constraints: NA Default Value: NA Presence: M
Error Code Series Id	Indicates the error list IDs. The <code>serverheaderdetails.errorCodeSeriesId</code> attribute is compared with the <code>errorCodeSeriesList.Id</code> . If the <code>serverheaderdetails.errorCodeSeriesId</code> matches with the <code>errorCodeSeriesList.Id</code> , NRF adds the server header in the responses if the error code generated by the error response matches with the error codes defined in the error code series (<code>errorCodeSeriesList.errorCodeSeries.errorCodes</code>). For more information about <code>errorCodeSeriesList</code> , see Error Code Series .	Data Type: String Constraints: NA Default Value: NA Presence: M

Table 5-93 Server Header Details Configuration

Attribute Name	Description	Details
NF Type	Indicates the <code>nfType</code> of the Network Function. For NRF use cases, the value is always NRF. Note: These values are pre-populated.	Data Type: String Constraints: NA Default Value: NRF Presence: M
NF Instance Id	Indicates the <code>nfInstanceId</code> of NRF. Note: These values are pre-populated.	Data Type: String Constraints: NA Default Value: NA Presence: M

4. Use the toggle option to **Enabled** to turn on the feature.
5. Click **Save** on the **Edit Server Header Details** page to save the details.
6. Click **Cancel** to discard your progress and go back to **Server Header Details** page.

5.3.17.11 Congestion Level Configuration

This configuration is used to configure the congestion level of the pods.

Perform the following configurations:

1. From the left navigation menu, navigate to **Ingress Gateway** option to configure the Ingress Gateway APIs.
2. Click the **Congestion Level Configuration** option under Ingress Gateway. The **Congestion Level Configuration** page is displayed.
3. Click **Edit** to edit the configuration. The **Congestion Level Configuration** page is displayed.
4. Configure the fields in the **Edit Congestion Level Configuration** page as mentioned in the below table.

Table 5-94 Congestion Level Configuration

Field Name	Description	Details
Refresh Interval (seconds)	This attribute indicates the refresh interval for the scheduler to calculate congestion level in milliseconds. CPU levels are stable when tested with values more than 500 ms as a refresh interval. Any value less than this, CPU spikes are observed for a shorter period of time, and denied requests are processed based on the action defined for that congestion level.	Data Type: Integer Constraints: NA Default Value: 500
Levels	This attribute indicates an array of different levels of congestion.	Data Type: Object Constraints: NA Default Value: NA

5. Click **Add** to add the configuration levels.
6. Configure the fields in the **Add Levels** page as mentioned in the below table.

Table 5-95 Congestion Levels

Attribute Name	Description	Details
Level Name	Indicates the name of the congestion level. Note: This value should be unique.	Data Type: String Constraints: NA Default Value: NA
Level Value	Indicates numerical values for each congestion level. The value ranges from 1-10. The values should be defined from 1 to 10 in increasing order. The default level of the system is 0. This is the state of the system when the CPU is less than the onset of L1 defined in the configuration.	Data Type: Integer Constraints: 1 -10 Default Value: NA
Resources	Indicates the list of resources.	Data Type: Object Constraints: NA Default Value: NA

7. Click **Add** to add the resource details.
8. Configure the fields in the **Add Resources** page as mentioned in the below table.

Table 5-96 Resources

Attribute Name	Description	Details
Name	Indicates the resource names. The possible value is CPU.	Data Type: String Constraints: NA Default Value: CPU
Onset Threshold	Indicates the onset threshold. Note: Onset should be more than the abatement of the level. Denoted by percentage.	Data Type: Integer Constraints: NA Default Value: NA
Abatement Threshold	Indicates the abatement threshold. Denoted by percentage. Note: - Abatement should be less than the onset of the same level. - Abatement should be more than the onset of the previous level.	Data Type: Integer Constraints: NA Default Value: NA

9. Click **Save** on the **Add Resources** page to save the details. Click **Cancel** to discard your progress and go back to **Add Levels** page.
10. Click **Save** on the **Add Levels** page to save the details. Click **Cancel** to discard your progress and go back to **Edit Congestion Level Configuration** page.
11. Click **Save** on the **Congestion Level Configuration** page to save the details.

5.3.17.12 Pod Protection By Rate Limiting

This configuration is used to enable and identify the pods that should be protected by rate limiting feature.

Perform the following configurations:

1. From the left navigation menu, navigate to **Ingress Gateway** option to configure the Ingress Gateway APIs.
2. Click the **Pod Protection By Rate Limiting** option under Ingress Gateway. The **Pod Protection By Rate Limiting** page is displayed.
3. Click **Edit** to edit the configuration. The **Edit Pod Protection By Rate Limiting** page is displayed.
4. Configure the fields in the **Edit Pod Protection By Rate Limiting** page as mentioned in the below table.

Table 5-97 Pod Protection By Rate Limiting

Field Name	Description	Details
Enabled	The attribute indicates if the Ingress Gateway pod protection using rate limiting feature is enabled or not.	Data Type: Boolean Constraints: true, false Default Value: NA
Fill Rate	This attribute indicates the number of requests to be processed by an Ingress Gateway pod in one second (1000 ms).	Data Type: Integer Constraints: NA Default Value: 2500

Table 5-97 (Cont.) Pod Protection By Rate Limiting

Field Name	Description	Details
Routes	This attribute indicates the route for rate limiting.	Data Type: Array (object of Routes) Constraints: NA Default Value: See Routes for more details
Error Code Profile	This attribute indicates error profile to be sent for the rejected requests.	Data Type: String Constraints: NA Default Value: ERR_POD_PROTECTION_RATE_LIMIT
Denied Request Actions	This attribute indicates the request actions to be performed for the requests which exceeds the fill rate.	Data Type: Object Constraints: NA Default Value: See Denied Request Actions Table.
Priority Header Name	Determines the priority of the request using the configured header. Indicates the name of the header. Note: This is for future release and not to be used in release 25.1.200.	Data Type: String Constraints: NA Default Value: 3gpp-sbi-message-priority
Default Priority	This attribute indicates the default priority in the absence of a priority header in the request. Note: This is for future release and not to be used in release 25.1.200.	Data Type: Integer Constraints: NA Default Value: 24

5. Click **Add** in the **Routes** section to configure different routes for Pod protection.
6. The **Add Routes** page is displayed.
7. Configure the fields in the **Add Routes** page as mentioned in the below table.

Table 5-98 Routes

Field Name	Description	Details
Id	Indicates the route Id that processes the request. The number of route Ids can be more than 1. Note: Each route should have a unique route Id.	Data Type: Integer Constraints: NA Default Value: NA
Path	Indicates the path to be matched to apply fill rate on the route.	Data Type: String Constraints: NA Default Value: NA
Methods	Indicates the Http method of the route for which the rate limiting is defined. All valid Http methods are allowed, for example: • POST • PUT • PATCH • DELETE • GET	Data Type: Array Constraints: • POST • PUT • PATCH • DELETE • GET Default Value: NA

Table 5-98 (Cont.) Routes

Field Name	Description	Details
Percentage	This attribute indicates the percentage of requests for a route. If Fill Rate is 1000 and routes id<id value> percentage is 40%, the route will process 400 requests in 1000 ms.	Data Type: Number Constraints: - The minimum value is 0.1. - The total percentage across all routes should not exceed 100. Default Value: NA

8. Click **Save** on the **Add Routes** page to save the details. Click **Cancel** to discard your progress and go back to **Edit Pod Protection By Rate Limiting** page.
9. Click **Add** in the **Denied Request Actions** section to configure the actions for rejected requests.
10. The **Add Denied Request Actions** page is displayed.
11. Configure the fields in the **Add Denied Request Actions** page as mentioned in the below table.

Table 5-99 Denied Request Actions

Field Name	Description	Details
Id	Indicates the unique Id of the request.	Data Type: Integer Constraints: NA Default Value: NA
Congestion Level	Indicates the congestion level of the pods. This value depends on the Level Value field in the congestion level configuration or the default level of the system which is 0 (This is the state of the system when the CPU is less than the onset of L1 defined in the configuration). For more information about congestion level configuration, see Congestion Level Configuration .	Data Type: Integer Constraints: 0-10 Default Value: NA
Action	Rejects or processes a denied request based on the value of congestionLevel attribute in the deniedRequestActions object. The possible values are REJECT and CONTINUE.	Data Type: String Constraints: REJECT, CONTINUE Default Value: NA
Error Code Profile	This attribute indicates error profile to be sent for the rejected requests.	Data Type: String Constraints: NA Default Value: NA

12. Click **Save** on the **Add Denied Request Actions** page to save the details. Click **Cancel** to discard your progress and go back to **Edit Pod Protection By Rate Limiting** page.
13. Click **Save** on the **Edit Pod Protection By Rate Limiting** page to save the details. Click **Cancel** to discard your progress and go back to **Pod Protection By Rate Limiting** page.

5.3.18 Egress Gateway

This section describes the Egress Gateway configurations.

5.3.18.1 Peer Configuration

This configuration is used to add or update the list of peers wherein each peer consists of ID, host, port or virtualHost, and apiPrefix. The ID of each peer is mapped to Peer Identifier in Peer Set Configuration. The default value is null.

Perform the following configurations to configure the peers:

1. From the left navigation menu, navigate to **Egress Gateway** option to configure the Egress Gateway APIs.
2. Click the **Peer Configuration** option under **Egress Gateway** to configure peers.
The **Peer Configuration** page is displayed.
3. Click **Add** to add the peer configuration
The **Create Peer Configuration** page is displayed.
4. Configure the fields in the **Create Peer Configuration** page as mentioned in [Table 5-100](#).
5. Click **Save** on the **Create Peer Configuration** page to save the peer configuration. Click **Cancel** to discard your progress and go back to Peer Configuration page.

Note

- Use the **Edit** icon available in the next column of the specific entry to update the Peer Configuration information.
- Use **Refresh** icon to refresh the list of peers configured.

Table 5-100 Peer Configuration

Field Name	Description	Details
ID	Enter an unique peer identifier value.	DataType: string Constraints: NA Default Value: NA
Host	Host details of a local peer. It can be IPv4, IPv6 and FQDN details.	DataType: string Constraints: NA Default Value: NA
Port	Port details of a local host peer.	DataType: string Constraints: NA Default Value: NA
Virtual Host	Host details of a remote peer. This FQDN is sent to Alternate Route Service for DNS SRV resolution.	DataType: string Constraints: NA Default Value: NA
API Prefix	API prefix details of a peer. Note: The recommended value is / .	DataType: string Constraints: NA Default Value: NA
healthApiPath	Include the SCP API details.	DataType: string Constraints: NA Default Value: /{scpApiRoot}/{apiVersion}/status

For more information about the configuration parameters, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

5.3.18.2 Peer Set Configuration

This configuration is used to add or update the list of peer sets wherein each peer set consists of **ID** and list of HTTP/HTTPS instances. Each instance consists of priority and peer identifier that is mapped to id in peerconfiguration resource. The **ID** of each peer set is mapped to **Peer Set Identifier** in **Routes Configuration** resource. The default value is null.

Perform the following configurations to configure the peer set:

1. From the left navigation menu, navigate to **Egress Gateway** option to configure the Egress Gateway APIs.
2. Click the **Peer Set Configuration** option under **Egress Gateway** to configure peers.
The **Peer Set Configuration** page is displayed.
3. Click **Add** to add the peer set configuration.
The **Create Peer Set Configuration** page is displayed.
4. Configure the fields in the **Create Peer Set Configuration** page as mentioned in [Table 5-101](#).
5. Click **Add** to add HTTP Configuration.
The **Add HTTP Configuration** page is displayed.
6. In the **Add HTTP Configuration** page, configure the fields as mentioned in [Table 5-102](#).
7. Click **Save** to save the details. Click **Cancel** to discard your progress, close the dialog box, and go back to **Create Peer Set Configuration** page.
8. Click **Add** to add HTTPS Configuration.
The **Add HTTPS Configuration** page is displayed.
9. In the **Add HTTPS Configuration** page, configure the fields as mentioned in [Table 5-102](#).
10. Click **Save** to save the details. Click **Cancel** to discard your progress, close the dialog box, and go back to **Create Peer Set Configuration** page.
11. Click **Save** on the **Create Peer Set Configuration** page to save the details. Click **Cancel** to discard your progress and go back to **Peer Set Configuration** page.

Note

- Use the **Edit** icon available in the next column of the specific entry to update the peer set configuration information.
- Use **Refresh** icon to refresh the list of peers configured.

Table 5-101 Peer Set Configuration

Field Name	Description	Details
ID	Enter the unique identifier for Peer Set.	DataType: string Constraints: Unique value in peer set configuration. Default Value: NA

Table 5-101 (Cont.) Peer Set Configuration

Field Name	Description	Details
HTTP Configuration	Configuration for HTTP based Peers. This value will be selected, if 3GPPAPIRootScheme value is http.	DataType: array (Table 5-102) Constraints: NA Default Value: NA
HTTPS Configuration	Configuration for HTTPS based Peers. This value will be selected, if 3GPPAPIRootScheme value is https.	DataType: array (Table 5-102) Constraints: NA Default Value: NA

Table 5-102 Peer Identifier Configuration

Field Name	Description	Details
Priority	Priority of peer to be used in a peer set.	DataType: integer Constraints: Priority must be unique. Default Value: NA
Peer Identifier	Peer identifier is the value of peer configured during PeerConfiguration.	DataType: string Constraints: NA Default Value: NA

For more information about the configuration parameters, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

5.3.18.3 Peer Monitoring Configuration

This configuration is used to retrieve the peer monitoring configuration.

Perform the following configurations to retrieve peer configuration.

1. From the left navigation menu, navigate to **Egress Gateway** option to configure the Egress Gateway APIs.
2. Click the **Peer Monitoring Configuration** option under **Egress Gateway**.
The **Peer Monitoring Configuration** page is displayed with default values.
3. Click **Edit** to update the peer monitoring configuration.
The **Edit Peer Monitoring Configuration** page is displayed.
4. Modify the fields in the **Edit Peer Monitoring Configuration** page as mentioned in [Table 5-103](#).
5. Click **Save** on the **Edit Peer Monitoring Configuration** page to save the details. Click **Cancel** to discard your progress and go back to **Peer Monitoring Configuration** page.

Note

- Use the **Edit** icon available in the next column of the specific entry to update the peer monitoring configuration information.
- Use **Refresh** icon to refresh the peers configured.

Table 5-103 Peer Monitoring Configuration

Field Name	Description	Details
Enabled	Indicates the attribute to enable or disable monitoring at a global level.	DataType: Boolean Constraints: true or false Default Value: false
Timeout	Indicates the flag to configure the duration of time after which calls to the SCP health API is timed out.	DataType: long Constraints: NA Recommended Range: 300 milliseconds to 10000 milliseconds Default Value: 1000 milliseconds
Frequency	Indicates the frequency or interval at which Egress Gateway microservice initiates health check calls toward SCP.	DataType: long Constraints: NA Recommended Range: 300 milliseconds to 10000 milliseconds Default Value: 2000 milliseconds
Failure Threshold	Indicates the number of consecutive failure responses after which a healthy SCP can be marked as unhealthy. Health API call to given SCP fails consecutively to these many attempts before it is marked as Unavailable from Available.	Data Type: Integer Constraints: NA Recommended Range: 1 to 5 Default Value: 3
Success Threshold	Indicates the number of successful responses after which an unhealthy SCP can be marked as healthy. Health API call to given SCP will succeed consecutively to these many attempts before it is marked as Available from Unavailable.	Data Type: Integer Constraints: NA Recommended Range: 1 to 5 Default Value: 4

For more information about the configuration parameters, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

5.3.18.4 Routes Configuration

This configuration is used to fetch and update the list of routes configuration.

1. From the left navigation menu, navigate to **Egress Gateway** option to configure the Egress Gateway APIs.
2. Click the **Routes Configuration** option under **Egress Gateway** to configure routes.
The **Routes Configuration** page is displayed.
3. Click **Add** to add the peer configuration.
The **Create Routes Configuration** page is displayed.
4. Configure the fields in the **Create Routes Configuration** page as mentioned in [Table 5-104](#).

5. Configure the fields in the **metadata** section as mentioned in [Table 5-104](#).
6. Click **Add** in the right side column to add predicates.
The **Add predicates** page is displayed.
7. Configure the fields in the **Add predicates** page as mentioned in [Table 5-104](#).
8. Click **Save** to save predicates configuration. Click **Cancel** to discard your progress, close the window, and go back to **Create Routes Configuration** page.
9. Configure the fields in the **Filters** section as mentioned in the table.
10. Click **Add** in the right side column to add filters.
The **Add Filters** window is displayed.
11. Configure the fields in the **Add Filters** window as mentioned in [Table 5-105](#).
12. Click **Add** at the bottom of the window to save filters configuration. Click **Remove** to remove filter configuration.
13. Click **Save** in **Add Filters** window to save the details. Click **Cancel** to discard your progress, close the window, and go back to **Create Routes Configuration** page.
14. Click **Save** on the **Create Routes Configuration** page to save the details. Click **Cancel** to discard your progress and go back to **Routes Configuration** page.

Note

- Use the **Edit** icon available in the next column of the specific entry to update the routes configuration.
- Use **Refresh** icon to refresh the routes configuration.

Table 5-104 Routes Configuration

Field Name	Description	Details
ID	Indicates the unique route configuration identifier	Data Type: string Constraints: Unique value of route Default Value: NA
URI	Provide any dummy URL, or leave the existing URL with the existing value.	Data Type: string Constraints: NA Default Value: NA
Order	Provide the sequence in which this route should be followed. Note: The value of the order attribute must be unique for each routing configuration.	Data Type: integer Constraints: NA Default Value: NA

Table 5-104 (Cont.) Routes Configuration

Field Name	Description	Details
httpRuriOnly	This flag indicates the scheme of the outgoing request from NRF. If the value is set to true, the scheme of RURI is changed to http. If the value is set to false, no change occurs to the scheme. Note: - In case of non-ASM configuration and 3GPPAPIRootScheme in Roaming Options is set to https, set the value as false. - If the <i>Simultaneous Support for HTTP and HTTPS Connections</i> feature is enabled, set the value as false.	Data Type: boolean (true,false) Constraints: NA Default Value: NA
httpsTargetOnly	For NRF, the value of this flag must always be set to true. For NRF, the value of this attribute is set to true, if NRF targets only HTTPS mode. The value is set to true, when outgoing connections are for HTTP or HTTPS only. Note: - Do not modify this attribute value. Consider it as a read-only attribute. - If the <i>Simultaneous Support for HTTP and HTTPS Connections</i> feature is enabled, set the value as false.	Data Type: boolean Constraints: true, false Default Value: NA
sbiRoutingEnabled	Enables or disables SBI routing. true: SbiRouting functionality is enabled. false: SbiRouting functionality is disabled.	Data Type: boolean Constraints: true, false Default Value: false
Predicates	Header predicate details for matching target PLMN mapped to this SBIRoute rule. Note: The predicates can be combined in a single configuration as shown in the Body, or only the required configuration can be retained for processing the message. Sample value:- <pre>"predicates": [{ "args": { "header": "OC-MCCMNC", "regexp": "310014" }, "name": "Header" }]</pre> Note: "header": "OC-MCCMNC" must not be changed. Only "regexp": "310014" can be modified. regexp consists of MCC and MNC values. In this example, value of MCC and MNC is 310 and 014. Multiple values can be provided for regexp as shown below: <pre>"predicates": [{ "args": { "header": "OC-MCCMNC", "regexp": "310014" }, "name": "Header" }, { "args": { "header": "OC-MCCMNC", "regexp": "315012" }, "name": "Header" }]</pre>	Data Type: Predicate structure. See description for more details. Constraints: NA Default Value: NA

Table 5-105 Filters Configuration

Field Name	Description	Details
Name	Provide filter name as "SBIRoutingFilter".	Data Type: boolean Constraints: true, false Default Value: NA
PeerSetIdentifier	This flag maps to id of peerSetConfiguration.	Data Type: string Constraints: NA Default Value: NA
CustomPeerSelectorEnabled	This flag allows the user to send request to a particular instance directly when enabled according to "ocalternaterouteattempt" header. Note: When Use OAuth Token is set to true in SLF Options , this parameter must also be set to true .	Data Type: boolean Constraints: true, false Default Value: NA

For more information about the configuration parameters, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

5.3.18.5 SBI Error Action Sets

This configuration is used to list or update the error action set configuration at Egress Gateway.

Perform the following configurations:

1. From the left navigation menu, navigate to **Egress Gateway** option to configure the Egress Gateway APIs.
2. Click **SBI Error Action Sets** option under **Egress Gateway** to configure action sets.
The **SBI Error Action Sets** page is displayed.
3. Click **Add** to add an error action set configuration.
The **Create SBI Error Action Sets** page is displayed.
4. Configure the fields in the **Create SBI Error Action Sets** page as mentioned in [Table 5-106](#).
5. Configure the fields under the Black List section as mentioned in [Table 5-107](#).
6. Click **Save** on the **Create SBI Error Action Sets** page to save the details. Click **Cancel** to discard your progress and go back to **SBI Error Action Sets** page.

Note

- Use the **Edit** icon available in the next column of the specific entry to update the action sets information.
- Use **Refresh** icon to refresh the list of action sets.

Table 5-106 SBI Error Action Sets

Field Name	Description	Details
ID	Indicate the unique Id for SBI routing error action set.	DataType: string Constraints: Default Value: NA
Action	Action that needs to be taken when specific criteria set is matched.	DataType: string Constraints: reroute, retry Default Value: reroute
Attempts	Maximum number of retries to either same or different peer in case of error or failures from backend.	DataType: string Constraints: NA Default Value: 3

Table 5-107 Blacklist

Field Name	Description	Details
Enabled	This flag enables the peer blacklist feature using the server headers received in the response.	DataType: boolean Constraints: true, false Default Value: false
Duration	The duration for which the peer is blacklisted and no traffic is routed to that peer for this period.	DataType: integer Constraints: NA Default Value: 60000

For more information about the configuration parameters, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

5.3.18.6 SBI Error Criteria Sets

This configuration is used to list or update SBI error criteria sets configuration at Egress Gateway. By default, this configuration is disabled.

Perform the following configurations:

1. From the left navigation menu, navigate to **Egress Gateway** option to configure the Egress Gateway APIs.
2. Click **SBI Error Criteria Sets** option under **Egress Gateway** to configure action sets.
The **SBI Error Criteria Sets** page is displayed.
3. Click **Add** to add an error criteria set configuration.
The **Create SBI Error Criteria Sets** page is displayed.
4. Configure the fields in the **Create SBI Error Criteria Sets** page as mentioned in [Table 5-108](#).
5. Click **Add** to add HTTP status details under the **Statuses** section.
The **Add Statuses** page is displayed.
6. Configure the following under **Add Statuses** section as mentioned in [Table 5-109](#).
7. Click **Save** on the **Add Statuses** page to save the details. Click **Cancel** to discard your progress and go back to **Create SBI Error Criteria Sets** page.

8. Click **Save** on the **Create SBI Error Criteria Sets** page to save the details. Click **Cancel** to discard your progress and go back to **SBI Error Criteria Sets** page.

Note

- Use the **Edit** icon available in the next column of the specific entry to update the criteria sets information.
- Use **Refresh** icon to refresh the list of criteria sets.

Table 5-108 SBI Error Criteria Sets

Field Name	Description	Details
ID	Unique id for a sbiRoutingErrorCriteriaSet	DataType: string Constraints: Unique value of route Default Value: NA
Method	Methods for which reroute or retry is triggered.	DataType: string Constraints: GET, POST, PUT, PATCH, DELETE Default Value: NA
Exceptions	Specific exceptions for which reroute or retry is triggered. Note: exceptions and response cannot be configured under same criteria Id.	DataType: string Constraints: NA Default Value: java.util.concurrent.TimeoutException

Table 5-109 Statuses

Field Name	Description	Details
Status Series	HTTP Status Series for which reroute or retry is triggered, when the error response is received from downstream.	DataType: string Constraints: 4xx, 5xx Default Value: NA
Status	Specific HTTP Statuses that belongs to above mentioned status series for which reroute or retry is triggered. To enable retry or reroute for all the HTTP status belonging to a status series, configure this as -1 .	DataType: string Constraints: 401, 404 or -1 Default Value: NA

For more information about the configuration parameters, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

5.3.18.7 Pod Protection By Rate Limiting

This configuration is used to enable and identify the pods that should be protected by rate limiting feature.

Perform the following configurations:

1. From the left navigation menu, navigate to **Egress Gateway** option to configure the Egress Gateway APIs.
2. Click the **Pod Protection By Rate Limiting** option under Egress Gateway. The **Pod Protection By Rate Limiting** page is displayed.

3. Click **Edit** to edit the configuration.
The **Edit Pod Protection By Rate Limiting** page is displayed.
4. Configure the fields in the **Edit Pod Protection By Rate Limiting** page as mentioned in the below table.

Table 5-110 Pod Protection By Rate Limiting

Field Name	Description	Details
Enabled	The attribute indicates if the Egress Gateway pod protection using rate limiting feature is enabled or not.	Data Type: Boolean Constraints: true, false Default Value: NA
Fill Rate	This attribute indicates the number of requests to be processed by an Egress Gateway pod in one second (1000 ms).	Data Type: Integer Constraints: NA Default Value: 2500
Routes	This attribute indicates the route for rate limiting.	Data Type: Array (object of Table 5-111) Constraints: NA Default Value: See Table 5-111 .
Error Code Profile	This attribute indicates error profile to be sent for the rejected requests.	Data Type: String Constraints: NA Default Value: error429
Denied Request Actions	This attribute indicates the request actions to be performed for the requests which exceeds the fill rate.	Data Type: Array of Object Constraints: NA Default Value: See Table 5-112 .
Priority Header Name	Determines the priority of the request using the configured header. Indicates the name of the header. Note: This is for future release and not to be used in release 25.1.201.	Data Type: String Constraints: NA Default Value: 3gpp-sbi-message-priority
Default Priority	This attribute indicates the default priority in the absence of a priority header in the request. Note: This is for future release and not to be used in release 25.1.201.	Data Type: Integer Constraints: NA Default Value: 24

5. Click **Add** in the Routes section to configure different routes for Pod protection.
The **Add Routes** page is displayed.
6. Configure the fields in the **Add Routes** page as mentioned in the below table.

Table 5-111 Routes

Field Name	Description	Details
Id	Indicates the route Id that processes the request. The number of route Ids can be more than 1. Note: Each route should have a unique route Id.	Data Type: Integer Constraints: NA Default Value: NA
Path	Indicates the path to be matched to apply fill rate on the route.	Data Type: String Constraints: NA Default Value: NA

Table 5-111 (Cont.) Routes

Field Name	Description	Details
Methods	Indicates the Http method of the route for which the rate limiting is defined. All valid Http methods are allowed, for example: • POST • PUT • PATCH • DELETE • GET	Data Type: Array Constraints: • POST • PUT • PATCH • DELETE • GET Default Value: NA
Percentage	This attribute indicates the percentage of requests for a route. If Fill Rate is 1000 and routes id<id value> percentage is 40%, the route will process 400 requests in 1000 ms.	Data Type: Number Constraints: • The minimum value is 0.1. • The total percentage across all routes should not exceed 100. Default Value: NA
Default Priority	This attribute indicates the default priority configured for a specific route.	Data Type: Integer Constraints: NA Default Value: NA

7. Click **Save** on the **Add Routes** page to save the details. Click **Cancel** to discard your progress and go back to **Edit Pod Protection By Rate Limiting** page.
8. Click **Add** in the **Denied Request Actions** section to configure the actions for rejected requests.
The **Add Denied Request Actions** page is displayed.
9. Configure the fields in the **Add Denied Request Actions** page as mentioned in the below table.

Table 5-112 Denied Request Actions

Field Name	Description	Details
Id	Indicates the unique Id of the request.	Data Type: Integer Constraints: NA Default Value: NA
Congestion Level	Indicates the congestion level of the pods. This value depends on the Level Value field in the congestion level configuration or the default level of the system which is 0 (This is the state of the system when the CPU is less than the onset of L1 defined in the configuration). For more information about congestion level configuration, see Congestion Level Configuration	Data Type: Integer Constraints: 0-10 Default Value: NA
Action	Rejects or processes a denied request based on the value of congestionLevel attribute in the deniedRequestActions object. The possible values are REJECT and CONTINUE.	Data Type: String Constraints: REJECT, CONTINUE Default Value: NA

Table 5-112 (Cont.) Denied Request Actions

Field Name	Description	Details
Error Code Profile	Indicates error profile to be sent for the rejected requests.	Data Type: String Constraints: NA Default Value: NA
Priority	Indicates the priority of the requests which should be processed for the CONTINUE action.	Data Type: Integer Constraints: NA Default Value: NA

10. Click **Save** on the **Add Denied Request Actions** page to save the details. Click **Cancel** to discard your progress and go back to **Edit Pod Protection By Rate Limiting** page.
11. Click **Save** on the **Edit Pod Protection By Rate Limiting** page to save the details. Click **Cancel** to discard your progress and go back to Pod Protection By Rate Limiting page.

For more information about the configuration parameters, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

5.3.18.8 Error Code Profile

This configuration is used to update the error code profiles that is used in Pod Protection by Rate Limiting feature for populating details in error responses when a request is discarded.

Perform the following configurations:

1. From the left navigation menu, navigate to **Egress Gateway** option to configure the Egress Gateway APIs.
 2. Click **Error Code Profiles** option under Egress Gateway.
The **Error Code Profiles** page is displayed with default values for few fields.
 3. Click **Add** to add the profiles.
The **Create Error Code Profiles** page is displayed.
 4. Configure the fields in the **Create Error Code Profiles** page as mentioned in [Table 5-113](#).
 5. Click **Save** on the **Create Error Code Profiles** page to save the details. Click **Cancel** to discard your progress and go back to **Error Code Profiles** page.
- Use the **Edit** icon available in the next column of the specific entry to update the route error profile information.
 - Use **Refresh** icon to refresh the route error profile information.

Table 5-113 Error Code Profile Configuration

Field Name	Description	Details
Name	Indicate the error name.	Data Type: string Constraints: NA Default Value: NA Presence: M

Table 5-113 (Cont.) Error Code Profile Configuration

Field Name	Description	Details
Error Code	Error Code field in an errorScenario determines the HttpStatusCode that needs to be populated in ProblemDetails (HttpStatus field) response from Egress Gateway when the exception occurred at Egress Gateway matches the configured errorScenario's exceptionType field.	Data Type: integer Constraints: NA Default Value: NA Presence: M
Error Cause	Error Cause field in an errorScenario determines the error cause that needs to be populated in ProblemDetails (Cause field) response from Egress Gateway when the exception occurred at Egress Gateway matches the configured errorScenario's exceptionType parameter.	Data Type: string Constraints: NA Default Value: NA Presence: O
Error Title	Error Title field in an errorScenario determines the title that needs to be populated in ProblemDetails (Title field) response from Egress Gateway when the exception occurred at Egress Gateway matches the configured errorScenario's exceptionType parameter.	Data Type: string Constraints: NA Default Value: NA Presence: O
Redirect URL	Redirect URL field in an errorScenario determines the redirection URL, this value is populated in LOCATION header while sending response from Egress Gateway. The header is populated only when the exception occurred at Egress Gateway matches the configured errorScenario's exceptionType parameter, the errorCode configured for the particular errorScenario lies in 3xx error series and the redirectUrl field for the particular errorScenario is configured appropriately.	Data Type: string Constraints: NA Default Value: NA Presence: O
Retry After	Retry After field in an errorScenario determines the value in seconds or particular date after which the service should be retried, this value is populated in Retry-After header while sending response from Egress Gateway. The header is populated only when the exception occurred at Egress Gateway matches the configured errorScenario's exceptionType parameter, the errorCode configured for the particular errorScenario lies in 3xx error series and the retry-after field for the particular errorScenario is configured appropriately in seconds.	Data Type: integer Constraints: NA Default Value: NA Presence: O
Error Description	Error Description field in an errorScenario determines the description that needs to be populated in ProblemDetails (Detail field) response from Egress Gateway when the exception occurred at Egress Gateway matches the configured errorScenario's exceptionType field.	Data Type: string Constraints: NA Default Value: NA Presence: O

For more information about the configuration parameters, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

5.3.18.9 Congestion Level Configuration

This configuration is used to configure the congestion level of the pods.

Perform the following configurations:

1. From the left navigation menu, navigate to **Egress Gateway** option to configure the Egress Gateway APIs.
2. Click the **Congestion Level Configuration** option under Egress Gateway. The **Congestion Level Configuration** page is displayed.
3. Click **Edit** to edit the configuration. The **Edit Congestion Level Configuration** page is displayed.
4. Configure the fields in the **Edit Congestion Level Configuration** page as mentioned in the below table.

Table 5-114 Congestion Level Configuration

Field Name	Description	Details
Refresh Interval (seconds)	This attribute indicates the refresh interval for the scheduler to calculate congestion level in milliseconds. CPU levels are stable when tested with values more than 500 ms as a refresh interval. Any value less than this, CPU spikes are observed for a shorter period of time, and denied requests are processed based on the action defined for that congestion level.	Data Type: Integer Constraints: NA Default Value: 500
Levels	This attribute indicates an array of different levels of congestion.	Data Type: Object Constraints: NA Default Value: NA

5. Click **Add** to add the configuration levels.
6. Configure the fields in the **Add Levels** page as mentioned in the below table.

Table 5-115 Congestion Levels

Field Name	Description	Details
Level Name	Indicates the name of the congestion level. Note: This value should be unique.	Data Type: String Constraints: NA Default Value: NA
Level Value	Indicates numerical values for each congestion level. The value ranges from 1-10. The values should be defined from 1 to 10 in increasing order. The default level of the system is 0. This is the state of the system when the CPU is less than the onset of L1 defined in the configuration.	Data Type: Integer Constraints: 1 -10 Default Value: NA

Table 5-115 (Cont.) Congestion Levels

Field Name	Description	Details
Resources	Indicates the list of resources.	Data Type: Object Constraints: NA Default Value: NA

7. Click **Add** to add the resource details.
8. Configure the fields in the **Add Resources** page as mentioned in the below table.

Table 5-116 Resources

Field Name	Description	Details
Name	Indicates the resource names. The possible value is CPU.	Data Type: String Constraints: NA Default Value: NA
Onset Threshold	Indicates the onset threshold. Note: Onset should be more than the abatement of the level. Denoted by percentage.	Data Type: Integer Constraints: NA Default Value: NA
Abatement Threshold	Indicates the abatement threshold. Denoted by percentage. Note: - Abatement should be less than the onset of the same level. - Abatement should be more than the onset of the previous level.	Data Type: Integer Constraints: NA Default Value: NA

9. Click **Save** on the **Add Resources** page to save the details. Click **Cancel** to discard your progress and go back to **Add Levels** page.
10. Click **Save** on the **Add Levels** page to save the details. Click **Cancel** to discard your progress and go back to **Edit Congestion Level Configuration** page.
11. Click **Save** on the **Congestion Level Configuration** page to save the details.

5.3.19 Alternate Route Service

This section describes the Alternate Route Service configurations.

5.3.19.1 Upstream Dns Config

This configuration is used to update the Upstream Dns Config that is used in Overload Control, Controlled Shutdown feature for populating details in error responses when a request is discarded.

Perform the following configurations:

1. From the left navigation menu, navigate to **Alternate Route Service** option to configure the Alternate Route Service APIs.
2. Click **Upstream Dns Config** option under **Alternate Route Service**. The **Upstream Dns Config** page is displayed.
3. Click **Edit** to configure the upstream Dns.

The **Edit Upstream Dns Config** page is displayed.

4. Configure the fields in the **Edit Upstream Dns Config** page as mentioned in [Table 5-117](#).
5. Click **Save** on the **Edit Upstream Dns Config** page to save the details. Click **Cancel** to discard your progress and go back to **Upstream Dns Config** page.

Table 5-117 Upstream Dns Config

Field Name	Description	Details
Enabled	Indicates if the Alternate Route can communicate to upstream DNS server for dynamic DNS updates for the types A/AAAA/NAPTR.	DataType: boolean Constraints: NA Default Value: false Presence: M
Host	Indicates the host IP address of a upstream dns server.	DataType: string Constraints: NA Default Value: NA Presence: M
Port	Indicates the port of a upstream dns server.	DataType: string Constraints: NA Default Value: NA Presence: O
Zone	Indicates the zone of a upstream dns server.	DataType: string Constraints: NA Default Value: NA Presence: O
TsigKeyNamespace	Indicates the namespace where the secret is created.	DataType: string Constraints: NA Default Value: NA Presence: M
TsigKeySecretName	Indicates the secret name configuration.	DataType: string Constraints: NA Default Value: NA Presence: O
UpstreamDNSTimeout	Indicates the timeout set for a upstream dns server. Unit: Milliseconds	DataType: integer Constraints: NA Default Value: NA Presence: M
WatchSecretTimeout	Indicates the watch event timeout (in second). The value should be always 2000 or 3000 ms less than the fixedTsigKeyMonitorDelay . Unit: Milliseconds	DataType: integer Constraints: NA Default Value: NA Presence: M
FixedTsigKeyMonitorDelay	Indicates the monitoring interval for secret to be added or updated. Unit: Milliseconds	DataType: integer Constraints: NA Default Value: NA Presence: M

For more information about the configuration parameters, see *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

5.3.20 Common Configuration

This section describes the common configurations.

5.3.20.1 Request SMP Headers

Perform the following steps to configure the Request SMP Headers for Setting SBI Message Priority feature.

1. From the left navigation menu, navigate to **NRF** and then click the **Global Configurations** and then click on the **SBI Message Priority Feature**.
2. Select **Request SMP Headers** under **SBI Message Priority Feature** in the left navigation menu.
The **Request SMP Headers** page is displayed.
3. Click **Edit** from the top right side to edit or update the request SMP headers.
The **Edit Request SMP Headers** page is enabled for modification.
4. Configure **Request SMP Headers** details. Enter the values for request SMP headers as described in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.
5. Click **Save** to save the SMP header details.

5.3.20.2 Priority Mapping Rules

Perform the following steps to configure the Setting SBI Message Priority feature.

1. From the left navigation menu, navigate to **NRF** and then click the **Global Configurations** and then click on the **SBI Message Priority Feature**.
2. Select **Priority Mapping Rules** under **SBI Message Priority Feature** in the left navigation menu.
The **Priority Mapping Rules** page is displayed.
3. Click **Add** from the top right side to Add the Priority Mapping Rules.
The **Add Priority Mapping Rules** page is enabled for modification.
4. Configure **Priority Mapping Rules** details as mentioned in the below table.

Table 5-118 Priority Rule

Attribute	Description	Details
Name	Specifies the unique name of the priority mapping rule. This name is referenced in service operation configuration.	Data Type: string Default Value: NA Constraints: Unique rule name Presence: M
Default SMP Header Name	Specifies the HTTP header name used for SBI message priority. NRF uses this header when the incoming request or response does not contain a valid priority header for applying mapping rules.	Data Type: string Default Value: NA Constraints: Valid HTTP header name Presence: M

Table 5-118 (Cont.) Priority Rule

Attribute	Description	Details
Rules	Specifies the list of priority mapping rules. NRF evaluates them sequentially, where the matching rule determines the final SBI message priority value. Note: There's no defined upper limit for the number of RulesSet elements in the rules array. However, considering there is 0-31 priority values can be configured for configuration individually and unique range, a recommended maximum would be around 49 RulesSet entries (including *).	Data Type: array (RulesSet) Default Value: NA Constraints: At least one rule required Presence: M

Table 5-119 RulesSet

Attribute	Description	Details
Received	Specifies the received priority value or range used for rule matching. - If the received value matches the configured value or range, the rule is applied. * is used only when there is no matching exact value or range is configured. The rule matching order is as follows: exact match, range-based match, and finally the default match (*). Note: The exact values must fall within 0 to 31, and any defined ranges must also lie within 0 to 31 and remain non-overlapping. Exact values can coexist with ranges, but they take precedence over any matching range.	Data Type: string Default Value: NA Constraints: Valid exact value or range (0 - 31). Presence: M

Table 5-119 (Cont.) RulesSet

Attribute	Description	Details
Used	Specifies the mapped priority value to be used in outgoing request and response messages. If an exact value is specified, it is used directly. If +Number or -Number is specified, the value is incremented or decremented accordingly. The final value is constrained within the range 0–31. The value specified in the used attribute determines the SBI message priority header applied to outgoing request and response messages. The input value may originate from: - The priority value received from request message. - The priority value received from response message. - A configured default value. This input value is processed based on the configured rule: Exact value: Used directly: The specified number is used directly without any change. +0: No change: The input value is used as-is, with no modification. For example: If the input value is 5, then 5 is used in the message. +Number: Increment: The specified number is added to the input value. For example: +2 increases the input value by 2. -Number: Decrement: The specified number is subtracted from the input value. For example: -2 decreases the input value by 2. Note: After processing (any increment or decrement), the final value is restricted to the range 0–31. Values below 0 are set to 0, and values above 31 are capped at 31.	Data Type: string Default Value: NA Constraints: Valid exact value or range need to be from 0 to 31 or (+/- arithmetic number) Presence: M

- Click **Save** to save the Rules Set details.
- Click **Save** to save the Priority Mapping Rules.

5.3.20.3 SBI Service Operations

Perform the following steps to configure the Setting SBI Message Priority feature.

- From the left navigation menu, navigate to **NRF** and then click the **Global Configurations** and then click on the **SBI Message Priority Feature**.
- Select **SBI Service Operations** under **SBI Message Priority Feature** in the left navigation menu.
The **SBI Service Operations** page is displayed.
- Click **Add** from the top right side to edit or update SBI Service Operations.
The **Edit SBI Service Operations** page is enabled for modification.

4. Configure **SBI Service Operations** details as mentioned in the below table.

Table 5-120 SBI Service Operations

Attribute	Description	Details
SBI Service Operation	Specifies the SBI service operation for which the configuration is applied. Note: The value must correspond to a valid entry in the supported <code>SbiServiceOperationList</code> . For more details about the supported <code>SbiServiceOperationList</code> , see <i>Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide</i> .	Data Type: string Default Value: NA Constraints: Must be a supported SBI service operation Presence: M
Default Priority	Specifies the default priority value to be applied for further processing, when the SBI message-priority header is absent in incoming request or response messages. This attribute is also used when NRF initiates a request as a standalone client (For example, <code>NFStatusNotify</code>). If the header is not present, NRF uses this value as the priority.	Data Type: integer Default Value: NA Constraints: 0–31 (inclusive) Presence: M
Prefer Received Priority	Indicates whether the received priority value should be used for the next hop. If set to true, the received priority is used for the next hop. If set to false, the received priority is overridden using the configured <code>defaultPriority</code> . Note: This parameter must always be set to true.	Data Type: boolean Default Value: NA Constraints: true, false Presence: M
Response Priority Rule	Specifies the priority mapping rule to be applied when generating response messages. If configured, NRF applies the rule to derive response priority. Note: The value must reference a rule defined in the <code>priorityMappingRules</code> API (<code>/nf-common-component/v1/global-configuration/prioritymappingrules</code>).	Data Type: string Default Value: NA Constraints: Must match a rule name configured using the <code>priorityMappingRules</code> API Presence: O
Initiated Request Priority Rule	Specifies the priority mapping rule to be applied when initiating outbound requests. If configured, NRF applies the rule for outgoing requests. Note: The value must reference a rule defined in the <code>priorityMappingRules</code> API (<code>/nf-common-component/v1/global-configuration/prioritymappingrules</code>).	Data Type: string Default Value: NA Constraints: Must match a rule name configured using the <code>priorityMappingRules</code> API Presence: O

5. Click **Save** to save the SBI service operation details.

5.3.20.4 SBI Message Priority

Perform the following steps to enable the Setting SBI Message Priority feature.

1. From the left navigation menu, navigate to **NRF** and then click the **Global Configurations** and then click on the **SBI Message Priority Feature**.
2. Select **SBI Message Priority** under **SBI Message Priority Feature** in the left navigation menu.
The **SBI Message Priority** page is displayed.
3. Click **Edit** from the top right side to edit or update the SBI Message Priority.
The **Edit SBI Message Priority** page is enabled for modification.
4. Toggle **Enabled** to turn on or off the feature.

Table 5-121 SBI Message Priority

Attribute	Description	Details
Enabled	Enables or disables the SBI message priority feature. If set to true, the feature is enabled. If set to false, the feature is disabled.	Data Type: boolean Default Value: false Constraints: true, false Presence: M

5. Click **Save** to save the SMP header details.

6

NRF Metrics, KPIs, and Alerts

6.1 NRF Metrics

This section includes information about metrics for Oracle Communications Cloud Native Core, Network Repository Function.

Note

- Sample NRF dashboard for Grafana is delivered to the customer through NRF CSAR package. Metrics and functions used to achieve KPI are covered in NRF CSAR package. For more information on how to download the NRF CSAR package from MOS, see *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.
- The metric scraping time varies as per the environment in which it is deployed.

The name of the metrics may contain suffix such as total, seconds, max and so on. It gets added by the micrometer registry if it is not present in the metrics name. The metric name has the following format for suffix: <Basename of the metric>_<Suffix>

Table 6-1 Metrics type and Suffix

Metric Type	Suffix	Description
Counter	_total	Represents the total number of occurrences of an event or traffic, such as measuring the total amount of traffic received and transmitted by NRF, and so on.
Gauge	NA	Represents a single numerical value that changes randomly. This metric type is used to measure various parameters, such as NRF load values, memory usage, and so on.
Histogram	_max, _bucket, _count, or _sum	Represents the sample observations like request durations or response sizes and counts them in configurable buckets.

Latency Metrics Format Change for NRF Microservices

With the migration of Springboot to Micronaut, the support for latency metric *_latency_seconds has been deprecated. The below metrics *_latency_seconds_[suffix] continue to be supported and can be used in lieu of *_latency_seconds

- *_latency_seconds_max
- *_latency_seconds_bucket
- *_latency_seconds_count

- *_latency_seconds_sum

This update applies to the metrics of all NRF associated microservices, as well as Ingress and Egress Gateway microservices.

Note

Support for the metric *_latency_seconds continues to be present only in Ingress and Egress Gateway.

Dimensions Legend for the Metrics

The following table includes the details about the metrics dimensions:

Table 6-2 Dimensions Legend

Dimension	Description
Action	Used in Gateway metrics. Indicates the type of action taken for the requests. (rejects or processes a denied request based on the value of congestion level attribute in the denied request actions object. Sample Values: REJECT, CONTINUE
ActionId	Used in Gateway metrics. Indicates the unique Id of the request. Sample Values: 1, 2
Allowed	Used in Gateway metrics. Indicates if the requests are accepted or rejected. If the request is below fillRate, the value is set as true. If the request is above the fillRate, the value is set as false. Sample Values: true, false
application	Indicates the application name. Sample Values: ocnrf
authority	Used in Gateway metrics. Indicates the destination address.
BackendSvc	Used in Gateway metrics. Indicates the address of destination.
BackendSvcAddressType	Used in Gateway metrics. Indicates the IP type (IPv4/IPv6) of the destination from the Egress Gateway.
Bucket	Indicates how many profiles are returned in the response of Discovery request. Range is not configurable. Possible values are 0-10, +Inf. According to NF profiles returned, corresponding bucket will be incremented by one. For example, if 2 profiles are returned, then bucket 2 will be incremented by one. Profiles getting returned more than 10 will fall in +Inf bucket.
CertificateName	Indicates the ccaHeaderValidation file name configured in Helm.
ClientNfInstanceId	Indicates the client NF Instance Id for NF Access Token.
client_type	Used in Gateway metrics. Indicates the type of jetty client being used at Ingress Gateway. Sample Values: h2, h2c

Table 6-2 (Cont.) Dimensions Legend

Dimension	Description
CongestionLevel	Used in Gateway metrics. Indicates the congestion level of the pods. Sample Values: 0, 1, 2, 3
connectionId	Indicates the connectionId of the http2 connection.
ConsumerInstancelId	Indicates the consumer NF's NfInstancelId configured in Sub in JWT token.
ConsumerNFInstancelId	Indicates the consumer NF Instance Id for NF Access Token
ConsumerNFType	Indicates request is for which consumer NF type.
content_available	Used in Gateway metrics. Indicates if the incoming request to Ingress Gateway has a request body present in it. Sample Values: true, false
DataType	Indicates the type of data. Sample Values: NfProfiles, NfSubscriptions
dbOperation	Indicates the database operation type such as Create, update, delete, and find.
DestinationHost	Used in Gateway metrics. Indicates the destination IP address or FQDN of the host.
destinationHostAddressType	Used in Gateway metrics. Indicates the destination IP type (IPv4 or IPv6) from Egress Gateway.
Direction	Used in Gateway metrics. Indicates the direction of the request or response. In case of Ingress Gateway, the value is ingress. In case of Egress Gateway, the values are egress, egressOut.
DiscardAction	Used in Gateway metrics. Indicates the type of pod discard in overload filter. Sample Values: PercentageBased, PriorityBased
dnsResolvedType	Used in Gateway metrics. Indicates the actual DNS resolved IP type (IPv4 or IPv6) of the destination.
egressRoutingMode	Used in Gateway metrics. Indicates the value of the egressRoutingMode configured in Egress Gateway. Sample Values: IPv4, IPv6, IPv4_IPv6, IPv6_IPv4, None
ErrorProfile	Used in Gateway metrics. Indicates a valid error code for rejected requests based on the action. Sample Values: "ERR_POD_PROTECTION_RATE_LIMIT"

Table 6-2 (Cont.) Dimensions Legend

Dimension	Description
error_reason	Indicates the reason for failure response received. If message is sent in the response, then it is filled with the message otherwise exception class is filled. In case of successful response it is filled with "no-error". Sample Values: "no_error" (In case successful response is received) "java.nio.channels.ClosedChannelException" "unable to find valid certification path to requested target" "SSL handshake failed due to invalid SNI"
ErrorOriginator	Used in Gateway metrics. Indicates the source of error like ServiceProducer, Nrf, IngressGW, None.
ErrorReason	Indicates the CCA header validation failed message like: aud claim validation failed, sub claim validation failed, JWT Signature does not match, X5C certificate has expired.
event	Used in Gateway metrics. Indicates the lifecycle event processed during the jetty request processing with the back-end services. Sample Values: onQueued, onBegin, onHeaders, onCommit, onContent, onSuccess, onFailure
ExceptionAttribute	Indicates the NFDdiscover search query attribute due to which NFDdiscover service operation is not rejected even SLF specific mandatory attributes are missing from search query.
FailureReason	Indicates the failure reason for Roaming Support. Sample Values: - PeerGeneratedError: Error response received from NRF Peer node. - EgressGatewayGeneratedError: Error response received from NRF Egress Gateway. - InternalError: Roaming request not sent to hNRF because failure occurred at hNRF due to internal error.
ForwardingBarringReason	Indicates the forwarding barring reason for NF Access Token and NFDdiscover service operations. Sample Values: - forwardingFeatureDisabled: Forwarding feature is disabled. - forwardingRuleNotMatched: Forwarding Rule is not matching with the configuration.
GroupId	Indicates the GroupId returned by SLF/UDR corresponding to SubscriptionId.
HeartbeatTimer	Indicates the heartbeatTimer of the NfProfile. The value is considered in seconds.
Host	Used in Gateway metrics. Indicates the gateway port (IP or FQDN). Indicates the remote address of client connected to the Ingress Gateway.
HttpStatus	Used in Gateway metrics. Indicates the HTTP Status Code and its associated reason. Sample Values: HttpStatus="503 SERVICE_UNAVAILABLE" , HttpStatus="408 REQUEST_TIMEOUT"

Table 6-2 (Cont.) Dimensions Legend

Dimension	Description
HttpStatusCode	Indicates the HTTP Status Code. Sample Values 429, 500 Note: If this error code is generated by Egress Gateway microservice, then the status code is updated as Egw- <response code>. Sample Value: Egw-429
HttpVersion	Indicates the Http protocol version. Sample Values: • HTTP/1.1 • HTTP/2.0
Id	Used in Gateway metrics. Corresponds to the id defined in the routes of the Pod Protection configuration. Sample Values: 1, 2, 3, default_route
InstanceIdentifier	Used in Gateway metrics. Indicates the pod prefixes configured in helm when there are multiple instances in same deployment- Prefix configured in helm otherwise UNKNOWN.
isCurrentKeyId	Indicates if a specific metric is for current key id in Access Token Configuration. Sample Values: true, false
isLeaderPod	Used in Perf-Info. Indicates if the pod calculating the threshold level is a leader pod or not. Sample Values: true, false
jetty_request_timeout	Used in Gateway metrics. Indicates if a request at Egress Gateway failed due to request timeout at jetty level. Sample Values: true, false
KeyId	Indicates if the Key Id from Access Token Configuration is used to sign the Access Token.
KeyType	Indicates the Key type of Access Token Configuration (private key or certificate).
level	Indicates the type of log level. Sample Values: debug, error, info, fatal, warn, trace
LoadLevel	Used in Gateway metrics. Indicates the load level of backend microservices which are configured in the "routes" of the Ingress Gateway microservice. Sample Values: L1, L2
Method/method	Indicates the HTTP method name. Sample Values: • PUT • GET
NegotiatedTLSVersion	This denotes the TLS version used for communication between the server and the client. Sample Values: TLSv1.2, TLSv1.3.

Table 6-2 (Cont.) Dimensions Legend

Dimension	Description
NewStatus	Indicates the new NfStatus of the NfProfile or NfService. Sample Values: - REGISTERED - SUSPENDED - UNDISCOVERABLE - DEREGISTERED
NfFqdn	Indicates the FQDN of consumer NF. The nfFqdn dimension will contain the FQDN as present in the nfProfile. When service mesh is enabled, this dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.
NfInstanceId	Indicates the Unique identity of the NF Instance sending request to NRF.
NfServiceFqdn	Indicates the FQDN of the NfService.
NfServiceType	Used in Gateway metrics. Indicates the NFType extracted from URI. Path is /nxxx-yyy/vz/..... Where nxxx-yyy is NfServiceType UNKNOWN if unable to extract NfServiceType from the path Example: nnrf-nfm/v1/nf-instances
NfSetFqdn	Indicates the domain name or FQDN for NAPTR record. It is populated using amfSetFqdn.
nfSetId	Identifies the NRF set in which the subscription is created. The setId is retrieved from the Helm attribute <code>global.nrfSetId</code> . If Growth feature is enabled, the nfSetId is retrieved from <code>/nrf-configuration/v1/nrfGrowth/featureOptions</code> . If not configured, the value will be UNKNOWN.
NfType	Indicates the types of Network Functions (NF).
NFType	Used in Gateway metrics. Indicates the NFType extracted from URI. Path is /nxxx-yyy/vz/..... Where xxx will be changed to (Upper Case) is NFType UNKNOWN if unable to extract NFType from the path Example: nnrf-nfm/v1/nf-instances
Node	Indicates the name of the Kubernetes worker node on which microservice is running.
NotificationEventType	Indicates the subscription request is for which event types. Sample Values: - NF_REGISTERED - NF_DEREGISTERED - NF_PROFILE_CHANGED
NotificationHostPort	Indicates the port of notification callback server.
NRFRole	Indicates the NRF role whether it is hNRF or vNRF. Sample Values: hNRF, vNRF
NrfFqdn	Indicates the FQDN of NRF.

Table 6-2 (Cont.) Dimensions Legend

Dimension	Description
nrfInstanceId	Indicates the Nrf Instance Id of NRF.
NrfLevel	Indicates the NRF Deployment Name by which NRF can be identified, it will be NRF Instance Id passed through Helm.
Nsi	Indicates the Network slices are identified by Network Slice Instances (NSIs). It is in the string format.
NumberOfRetriesAttempted	Indicates the number of retries attempted to notification callback server.
oAuthHeaderPresent	Used in Gateway metrics. Indicates if the oAuth header is present or not. Sample Values: true, false
oAuthTokenPresent	Used in Gateway metrics. Indicates if the oAuth token is present or not. Sample Values: true, false
OperationType	Indicates the Operation type of the request sent towards DNS server. Sample Values: - Create: NF create request towards DNS server - Update: NF update request towards DNS Server - Delete: NF delete request towards DNS Server
OperationType	Indicates if the NFSubscribe Service operation to specify if the request is to create or update the subscription. Sample Values: - Create - Update
peer	Indicates the SCP peer.
peerset	Indicates the SCP peerset.
PreviousSLFFqdn	Indicates the target SLF FQDN where the previous request was sent to and failed.
PreviousStatus	Indicates the previous NfStatus of the NfProfile or NfService. Sample Values: - REGISTERED - SUSPENDED - UNDISCOVERABLE - DEREGISTERED
Priority	Used in Gateway metrics. Indicates the priority of the request. Sample Values: 24
ProducerInstanceId	Indicates the NrfInstanceId.
quantile	Indicates the latency values with ranges as 10ms, 20ms, 40ms, 80ms, 100ms, 200ms, 500ms, 1000ms, and 5000ms.
QueryType	Indicates the type of the query sent by the NF. Sample Values: - NfProfiles - NfSubscriptions

Table 6-2 (Cont.) Dimensions Legend

Dimension	Description
reason	Indicates the cause for SMP header mismatch when the SMP feature is enabled but not applied correctly. Sample Values or Possible Values: - MISSING_SBI_OP: Indicates that the SBI service operation is not configured for the request or response. - MISSING_MAP_RULE: Indicates that the mapping rule is not configured (for example, responsePriorityRule or initiatedRequestPriorityRule). - MISSING_PRIORITY_RULE: Indicates that the priority rule value is missing for the received or default priority.
receivedAddressType	Used in Gateway metrics. Indicates the IP type (IPv4/IPv6) of the remote client connected to the Ingress Gateway.

Table 6-2 (Cont.) Dimensions Legend

Dimension	Description
RejectionReason	Indicates the rejection reason for NF Access Token, Roaming Support, Subscription limit breached. Sample Values: - ClientNotAuthorized: Number of access token request for which client authorized failed - ProducerWithRequestedScopeNotFound: Number of access token not granted because of no producer instance registered for service/s in the scope - ProducerWithRequestedNfInstancelIdNotFound: Number of access token not granted because of no producer instance registered for No producer instance is registered at all for provided target Instance Id in request. - InconsistentScope: Number of access token not granted because services in the scope belong to different NF types. - ProducerNFTypeMismatch: Number of access token not granted because producer NF type in profile is not matching with the access token request. - InternalError: Number of access token not granted because failure at NRF due to internal error. - ConsumerNFTypeNotAllowed: Number of access token not granted because the consumer NFType is not allowed to access the requested NF. - ConsumerPlmnNotAllowed: Number of access token not granted because the consumer NF PLMN is not allowed to access the requested NF. - SecretNotAccessible: Number of access token not granted because the secret for current key id is not accessible. - InvalidFileData: Number of access token not granted because the current key id file data is invalid. - NamespaceNotAccessible: Number of access token not granted because the namespace for current key id is not accessible. - FileNotFound: Number of access token not granted because the file not found in secrets. - CurrentKeyIdNotConfigured: Number of access token not granted because the current key id is not configured. - ExpiredCertificate: Number of access token not granted because the NRF certificate is expired. - BadRequest: Number of access token not granted because the Request is incorrect. - NFFqdnAuthenticationFailed: Number of access token not granted because of NF Fqdn Authentication Failure - ConfigurationMissing: Number of access token not granted because of configuration missing - ConsumerDetailsNotMatched: Number of access token not granted because consumer details in profile is not matching with the access token request. - InvalidProducerPlmn: Number of access token not granted because targetPlmn in profile is not matching with the access token request. - ProducerNFProfileNotFound: Number of access token not granted because there are no NFs found for the requested profile

Table 6-2 (Cont.) Dimensions Legend

Dimension	Description
	- AuthScreeningFailed: Number of access token not granted because the consumer NF is not authorized to access the requested NF or its services. - InternalError: Request not forwarded because failure occurred at NRF due to internal error. - NRFCommunicationFailure: Request not forwarded because NRF is not able to connect with another NRF. - ErrorFromNRF: Error response received from another NRF. - NRFForwardingConfigurationMissing: Request not forwarded due to missing forwarding configuration. - LoopDetected: Received request message is already processed by NRF during forwarding mechanism. *NotApplicable is applicable for 2xx Status code. - MandatoryAttributesMissing: Roaming request is rejected due to mandatory attribute missing in the request. - TargetMatchesNRFPLMN: Request intended for roaming but target PLMN matches with the vNRF PLMN. - TargetNotMatchesNRFPLMN: Request intended for roaming hNRF but target PLMN not matches with the hNRF PLMN. - NotificationURINonPLMNFormat: Notification URI in NFStatusSubscribe request is not in 3GPP defined PLMN format for roaming. - RoamingDisabledAttributesPresent: Roaming is disabled but roaming specific parameters are present. - RequesterNFTypeNotAllowed: Requester NF Type is not allowed to access the NF Producer Type. - RequesterPLMNNotAllowed: Requester PLMN Type is not allowed to access the NF Producer Type. - RequesterSNSSAINotAllowed: Requester SNSSAI Type is not allowed to access the NF Producer Type. - PeerGeneratedError: Error response received from NRF Peer node. - EgressGatewayGeneratedError: Error response received from NRF Egress Gateway. - InternalError: Roaming request not sent to hNRF because failure occurred at hNRF due to internal error. - EgressGatewayOverloaded: Error response received from NRF Egress Gateway when it is overloaded.
RemoteNrfInstanceId	Indicates the Nrf Instance Id of the remote NRF.
RemoteSiteName	Indicates the site name of remote NRF.
Replacement	Indicates the value as populated using 3GPP AMF name. Sample Values: 0 - Healthy 1 - Failure - Any Failure which is not covered below 2 - Not Found in DNS server 3 - Mismatch with DNS Server and NRF data
RequesterNfType	Indicates the NF type which originating the request. This value comes from UserAgent header. For NFDDiscover Service operation it is taken from Search Query. In case, there is no header or value, this value will be UNKNOWN in the metrics.

Table 6-2 (Cont.) Dimensions Legend

Dimension	Description
RequesterPLMNId	Indicates the PLMN ID which originating the request.
RequestType	Indicates the type of the service request sent by the NF. Sample Values: - RemoteAndLocalSetProfiles - is pegged for the requests received from discovery and remote cache data service. - ProfilesByQueryParam - is pegged for the requests received from the nfregistration service for NfProfileRetrieval and NfListRetrieval, and from nfaccess token service for AccessToken requests. - RemoteAndLocalSetSubscriptions - is pegged for requests querying for subscription data.
ResponseReason	Indicates the response reason in response sent back to NF. Sample Values: - ResponseReason =SLFCommunicationFailure = NRF unable to communication with SLF - ResponseReason =MandatoryParamsMissing = Mandatory Parameter (Subscriber data) for performing SLF is missing in the incoming discovery request - ResponseReason =SLFSubscriberNotProvisioned = Subscriber not provisioned - ResponseReason =ErrorFromSLF = Error response received from SLF (non 2xx, excluding 404) - ResponseReason =InternalError = NRF internal error - ResponseReason =SuccessFromSLF = Successful SLF lookup - ResponseReason = SkipSlfAttributeUsedFromSearchQuery = No SLF performed due to SkipSLF attribute configuration - ResponseReason = ExceptionAttributePresentInSearchQuery = No SLF performed due to Exception attribute configuration
route_id	Used in Gateway metrics. Indicates a unique Id to identify a specific route. All the requests always get mapped to a unique route. Sample Values: egress_scp_proxy1, default_route
routeId	Identifies the specific route configuration in the Ingress or Egress Gateway where the metric is generated. This dimension helps in correlating the metric with a particular gateway routing rule.
RouteLevelColor	Used in Gateway metrics. Indicates Green color for the requests accepted at route level policer and Red for requests rejected at route level policer. Sample Values: RED, GREEN
Route_path	Used in Gateway metrics. Indicates the Path predicate or Header predicate that matched the current request.
Scheme	Indicates the HTTP protocol scheme. Sample Values: - HTTP - HTTPS - UNKNOWN

Table 6-2 (Cont.) Dimensions Legend

Dimension	Description
Scope	Indicates the scope as received in the AccessToken Request Sample Values: NfDiscover, NfProfileRetrieval
SecretName	Indicates the k8SecretName configured in Helm.
serialNumber	Indicates the type of the certificate. Sample Values: serialNumber=4661 is used for RSA and serialNumber =4662 is used for ECDSA
service	Used in Perf-Info. Indicates the NRF microservice type. Sample Values: ocnrf-nfaccess token, ocnrf-nfdiscovery
ServiceInstanceId	Indicates the unique ID of the service instance within a given NF Instance.
ServiceName	Indicates the service instance name. Sample Values: nudm-sdm
ServiceOperation	Indicates the service operations as defined in 3GPP specification for NRF. Sample Values • NfProfileRetrieval • NfListRetrieval • NfAccessToken • NfDiscover • NfStatusSubscribe • NfStatusUnsubscribe • NfStatusNotify • nrfCacheDataService
siteName	Indicates the site name of NRF.
SkipSLFLookupParameter	Indicates the NfDiscover search query attribute due to which SLF lookup is skipped. Sample Values: group-id-list
SkipSLFLookupValue	Indicates the configured value for which SLF lookup is skipped, if enableValueBasedSkipSLFLookup is set to true. If the value of enableValueBasedSkipSLFLookup is set as false, the value of SkipSLFLookupValue dimension is set as NotApplicable.
slfFqdn	Indicates the FQDN of the SLF.

Table 6-2 (Cont.) Dimensions Legend

Dimension	Description
SmpServiceOperation	Indicates the SBI service operation associated with the metric. The value represents the specific NRF operation for which the metric is recorded. It varies depending on whether NRF processes the message in server mode (handling incoming requests such as nfRegister, nfDiscover, nfAccessToken) or client mode (handling responses such as forwarding or roaming responses). Sample Values: These values are applicable to: - ocnrf_smp_parsing_error_total - ocnrf_smp_no_match_total - Server Mode (Request Handling) - nfRegister - nfUpdateFull - nfUpdatePartial - nfHeartbeat - nfDeregister - nfOptions - nfListRetrieval - nfInstanceRetrieval - nfCreateSubscription - nfUpdateSubscription - nfDeleteSubscription - nfDiscover - nfAccessToken - Client Mode (Response Handling) - nfInstanceRetrievalFwdResponse - nfCreateSubscriptionFwdResponse - nfCreateSubscriptionRoamResponse - nfUpdateSubscriptionFwdResponse - nfUpdateSubscriptionRoamResponse - nfDeleteSubscriptionFwdResponse - nfDeleteSubscriptionRoamResponse - nfDiscoverFwdResponse - nfDiscoverRoamResponse - nfAccessTokenFwdResponse - nfAccessTokenRoamResponse - Apart from these the following values are also supported for the ocnrf_smp_no_match_total metric. - Forwarding Requests * nfInstanceRetrievalFwdRequest * nfCreateSubscriptionFwdRequest * nfUpdateSubscriptionFwdRequest * nfDeleteSubscriptionFwdRequest * nfDiscoverFwdRequest * nfAccessTokenFwdRequest - Roaming Requests * nfCreateSubscriptionRoamRequest * nfUpdateSubscriptionRoamRequest * nfDeleteSubscriptionRoamRequest * nfDiscoverRoamRequest

Table 6-2 (Cont.) Dimensions Legend

Dimension	Description
	* nfAccessTokenRoamRequest * SLF Operations * nfDiscoverSlfRequest * Cache / Internal Operations * * nfDiscoverCachedataPeriodicRequest * nrfConfigurationCachedataRequest * cacheDataRequest * cacheDataResponse * Other Operations * nfStatusNotify * default
sni_status	Indicates if the SNI feature is enabled or disabled when an invalid SNI (direct and indirect routing) is sent. Sample Values: • true • false
sNssai	Indicates the Network slices are identified by Single Network Slice Selection Assistance Information (SNSSAI). It is in string format as outlined in 3GPP TS 29.571 section 5.4.4.2.
SourceNrfSetId	Indicates the set ID of the source NRF.
Status	Indicates the HTTP Status Code in response. When used in Gateway metrics it indicates the status of the pod. Sample Values: DISCARDED
StatusCode	Indicates the HTTP Status code.
SubscrCondType	Indicates the subscription condition type for which the subscription is created. Supported values are NfInstanceIdCond, NfTypeCond, ServiceNameCond, AmfCond, GuamiListCond, NetworkSliceCond, NfGroupCond, NfSetCond, and NoCond.
SubscrReqNfType	Identifies the requester NF type that creates the subscription. The value of the requester NF type is derived using any one of the following in the given order: • the SubscriptionData.reqNfType attribute (if present) or • from the nfStatusNotificationUri attribute (if available). An attempt is made to extract the requester NF Type from this attribute. The URI must have the nfType separated by '.' • If the value cannot be determined, the dimension is set to UNKNOWN.
SubscriberIdType	Indicates the subscriber Id type for each SLF request received or the SLF response sent.
SubscriberPLMNid	Indicates request is for which subscriber PLMN ID.
subscriptionLimitFeatureStatus	Indicates whether the Subscription Limit feature is enabled or disabled. Sample Values: • enabled • disabled

Table 6-2 (Cont.) Dimensions Legend

Dimension	Description
SubscriptionStatus	Indicates the Status of subscription. Sample Values: - SUBSCRIBED - SUSPENDED - UNSUBSCRIBED
tableName	Indicates the NRF Table Name
TargetNfInstanceId	Indicates the target NF Instance Id for NF Access Token.
TargetNfType	Indicates request is for which target NF type.
TargetNrfFqdn	Indicates the FQDN of the NRF to which the request is forwarded to.
TargetNrfSetId	Indicating the set ID of the target NRF.
TargetPLMNId	Indicates request is for which target PLMN ID.
TargetSLFFqdn	Indicates the target SLF FQDN where the current SLF request is sent.
TLSFqdn	Indicates the Fully Qualified Domain Name (FQDN) received in TLS Certificate.
TriggerMode	Indicates the trigger mode. Sample Values - Automatic: Triggers generated by 3GPP service operations or NRF Audit. - Manual: Triggers generated by the operator initiated retrigger API.
type	This dimension is used in Gateway services and in Perf-Info. - Gateway services: Indicates whether it is a request towards Data Director or an acknowledgement from Data Director. Sample Values: - req: Indicates request is sent from Ingress Gateway Microservice towards Data Director. - ack: Indicates Data Director has sent an acknowledgement for the received request. This will be only pegged if ack is enabled in NRF Message Feed feature. - Perf-Info: Indicates the resource type. Sample Value: svc_failure_count, svc_pending_count, cpu
Updatetype (Partial/Complete)	Indicates if the NF Update is with PUT (Complete) or PATCH (Partial) methods. Sample Values: - PUT - PATCH
Uri	Indicates the URI defined to identify the service operation at Ingress Gateway.
vendor	Indicates the Vendor name of NRF. Sample Values: Oracle
vfqdn	Indicates the FQDN of the peer.

Table 6-2 (Cont.) Dimensions Legend

Dimension	Description
XfccHeaderPresent	Used in Gateway metrics. Indicates if the XFCC header is present or not. Sample Values: true, false

6.1.1 NRF Gateways Metrics

This section provides details about the Gateway metrics of NRF.

6.1.1.1 Ingress Gateway Metrics

Table 6-3 oc_ingressgateway_msgcopy_requests_total

Field	Details
Description	This is incremented whenever request message is sent or acknowledged from Kafka.
Type	Counter
Dimensions	type

Table 6-4 oc_ingressgateway_msgcopy_responses_total

Field	Details
Description	This is incremented whenever response message is sent or acknowledged from Kafka.
Type	Counter
Dimensions	type

Table 6-5 oc_ingressgateway_dd_unreachable

Field	Details
Description	This indicates whether DD (kafka) is reachable or not 0 - reachable, 1 - unreachable
Type	Gauge

Table 6-6 oc_ingressgateway_jetty_request_stat_metrics_total

Field	Details
Description	This metric is pegged for every event occurred when a request is sent to Ingress Gateway.
Type	Counter
Dimensions	event, client_type, InstanceIdentifier, DestinationHost Note: The dimension DestinationHost will be pegged if the ingress-gateway.addDestHostToJettyStatMetric is set to true.

Table 6-7 oc_ingressgateway_jetty_response_stat_metrics_total

Field	Details
Description	This metric is pegged for every event occurred when a response is received by Ingress Gateway.
Type	Counter
Dimensions	event, client_type, InstanceIdentifier, DestinationHost Note: The dimension DestinationHost will be pegged if the ingress-gateway.addDestHostToJettyStatMetric is set to true.

Table 6-8 oc_ingressgateway_traffic_rejection_mode

Field	Details
Description	Gauge metric that pegs if the traffic is being rejected or not. The possible values are 0 and 1 (where "1" stands for rejected).
Type	Gauge

Table 6-9 oc_ingressgateway_http_requests_total

Field	Details
Description	Total number of ingress requests received at NRF.
Type	Counter
Dimensions	NFType, NFServiceType, Host, DestinationHost, OAuthTokenPresent, HttpVersion, Scheme, Route_path, InstanceIdentifier, consumerNFType, consumerInstanceID, ConsumerFqdn, Method Note: The dimension DestinationHost will be pegged if the ingress-gateway.addDestHostToHttpRequestMetric is set to true.

Table 6-10 oc_ingressgateway_http_responses_total

Field	Details
Description	Total number of responses for the following service operations at NRF: - NfRegister - NfUpdate (complete or partial replacement) - NfDelete - NfProfileRetrieval - NfListRetrieval - NFStatusSubscribe - NFStatusUnSubscribe - NfDiscover - NfAccessToken
Type	Counter
Dimensions	Status, Method, Route_path, NFType, NFServiceType, Host, DestinationHost, HttpVersion, Scheme, InstanceIdentifier, ErrorOriginator, jetty_request_timeout, error-reason Note: - The dimension DestinationHost will be pegged if the ingress-gateway.addDestHostToHttpResponseMetric is set to true. - The dimension error-reason will be pegged if the ingress-gateway.addErrReasonToHttpResponseMetric is set to true.

Table 6-11 oc_ingressgateway_http_responses_total (4xx responses)

Field	Details
Description	Total number of 4xx responses for the following service operations at NRF. - NfRegister - NfUpdate (complete/partial replacement) - NfDelete - NfProfileRetrieval - NfListRetrieval - NFStatusSubscribe - NFStatusUnSubscribe - NfDiscover - NfAccessToken
Type	Counter
Dimensions	Status, Method, Route_path, NFType, NFServiceType, Host, DestinationHost, HttpVersion, Scheme, InstanceIdentifier, ErrorOriginator, jetty_request_timeout, error-reason

Table 6-12 oc_ingressgateway_http_responses_total (5xx responses)

Field	Details
Description	Total number of 5xx responses for the following service operations at NRF. - NfRegister - NfUpdate (complete/partial replacement) - NfDelete - NfProfileRetrieval - NfListRetrieval - NFStatusSubscribe - NFStatusUnSubscribe - NfDiscover - NfAccessToken
Type	Counter
Dimensions	Status, Method, Route_path, NFType, NFServiceType, Host, DestinationHost, HttpVersion, Scheme, InstanceIdentifier, ErrorOriginator, jetty_request_timeout, error-reason

Table 6-13 oc_ingressgateway_request_latency_seconds [suffix]

Field	Details
Description	This metric is pegged when a request comes to Ingress gateway. It indicates the time (in microseconds) to process an Ingress Gateway request. It is measured from when the request is received to when the response is sent. Note: - Support for the metric *_latency_seconds continues to be present only in Ingress and Egress Gateway. *_latency_seconds[suffix] can represent any of the supported formats: *_latency_seconds_max *_latency_seconds_bucket *_latency_seconds_count *_latency_seconds_sum
Type	Histogram
Dimensions	quantile, InstanceIdentifier, Route_path, Method

Table 6-14 oc_ingressgateway_connection_failure_total

Field	Details
Description	Total number of failures at Ingress Gateway while establishing a connection with NRF.
Type	Counter
Dimensions	Direction, InstanceIdentifier, ErrorOriginator, error_reason Note: The dimension error_reason will be pegged if the ingress-gateway.addErrorReasonToConnectionFailureMetric is set to true.

Table 6-15 oc_ingressgateway_request_processing_latency_seconds_[suffix]

Field	Details
Description	Metric to capture the amount of time taken for processing of the request only within Ingress Gateway. Note: - Support for the metric *_latency_seconds continues to be present only in Ingress and Egress Gateway. *_latency_seconds_[suffix] can represent any of the supported formats: *_latency_seconds_max *_latency_seconds_bucket *_latency_seconds_count *_latency_seconds_sum
Type	Histogram
Dimensions	quantile, InstanceIdentifier, Route_path, Method

Table 6-16 oc_ingressgateway_request_content_metrics_total

Field	Details
Description	This metric is pegged by default filter RequestContentMetrics. It pegs whether a request has the request body or not.
Type	Counter
Dimensions	method, content_available, InstanceIdentifier

Table 6-17 oc_ingressgateway_xfcc_header_validate_total

Field	Details
Description	This metric is pegged when xfccHeaderValidation is enabled in XfccHeaderValidationFilter. This metric along with the specified dimension captures the successful/ un-successful validation of XFCC header in the incoming request.
Type	Counter
Dimensions	Route_path, Status, Cause, CertsCompared, InstanceIdentifier, ErrorOriginator, ServiceType, ErrorDetail

Table 6-18 oc_ingressgateway_incoming_connections

Field	Details
Description	Gauge metric that will peg active incoming connections from client to Ingress Gateway.
Type	Gauge

Table 6-18 (Cont.) oc_ingressgateway_incoming_connections

Field	Details
Dimensions	Direction, Host, InstanceIdentifier Note: The dimension Host will be pegged if the ingress-gateway.addHostToIncomingConnectionsMetric is set to true.

Table 6-19 oc_ingressgateway_outgoing_connections

Field	Details
Description	Gauge metric that will peg active outgoing connections from Ingress Gateway to destination.
Type	Gauge
Dimensions	Direction, Host, InstanceIdentifier Note: The dimension Host will be pegged if the ingress-gateway.addHostToOutgoingConnectionsMetric is set to true.

Table 6-20 oc_ingressgateway_count_invalid_route

Field	Details
Description	Counter metric that is pegged for every invalid route.
Type	Counter
Dimensions	oAuthHeaderPresent, XfccHeaderPresent

Table 6-21 oc_ingressgateway_server_latency_seconds_[suffix]

Field	Details
Description	This metric is pegged when a request comes to Ingress gateway. It shows latency consumed by the backend to process the request. Note: - Support for the metric *_latency_seconds continues to be present only in Ingress and Egress Gateway. *_latency_seconds_[suffix] can represent any of the supported formats: *_latency_seconds_max *_latency_seconds_bucket *_latency_seconds_count *_latency_seconds_sum
Type	Histogram
Dimensions	Method, Route_path, InstanceIdentifier

Table 6-22 oc_ingressgateway_cca_header_request_total

Field	Details
Description	This metric is pegged when CCA validation is enabled and CCA header is present in the request.
Type	Counter
Dimensions	ConsumerInstanceId, ProducerInstanceId

Table 6-23 oc_ingressgateway_cca_header_response_total

Field	Details
Description	This metric is pegged when an error response is sent due to a validation error of the CCA header.
Type	Counter
Dimensions	ConsumerInstanceId, ProducerInstanceId, StatusCode, ErrorReason

Table 6-24 oc_ingressgateway_cca_certificate

Field	Details
Description	Gauge metric used to peg the expiry date of the certificate. This metric is used further for raising alarms.
Type	Counter
Dimensions	CertificateName, SecretName, SerialNumber

Table 6-25 oc_ingressgateway_pod_congestion_state

Field	Details
Description	The metric is used to track the overall congestion state per Ingress Gateway pod. The values of the metric is as follow: -1: Feature is Disabled 0: Normal 1: DangerOfCongestion 2: Congested Note: Prometheus automatically injects pod name with label name "kubernetes_pod_name" to metric. This information is used for alert.
Type	Gauge
Dimensions	InstanceIdentifier

Table 6-26 oc_ingressgateway_pod_resource_stress

Field	Details
Description	This metric pegs the CPU usage and the pending message count, based on which Ingress Gateway pod is calculating its congestion state.
Type	Gauge
Dimensions	InstanceIdentifier, type Possible values for type are CPU, MEMORY, PENDING_REQUEST. Note: The type "MEMORY" is not used to determine the pod congestion state in NRF Ingress Gateway.

Table 6-27 oc_ingressgateway_pod_resource_state

Field	Details
Description	This metric pegs the congestion state per resource type which is calculated based on the resource usage and configured threshold. The values of the metric is as follow: • 0: Normal • 1: DoC • 2: Congested Note: Prometheus automatically injects pod name with label name "kubernetes_pod_name" to metric. This information is used for alert.
Type	Gauge
Dimensions	InstanceIdentifier, type Possible values for type are CPU, MEMORY, PENDING_REQUEST. Note: The type "MEMORY" is not used to determine the pod congestion state in NRF Ingress Gateway.

Table 6-28 oc_ingressgateway_incoming_pod_connections_rejected_total

Field	Details
Description	This metric pegs the number of connections dropped at Congested or DoC state. Note: Prometheus automatically injects pod name with label name "kubernetes_pod_name" to metric. This information is used for alert.
Type	Counter
Dimensions	InstanceIdentifier, Direction

Table 6-29 oc_ingressgateway_incoming_tls_connections

Field	Details
Description	Number of TLS connections received on the Ingress Gateway and their negotiated TLS versions. The versions can be TLSv1.3 or TLSv1.2.
Type	Gauge
Dimensions	NegotiatedTLSVersion, Host, Direction, InstanceIdentifier Note: The dimension Host will be pegged if the ingress-gateway.addHostToIncomingTlsConnectionsMetric is set to true.

Table 6-30 oc_ingressgateway_incoming_ip_type

Field	Details
Description	This is incremented when the IP type of the active incoming connections from the client to Ingress Gateway.
Type	Gauge
Dimensions	Host, receivedAddressType Note: The dimension Host will be pegged if the ingress-gateway.addHostToIncomingIpTypeMetric is set to true.

Table 6-31 oc_ingressgateway_outgoing_ip_type

Field	Details
Description	This is incremented when the IP type of the active outgoing connections from Ingress Gateway to the backend services.
Type	Gauge
Dimensions	BackendSvc, BackendSvcAddressType Note: The dimension BackendSvc will be pegged if the ingress-gateway.addBackendSvcToOutgoingIpTypeMetric is set to true.

Table 6-32 oc_ingressgateway_http_request_ratelimit_values_total

Field	Details
Description	This metric tracks the total count of requests handled by the rate limiting filter, categorized by whether each request was allowed or denied. If there was no route configuration for the dropped message, the id attribute is set to "NA".
Type	Counter
Dimension	Id, Allowed, RouteLevelColor

Table 6-33 oc_ingressgateway_http_request_ratelimit_reject_chain_duration_histogram_seconds_[suffix]

Field	Details
Description	This metric records the reject chain duration. Note: - Support for the metric *_histogram_seconds continues to be present only in Ingress and Egress Gateway. *_histogram_seconds_[suffix] can represent any of the supported formats: *_histogram_seconds_max *_histogram_seconds_bucket *_histogram_seconds_count *_histogram_seconds_sum
Type	Histogram
Dimension	NA

Table 6-34 oc_ingressgateway_http_request_ratelimit_reject_chain_length_histogram_[suffix]

Field	Details
Description	This metric records the number of sequential requests rejected due to rate limiting. This metric identifies periods of high traffic volume. Note: - Support for the metric *_histogram continues to be present only in Ingress and Egress Gateway. *_histogram_[suffix] can represent any of the supported formats: *_histogram_max *_histogram_bucket *_histogram_count *_histogram_sum
Type	Histogram

Table 6-34 (Cont.) oc_ingressgateway_http_request_ratelimit_reject_chain_length_histogram_[suffix]

Field	Details
Dimension	NA

Table 6-35 oc_ingressgateway_http_request_ratelimit_denied_count_total

Field	Details
Description	This metric records the details of the denied request. If there is no denied request action configuration, the ActionId attribute is set to "default".
Type	Counter
Dimension	Action, ActionId, CongestionLevel, Priority, ErrorProfile

Table 6-36 oc_ingressgateway_congestion_cpu_state

Field	Details
Description	This metric records the CPU levels at the congestion state.
Type	Gauge
Dimension	NA

Table 6-37 oc_ingressgateway_congestion_system_state

Field	Details
Description	Records the congestion level of the pod based on all the resources. The highest congestion level recorded for all resources in that interval is the system congestion level. However, currently, the congestion level is calculated based on CPU usage. Therefore, it records the system level based on CPU.
Type	Gauge
Dimension	NA

Table 6-38 oc_ingressgateway_system_state_duration_percentage

Field	Details
Description	This metric records the percentage of time the system was in a particular congestion level.
Type	Gauge
Dimension	level

Table 6-39 oc_ingressgateway_congestion_level_total

Field	Details
Description	This metric counts the number of times congestion levels, such as Normal, Danger Of Congestion, Congestion, and so on, were identified as defined in Ingress Gateway Pod Protection Using Rate Limiting . This congestion level value varies between 0-10.
Type	Counter
Dimension	NA

Table 6-40 oc_ingressgateway_congestion_level_group_total

Field	Details
Description	This metric identifies the number of times the congestion level was observed. Note: This metric also records any increase in CPU, which sometimes is not recorded in the oc_ingressgateway_congestion_cpu_state metric. Refer to both the metrics to obtain the congestion level of the pod.
Type	Counter
Dimension	NA

Table 6-41 oc_ingressgateway_congestion_cpu_percentage_[suffix]

Field	Details
Description	This metric records the CPU utilization percentages, tracking the distribution of values across predefined ranges. For example, 0 to 10 %, 11 to 20 %, 21 to 30 %, 31 to 40 %, 41 to 50 %, 51 to 60 %, 61 to 70 %, 71 to 80 %, 81 to 90 %, and 91 to 100%. Note: - Support for the metric *_percentage continues to be present only in Ingress and Egress Gateway. *_percentage_[suffix] can represent any of the supported formats: *_percentage_max *_percentage_bucket *_percentage_count *_percentage_sum
Type	Histogram
Dimension	NA

Table 6-42 oc_ingressgateway_route_overloadcontrol_discard_total

Field	Details
Description	This metric is pegged when the incoming request is discarded by the Overload load filter on percentage basis. Note: The LoadLevel label identifies the exact overload threshold at which each request is dropped.
Type	Counter
Dimension	DiscardAction, ErrorOriginator, InstanceIdentifier, LoadLevel, Method, Scheme, ServiceName, Status

Table 6-43 oc_ingressgateway_request_failure_total

Field	Details
Description	This metric is pegged to track requests discarded due to an invalid HTTP request.
Type	Counter
Dimension	Method, HttpStatus, Scheme, ErrorDetail, InstanceIdentifier, ErrorOriginator

Table 6-44 oc_ingressgateway_smp_parsing_error_total

Field	Details
Description	Indicates the number of instances where the SMP header is received with an invalid value (outside the range 0–31) at the Ingress Gateway.
Type	Counter
Dimensions	routeId

Table 6-45 oc_ingressgateway_smp_no_match_total

Field	Details
Description	Indicates the number of instances in which the SMP feature is enabled but the SMP header is not added to the response generated by the Ingress Gateway. This metric is incremented only when the feature is applied at the Ingress Gateway. The metric is not pegged by Ingress Gateway when the reason is MISSING_MAP_RULE or MISSING_PRIORITY_RULE. In all other applicable cases, the metric is incremented with the corresponding routeId and reason dimensions.
Type	Counter
Dimensions	routeId, reason

6.1.1.2 Egress Gateway Metrics

Table 6-46 oc_egressgateway_msgcopy_requests_total

Field	Details
Description	This is incremented whenever request message is sent or acknowledged from Kafka.
Type	Counter
Dimensions	type

Table 6-47 oc_egressgateway_msgcopy_responses_total

Field	Details
Description	This is incremented whenever response message is sent or acknowledged from Kafka.
Type	Counter
Dimensions	type

Table 6-48 oc_egressgateway_dd_unreachable

Field	Details
Description	This indicates whether DD (kafka) is reachable or not 0 - reachable, 1 - unreachable
Type	Gauge
Dimensions	NA

Table 6-49 oc_egressgateway_http_requests_total

Field	Details
Description	Metric to capture the request count reaches the Egress Gateway from the application microservice and pegs with Direction as egress. Also, when the request goes out of Egress Gateway and pegs with Direction as egressOut.
Type	Counter
Dimensions	Method, NFType, NFServiceType, Host, HttpVersion, Scheme, Proxy, InstanceIdentifier, Direction, DestinationHost Note: - The dimension DestinationHost will be pegged if the egress-gateway.addDestHostToHttpRequestMetric is set to true. - The dimension Host will be pegged if the egress-gateway.addHostToHttpRequestMetric is set to true.

Table 6-50 oc_egressgateway_http_responses_total

Field	Details
Description	Metric to capture when Egress Gateway sends response back to backend NF microservice and pegs with Direction as egress. Also, when the response is received Egress gateway and pegs with Direction as egressOut
Type	Counter
Dimensions	Status, Method, NFType, NFServiceType, Host, HttpVersion, Scheme, InstanceIdentifier, Direction, BlacklistedFqdn, DestinationHost, ErrorOriginator, jetty_request_timeout, error-reason Note: - The dimension DestinationHost will be pegged if the egress-gateway.addDestinationHostToResponseMetric is set to true. - The dimension error-reason will be pegged if the egress-gateway.addErrorReasonToResponseMetric is set to true.

Table 6-51 oc_egressgateway_connection_failure_total

Field	Details
Description	This metric will be pegged by jetty client when the destination is not reachable by Egress Gateway. Here, the destination is producer NF.
Type	Counter
Dimensions	Host, Port, InstanceIdentifier, Direction, error_reason, ErrorOriginator Note: - The dimension Host will be pegged if the egress-gateway.addHostToConnectionFailureMetric is set to true. - The dimension Port will be pegged if the egress-gateway.addPortToConnectionFailureMetric is set to true. - The dimension error_reason will be pegged if the egress-gateway.addErrReasonToConnectionFailureMetric is set to true.

Table 6-52 oc_egressgateway_request_processing_latency_seconds_[suffix]

Field	Details
Description	Metric captures the amount of time taken for processing the request only within Egress Gateway. Note: - Support for the metric *_latency_seconds continues to be present only in Ingress and Egress Gateway. *_latency_seconds_[suffix] can represent any of the supported formats: *_latency_seconds_max *_latency_seconds_bucket *_latency_seconds_count *_latency_seconds_sum
Type	Histogram
Dimensions	quantile, InstanceIdentifier, Route_path, Method

Table 6-53 oc_egressgateway_request_latency_seconds_[suffix]

Field	Details
Description	This metric is pegged in the last custom filter of the Egress Gateway while the response is being sent back to the consumer NF. This metric tracks the amount of time taken for processing the request. It starts as soon the request reaches the first custom filter of the application and lasts till the response is sent back to the consumer NF from the last custom filter of the application. Note: - Support for the metric *_latency_seconds continues to be present only in Ingress and Egress Gateway. *_latency_seconds_[suffix] can represent any of the supported formats: *_latency_seconds_max *_latency_seconds_bucket *_latency_seconds_count *_latency_seconds_sum
Type	Histogram
Dimensions	quantile, InstanceIdentifier, Route_path, Method

Table 6-54 oc_egressgateway_request_content_metrics_total

Field	Details
Description	This metric is pegged by default filter RequestContentMetrics. It pegs whether request has request body or not.
Type	Counter
Dimensions	method, content_available, InstanceIdentifier

Table 6-55 oc_egressgateway_incoming_connections

Field	Details
Description	Gauge metric that will peg active incoming connections from client to Egress Gateway.
Type	Gauge

Table 6-55 (Cont.) oc_egressgateway_incoming_connections

Field	Details
Dimensions	Direction, Host, InstanceIdentifier Note: The dimension Host will be pegged if the egress-gateway.addHostToIncomingConnectionsMetric is set to true.

Table 6-56 oc_egressgateway_outgoing_connections

Field	Details
Description	Gauge metric that will peg active outgoing connections from Egress Gateway to destination.
Type	Gauge
Dimensions	Direction, Host, InstanceIdentifier Note: The dimension Host will be pegged if the egress-gateway.addHostToOutgoingConnectionsMetric is set to true.

Table 6-57 oc_egressgateway_server_latency_seconds [suffix]

Field	Details
Description	This metric is pegged in Jetty response listener that captures the amount of time taken for processing of the request by jetty client. Note: - Support for the metric *_latency_seconds continues to be present only in Ingress and Egress Gateway. *_latency_seconds [suffix] can represent any of the supported formats: *_latency_seconds_max *_latency_seconds_bucket *_latency_seconds_count *_latency_seconds_sum
Type	Histogram
Dimensions	quantile, InstanceIdentifier, Host, Method

Table 6-58 oc_egressgateway_jetty_request_stat_metrics_total

Field	Details
Description	This metric is pegged for every outgoing request from Egress gateway to the backend at jetty level
Type	Counter
Dimensions	DestinationHost, InstanceIdentifier, event Note: The dimension DestinationHost will be pegged if the egress-gateway.addDestHostToJettyStatMetric is set to true.

Table 6-59 oc_egressgateway_jetty_response_stat_metrics_total

Field	Details
Description	This metric is pegged for every event occurred when a response is received by Egress Gateway.
Type	Counter

Table 6-59 (Cont.) oc_egressgateway_jetty_response_stat_metrics_total

Field	Details
Dimensions	event, client_type, InstanceIdentifier, DestinationHost Note: The dimension DestinationHost will be pegged if the egress-gateway.addDestHostToJettyStatMetric is set to true.

Table 6-60 oc_egressgateway_sni_error_total

Field	Details
Description	Indicates the count of TLS connection failure due to SNI validation failure.
Type	Counter
Dimensions	error_reason, sni_status

Table 6-61 oc_egressgateway_peer_health_status

Field	Details
Description	It defines Egress Gateway peer health status. - This metric is set to 1, if a peer is unhealthy. - This metric is reset to 0, when it becomes healthy again. - This metric is set to -1, if peer is removed from peerconfiguration.
Type	Gauge
Dimensions	peer, vfqdn

Table 6-62 oc_egressgateway_peer_health_ping_request_total

Field	Details
Description	This metric is incremented every time a health ping is sent toward a peer.
Type	Counter
Dimensions	peer, vfqdn Note: If virtual host is configured then vfqdn is pegged along with peer otherwise only peer will be pegged.

Table 6-63 oc_egressgateway_peer_health_ping_response_total

Field	Details
Description	This metric is incremented every time a health ping response is received from a peer irrespective of success or failure.
Type	Counter
Dimensions	peer, vfqdn, status, cause Note: If virtual host is configured then vfqdn is pegged along with peer otherwise only peer will be pegged.

Table 6-64 oc_egressgateway_peer_health_status_transitions_total

Field	Details
Description	This metric is incremented every time a peer is transitioned from Available to Unavailable or from Unavailable to Available.
Type	Counter
Dimensions	peer, vfqdn, from, to

Table 6-65 oc_egressgateway_peer_count

Field	Details
Description	This metric is incremented every time for the peer count.
Type	Gauge
Dimensions	peerset

Table 6-66 oc_egressgateway_peer_available_count

Field	Details
Description	This metric is incremented every time for the available peer count.
Type	Gauge
Dimensions	peerset

Table 6-67 oc_egressgateway_outgoing_tls_connections

Field	Details
Description	Number of TLS connections received on the Egress Gateway and their negotiated TLS versions. The versions can be TLSv1.3 or TLSv1.2.
Type	Gauge
Dimensions	NegotiatedTLSVersion, Host, Direction, InstanceIdentifier Note: The dimension Host will be pegged if the egress-gateway.addHostToOutgoingTlsConnectionsMetric is set to true.

Table 6-68 oc_egressgateway_incoming_ip_type

Field	Details
Description	This is incremented when the IP type of the active incoming connections from the NRF microservices to the Egress Gateway.
Type	Gauge
Dimensions	Host, receivedAddressType Note: The dimension Host will be pegged if the egress-gateway.addHostToIncomingIpTypeMetric is set to true.

Table 6-69 oc_egressgateway_outgoing_ip_type

Field	Details
Description	This is incremented when the IP type of the active outgoing connections from Egress Gateway to the destination.

Table 6-69 (Cont.) oc_egressgateway_outgoing_ip_type

Field	Details
Type	Gauge
Dimensions	DestinationHost, DestinationHostAddressType Note: The dimension DestinationHost will be pegged if the egress-gateway.addHostToOutgoingIpTypeMetric is set to true.

Table 6-70 oc_egressgateway_dualstack_ip_rejected_total

Field	Details
Description	This is incremented by counting the total IP rejections which are caused by a IP mismatch between the IP type configured in the egressRoutingMode and the IP type returned by DNS resolution.
Type	Gauge
Dimensions	authority, egressRoutingMode, dnsResolvedType

Table 6-71 oc_egressgateway_podlevel_throttling_allowed_total

Field	Details
Description	Indicates the total number of requests processed by Egress Gateway microservice when the Egress Gateway pod throttling feature is enabled. Note: The metric will not be pegged if the Egress Gateway pod throttling feature is disabled.
Type	Counter
Dimensions	route_id

Table 6-72 oc_egressgateway_http_request_ratelimit_values_total

Field	Details
Description	This metric tracks the total number of requests handled by the rate limiting filter, categorized by whether each request was allowed or denied. If there was no route configuration for the dropped message, the id attribute is set to "NA".
Type	Counter
Dimensions	Id, Allowed, RouteLevelColor

Table 6-73 oc_egressgateway_http_request_ratelimit_reject_chain_duration_histogram_seconds_[suffix]

Field	Details
Description	Records the reject chain duration. Note: - Support for the metric *_histogram_seconds continues to be present only in Ingress and Egress Gateway. *_histogram_seconds_[suffix] can represent any of the supported formats: *_histogram_seconds_max *_histogram_seconds_bucket *_histogram_seconds_count *_histogram_seconds_sum

Table 6-73 (Cont.)

oc_egressgateway_http_request_ratelimit_reject_chain_duration_histogram_seconds_[suffix]

Field	Details
Type	Histogram
Dimensions	NA

Table 6-74 oc_egressgateway_http_request_ratelimit_reject_chain_length_histogram_[suffix]

Field	Details
Description	Records the number of sequential requests rejected due to rate limiting. This metric identifies periods of high traffic volume. Note: - Support for the metric *_histogram_seconds continues to be present only in Ingress and Egress Gateway. *_histogram_seconds_[suffix] can represent any of the supported formats: *_histogram_seconds_max *_histogram_seconds_bucket *_histogram_seconds_count *_histogram_seconds_sum
Type	Histogram
Dimensions	NA

Table 6-75 oc_egressgateway_http_request_ratelimit_denied_count_total

Field	Details
Description	Records the details of the total denied requests. If there is no denied request action configuration, the ActionId attribute is set to "default".
Type	Counter
Dimensions	Action, ActionId, CongestionLevel, Priority, ErrorProfile

Table 6-76 oc_egressgateway_congestion_cpu_state

Field	Details
Description	Records the CPU levels at the congestion state.
Type	Gauge
Dimensions	NA

Table 6-77 oc_egressgateway_congestion_system_state

Field	Details
Description	Records the congestion level of the pod based on all the resources. The highest congestion level recorded for all resources in that interval is the system congestion level. However, currently, the congestion level is calculated based on CPU usage. Therefore, it records the system level based on CPU.
Type	Gauge
Dimensions	NA

Table 6-78 oc_egressgateway_system_state_duration_percentage

Field	Details
Description	Records the percentage of time the system was in a particular congestion level.
Type	Gauge
Dimensions	level

Table 6-79 oc_egressgateway_congestion_level_total

Field	Details
Description	Counts the number of times congestion levels, such as Normal, Danger Of Congestion, Congestion, and so on, were identified as defined in Egress Gateway Pod Protection Using Rate Limiting .
Type	Counter
Dimensions	NA

Table 6-80 oc_egressgateway_congestion_level_group_total

Field	Details
Description	Identifies the number of times the congestion level was observed. Note: This metric also records any increase in CPU, which sometimes is not recorded in the oc_egressgateway_congestion_cpu_state metric. Refer to both the metrics to obtain the congestion level of the pod. 0,1,2,3...10 based on configured levels.
Type	Counter
Dimensions	NA

Table 6-81 oc_egressgateway_congestion_cpu_percentage [suffix]

Field	Details
Description	Records the CPU utilization percentages, tracking the distribution of values across predefined ranges. For example, 0 to 10 %, 11 to 20 %, 21 to 30 %, 31 to 40 %, 41 to 50 %, 51 to 60 %, 61 to 70 %, 71 to 80 %, 81 to 90 %, and 91 to 100%. Note: - Support for the metric *_percentage continues to be present only in Ingress and Egress Gateway. *_percentage [suffix] can represent any of the supported formats: *_percentage_max *_percentage_bucket *_percentage_count *_percentage_sum
Type	Histogram
Dimensions	NA

Table 6-82 oc_egressgateway_request_failure_total

Field	Details
Description	This metric is pegged to track requests discarded due to an invalid HTTP request.

Table 6-82 (Cont.) oc_egressgateway_request_failure_total

Field	Details
Type	Counter
Dimensions	Scheme, ErrorDetail, InstanceIdentifier, ErrorOriginator, HttpStatus, Method

Table 6-83 oc_egressgateway_smp_parsing_error_total

Field	Details
Description	Indicates the number of instances where the SMP header is received in the incoming requests with an invalid value (outside the range 0–31) at the Egress Gateway. Note: This metric will not be pegged for any incoming response with invalid SMP header value (outside the range 0–31).
Type	Counter
Dimensions	routeId

Table 6-84 oc_egressgateway_smp_no_match_total

Field	Details
Description	Indicates the number of instances where the SMP feature is enabled but the SMP header is not added in the request generated by the Egress Gateway. This metric is incremented only when the feature is applied at the Egress Gateway. The Egress Gateway does not increment this metric when the reason dimension is MISSING_MAP_RULE or MISSING_PRIORITY_RULE.
Type	Counter
Dimensions	routeId, reason

6.1.1.3 Common Gateway Metrics

Table 6-85 oc_configserver_reachability

Field	Details
Description	Indicates whether microservices that uses a common config client to interact with the common config server is able to establish connection and fetch configuration from the common config server. - The value is set to 1 if the microservices are able to connect and read the value from the common config server. - The value is set to 0 if the microservices receive errors while connecting with the common config server.
Type	Gauge
Dimensions	NA

Table 6-86 oc_configclient_request_total

Field	Details
Description	This metric is pegged whenever the configuration client is polling for configuration update from common configuration server.
Type	Counter
Dimensions	releaseVersion, configVersion

Table 6-87 oc_configclient_response_total

Field	Details
Description	This metric is pegged whenever config client receives response from common configuration server.
Type	Counter
Dimensions	releaseVersion, configVersion, updated

Table 6-88 oc_oauth_nrf_request_total

Field	Details
Description	This metric is pegged in the OAuth client implementation if the request is sent to NRF for requesting the OAuth token. OAuth client implementation is used in Egress Gateway.
Type	Counter
Dimensions	ConsumerNFInstanceId, ConsumerNFType, TargetNFType, TargetNFInstanceId, scope, NrfFqdn

Table 6-89 oc_oauth_nrf_response_success_total

Field	Details
Description	This metric is pegged in the OAuth client implementation if an OAuth token is successfully received from the NRF. OAuth client implementation is used in Egress Gateway.
Type	Counter
Dimensions	ConsumerNFInstanceId, ConsumerNFType, TargetNFType, TargetNFInstanceId, scope, NrfFqdn, StatusCode

Table 6-90 oc_oauth_nrf_response_failure_total

Field	Details
Description	This metric is pegged in the OAuthClientFilter in Egress Gateway whenever GetAccessTokenFailedException is caught.
Type	Counter
Dimensions	ConsumerNFInstanceId, ConsumerNFType, TargetNFType, TargetNFInstanceId, scope, NrfFqdn, ErrorOriginator, StatusCode

Table 6-91 oc_oauth_request_failed_internal_total

Field	Details
Description	This metric is pegged in the OAuthClientFilter in Egress Gateway whenever InternalServerErrorException is caught.
Type	Counter
Dimensions	ConsumerNFInstanceId, ConsumerNFType, ErrorOriginator, Nrffqdn, StatusCode, TargetNFType, TargetNFInstanceId, scope

Table 6-92 oc_oauth_token_cache_total

Field	Details
Description	This metric is pegged in the OAuth Client Implementation if the OAuth token is found in the cache.
Type	Counter
Dimensions	ConsumerNFInstanceId, ConsumerNFType, TargetNFType, TargetNFInstanceId, scope, Nrffqdn

Table 6-93 oc_oauth_request_invalid_total

Field	Details
Description	This metric is pegged in the OAuthClientFilter in Egress Gateway whenever a BadAccessTokenRequestException/JsonProcessingException is caught.
Type	Counter
Dimensions	ConsumerNFInstanceId, ConsumerNFType, TargetNFType, TargetNFInstanceId, scope, StatusCode, ErrorOriginator, Nrffqdn

Table 6-94 security_cert_x509_expiration_seconds_[suffix]

Field	Details
Description	Indicates the time to certificate expiry in epoch seconds. Note: - Support for the metric *_expiration_seconds continues to be present only in Ingress and Egress Gateway. — *_expiration_seconds_[suffix] can represent any of the supported formats: * *_expiration_seconds_max * *_expiration_seconds_bucket * *_expiration_seconds_count * *_expiration_seconds_sum
Type	Histogram
Dimensions	serialNumber

6.1.2 Platform Metrics

This section provides details about the platform metrics used in NRF.

Table 6-95 log4j2_events_total

Field	Details
Description	This metric tracks the total number of logging events generated by a microservice at each specified log level. It helps monitor the volume of logs such as DEBUG, INFO, WARN, and ERROR over time.
Type	Counter
Service Operation	NFRegister, NFUpdate, NFDeregister, NFStatusSubscribe, NFStatusNotify, NFStatusUnSubscribe, NFListRetrieval, NFProfileRetrieval, NFDDiscover, Access Token Request
Dimensions	level

6.1.3 CNC Jetty Metrics

Table 6-96 oc_cnc_jetty_service_discovery_duration_seconds [suffix]

Field	Details
Description	This metric records the service discovery call latency. Note: - This metric is pegged only in the case of a non-ASM deployment. *_seconds_[suffix] can represent any of the supported formats: _seconds_max _seconds_bucket _seconds_count _seconds_sum
Type	Histogram
Dimensions	NA

Table 6-97 oc_cnc_jetty_service_discovery_up

Field	Details
Description	This metric records the status of service discovery calls. Note: This metric is pegged only in the case of a non-ASM deployment. In an ASM deployment, Eclipse Jetty is used for all communications, and service discovery is not scheduled. If the call is successful, the value is 1. If the call fails, the value is 0.
Type	Gauge
Dimensions	NA

Table 6-98 oc_cnc_jetty_service_discovery_fallbacks_total

Field	Details
Description	This metric records the details of the requests for which the FQDN-to-IP mapping failed, and the original FQDN was used as a fallback for further communication. The metric is incremented only when the IP is not found for an FQDN, and the FQDN gets used for further communication. Note: This metric is pegged only in the case of a non-ASM deployment.
Type	Counter
Dimensions	host

6.1.4 Configuring NRF Metrics Dashboard in OCI

This section describes the steps to upload the `ocnrf_oci_metric_dashboard_26.1.201.json` file on OCI Logging Analytics Dashboard. As OCI doesn't support Grafana, OCI uses the Logging Analytics Dashboard Service for visualizing the metrics and logs.

The steps are:

1. Log in to OCI Console.

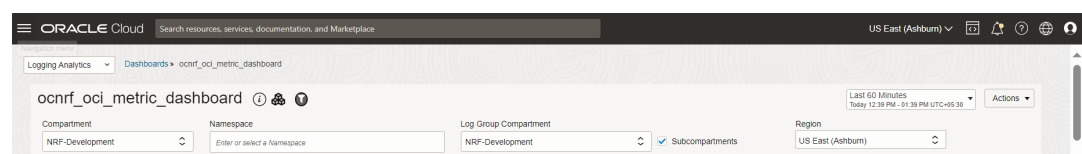
Note

For more details about logging in to the OCI, refer to [Signing In to the OCI Console](#).

2. Open the navigation menu and click **Observability & Management**.
3. Under **Logging Analytics**, click **Dashboards**. The **Dashboards** page appears.
4. Choose the **Compartment** on the left pane.
5. Click **Import dashboards**.
6. User can select and upload the `ocnrf_oci_metric_dashboard_26.1.201.json` file. `##METRIC_NAMESPACE` in json file must be customized to metrics namespace that the user provided while deploying OCI adaptor.
7. **Import dashboard** page appears. Click **Import** button on the page.
8. Click filter  option in the `ocnrf_oci_metric_dashboard` page and select the **Compartment**, **Namespace**, **Log Group Compartment**, and **Region** from the drop-down list.

User can view the imported dashboard and can view the metrics in the dashboard.

Figure 6-1 ocnrf_oci_metric_dashboard



For more details, see *Oracle Communications Cloud Native Core, OCI Adaptor Deployment Guide*.

6.1.5 NRF NF Metrics

This section provides details about the NRF metrics.

Table 6-99 ocnrf_nfRegister_rx_requests_total

Field	Details
Description	Number of Registration Requests received.
Type	Counter
Dimensions	NrfLevel, NfInstanceId, RequesterNfType, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-100 ocnrf_nfRegister_tx_responses_total

Field	Details
Description	Number of Registration Responses sent.
Type	Counter
Dimensions	NrfLevel, NfInstanceId, RequesterNfType, HttpStatusCode, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-101 ocnrf_nfRegister_rx_requests_success_perService_total

Field	Details
Description	Number of Registrations received and processed successfully per Service.
Type	Counter
Dimensions	NrfLevel, NfInstanceId, serviceName, serviceInstanceId, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.
Recommended legend to see dimension level data (as applicable)	NfRegistrations Per Service [serviceName :- {{ serviceName }}, nfInstanceId :- {{NfInstanceId}}]

Table 6-102 ocnrf_nfUpdate_rx_requests_total

Field	Details
Description	Number of Update Requests received.
Type	Counter
Dimensions	NrfLevel, NfInstanceId, RequesterNfType, Updatetype (Partial/Complete), NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-103 ocnrf_nfUpdate_tx_responses_total

Field	Details
Description	Number of Update Responses sent.
Type	Counter
Dimensions	NrfLevel, NfInstanceId, RequesterNfType, Updatetype (Partial/Complete), HttpStatusCode, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-104 ocnrf_nfUpdate_rx_requests_success_perService_total

Field	Details
Description	Number of NfUpdates received and processed successfully per Service.
Type	Counter
Dimensions	NrfLevel, Updatetype (Partial/Complete), NfInstanceId, ServiceName, ServiceInstanceId, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.
Recommended legend to see dimension level data (as applicable)	NfUpdates Per Service [serviceName :- {{ serviceName }}, serviceInstanceId:- {{ServiceInstanceId}}]

Table 6-105 ocnrf_nfHeartbeat_rx_requests_total

Field	Details
Description	Number of Heartbeat Requests received.
Type	Counter
Dimensions	NrfLevel, NfInstanceId, RequesterNfType, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-106 ocnrf_nfHeartBeat_tx_responses_total

Field	Details
Description	Number of Heartbeat Responses sent
Type	Counter
Dimensions	Nrflevel, NfInstanceId, RequesterNfType, HttpStatusCode, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-107 ocnrf_nfDeregister_rx_requests_total

Field	Details
Description	Number of deregistration requests received.

Table 6-107 (Cont.) ocnrf_nfDeregister_rx_requests_total

Field	Details
Type	Counter
Dimensions	NrfLevel, NfInstanceId, RequesterNfType, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-108 ocnrf_nfDeregister_tx_responses_total

Field	Details
Description	Number of deregistration responses sent.
Type	Counter
Dimensions	NrfLevel, NfInstanceId, RequesterNfType, HttpStatusCode, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-109 ocnrf_nfDeregister_rx_requests_success_perService_total

Field	Details
Description	Number of deregistration requests received and process successfully per service.
Type	Counter
Dimensions	NrfLevel, serviceName, serviceInstanceId, NfInstanceId, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.
Recommended legend to see dimension level data (as applicable)	NFDeregistration Per Service [serviceName :- {{ serviceName }}, serviceInstanceId:- {{ServiceInstanceId}}]

Table 6-110 ocnrf_nfListRetrieval_rx_requests_total

Field	Details
Description	Number of NFListRetrieval requests received.
Type	Counter
Dimensions	NrfLevel, RequesterNfType, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-111 ocnrf_nfListRetrieval_tx_responses_total

Field	Details
Description	Number of NFListRetrieval responses sent.
Type	Counter

Table 6-111 (Cont.) ocnrf_nfListRetrieval_tx_responses_total

Field	Details
Dimensions	NrfLevel, RequesterNfType, HttpStatusCode, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-112 ocnrf_nfProfileRetrieval_rx_requests_total

Field	Details
Description	Number of NFProfileRetrieval requests received.
Type	Counter
Dimensions	NrfLevel, NfInstanceId, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-113 ocnrf_nfProfileRetrieval_tx_responses_total

Field	Details
Description	Number of NFProfileRetrieval responses sent.
Type	Counter
Dimensions	NrfLevel, NfInstanceId, HttpStatusCode, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-114 ocnrf_heartbeat_missed_total

Field	Details
Description	Number of heartbeats missed.
Type	Counter
Dimensions	NrfLevel, NfType, NfInstanceId, NfFqdn Note: The NfFqdn dimension contain the FQDN as present in the NfProfile.

Table 6-115 ocnrf_nfStatusSubscribe_rx_requests_total

Field	Details
Description	Number of NStatusSubscribe requests received.
Type	Counter
Dimensions	NrfLevel, RequesterNfType, OperationType, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-116 ocnrf_nfStatusSubscribe_tx_responses_total

Field	Details
Description	Number of NfStatusSubscribe responses sent. In case of subscription limit feature, NRF includes and populates new measurements for number of new subscription requests or subscription renewal rejected (due to limit being exceeded) per second.
Type	Counter
Dimensions	NrfLevel, RequesterNfType, HttpStatusCode, OperationType, NfFqdn, RejectionReason Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-117 ocnrf_nfset_active_subscriptions

Field	Details
Description	Number of global subscription count status. For georedundancy, it reflects the total subscriptions in quad or triplet set.
Type	Gauge
Dimensions	NrfLevel

Table 6-118 ocnrf_nfset_limit_level

Field	Details
Description	Indicates the global subscription limit threshold level.
Type	Gauge
Dimensions	NrfLevel

Table 6-119 ocnrf_nfStatusUnsubscribe_rx_requests_total

Field	Details
Description	Number of NfStatusUnsubscribe requests received.
Type	Counter
Dimensions	NrfLevel, RequesterNfType, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-120 ocnrf_nfStatusUnsubscribe_tx_responses_total

Field	Details
Description	Number of NfStatusUnsubscribe responses sent.
Type	Counter
Dimensions	NrfLevel, RequesterNfType, HttpStatusCode, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-121 ocnrf_nfStatusNotify_tx_requests_total

Field	Details
Description	Number of NfStatusNotify requests sent.
Type	Counter
Dimensions	NrfLevel, NotificationEventType, TargetNfType, NfFqdn Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-122 ocnrf_nfStatusNotify_rx_responses_total

Field	Details
Description	Number of NfStatusNotify responses received.
Type	Counter
Dimensions	NrfLevel, NotificationEventType, NotificationHostPort, NumberOfRetriesAttempted, TargetNfType, HttpStatusCode, NfFqdn Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-123 ocnrf_nfStatusNotify_requests_failed_total

Field	Details
Description	Number of NfStatusNotify requests failed to sent out.
Type	Counter
Dimensions	NrfLevel, NotificationEventType, TargetNfType, NfFqdn Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-124 ocnrf_nfDiscover_rx_requests_total

Field	Details
Description	Number of NfDiscover Requests received.
Type	Counter
Dimensions	NrfLevel, TargetNfType, RequesterNfType, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.
Recommended legend to see dimension level data (as applicable)	NfDiscover Req [TargetNf :- {{ TargetNfType }}, RequesterNfType :- {{RequesterNfType}}]

Table 6-125 ocnrf_nfDiscover_tx_responses_total

Field	Details
Description	Number of NfDiscover responses sent.
Type	Counter
Dimensions	NrfLevel, TargetNfType, RequesterNfType, HttpStatusCode, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-126 ocnrf_nfDiscover_rx_requests_success_perService_total

Field	Details
Description	Number of NfDiscover requests received and processed successfully per Service.
Type	Counter
Dimensions	NrfLevel, RequesterNfType, serviceName, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.
Recommended legend to see dimension level data (as applicable)	NFDiscover Per Service [serviceName :- {{ serviceName }}]

Table 6-127 ocnrf_nfDiscover_profiles_discovered_total

Field	Details
Description	Number of Profiles returned in discovery response. Depending on bucket size and corresponding value will tell how many profiles are returned in discovery response.
Type	Counter
Dimensions	NrfLevel, TargetNfType, Bucket, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.
Recommended legend to see dimension level data (as applicable)	Discovered profiles [TargetNfType :- {{TargetNfType}}, Bucket :- {{ Bucket }}]

Table 6-128 ocnrf_active_registrations_count

Field	Details
Description	Number of active NFs that are registered at the local site at any point of time.
Type	Counter
Dimensions	RequesterNfType, NrfLevel
Recommended legend to see dimension level data (as applicable)	Active Registrations [NfType-{{ NfType }}, NrfLevel-{{ NrfLevel }}]

Table 6-129 ocnrf_message_processing_time_seconds_[suffix]

Field	Details
Description	Time taken by NRF specific microservice to process the service operation (NfRegister/NfUpdate-Partial/NfUpdate-Complete/NfDeregister/NfProfileRetrieval/NfListRetrieval/NfHeartBeat/NfDiscover/NFStatusSubscribe/NFStatusUnSubscribe/NfAccessToken) Note: - Latency calculated by this metric does not include time taken by NRF API gateway. *_seconds_[suffix] can represent any of the supported formats: *_seconds_max *_seconds_bucket *_seconds_count *_seconds_sum
Type	Histogram

Table 6-129 (Cont.) ocnrf_message_processing_time_seconds_[suffix]

Field	Details
Dimensions	NrfLevel, NfFqdn, RequesterNfType, ServiceOperation Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.
Recommended legend to see dimension level data (as applicable)	Avg NRF Latency {{ ServiceOperation }} {{ RequesterNfType }}

Table 6-130 ocnrf_dbmetrics_total

Field	Details
Description	Database operation count corresponding to every service operation.
Type	Counter
Dimensions	method, dbOperation, NrfLevel, HttpStatusCode

Table 6-131 ocnrf_dbmetrics_round_trip_time_seconds

Field	Details
Description	Time (in microseconds) taken by database operation corresponding to every service operation (NfRegister/NfUpdate/NfDeregister/NfProfileRetrieval/NfListRetrieval/NfHeartBeat/NfDiscover/NfSubscribe/NfUnsubscribe/NfStatusNotify/NfAccessToken/NrfConfiguration/InternalConfigurationCache) Note: *_seconds_[suffix] can represent any of the supported formats: *_seconds_max *_seconds_bucket *_seconds_count *_seconds_sum
Type	Histogram
Dimensions	method, dbOperation, serviceOperation, tableName: (NRF Table Names), NrfLevel, HttpStatusCode

Table 6-132 ocnrf_nf_suspended_total

Field	Details
Description	The number of profiles that have been marked as SUSPENDED when a profile has missed nfHeartBeatMissAllowed.
Type	Counter
Dimensions	NrfLevel, NfInstanceId, NfStatus, HeartbeatTimer, NfFqdn Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-133 ocnrf_nfSubscriptions_expired_total

Field	Details
Description	The number of NfSubscriptions whose validityTime has expired.

Table 6-133 (Cont.) ocnrf_nfSubscriptions_expired_total

Field	Details
Type	Counter
Dimensions	NrfLevel

Table 6-134 ocnrf_nfDiscover_emptyList_total

Field	Details
Description	This metric is pegged: - When feature flag is DISABLED and discovery request processing resulted in EMPTY LIST. - When feature flag is ENABLED and discovery request processing resulted in all matching NFs in SUSPENDED state.
Type	Counter
Dimensions	NfType, FeatureStatus

Table 6-135 ocnrf_operational_state

Field	Details
Description	This metric is pegged when the operational state of NRF switches between NORMAL and COMPLETE_SHUTDOWN. 0 - Indicates the operational state is NORMAL. 1 - Indicates the operational state is COMPLETE_SHUTDOWN. The metric is pegged in the NrfAuditor service, if any one of the NrfAuditor pod shows the operational state as COMPLETE_SHUTDOWN, then the state is considered as COMPLETE_SHUTDOWN.
Type	Gauge
Dimensions	NrfLevel

Table 6-136 ocnrf_audit_status

Field	Details
Description	This metric indicates whether the NRF Audit is in-progress or in paused state. The status of the audit procedures at . 0 - Indicates the NRF audit is in-progress. 1 - Indicates the NRF audit is paused. The metric is pegged in the NrfAuditor service, if any one of the NrfAuditor pod shows the operational state as COMPLETE_SHUTDOWN, then the state is considered as COMPLETE_SHUTDOWN. Note: NrfAuditor will continue to remain in the paused state for some time, even after 0cnrfOperationalStateCompleteShutdown alarm is cleared. For more information, see "From CONTROLLED_SHUTDOWN to NORMAL" in Controlled Shutdown of NRF section.
Type	Gauge
Dimensions	NrfLevel

Table 6-137 ocnrf_nfDiscover_limiting_profile_count_for_nfSet_total

Field	Details
Description	This metric will be pegged when the "Limiting the Number of Producers Based on NF Set Ids and Extended Preferred Locality" features are enabled and the number of NF profiles sent in the discovery response is less than the profileCountInDiscoveryResponse configuration.
Type	Counter
Dimensions	TargetNfType, RequesterNfType, NrfLevel

Table 6-138 ocnrf_nfDiscover_limiting_profiles_not_applied_for_nfSet_total

Field	Details
Description	This metric will be pegged when "Limiting the Number of Producers Based on NF Set Ids" feature could not be applied due to the unavailability of nfSetIdList in any one of the NF profiles selected with the first matching location(s) from targetPreferredLocations configuration in extendedPreferredLocality.
Type	Counter
Dimensions	TargetNfType, RequesterNfType, NrfLevel

Table 6-139 ocnrf_nfDiscover_tx_response_size_bytes_[suffix]

Field	Details
Description	The size of the NfDiscover response. The size is pegged in bytes and is published in buckets of 1KB, 3KB, 7KB, 10KB, 15KB, 20KB, 30KB, 40KB, 50KB, 60KB, 70KB, and 80KB. Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_size_bytes_max • *_size_bytes_bucket • *_size_bytes_count • *_size_bytes_sum
Type	Histogram
Dimensions	TargetNfType

Table 6-140 ocnrf_nf_profile_size

Field	Details
Description	The size of the registered NfProfiles. Note:The size of the metric is calculated as per the payload received during registration or update of the profile. To calculate the size of the payload, save the payload in a text file without spaces, and verify the size of the file using Linux tools like wc.
Type	Gauge
Dimensions	NfInstanceId, NfType

Table 6-141 ocnrf_nfProfile_size_limit_breached

Field	Details
Description	Indicates the number of NF profiles that get rejected due to profile size limit during registration or update service operations.
Type	Counter
Dimensions	NfInstanceId, NfType, ServiceOperation

Table 6-142 ocnrf_forward_jetty_latency_seconds_[suffix]

Field	Details
Description	This metric indicates the time taken to forward a request and receive the response. The time is measured from when the request is sent from the Jetty client, and the response is received by the Jetty client. This metric is pegged for both discovery and subscription forwarding and can be derived using the ServiceOperation dimension. Note: *_latency_seconds_[suffix] can represent any of the supported formats: • *_latency_seconds_max • *_latency_seconds_bucket • *_latency_seconds_count • *_latency_seconds_sum

Table 6-142 (Cont.) ocnrf_forward_jetty_latency_seconds_[suffix]

Field	Details
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-143 ocnrf_forward_jetty_request_total

Field	Details
Description	This metric measures the total number of times a request is sent by the Jetty client for discovery and subscription forwarding.
Type	Counter
Dimensions	ClientSvc, TargetSvc, Method

Table 6-144 ocnrf_forward_jetty_response_total

Field	Details
Description	This metric measures the total number of times a response is received by the Jetty client. The metric is applicable for discovery and subscription forwarding.
Type	Counter
Dimensions	ClientSvc, TargetSvc, Method

Table 6-145 ocnrf_forward_jetty_req_body_size_bytes_[suffix]

Field	Details
Description	This metric indicates the size (in bytes) of the request body sent by the Jetty client for discovery and subscription forwarding. Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_size_bytes_max • *_size_bytes_bucket • *_size_bytes_count • *_size_bytes_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-146 ocnrf_forward_jetty_res_body_size_bytes_[suffix]

Field	Details
Description	This metric indicates the size (in bytes) of the response body received by the Jetty client for discovery and subscription forwarding. Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_size_bytes_max • *_size_bytes_bucket • *_size_bytes_count • *_size_bytes_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-147 ocnrf_disc_cds_jetty_latency_seconds_[suffix]

Field	Details
Description	This metric indicates the time taken to send a request from the discovery microservice to the cache data microservice and receive the corresponding response. The time is measured from when the request is sent from the Jetty client, and the response is received by the Jetty client. Note: *_latency_seconds_[suffix] can represent any of the supported formats: Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_latency_seconds_max • *_latency_seconds_bucket • *_latency_seconds_count • *_latency_seconds_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-148 ocnrf_disc_cds_jetty_request_total

Field	Details
Description	This metric measures the total number of times a request is sent from the discovery microservice to cache data microservice by the Jetty client.
Type	Counter
Dimensions	ClientSvc, TargetSvc, Method

Table 6-149 ocnrf_disc_cds_jetty_response_total

Field	Details
Description	This metric measures the total number of times a response is received from the discovery microservice to CDS microservice by the Jetty client.

Table 6-149 (Cont.) ocnrf_disc_cds_jetty_response_total

Field	Details
Type	Counter
Dimensions	ClientSvc, TargetSvc, Method

Table 6-150 ocnrf_disc_cds_jetty_req_body_size_bytes_[suffix]

Field	Details
Description	This metric indicates the size (in bytes) of the request body sent by the Jetty client to the CDS service for discovery. Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_size_bytes_max • *_size_bytes_bucket • *_size_bytes_count • *_size_bytes_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-151 ocnrf_disc_cds_jetty_res_body_size_bytes_[suffix]

Field	Details
Description	This metric indicates the size (in bytes) of the response body received by the Jetty client from the CDS service for discovery. Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_size_bytes_max • *_size_bytes_bucket • *_size_bytes_count • *_size_bytes_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-152 ocnrf_oauth_jetty_latency_seconds_[suffix]

Field	Details
Description	This metric indicates the time taken to send a request from the access token service and receive the corresponding response. The time is measured from when the request is sent from the Jetty client, and the response is received by the Jetty client. Note: *_latency_seconds_[suffix] can represent any of the supported formats: • *_latency_seconds_max • *_latency_seconds_bucket • *_latency_seconds_count • *_latency_seconds_sum

Table 6-152 (Cont.) ocnrf_oauth_jetty_latency_seconds_[suffix]

Field	Details
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-153 ocnrf_oauth_jetty_request_total

Field	Details
Description	This metric measures the total number of times an access token request is sent by the Jetty client to the OAuth microservice.
Type	Counter
Dimensions	ClientSvc, TargetSvc, Method

Table 6-154 ocnrf_oauth_jetty_response_total

Field	Details
Description	This metric measures the total number of access token responses received by the Jetty client from the OAuth service.
Type	Counter
Dimensions	ClientSvc, TargetSvc, Method

Table 6-155 ocnrf_oauth_jetty_req_body_size_bytes_[suffix]

Field	Details
Description	This metric indicates the size (in bytes) of the request body sent by the Jetty client to the OAuth service. Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_size_bytes_max • *_size_bytes_bucket • *_size_bytes_count • *_size_bytes_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-156 ocnrf_oauth_jetty_res_body_size_bytes_[suffix]

Field	Details
Description	This metric indicates the size (in bytes) of the response body received by the Jetty client from the OAuth service. Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_size_bytes_max • *_size_bytes_bucket • *_size_bytes_count • *_size_bytes_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-157 ocnrf_roaming_jetty_latency_seconds_[suffix]

Field	Details
Description	This metric indicates the time taken to send a roaming request and receive the corresponding response. The time is measured from when the request is sent from the Jetty client, and the response is received by the Jetty client. Note: *_latency_seconds_[suffix] can represent any of the supported formats: • *_latency_seconds_max • *_latency_seconds_bucket • *_latency_seconds_count • *_latency_seconds_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-158 ocnrf_roaming_jetty_request_total

Field	Details
Description	This metric measures the total number of roaming requests sent by the Jetty client to the roaming peer.
Type	Counter
Dimensions	ClientSvc, TargetSvc, Method

Table 6-159 ocnrf_roaming_jetty_response_total

Field	Details
Description	This metric measures the total number of roaming responses received by the Jetty client from the roaming peer.
Type	Counter
Dimensions	ClientSvc, TargetSvc, Method

Table 6-160 ocnrf_roaming_jetty_req_body_size_bytes_[suffix]

Field	Details
Description	This metric indicates the size (in bytes) of the request body sent by the Jetty client to the roaming peer. Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_size_bytes_max • *_size_bytes_bucket • *_size_bytes_count • *_size_bytes_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-161 ocnrf_roaming_jetty_res_body_size_bytes_[suffix]

Field	Details
Description	This metric indicates the size (in bytes) of the response body received by the Jetty client from the roaming peer. Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_size_bytes_max • *_size_bytes_bucket • *_size_bytes_count • *_size_bytes_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-162 ocnrf_slf_jetty_latency_seconds_[suffix]

Field	Details
Description	This metric indicates the time taken to send an SLF request and receive the corresponding response. The time is measured from when the request is sent from the Jetty client, and the response is received by the Jetty client. Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_size_bytes_max • *_size_bytes_bucket • *_size_bytes_count • *_size_bytes_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-163 ocnrf_slf_jetty_request_total

Field	Details
Description	The metric measures the total number of SLF requests sent by the Jetty client from the discovery microservice to the Egress Gateway microservice.
Type	Counter
Dimensions	ClientSvc, TargetSvc, Method

Table 6-164 ocnrf_slf_jetty_response_total

Field	Details
Description	The metric measures the total number of SLF responses received by the jetty client in discovery microservice to the Egress Gateway microservice.
Type	Counter
Dimensions	ClientSvc, TargetSvc, Method

Table 6-165 ocnrf_slf_jetty_req_body_size_bytes_[suffix]

Field	Details
Description	This metric indicates the size (in bytes) of the request body sent by the Jetty client. The metric is applicable for requests exchanged between the discovery microservice and the Egress Gateway microservice. Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_size_bytes_max • *_size_bytes_bucket • *_size_bytes_count • *_size_bytes_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-166 ocnrf_slf_jetty_res_body_size_bytes_[suffix]

Field	Details
Description	This metric indicates the size (in bytes) of the response body received by the Jetty client. The metric is applicable for responses exchanged between the discovery microservice and the Egress Gateway microservice. Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_size_bytes_max • *_size_bytes_bucket • *_size_bytes_count • *_size_bytes_sum

Table 6-166 (Cont.) ocnrf_slf_jetty_res_body_size_bytes_[suffix]

Field	Details
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-167 ocnrf_subs_cds_jetty_latency_seconds_[suffix]

Field	Details
Description	This metric indicates the time taken to send a request and receive a response between the subscription microservice and the cache data microservice. The time is measured from when the request is sent from the Jetty client, and the response is received by the Jetty client. Note: *_latency_seconds_[suffix] can represent any of the supported formats: • *_latency_seconds_max • *_latency_seconds_bucket • *_latency_seconds_count • *_latency_seconds_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-168 ocnrf_subs_cds_jetty_request_total

Field	Details
Description	This metric measures the total number of requests sent between the subscription microservice and the cache data microservice.
Type	Counter
Dimensions	ClientSvc, TargetSvc, Method

Table 6-169 ocnrf_subs_cds_jetty_response_total

Field	Details
Description	This metric measures the total number of subscription responses received by the Jetty client from the cache data microservice.
Type	Counter
Dimensions	ClientSvc, TargetSvc, Method

Table 6-170 ocnrf_subs_cds_jetty_req_body_size_bytes_[suffix]

Field	Details
Description	This metric indicates the size (in bytes) of the request body sent by the Jetty client. The metric is applicable for requests exchanged between the subscription microservice and the cache data microservice. Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_size_bytes_max • *_size_bytes_bucket • *_size_bytes_count • *_size_bytes_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-171 ocnrf_subs_cds_jetty_res_body_size_bytes_[suffix]

Field	Details
Description	This metric indicates the size (in bytes) of the response body received by the Jetty client. The metric is applicable for the responses between the subscription microservice and the cache data microservice. Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_size_bytes_max • *_size_bytes_bucket • *_size_bytes_count • *_size_bytes_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-172 ocnrf_subs_notif_jetty_latency_seconds_[suffix]

Field	Details
Description	This metric indicates the time taken to send a subscription notification request and receive the corresponding response. The time is measured from when the request is sent by the Jetty client to when the response is received by the Jetty client. Note: *_latency_seconds_[suffix] can represent any of the supported formats: • *_latency_seconds_max • *_latency_seconds_bucket • *_latency_seconds_count • *_latency_seconds_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-173 ocnrf_subs_notif_jetty_request_total

Field	Details
Description	This metric measures the total number of subscription notification requests sent by the Jetty client.
Type	Counter
Dimensions	ClientSvc, TargetSvc, Method

Table 6-174 ocnrf_subs_notif_jetty_response_total

Field	Details
Description	This metric measures the total number of subscription notification responses received by the Jetty client.
Type	Counter
Dimensions	ClientSvc, TargetSvc, Method

Table 6-175 ocnrf_subs_notif_jetty_req_body_size_bytes_[suffix]

Field	Details
Description	This metric indicates the size (in bytes) of the request body sent by the Jetty client. Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_size_bytes_max • *_size_bytes_bucket • *_size_bytes_count • *_size_bytes_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-176 ocnrf_subs_notif_jetty_res_body_size_bytes_[suffix]

Field	Details
Description	This metric indicates the size (in bytes) of the response body received by the Jetty client. Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_size_bytes_max • *_size_bytes_bucket • *_size_bytes_count • *_size_bytes_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-177 ocnrf_subs_roaming_jetty_latency_seconds_[suffix]

Field	Details
Description	This metric indicates the time taken to send a subscription-related roaming request and receive the corresponding response. The time is measured from when the request is sent from the Jetty client, and the response is received by the Jetty client. Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_size_bytes_max • *_size_bytes_bucket • *_size_bytes_count • *_size_bytes_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-178 ocnrf_subs_roaming_jetty_request_total

Field	Details
Description	The metric measures the total number of requests sent by the Jetty client for Subscription Roaming requests.
Type	Counter
Dimensions	ClientSvc, TargetSvc, Method

Table 6-179 ocnrf_subs_roaming_jetty_response_total

Field	Details
Description	This metric measures the total number of responses received by the Jetty client for Subscription Roaming requests.
Type	Counter
Dimensions	ClientSvc, TargetSvc, Method

Table 6-180 ocnrf_subs_roaming_jetty_req_body_size_bytes_[suffix]

Field	Details
Description	This metric indicates the size (in bytes) of the request body sent by the Jetty client to the roaming peer for subscription-related roaming requests. Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_size_bytes_max • *_size_bytes_bucket • *_size_bytes_count • *_size_bytes_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-181 ocnrf_subs_roaming_jetty_res_body_size_bytes_[suffix]

Field	Details
Description	This metric indicates the size (in bytes) of the response body received by the Jetty client from the roaming peer for subscription-related roaming requests. Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_size_bytes_max • *_size_bytes_bucket • *_size_bytes_count • *_size_bytes_sum
Type	Histogram
Dimensions	ClientSvc, TargetSvc, Method, ServiceOperation

Table 6-182 ocnrf_smp_no_match_total

Field	Details
Description	Indicates the number of instances in which the SMP feature is enabled but the SMP header is not added to requests or responses generated by NRF backend microservices. This metric is incremented only when the message reaches the NRF application.
Type	Counter
Dimensions	SmpServiceOperation, reason Additional details for SmpServiceOperation: If the service operations listed in SbiServiceOperationList are not explicitly configured, the system uses the default SBI service operation (NRF_*_*) if configured. The reason for non -matching is then determined based on this default operation and its associated rules. However, for missing rule cases and missing SBI Service operation cases (even if the default is not configured), the SmpServiceOperation value is still recorded based on the actual SBI service operation. For example: • If Nnrf_NFDDiscovery_Request is not configured, the system falls back to the default SBI Service Operation (NRF_*_*). This default SBI Service operation is then used when processing the NFDDiscover service operation. If no rule is configured or if no matching rule is found for the default SBI Service operation, the metric is recorded with the reason MISSING_MAP_RULE or MISSING_PRIORITY_RULE corresponding to missing configuration. In this scenario, the SmpServiceOperation value remains nFDDiscover, while the default SBI service operation effectively substitutes for Nnrf_NFDDiscovery_Request. • If Nnrf_NFDDiscovery_Response is not configured and the default is also not configured then reason MISSING_SBI_OP with SmpServiceOperation value remains nFDDiscover.

Table 6-183 ocnrf_smp_parsing_error_total

Field	Details
Description	Indicates the number of instances where the SMP header is received with an invalid value (outside the range 0–31) by NRF backend microservices. This metric is incremented only when the message reaches the NRF application.
Type	Counter
Dimensions	SmpServiceOperation Note: The value of SmpServiceOperation depends on whether NRF is receiving a request or a response. - For received requests, ocnrf_smp_parsing_error_total is pegged using the service operation handled in server role (for example, nfAccessToken, nfDiscover). - For received responses, ocnrf_smp_parsing_error_total is pegged using the service operation handled in client role (for example, nfCreateSubscriptionFwdResponse). Possible values: - Server role possible values: nfRegister, nfUpdateFull, nfUpdatePartial, nfHeartbeat, nfDeregister, nfOptions, nfListRetrieval, nfInstanceRetrieval, nfCreateSubscription, nfUpdateSubscription, nfDeleteSubscription, nfDiscover, nfAccessToken - Client role possible values: nfInstanceRetrievalFwdResponse, nfCreateSubscriptionFwdResponse, nfCreateSubscriptionRoamResponse, nfUpdateSubscriptionFwdResponse, nfUpdateSubscriptionRoamResponse, nfDeleteSubscriptionFwdResponse, nfDeleteSubscriptionRoamResponse, nfDiscoverFwdResponse, nfDiscoverRoamResponse, nfAccessTokenFwdResponse, nfAccessTokenRoamResponse

Table 6-184 ocnrf_active_subscriptions_count

Field	Details
Description	Number of active subscriptions for a given NRF set. The metric is reported only for subscriptions created within that NRF set.
Type	Gauge
Dimensions	NrfLevel, nfSetId, SubscrReqNfType, SubscrCondType - SubscrReqNfType: The value of the requester NF type is derived using any one of the following in the given order: - the SubscriptionData.reqNfType attribute (if present) or - from the nfStatusNotificationUri attribute (if available). An attempt is made to extract the requester NF Type from this attribute. The URI must have the nfType separated by '.' - If the value cannot be determined, the dimension is set to UNKNOWN. - nfSetId: - The setId is retrieved from the Helm attribute global.nrfSetId. - If Growth feature is enabled, the nfSetId is retrieved from /nrf-configuration/v1/nrfGrowth/featureOptions. - If not configured, the value will be UNKNOWN.

6.1.6 NF Screening Metrics

This section provides details about the NF screening metrics.

Table 6-185 ocnrf_nfScreening_nfFqdn_requestFailed_total

Field	Details
Description	The total number of requests for which screening failed against NF FQDN screening list.
Type	Counter
Service Operation	NFRegister, NFUpdate
Dimensions	NrfLevel, RequesterNfType, NfFqdn Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-186 ocnrf_nfScreening_nfFqdn_requestRejected_total

Field	Details
Description	The total number of requests rejected for which screening failed against NF FQDN screening list.
Type	Counter
Service Operation	NFRegister, NFUpdate
Dimensions	NrfLevel, RequesterNfType, NfFqdn Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-187 ocnrf_nfScreening_nflpEndPoint_requestFailed_total

Field	Details
Description	The total number of requests for which screening failed against NF IP endpoint screening list.
Type	Counter
Service Operation	NFRegister, NFUpdate
Dimensions	NrfLevel, RequesterNfType, NfFqdn

Table 6-188 ocnrf_nfScreening_nflpEndPoint_requestRejected_total

Field	Details
Description	The total number of requests rejected because screening failed against NF IP endpoint screening list.
Type	Counter
Service Operation	NFRegister, NFUpdate
Dimensions	NrfLevel, RequesterNfType, NfFqdn Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-189 ocnrf_nfScreening_callbackUri_requestFailed_total

Field	Details
Description	The total number of requests for which screening failed against Callback URI screening list.
Type	Counter

Table 6-189 (Cont.) ocnrf_nfScreening_callbackUri_requestFailed_total

Field	Details
Service Operation	NFRegister, NFUpdate, NFStatusSubscribe
Dimensions	NrfLevel, RequesterNfType, NfFqdn Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-190 ocnrf_nfScreening_callbackUri_requestRejected_total

Field	Details
Description	The total number of requests rejected because screening failed against Callback URI screening list.
Type	Counter
Service Operation	NFRegister, NFUpdate, NFStatusSubscribe
Dimensions	NrfLevel, RequesterNfType, NfFqdn Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-191 ocnrf_nfScreening_plmnId_requestFailed_total

Field	Details
Description	The total number of requests for which screening failed against PLMN id screening list.
Type	Counter
Service Operation	NFRegister, NFUpdate
Dimensions	NrfLevel, RequesterNfType, NfFqdn Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-192 ocnrf_nfScreening_nfFqdn_requestRejected_total

Field	Details
Description	The total number of requests rejected because screening failed against PLMN id screening list.
Type	Counter
Service Operation	NFRegister, NFUpdate
Dimensions	NrfLevel, RequesterNfType, NfFqdn Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-193 ocnrf_nfScreening_nfTypeRegister_requestFailed_total

Field	Details
Description	The total number of NFRegister requests rejected as NF type was not allowed to register with NRF.
Type	Counter
Service Operation	NFRegister
Dimensions	NrfLevel, RequesterNfType, NfFqdn Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-194 ocnrf_nfScreening_nfTypeRegister_requestRejected_total

Field	Details
Description	The total number of NFRegister requests for which screening failed against NF type screening list.
Type	Counter
Service Operation	NFRegister
Dimensions	NrfLevel, RequesterNfType, NfFqdn Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-195 ocnrf_nfScreening_notApplied_InternalError_total

Field	Details
Description	The total number of times screening not applied due to internal error.
Type	Counter
Service Operation	NFRegister, NFUpdate, NFStatusSubscribe
Dimensions	NrfLevel, RequesterNfType, NfFqdn Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

6.1.7 NF Access token Metrics

This section provides details about the NF access token metrics.

Table 6-196 ocnrf_accessToken_rx_requests_total

Field	Details
Description	The total number of access token requests received.
Type	Counter
Service Operation	AccessToken
Dimensions	TargetNfType, ClientNfType, TargetNfInstanceId, ClientNfInstanceId, ServiceName, NrfLevel, NfFqdn Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-197 ocnrf_accessToken_tx_responses_total

Field	Details
Description	The total number of access token responses sent.
Type	Counter
Service Operation	AccessToken
Dimensions	TargetNfType, RequesterNfType, TargetNfInstanceId, ClientNfInstanceId, Scope, NrfLevel, HttpStatusCode, NfFqdn, KeyId, RejectionReason Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

6.1.8 NRF Configuration Metrics

This section provides details about the NRF configuration metrics.

Table 6-198 ocnrf_oauth_keyData_healthStatus

Field	Details
Description	Oauth Token Signing keys health status Value 0 - Healthy Value 1 - Unhealthy
Type	Gauge
Service Operation	Configuration
Dimensions	KeyId, KeyType, isCurrentKeyId, NrfLevel

Table 6-199 ocnrf_oauth_currentKeyId_configuredStatus

Field	Details
Description	Oauth Current Key Id Configuration Status Value 0 - Healthy Value 1 - Unhealthy
Type	Gauge
Service Operation	Configuration
Dimensions	NrfLevel

Table 6-200 ocnrf_oauth_keyData_expiryStatus

Field	Details
Description	Oauth Token Signing keys Expiry Status (Value is expiry time in epoch time)
Type	Gauge
Service Operation	Configuration
Dimensions	KeyId, isCurrentKeyId, NrfLevel

6.1.9 NRF SLF Metrics

This section provides details about the NRF SLF metrics.

Table 6-201 ocnrf_nfDiscover_forSLF_rx_requests_total

Field	Details
Description	The total number of NF Discover request received for SLF.
Type	Counter
Service Operation	NFDiscover
Dimensions	TargetNfType, NrfLevel, NfFqdn Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-202 ocnrf_nfDiscover_forSLF_tx_responses_total

Field	Details
Metric Name	ocnrf_nfDiscover_forSLF_tx_responses_total
Description	The total number of NF Discover responses sent for SLF.
Type	Counter
Service Operation	NFDiscover
Dimensions	TargetNfType, NrfLevel, HttpStatusCode, ResponseReason, NfFqdn Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-203 ocnrf_SLF_tx_requests_total

Field	Details
Description	The total number of SLF query request sent.
Type	Counter
Service Operation	NFDiscover
Dimensions	TargetNfType, NrfLevel, SubscriberIdType, NfFqdn, slfFqdn Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-204 ocnrf_SLF_rx_responses_total

Field	Details
Description	The total number of SLF query response received.
Type	Counter
Service Operation	NFDiscover
Dimensions	TargetNfType, NrfLevel, SubscriberIdType, HttpStatusCode, GroupId, NfFqdn, slfFqdn Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-205 ocnrf_nfDiscover_SLFlookup_skipped_total

Field	Details
Description	The total number of NF Discover requests received for SLF but SLF lookup is skipped.
Type	Counter
Service Operation	NFDiscover
Dimensions	TargetNfType, NrfLevel, NfFqdn, SkipSLFLookupParameter, SkipSLFLookupValue Note: - The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN. - If the value of enableValueBasedSkipSLFLookup is set as false, the value of SkipSLFLookupValue dimension is set as NotApplicable.

Table 6-206 ocnrf_nfDiscover_continue_mandatoryAttributes_missing_total

Field	Details
Description	The total number of NF Discover requests processed while SLF is enabled but SLF mandatory attributes are missing in Search query.
Type	Counter
Service Operation	NFDiscover
Dimensions	TargetNfType, NrfLevel, NfFqdn, ExceptionAttribute Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-207 ocnrf_max_slf_attempts_exhausted_total

Field	Details
Description	The maximum number of SLF attempts to the hosts present in the SLF configuration. This metric is pegged when either of the following reasons: - when maxslfattempts is configured to a value > 0 and the maxslfattempts is exhausted. - when maxslfattempts is configured to a value =0, and the number of SLF attempts have exceeded maximumHopCount. - when the available SLF hosts are exhausted.
Type	Counter
Service Operation	NFDiscover
Dimensions	TargetNfType, NfFqdn Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-208 ocnrf_slf_jetty_latency_seconds [suffix]

Field	Details
Description	Time (in microseconds) after sending query to SLF and getting response from SLF. Note: *_latency_seconds_[suffix] can represent any of the supported formats: *_latency_seconds_max *_latency_seconds_bucket *_latency_seconds_count *_latency_seconds_sum
Type	Histogram
Service Operation	NFDiscover
Dimensions	Host, InstanceIdentifier, Method, NrfLevel, ServiceOperation

Table 6-209 ocnrf_SLF_reroutes_total

Field	Details
Description	The total number of SLF query which is rerouted to alternate SLFs.
Type	Counter
Service Operation	NFDiscover

Table 6-209 (Cont.) ocnrf_SLF_reroutes_total

Field	Details
Dimensions	RequesterNfType, TargetNfType, TargetSLFFqdn, and PreviousSLFFqdn

6.1.10 NRF Forwarding Metrics

This section provides details about the NRF forwarding metrics.

Table 6-210 ocnrf_forward_accessToken_tx_requests_total

Field	Details
Description	The total number of Access Token Request forwarded to Primary or Secondary NRF.
Type	Counter
Service Operation	AccessToken
Dimensions	TargetNfType, RequesterNfType, TargetNfInstanceId, ClientNfInstanceId, Scope, NrfLevel, NfFqdn Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-211 ocnrf_forward_accessToken_rx_responses_total

Field	Details
Description	The total number of Access Token Responses for request forwarded to Primary/Secondary NRF
Type	Counter
Service Operation	AccessToken
Dimensions	TargetNfType, RequesterNfType, TargetNfInstanceId, ClientNfInstanceId, Scope, NrfLevel, HttpStatusCode, RejectionReason, NfFqdn Note The NfFqdn dimension indicates the FQDN of the consumer NF. This dimension will contain the FQDN if the service mesh sends the FQDN of the consumer NF in the XFCC header, else the dimension contains the value as UNKNOWN. Rejection reason with meaning • InternalError: Request not forwarded because failure occurred at NRF due to internal error. • NRFCCommunicationFailure: Request not forwarded because NRF is not able to connect with another NRF. • ErrorFromNRF: Error response received from another NRF. • NRFForwardingConfigurationMissing: Request not forwarded due to missing forwarding configuration. • LoopDetected: Received request message is already processed by NRF during forwarding mechanism. • *NotApplicable is applicable for 2xx Status code

Table 6-212 ocnrf_forward_nfProfileRetrieval_tx_requests_total

Field	Details
Description	The total number of Profile Retrieval Request forwarded to Primary/Secondary NRF.
Type	Counter
Service Operation	NFProfileRetrieval
Dimensions	NrfLevel, NfInstanceId, NfFqdn Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-213 ocnrf_forward_nfProfileRetrieval_rx_responses_total

Field	Details
Description	The total number of Profile Retrieval Responses for Request forwarded to Primary/Secondary NRF.
Type	Counter
Service Operation	NFProfileRetrieval
Dimensions	NrfLevel, NfInstanceId, HttpStatusCode, RejectionReason, NfFqdn Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-214 ocnrf_forward_nfStatusSubscribe_tx_requests_total

Field	Details
Description	The total number of Status Subscribe Request forwarded to Primary/Secondary NRF.
Type	Counter
Service Operation	NFStatusSubscribe, NFStatusUnsubscribe
Dimensions	NrfLevel, RequesterNfType, OperationType, NfFqdn Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-215 ocnrf_forward_nfStatusSubscribe_rx_responses_total

Field	Details
Description	The total number of Responses for Status Subscribe Request forwarded to Primary/Secondary NRF.
Type	Counter
Service Operation	NFStatusSubscribe, NFStatusUnsubscribe
Dimensions	NrfLevel, RequesterNfType, HttpStatusCode, OperationType, RejectionReason, NfFqdn Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-216 ocnrf_forward_nfDiscover_tx_requests_total

Field	Details
Description	The total number of NF Discovery Request forwarded to Primary/Secondary NRF.
Type	Counter
Service Operation	NFDiscover
Dimensions	NrfLevel, TargetNfType, RequesterNfType, NfFqdn Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-217 ocnrf_forward_nfDiscover_rx_responses_total

Field	Details
Description	The total number of Responses for NF Discovery Request forwarded to Primary/Secondary NRF.
Type	Counter
Service Operation	NFDiscover
Dimensions	NrfLevel, TargetNfType, RequesterNfType, HttpStatusCode, RejectionReason, NfFqdn Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-218 ocnrf_forward_round_trip_time_seconds_[suffix]

Field	Details
Description	Time taken by NRF specific microservice to forward the message to other Primary or Secondary NRF with the service operation: NFProfileRetrieval/NFStatusSubscribe/NFStatusUnsubscribe/AccessToken Note: *_trip_time_seconds_[suffix] can represent any of the supported formats: *_trip_time_seconds_max *_trip_time_seconds_bucket *_trip_time_seconds_count *_trip_time_seconds_sum
Type	Histogram
Service Operation	NFStatusSubscribe, NFStatusUnsubscribe, NFProfileRetrieval, AccessToken
Dimensions	NrfLevel, RequesterNfType, serviceOperation, NfFqdn Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-219 ocnrf_forward_nfDiscover_barred_total

Field	Details
Description	The total number of discovery requests barred from getting forwarded to another NRF.
Type	Counter
Service Operation	NFDiscover

Table 6-219 (Cont.) ocnrf_forward_nfDiscover_barred_total

Field	Details
Dimensions	NrfLevel, TargetNfType, RequesterNfType, NfFqdn, ForwardingBarringReason Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-220 ocnrf_forward_accessToken_barred_total

Field	Details
Description	The total number of access token requests barred from getting forwarded to another NRF.
Type	Counter
Service Operation	AccessToken
Dimensions	TargetNfType, RequesterNfType, TargetNfInstanceId, ClientNfInstanceId, Scope, NrfLevel, NfFqdn, ForwardingBarringReason Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-221 ocnrf_forward_nfStatusSubscribe_barred_total

Field	Details
Description	The total number of status subscribe requests barred from getting forwarded to another NRF.
Type	Counter
Service Operation	NFStatusSubscribe, NFStatusUnsubscribe
Dimensions	NrfLevel, RequesterNfType, OperationType, NfFqdn Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-222 ocnrf_forward_profileRetrieval_barred_total

Field	Details
Description	The total number of profile retrieval requests barred from getting forwarded to another NRF.
Type	Counter
Service Operation	NFProfileRetrieval
Dimensions	NrfLevel, NfInstanceId, NfFqdn Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-223 ocnrf_forward_jetty_latency_seconds_[suffix]

Field	Details
Description	Time (in microseconds) after sending query to SLF and getting response from SLF. Note: *_latency_seconds_[suffix] can represent any of the supported formats: *_latency_seconds_max *_latency_seconds_bucket *_latency_seconds_count *_latency_seconds_sum
Type	Histogram
Service Operation	NFDiscover
Dimensions	Host, InstanceIdentifier, Method, NrfLevel, ServiceOperation

6.1.11 Roaming Support Metrics

This section provides details about the NRF roaming metrics.

Table 6-224 ocnrf_roaming_nfStatusSubscribe_rx_requests_total

Field	Details
Description	Number of inter-PLMN subscription creation requests received by NRF from NF Consumers (in case of vNRF) and hSEPP (in case of hNRF).
Type	Counter
Service Operation	NFStatusSubscribe
Dimensions	NrfLevel, RequesterPLMNId, TargetPLMNId, NfFqdn, NRFRole, OperationType Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-225 ocnrf_roaming_nfStatusSubscribe_tx_responses_total

Field	Details
Description	Number of inter-PLMN subscription creation responses sent by NRF.
Type	Counter
Service Operation	NFStatusSubscribe
Dimensions	NrfLevel, RequesterPLMNId, TargetPLMNId, NfFqdn, NRFRole, OperationType, HttpStatusCode, RejectionReason Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-226 ocnrf_roaming_nfStatusSubscribe_tx_requests_total

Field	Details
Description	Number of inter-PLMN subscription creation requests sent by vNRF towards hNRF.
Type	Counter
Service Operation	NFStatusSubscribe

Table 6-226 (Cont.) ocnrf_roaming_nfStatusSubscribe_tx_requests_total

Field	Details
Dimensions	NrfLevel, RequesterPLMNId, TargetPLMNId, NfFqdn, OperationType Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-227 ocnrf_roaming_nfStatusSubscribe_rx_responses_total

Field	Details
Description	Number of inter-PLMN subscription creation response received by vNRF from hNRF for routed or forwarded requests.
Type	Counter
Service Operation	NFStatusSubscribe
Dimensions	NrfLevel, RequesterPLMNId, TargetPLMNId, NfFqdn, OperationType, HttpStatusCode, FailureReason Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-228 ocnrf_roaming_nfStatusSubscribe_rx_requests_total

Field	Details
Description	Number of inter-PLMN subscription update requests received by NRF from NF Consumers (in case of vNRF) and hSEPP (in case of hNRF).
Type	Counter
Service Operation	NFStatusSubscribe - Update
Dimensions	NrfLevel, NfFqdn, NRFRole, OperationType Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-229 ocnrf_roaming_nfStatusSubscribe_tx_responses_total

Field	Details
Description	Number of inter-PLMN subscription update responses sent by NRF.
Type	Counter
Service Operation	NFStatusSubscribe - Update
Dimensions	NrfLevel, NfFqdn, NRFRole, OperationType, HttpStatusCode, RejectionReason Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-230 ocnrf_roaming_nfStatusSubscribe_tx_requests_total

Field	Details
Description	Number of inter-PLMN subscription update requests routed or forwarded by vNRF towards hNRF.

Table 6-230 (Cont.) ocnrf_roaming_nfStatusSubscribe_tx_requests_total

Field	Details
Type	Counter
Service Operation	NFStatusSubscribe - Update
Dimensions	NrfLevel, NfFqdn, OperationType Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-231 ocnrf_roaming_nfStatusSubscribe_rx_responses_total

Field	Details
Description	Number of inter-PLMN subscription update response received by vNRF from hNRF for routed/forwarded requests.
Type	Counter
Service Operation	NFStatusSubscribe - Update
Dimensions	NrfLevel, NfFqdn, OperationType, HttpStatusCode, FailureReason Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-232 ocnrf_roaming_nfStatusUnSubscribe_rx_requests_total

Field	Details
Description	Number of inter-PLMN subscription unsubscribe requests received by NRF from NF Consumers (in case of vNRF) and hSEPP (in case of hNRF).
Type	Counter
Service Operation	NFStatusUnSubscribe
Dimensions	NrfLevel, NfFqdn, NRFRole Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-233 ocnrf_roaming_nfStatusUnSubscribe_tx_responses_total

Field	Details
Description	Number of inter-PLMN subscription unsubscribe responses sent by NRF.
Type	Counter
Service Operation	NF Status UnSubscribe
Dimensions	NrfLevel, NfFqdn, NRFRole, HttpStatusCode, RejectionReason Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-234 ocnrf_roaming_nfStatusUnSubscribe_tx_requests_total

Field	Details
Description	Number of inter-PLMN subscription unsubscribe requests routed or forwarded by vNRF towards hNRF.
Type	Counter
Service Operation	NFStatusUnSubscribe
Dimensions	NrfLevel, NfFqdn Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-235 ocnrf_roaming_nfStatusUnSubscribe_rx_responses_total

Field	Details
Description	Number of inter-PLMN subscription unsubscribe response received by vNRF from hNRF for routed or forwarded requests.
Type	Counter
Service Operation	NFStatusUnSubscribe
Dimensions	NrfLevel, NfFqdn, HttpStatusCode, FailureReason Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-236 ocnrf_roaming_nfDiscover_rx_requests_total

Field	Details
Description	Number of inter-PLMN NFDiscover requests received by NRF from NF Consumers (in case of vNRF) and hSEPP (in case of hNRF).
Type	Counter
Service Operation	NFDiscover
Dimensions	NrfLevel, RequesterPLMNId, TargetPLMNId, NfFqdn, NRFRole Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-237 ocnrf_roaming_nfDiscover_tx_responses_total

Field	Details
Description	Number of inter-PLMN NFDiscover response sent by NRF.
Type	Counter
Service Operation	NFDiscover
Dimensions	NrfLevel, RequesterPLMNId, TargetPLMNId, NfFqdn, NRFRole, HttpStatusCode, RejectionReason Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-238 ocnrf_roaming_nfDiscover_tx_requests_total

Field	Details
Description	Number of inter-PLMN NF Discover request routed or forwarded by vNRF towards hNRF
Type	Counter
Service Operation	NFDiscover
Dimensions	NrfLevel, RequesterPLMNId, TargetPLMNId, NfFqdn Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-239 ocnrf_roaming_nfDiscover_rx_responses_total

Field	Details
Description	Number of inter-PLMN NFDiscover response received by vNRF from hNRF for routed or forwarded requests.
Type	Counter
Service Operation	NFDiscover
Dimensions	NrfLevel, RequesterPLMNId, TargetPLMNId, NfFqdn, HttpStatusCode, FailureReason Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-240 ocnrf_roaming_accessToken_rx_requests_total

Field	Details
Description	Number of inter-PLMN Access Token requests received by NRF from NF Consumers (in case of vNRF) and hSEPP (in case of hNRF).
Type	Counter
Service Operation	AccessToken
Dimensions	NrfLevel, RequesterPLMNId, TargetPLMNId, NfFqdn, NRFRole Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-241 ocnrf_roaming_accessToken_tx_responses_total

Field	Details
Description	Number of inter-PLMN Access Token response sent by NRF
Type	Counter
Service Operation	AccessToken
Dimensions	NrfLevel, RequesterPLMNId, TargetPLMNId, NfFqdn, NRFRole, HttpStatusCode, RejectionReason Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-242 ocnrf_roaming_accessToken_tx_requests_total

Field	Details
Description	Number of inter-PLMN Access Token request routed or forwarded by vNRF towards hNRF.
Type	Counter
Service Operation	AccessToken
Dimensions	NrfLevel, RequesterPLMNId, TargetPLMNId, NfFqdn Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-243 ocnrf_roaming_accessToken_rx_responses_total

Field	Details
Description	Number of inter-PLMN Access Token response received by vNRF from hNRF for routed or forwarded requests.
Type	Counter
Service Operation	AccessToken
Dimensions	NrfLevel, RequesterPLMNId, TargetPLMNId, NfFqdn, HttpStatusCode, FailureReason Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-244 ocnrf_roaming_nfStatusNotify_tx_requests_total

Field	Details
Description	Number of NFStatusNotify requests sent for inter_PLMN cases
Type	Counter
Service Operation	NFNotify
Dimensions	NrfLevel, NotificationEventType, TargetNfType, NfFqdn, SubscriptionId, SubscriberPLMNId Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-245 ocnrf_roaming_nfStatusNotify_rx_responses_total

Field	Details
Description	Number of NFStatusNotify responses received for inter_PLMN cases.
Type	Counter
Service Operation	NFNotify
Dimensions	NrfLevel, NotificationEventType, TargetNfType, NfFqdn, HttpStatusCode, SubscriptionId, SubscriberPLMNId Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-246 ocnrf_roaming_round_trip_time_seconds_[suffix]

Field	Details
Description	Average Latency between messages sent by visited NRF towards home NRF and after receiving response from home NRF for NRF Roaming messages. Note: *_time_seconds_[suffix] can represent any of the supported formats: • *_time_seconds_max • *_time_seconds_bucket • *_time_seconds_count • *_time_seconds_sum
Type	Counter
Service Operation	NFStatusSubscribe, NFStatusUnSubscribe, NfAccessToken
Dimensions	NrfLevel, RequesterPLMNId, TargetPLMNId, ServiceOperation, NfFqdn Note: The NfFQDN dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-247 ocnrf_roaming_jetty_latency_seconds_[suffix]

Field	Details
Description	Time (in microseconds) after sending query to SLF and getting response from SLF. Note: *_latency_seconds_[suffix] can represent any of the supported formats: • *_latency_seconds_max • *_latency_seconds_bucket • *_latency_seconds_count • *_latency_seconds_sum
Type	Histogram
Service Operation	NFDiscover
Dimensions	Host, InstanceIdentifier, Method, NrfLevel, ServiceOperation

6.1.12 Georedundancy Metrics

This section provides details about the georedundancy metrics.

Table 6-248 ocnrf_dbreplication_status

Field	Details
Description	The current status of the replication channel between the given site and the remote site(s). This metric is pegged only if the georedundancy feature is enabled. Value 0 - UP Value 1 - DOWN
Type	Gauge
Service Operation	NA
Dimensions	NrfLevel, RemoteSiteName, RemoteNrfInstanceId

Table 6-249 ocnrf_dbreplication_down_time_seconds

Field	Details
Description	Time taken for the replication status to change from "INACTIVE" to "ACTIVE". This metric is pegged only if the georedundancy feature is enabled.
Type	Histogram
Service Operation	NA
Dimensions	NrfLevel, DbReplicationDownStartTime, DbReplicationDownEndTime, RemoteSiteName, RemoteNrfInstanceId

Table 6-250 ocnrf_nf_switch_over_total

Field	Details
Description	The number of NFInstances that got switched over from the mated site.
Type	Counter
Service Operation	NfRegister, NfUpdate, NfDeregister, NfHeartbeat
Dimensions	NrfLevel, NfInstanceId, RemoteNrfInstanceId, Service_Operation, OperationType, NfFqdn Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-251 ocnrf_nfSubscriptions_switch_over_total

Field	Details
Description	The number of NfSubscriptions that got switched over from the mated site.
Type	Counter
Service Operation	NfStatusSubscribe, NfStatusUnsubscribe, NrfAuditor
Dimensions	NrfLevel, RemoteNrfInstanceId, serviceOperation, OperationType

Table 6-252 ocnrf_stale_nf_deleted_total

Field	Details
Description	The number of NFInstances that get deleted by the NrfAuditor when it detects a record to be stale.
Type	Counter
Service Operation	NA
Dimensions	NrfLevel, NfInstanceId, NfStatus, NfFqdn Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-253 ocnrf_stale_nfSubscriptions_deleted_total

Field	Details
Description	The number of NfSubscriptions that get deleted by the NrfAuditor when it detects a record to be stale.
Type	Counter
Service Operation	NA
Dimensions	NrfLevel, SubscriptionStatus

Table 6-254 ocnrf_reported_dbreplication_status

Field	Details
Description	The current status of the replication channel between the given site and a remote site(s) as reported by the DB Monitor Service. This metric shall be pegged only if the georedundancy feature is enabled. Value 0 - UP Value 1 - DOWN
Type	Gauge
Service Operation	NA
Dimensions	NrfLevel, nrfInstanceId, SiteName

Table 6-255 ocnrf_replication_status_check_total

Field	Details
Description	If the metric value remains constant over a period of time, an alert is raised.
Type	Counter
Service Operation	NA
Dimensions	NrfLevel

Table 6-256 ocnrf_replication_status_check_total

Field	Details
Description	This metric measures whether replication status monitoring thread is running in the following NRF microservices: • nfsubscription • nrfconfiguration • nrfdiscovery • nrfregistration • nfaccessstoken • nrfartisan This metric is pegged before the replication status monitoring performs the replication check as per the interval configured in monitorDBReplicationStatusInterval parameter under geoRedundancyOptions.
Type	Counter
Service Operation	NA
Dimensions	NrfLevel

6.1.13 NF Authentication Metrics

This section provides details about the network function authentication metrics.

Table 6-257 ocnrf_nf_authentication_failure_total

Field	Details
Description	The total number of request for which FQDN based authentication failed at OCNRF.
Type	Counter

Table 6-257 (Cont.) ocnrf_nf_authentication_failure_total

Field	Details
Service Operation	NFAccessToken/NFRegistration/NFSubscription/NFDiscovery/NfListRetrieval/NfProfileRetrieval For NfListRetrieval and NfProfileRetrieval serviceOperations NfFqdn is filled as NotApplicable. If OC-XFCC-DNS header is not received at NRF microservice then TLSFqdn is filled as "UNKNOWN".
Dimensions	NrfLevel, Method, ServiceOperation, NfFqdn, TLSFqdn Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

6.1.14 NF Instance and NF Services Status Change Metrics

This section provides details about the NF Instance and NF Services Status Change metrics.

Table 6-258 ocnrf_nflInstance_status_change_total

Field	Details
Description	This metric indicates the total number of times the NfStatus changed for a given NfInstance. For each NfStatus change this metric will be pegged with a combination of NfInstanceId, PreviousStatus, and NewStatus (with other dimensions). For example, NfInstanceId-1 changed its NfStatus from SUSPENDED to REGISTERED, then the metric will be pegged with a combination of NfInstanceId-1, PreviousStatus as SUSPENDED, and NewStatus as REGISTERED. Similarly, NfInstanceId-1 changed its NfStatus from REGISTERED to UNDISCOVERABLE, then the metric will be pegged with a combination of NfInstanceId-1, PreviousStatus as REGISTERED, and NewStatus as UNDISCOVERABLE.
Type	Counter
Service Operation	NfRegister, NfUpdate, NfDeregister
Dimensions	NrfLevel, NfInstanceId, NfProfileFqdn, NfType, PreviousStatus, NewStatus

Table 6-259 ocnrf_nfService_status_change_total

Field	Details
Description	This metric indicates the total number of times the NfServiceStatus changed for a given NfServiceInstance of a NfProfile. For each NfServiceStatus change this metric will be pegged with a combination of NfInstanceId, NfServiceInstanceId, PreviousStatus, and NewStatus (with other dimensions). For example, NfInstanceId-1's NfServiceInstanceId-1 changed its NfServiceStatus from SUSPENDED to REGISTERED, then the metric will be pegged with a combination of NfInstanceId-1, NfServiceInstanceId-1, PreviousStatus as SUSPENDED, and NewStatus as REGISTERED. Similarly, NfInstanceId-1's NfServiceInstanceId-1 changed its NfServiceStatus from REGISTERED to UNDISCOVERABLE, then the metric will be pegged with a combination of NfInstanceId-1, NfServiceInstanceId-1, PreviousStatus as REGISTERED, and NewStatus as UNDISCOVERABLE.
Type	Counter
Service Operation	NfRegister, NfUpdate, NfDeregister

Table 6-259 (Cont.) ocnrf_nfService_status_change_total

Field	Details
Dimensions	NrfLevel, NfInstanceId, NfServiceName, NfServiceInstanceId, NfProfileFqdn, NfServiceFqdn, PreviousStatus, NewStatus

6.1.15 DNS NAPTR Update Metrics

This section provides details about the DNS NAPTR update metrics.

NRF Microservices Metrics

Table 6-260 ocnrf_dns_naptr_tx_requests_total

Field	Details
Description	Number of DNS record update requests sent. Note: The value of OperationType dimension is Update.
Type	Counter
Service Operation	NFRegister, NFUpdate, NFDeregister, NRF Audit
Dimensions	NrfLevel, NfInstanceId, NfFqdn, NfSetFqdn, Replacement, OperationType, TriggerMode Possible Values: - OperationType: - Update: NF update request towards DNS Server - Delete: NF delete request towards DNS Server - TriggerMode: - Automatic: Triggers generated by 3GPP service operations or NRF Audit. - Manual: Triggers generated by the operator initiated retrigger API. Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-261 ocnrf_dns_naptr_rx_responses_total

Field	Details
Description	Number of DNS record update responses received.
Type	Counter
Service Operation	NFRegister, NFUpdate, NFDeregister, NRF Audit
Dimensions	NrfLevel, NfInstanceId, NfFqdn, NfSetFqdn, Replacement, OperationType, HttpStatusCode, FailureReason, TriggerMode Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-262 ocnrf_dns_naptr_tx_requests_total

Field	Details
Description	Number of DNS record delete requests sent. Note: The value of OperationType dimension is Delete.
Type	Counter
Service Operation	NFRegister, NFUpdate, NFDeregister, NRF Audit

Table 6-262 (Cont.) ocnrf_dns_naptr_tx_requests_total

Field	Details
Dimensions	NrfLevel, NfInstanceId, NfFqdn, NfSetFqdn, Replacement, OperationType, HttpStatusCode, FailureReason, TriggerMode Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-263 ocnrf_dns_naptr_rx_responses_total

Field	Details
Description	Number of DNS record delete responses received. Note: The value of OperationType dimension is Delete.
Type	Counter
Service Operation	None
Dimensions	NrfLevel, NfInstanceId, NfFqdn, NfSetFqdn, Replacement, OperationType, HttpStatusCode, FailureReason, TriggerMode Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-264 ocnrf_dns_naptr_audit_tx_requests_total

Field	Details
Description	Number of DNS record audit requests sent. Note: The value of OperationType dimension is Get.
Type	Counter
Service Operation	None
Dimensions	NrfLevel, NfInstanceId, NfFqdn, NfSetFqdn, Replacement, OperationType Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-265 ocnrf_dns_naptr_audit_rx_responses_total

Field	Details
Description	Number of DNS record audit responses received. Note: The value of OperationType dimension is Get.
Type	Counter
Service Operation	None
Dimensions	NrfLevel, NfInstanceId, NfFqdn, NfSetFqdn, Replacement, OperationType, HttpStatusCode, FailureReason Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-266 ocnrf_dns_naptr_failure_rx_responses

Field	Details
Metric Name	ocnrf_dns_naptr_failure_rx_responses
Description	Number of DNS record failed responses received.
Type	Gauge
Service Operation	None

Table 6-266 (Cont.) ocnrf_dns_naptr_failure_rx_responses

Field	Details
Dimensions	NrfLevel, NFInstanceId, NfFqdn, NfSetFqdn, Replacement Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-267 ocnrf_dns_naptr_round_trip_time_seconds_[suffix]

Field	Details
Description	Average Latency between messages sent by NRF towards DNS and after receiving response from DNS. Note: *_time_seconds_[suffix] can represent any of the supported formats: *_time_seconds_max *_time_seconds_bucket *_time_seconds_count *_time_seconds_sum
Type	Histogram
Service Operation	NFRegister, NFUpdate, NFDeregister, NRFAudit, DNS NAPTR Audit, Manual
Dimensions	NrfLevel, NFInstanceId, NfFqdn, NfSetFqdn, Replacement, OperationType, TriggerMode Note: The NfFqdn dimension contains the FQDN as present in the NfProfile.

Table 6-268 ocnrf_dns_naptr_nfRegistration_tx_requests_total

Field	Details
Description	Number of DNS record trigger sent by NFRegistration microservice to Artisan microservice.
Type	Counter
Service Operation	NFRegister, NFUpdate, NFDeregister
Dimensions	NfInstanceId, TriggerType, NrfLevel

Table 6-269 ocnrf_dns_naptr_nfRegistration_rx_responses_total

Field	Details
Description	Number of DNS record trigger response received by NFRegistration microservice from Artisan microservice.
Type	Counter
Service Operation	NFRegister, NFUpdate, NFDeregister
Dimensions	NfInstanceId, TriggerType, NrfLevel

Table 6-270 ocnrf_dns_naptr_nrfAuditor_tx_requests_total

Field	Details
Description	Number of DNS record trigger sent by NRFAuditor microservice to Artisan microservice.
Type	Counter
Service Operation	NRFAuditor
Dimensions	NfInstanceId, TriggerType, NrfLevel

Table 6-271 ocnrf_dns_naptr_nrfAuditor_rx_responses_total

Field	Details
Description	Number of DNS record trigger response received by NRFAuditor microservice from Artisan microservice.
Type	Counter
Service Operation	NRFAuditor
Dimensions	NfInstanceId, NrfLevel

Table 6-272 ocnrf_dns_naptr_trigger_rx_requests_total

Field	Details
Description	Number of DNS record trigger request received by Artisan microservice.
Type	Counter
Service Operation	None
Dimensions	NfInstanceId, NrfLevel

Table 6-273 ocnrf_dns_naptr_trigger_tx_responses_total

Field	Details
Description	Number of DNS record trigger responses sent by Artisan microservice.
Type	Counter
Service Operation	None
Dimensions	NfInstanceId, NrfLevel

NRF Alternate Route Service Metrics

Table 6-274 oc_alternate_route_upstream_dns_request_timeout_total

Field	Details
Description	Number of DNS record requests timeout total.
Type	Counter
Service Operation	Service towards DNS server
Dimensions	amfFqdn, host, port, replacement

6.1.16 Pod Protection Metrics

This section provides details about the Pod Protection metrics.

Table 6-275 ocnrf_pod_congestion_state

Field	Details
Description	The metric is used to track the overall congestion state per nfSubscription pod. The values of the metric is as follow: • -1: NotApplicable • 0: Normal • 1: DangerOfCongestion • 2: Congested Note: If the pod protection feature is disabled, this metric will not be available or will contain value as -1.
Type	Gauge
Dimensions	NrfLevel

Table 6-276 ocnrf_pod_cpu_congestion_state

Field	Details
Description	The metric is used to track the congestion state based on the CPU usage of the subscription pod. This metric is valid only when the nfSubscription pod protection feature is enabled. The values of the metric is as follow: • -1: NotApplicable • 0: Normal • 1: DangerOfCongestion • 2: Congested Note: If the pod protection feature is disabled, this metric will not be available or will contain value as -1.
Type	Gauge
Dimensions	NrfLevel

Table 6-277 ocnrf_pod_pending_message_count_congestion_state

Field	Details
Description	The metric is used to track the congestion state based on the message pending count of the subscription pod. This metric is valid only when the nfSubscription pod protection feature is enabled. The values of the metric is as follow: • -1: NotApplicable • 0: Normal • 1: DangerOfCongestion • 2: Congested Note: If the pod protection feature is disabled, this metric will not be available or will contain value as -1.
Type	Gauge
Dimensions	NrfLevel

Table 6-278 ocnrf_incoming_connections

Field	Details
Metric Name	ocnrf_incoming_connections
Description	The metric is used to track the number of incoming connections. This metric is applicable only for nfsubscription service.

Table 6-278 (Cont.) ocnrf_incoming_connections

Field	Details
Type	Gauge
Dimensions	NrfLevel

Table 6-279 ocnrf_max_concurrent_streams

Field	Details
Description	The metric is used to track the maximum concurrent streams per connection. This metric is applicable only for nfsubscription service.
Type	Gauge
Dimensions	NrfLevel , connectionId

Table 6-280 ocnrf_pod_cpu_usage

Field	Details
Description	The CPU usage of the pod. Note: If the pod protection feature is disabled, this metric will not be available or will contain value as 0.
Type	Gauge
Dimensions	NrfLevel

Table 6-281 ocnrf_pod_pending_message_count

Field	Details
Description	The Pending Message Count value of the pod. Note: If the pod protection feature is disabled, this metric will not be available or will contain value as 0.
Type	Gauge
Dimensions	NrfLevel

Table 6-282 ocnrf_pod_incoming_connection_rejected_total

Field	Details
Description	The number of connections that have been rejected in the DoC or Congested state. This metric is applicable only for nfsubscription service.
Type	Counter
Dimensions	NrfLevel

Table 6-283 ocnrf_nfNotification_trigger_total

Field	Details
Description	The number of times a notification trigger is sent to nfSubscription service from the nfregistration and nrfauditor services.
Type	Counter

Table 6-283 (Cont.) ocnrf_nfNotification_trigger_total

Field	Details
Dimensions	NotificationEventType, errorReason: The reason if nfNotification trigger failed from nregistration or nrfauditor service pods to nsubscription service pods.

6.1.17 Network Slice Specific Metrics

This section describes the Network Slice Specific metrics that are pegged based on Network Slice Instances (NSIs) and Single Network Slice Selection Assistance Information (SNSSAI).

Table 6-284 ocnrf_nfDiscover_rx_requests_perSnssai_total

Field	Details
Description	The total number of NFDiscover requests received at a slice that is identified by specific SNSSAI. This metric is pegged for each snssai present in the search query parameters. The search query attributes are snssais and plmn-specific-snssai-list. Note: - snssais of NfService and NfServiceList are not considered for pegging. - The SNSSAI belongs to the Producer NF that is discovered. - The metric will not get pegged if any of the search query parameters are invalid.
Type	Counter
Service Operation	NFDiscover
Dimensions	sNssai

Table 6-285 ocnrf_nfDiscover_tx_success_response_perSnssai_total

Field	Details
Description	The total number of success discovery responses with one or more matching NfProfiles sent per slice that is identified by SNSSAI. The metric is pegged for each unique snssai present in the profiles of discovery response. The search query attributes are snssais and plmn-specific-snssai-list. The NfProfile attributes are snssais, perPlmnSnssaiList, sNssaiSmfInfoList, and sNssaiUpfInfoList. Note: - The SNSSAI belongs to the Producer NF that is discovered. - Only snssais of NfProfile and xxxInfo are considered for pegging. - Response metric may not get pegged for all SNSSAI that is being received in the request message, if there is no matching profiles sent in discovery response for some SNSSAIs.
Type	Counter
Service Operation	NFDiscover
Dimensions	sNssai

Table 6-286 ocnrf_nfDiscover_tx_empty_response_perSnssai_total

Field	Details
Description	The total number of discovery responses sent with no matching NfProfiles for a slice identified by SNSSAI. This metric is pegged for each snssai present in the search query parameters. The search query attributes are snssais and plmn-specific-snssai-list. Note: - The SNSSAI belongs to the Producer NF that is discovered. - In this case, response metric will get pegged for all SNSSAI that is being received in the request message.
Type	Counter
Service Operation	NFDiscover
Dimensions	sNssai

Table 6-287 ocnrf_nfDiscover_tx_failure_response_perSnssai_total

Field	Details
Description	The total number of failure discovery responses sent per slice that is identified by specific SNSSAI. This metric is pegged for each snssai present in the search query parameters. The search query attributes are snssais and plmn-specific-snssai-list. Note: - The SNSSAI belongs to the Producer NF that is discovered. - In this case, response metric will get pegged for all SNSSAI that is being received in the request message. - The metric will not get pegged if any of the search query parameters are invalid.
Type	Counter
Service Operation	NFDiscover
Dimensions	sNssai, HttpStatusCode

Table 6-288 ocnrf_nfDiscover_rx_requests_perNsi_total

Field	Details
Description	The total number of NFDiscover requests received at a slice that is identified by NSI. This metric is pegged for each nsi present in the search query parameter. The search query attribute is nsi-list. Note: - The NSI belongs to the Producer NF that is discovered. - The metric will not get pegged if any of the search query parameters are invalid.
Type	Counter
Service Operation	NFDiscover
Dimensions	Nsi

Table 6-289 ocnrf_nfDiscover_tx_success_response_perNsi_total

Field	Details
Description	The total number of success discovery responses with one or more matching NfProfiles sent per slice that is identified by specific NSI. The metric is pegged for each nsi in the intersection of nsi-list search query parameter and nsiList attribute in the NfProfile present in the discovery response. Note: - The NSI belongs to the Producer NF that is discovered. - The metric will not get pegged if any of the search query parameters are invalid. - Response metric may not get pegged for all NSI that is being received in the request message, if there is no matching profiles sent in discovery response for some NSIs.
Type	Counter
Service Operation	NFDiscover
Dimensions	Nsi

Table 6-290 ocnrf_nfDiscover_tx_empty_response_perNsi_total

Field	Details
Description	The total number of discovery response with no matching NfProfiles for a slice identified by NSI. The metric is pegged for each nsi present in the search query parameter. The search query attribute is nsi-list. Note: - The NSI belongs to the Producer NF that is discovered. - The metric will not get pegged if any of the search query parameters are invalid. - In this case, response metric will get pegged for all SNSSAI that is being received in the request message.
Type	Counter
Service Operation	NFDiscover
Dimensions	Nsi

Table 6-291 ocnrf_nfDiscover_tx_failure_response_perNsi_total

Field	Details
Description	The total number of failure discovery response for a slice identified by NSI. The metric is pegged for each nsi present in the search query parameter. The search query attribute is nsi-list. Note: - The NSI belongs to the Producer NF that is discovered. - The metric will not get pegged if any of the search query parameters are invalid. - In this case, response metric will get pegged for all SNSSAI that is being received in the request message.
Type	Counter
Service Operation	NFDiscover
Dimensions	Nsi, HttpStatusCode

Table 6-292 ocnrf_nfDiscover_tx_forwarded_requests_perSnssai_total

Field	Details
Description	The total number of discovery requests forwarded to another NRF for a slice identified by SNSSAI. The metric is pegged for each snssai present in the search query parameters. The search query attributes are snssais and plmn-specific-snssai-list. Note: - Only snssais of NfProfile and xxxInfo are considered for pegging. - The SNSSAI belongs to the Producer NF that is discovered.
Type	Counter
Service Operation	NFDiscover
Dimensions	sNssai, TargetNrfFqdn, NfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-293 ocnrf_nfDiscover_rx_success_forwarded_responses_perSnssai_total

Field	Details
Description	The total number of success responses with one or more matching NfProfiles that is received for forwarded discovery request for a slice identified by SNSSAI. The metric is pegged for each snssai present in the intersection of the snssai present in the search query and in the profile. The search query attributes are snssais and plmn-specific-snssai-list. The NfProfile attributes are snssais, perPlmnSnssaiList, sNssaiSmfInfoList, and sNssaiUpfInfoList. Note: - The SNSSAI is associated with producer NF being discovered. - Only snssais of NfProfile and xxxInfo are considered for pegging. - Response metric may not get pegged for all SNSSAI that is being received in the request message, if there is no matching profiles sent in discovery response for some SNSSAIs.
Type	Counter
Service Operation	NFDiscover
Dimensions	sNssai, NfFqdn, TargetNrfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-294 ocnrf_nfDiscover_rx_empty_forwarded_responses_perSnssai_total

Field	Details
Description	The total number of responses that is received for forwarded discovery request with no matching NfProfiles for a slice identified by SNSSAI. The metric is pegged for each snssai present in the search query parameters. The search query attributes are snssais and plmn-specific-snssai-list. Note: - The SNSSAI belongs to the Producer NF that is discovered. - The metric will not get pegged if any of the search query parameters are invalid. - In this case, response metric will get pegged for all SNSSAI that is being received in the request message.
Type	Counter

Table 6-294 (Cont.) ocnrf_nfDiscover_rx_empty_forwarded_responses_perSnssai_total

Field	Details
Service Operation	NFDiscover
Dimensions	sNssai, NfFqdn, TargetNrfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-295 ocnrf_nfDiscover_rx_failure_forwarded_responses_perSnssai_total

Field	Details
Description	The total number of failure responses for forwarded discovery requests for a slice identified by SNSSAI. The metric is pegged for each snssai present in the search query parameters. The search query attributes are snssais and plmn-specific-snssai-list. Note: - The SNSSAI belongs to the Producer NF that is discovered. - The metric will not get pegged if any of the search query parameters are invalid. - In this case, response metric will get pegged for all SNSSAI that is being received in the request message.
Type	Counter
Service Operation	NFDiscover
Dimensions	sNssai, NfFqdn, HttpStatusCode, TargetNrfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-296 ocnrf_nfDiscover_tx_forwarded_requests_perNsi_total

Field	Details
Description	The total number of discovery requests forwarded to another NRF for a slice identified by NSI. The metric is pegged for each nsi present in the search query parameter. The search query attribute is nsi-list. Note: The NSI belongs to the Producer NF that is discovered.
Type	Counter
Service Operation	NFDiscover
Dimensions	Nsi, NfFqdn, TargetNrfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-297 ocnrf_nfDiscover_rx_success_forwarded_responses_perNsi

Field	Details
Description	The total number of success response for forwarded discovery requests for a slice identified by NSI. The NSI associated with producer NF being discovered. The metric is pegged for each <code>nsi</code> in the intersection of <code>nsi-list</code> search query parameter and <code>nsiList</code> attribute in the <code>NfProfiles</code> present in the discovery response. Note: - The NSI is associated with producer NF being discovered. - Only <code>nsi</code> of <code>NfProfile</code> and <code>xxxInfo</code> are considered for pegging. - Response metric may not get pegged for all NSI that is being received in the request message, if there is no matching profiles sent in discovery response for some NSIs.
Type	Counter
Service Operation	NFDiscover
Dimensions	<code>Nsi</code>, <code>NfFqdn</code>, <code>TargetNrfFqdn</code> Note: The <code>NfFqdn</code> dimension indicates the consumer NF FQDN. This dimension contains the <code>NfFqdn</code> if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-298 ocnrf_nfDiscover_rx_empty_forwarded_responses_perNsi

Field	Details
Description	The total number of responses with no matching <code>NfProfiles</code> for forwarded discovery request for a slice identified by NSI. The NSI is associated with the producer NF being discovered. The metric is pegged for each <code>nsi</code> present in the search query parameter. The search query attribute is <code>nsi-list</code>. Note: - The NSI belongs to the Producer NF that is discovered. - The metric will not get pegged if any of the search query parameters are invalid. - In this case, response metric will get pegged for all NSI that is being received in the request message.
Type	Counter
Service Operation	NFDiscover
Dimensions	<code>Nsi</code>, <code>NfFqdn</code>, <code>TargetNrfFqdn</code> Note: The <code>NfFqdn</code> dimension indicates the consumer NF FQDN. This dimension contains the <code>NfFqdn</code> if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-299 ocnrf_nfDiscover_rx_failure_forwarded_responses_perNsi_total

Field	Details
Description	The total number of failure response for forwarded discovery requests for a slice identified by NSI. The metric is pegged for each <code>nsi</code> present in the search query parameter. The search query attribute is <code>nsi-list</code>. Note: - The NSI belongs to the Producer NF that is discovered. - The metric will not get pegged if any of the search query parameters are invalid. - In this case, response metric will get pegged for all NSI that is being received in the request message.
Type	Counter
Service Operation	NFDiscover

Table 6-299 (Cont.) ocnrf_nfDiscover_rx_failure_forwarded_responses_perNsi_total

Field	Details
Dimensions	Nsi, NfFqdn, HttpStatusCode, TargetNrfFqdn Note: The NfFqdn dimension indicates the consumer NF FQDN. This dimension contains the NfFqdn if the service mesh sends the consumer NF FQDN in XFCC header, else the dimension will contain the value as UNKNOWN.

Table 6-300 ocnrf_nfRegister_requests_perSnssai_total

Field	Details
Description	The total number of NFRegister requests received at a slice that is identified by specific SNSSAI. The metric is pegged for each snssai present in the NfProfile being registered. The attributes considered are snssais, perPlmnSnssaiList, sNssaiSmfInfoList, and sNssaiUpfInfoList. Note: - snssais of NfService and NfServiceList are not considered for pegging. - If the NFRegister request has an invalid body, the metric may not get pegged.
Type	Counter
Service Operation	NFRegister
Dimensions	sNssai

Table 6-301 ocnrf_nfRegister_success_responses_perSnssai_total

Field	Details
Description	The total number of successful NFRegister responses with one or more matching NfProfiles sent per slice identified by SNSSAI. The metric is pegged for each snssai present in the NfProfile being registered. The attributes considered are snssais, perPlmnSnssaiList, sNssaiSmfInfoList, and sNssaiUpfInfoList. Note: Only snssais of NfProfile and xxxInfo are considered for pegging.
Type	Counter
Service Operation	NFRegister
Dimensions	sNssai

Table 6-302 ocnrf_nfRegister_failure_responses_perSnssai_total

Field	Details
Description	The total number of failure NFRegister responses sent per slice identified by SNSSAIs. The metric is pegged for each snssai present in the NfProfile being registered. The attributes considered are snssais, perPlmnSnssaiList, sNssaiSmfInfoList, and sNssaiUpfInfoList. Note: - Only snssais of NfProfile and xxxInfo are considered for pegging. - The metric may not get pegged if the NFRegister request has an invalid body.
Type	Counter
Service Operation	NFRegister
Dimensions	sNssai, HttpStatusCode

Table 6-303 ocnrf_nfRegister_requests_perNsi_total

Field	Details
Description	The total number of NFRegister requests received at a slice that is identified by NSI. The metric is pegged for each nsi present in the NfProfile being registered. The attribute considered is nsilist. Note: The metric may not get pegged if the NFRegister request has an invalid body.
Type	Counter
Service Operation	NFRegister
Dimensions	Nsi

Table 6-304 ocnrf_nfRegister_success_responses_perNsi_total

Field	Details
Description	The total number of successful NFRegister responses with one or more matching NfProfiles sent per slice that is identified by NSI. The metric is pegged for each nsi present in the NfProfile being registered. The attribute considered is nsilist.
Type	Counter
Service Operation	NFRegister
Dimensions	Nsi

Table 6-305 ocnrf_nfRegister_failure_responses_perNsi_total

Field	Details
Description	The total number of failure NFRegister responses sent per slice that is identified by NSI. The metric is pegged for each nsi present in the NfProfile being registered. The attribute considered is nsilist. Note: The metric may not get pegged if the NFRegister request has an invalid body.
Type	Counter
Service Operation	NFRegister
Dimensions	Nsi, HttpStatusCode

Table 6-306 ocnrf_nfUpdate_requests_perSnssai_total

Field	Details
Description	The total number of NFUpdate requests for slices identified by SNSSAIs. The metric is pegged for Complete Update and Partial Update(PATCH) of a registered NfProfile and for each snssais present in the NfProfile registered. The attributes considered are snssais, perPlmnSnssaiList, sNssaiSmfInfoList, and sNssaiUpfInfoList. Note: - Only snssais of NfProfile and xxxInfo are considered for pegging. - If the NFUpdate request has an invalid body, the metric may not get pegged. - In case of partial update (PATCH), the metric is pegged only based on the final list of SNSSAI updated in the profile. - In case of NFUpdate (PATCH), if the profile is not found, the metric will not be pegged.
Type	Counter
Service Operation	NFUpdate
Dimensions	sNssai

Table 6-307 ocnrf_nfUpdate_success_responses_perSnssai_total

Field	Details
Description	The total number of successful NFUpdate responses with one or more matching NfProfiles sent per slice identified by SNSSAI. The metric is pegged for Complete Update and Partial Update(PATCH) of a registered NfProfile and for each snssais present in the NfProfile registered. The attributes considered are snssais, perPlmnSnssaiList, sNssaiSmfInfoList, and sNssaiUpfInfoList. Note: • snssais of NfService and NfServiceList are not considered for pegging. • If the NFUpdate request has an invalid body, the metric may not get pegged. • In case of partial update (PATCH), the metric is pegged only based on the final list of SNSSAI updated in the profile. • In case of NFUpdate (PATCH), if the profile is not found, the metric will not be pegged.
Type	Counter
Service Operation	NFUpdate
Dimensions	sNssai

Table 6-308 ocnrf_nfUpdate_failure_responses_perSnssai_total

Field	Details
Description	The total number of failure NFUpdate responses sent per slice identified by SNSSAIs. The metric is pegged for Complete Update and Partial Update(PATCH) of a registered NfProfile and for each snssais present in the NfProfile registered. The attributes considered are snssais, perPlmnSnssaiList, sNssaiSmfInfoList, and sNssaiUpfInfoList. Note: • Only snssais of NfProfile and xxxInfo are considered for pegging. • If the NFUpdate request has an invalid body, the metric may not get pegged. • In case of partial update (PATCH), the metric is pegged only based on the final list of SNSSAI updated in the profile. • In case of NFUpdate (PATCH), if the profile is not found, the metric will not be pegged.
Type	Counter
Service Operation	NFUpdate
Dimensions	sNssai, HttpStatusCode

Table 6-309 ocnrf_nfUpdate_requests_perNsi_total

Field	Details
Description	The total number of NFUpdate requests for slices identified by NSI. The metric is pegged for Complete Update and Partial Update (PATCH) of a registered NfProfile and for each nsi present in the NfProfile registered. The attribute considered is nsiList. Note: • Only nsi of NfProfile and xxxInfo are considered for pegging. • If the NFUpdate request has an invalid body, the metric may not get pegged. • In case of partial update (PATCH), the metric is pegged only based on the updated profile. • In case of NFUpdate (PATCH), if the profile is not found, the metric will not be pegged.
Type	Counter
Service Operation	NFUpdate
Dimensions	Nsi

Table 6-310 ocnrf_nfUpdate_success_responses_perNsi_total

Field	Details
Description	The total number of successful NFUpdate responses for slices identified by NSI. The metric is pegged for Complete Update and Partial Update (PATCH) of a registered NfProfile and for each nsi present in the NfProfile registered. The attribute considered is nsiList. Note: - Only nsi of NfProfile and xxxInfo are considered for pegging. - If the NFUpdate request has an invalid body, the metric may not get pegged. - In case of partial update (PATCH), the metric is pegged only based on the final list of SNSSAI updated in the profile. - In case of NFUpdate (PATCH), if the profile is not found, the metric will not be pegged.
Type	Counter
Service Operation	NFUpdate
Dimensions	Nsi

Table 6-311 ocnrf_nfUpdate_failure_responses_perNsi_total

Field	Details
Description	The total number of failure NFUpdate responses for slices identified by NSI. The metric is pegged for Complete Update and Partial Update (PATCH) of a registered NfProfile and for each nsi present in the NfProfile registered. The attribute considered is nsiList. Note: - Only nsi of NfProfile and xxxInfo are considered for pegging. - If the NFUpdate request has an invalid body, the metric may not get pegged. - In case of partial update (PATCH), the metric is pegged only based on the final list of SNSSAI updated in the profile. - In case of NFUpdate (PATCH), if the profile is not found, the metric will not be pegged.
Type	Counter
Service Operation	NFUpdate
Dimensions	Nsi, HttpStatusCode

Table 6-312 ocnrf_nfDeregister_requests_perSnssai_total

Field	Details
Description	The total number of NFDeregister requests received at a slice that is identified by SNSSAIs. The metric is pegged for each snssais present in the registered NfProfile. The attributes considered are snssais, perPlmnSnssaiList, snssaiSmfInfoList, and snssaiUpfInfoList. Note: - Only snssais of NfProfile and xxxInfo are considered for pegging. - If the profile is not found in the database or if the profile is in deregistered state, the metric will not get pegged.
Type	Counter
Service Operation	NFDeregister
Dimensions	snssai

Table 6-313 ocnrf_nfDeregister_success_responses_perSnssai_total

Field	Details
Description	The total number of successful NFDeregister responses with one or more matching NfProfiles sent per slice that is identified by SNSSAI. The metric is pegged for each snssais present in the registered NfProfile. The attributes considered are snssais, perPlmnSnssaiList, sNssaiSmfInfoList, and sNssaiUpfInfoList. Note: - Only snssais of NfProfile and xxxInfo are considered for pegging. - If the profile is not found in the database or if the profile is in deregistered state, the metric will not get pegged.
Type	Counter
Service Operation	NFDeregister
Dimensions	sNssai

Table 6-314 ocnrf_nfDeregister_failure_responses_perSnssai_total

Field	Details
Description	The total number of failure NFDeregister responses sent per slice that is identified by SNSSAIs. The metric is pegged for each snssais present in the registered NfProfile. The attributes considered are snssais, perPlmnSnssaiList, sNssaiSmfInfoList, and sNssaiUpfInfoList. Note: - Only snssais of NfProfile and xxxInfo are considered for pegging. - If the profile is not found in the database or if the profile is in deregistered state, the metric will not get pegged.
Type	Counter
Service Operation	NFDeregister
Dimensions	sNssai, HttpStatusCode

Table 6-315 ocnrf_nfDeregister_requests_perNsi_total

Field	Details
Description	The total number of NFDeregister requests received at a slice that is identified by NSI. The metric is pegged for each nsi present in the registered NfProfile. The attribute considered is nsiList. Note: - Only nsi of NfProfile and xxxInfo are considered for pegging. - If the profile is not found in the database or if the profile is in deregistered state, the metric will not get pegged.
Type	Counter
Service Operation	NFDeregister
Dimensions	Nsi

Table 6-316 ocnrf_nfDeregister_success_responses_perNsi_total

Field	Details
Description	The total number of successful NFDeregister responses with one or more matching NfProfiles sent per slice that is identified by NSI. The metric is pegged for each nsi present in the registered NfProfile. The attribute considered is nsilist. Note: - Only nsi of NfProfile and xxxInfo are considered for pegging. - If the profile is not found in the database or if the profile is in deregistered state, the metric will not get pegged.
Type	Counter
Service Operation	NFDeregister
Dimensions	Nsi

Table 6-317 ocnrf_nfDeregister_failure_responses_perNsi_total

Field	Details
Description	The total number of failure NFDeregister responses sent per slice that is identified by NSI. The metric is pegged for each nsi present in the registered NfProfile. The attribute considered is nsilist. Note: - Only nsi of NfProfile and xxxInfo are considered for pegging. - If the profile is not found in the database or if the profile is in deregistered state, the metric will not get pegged.
Type	Counter
Service Operation	NFDeregister
Dimensions	Nsi, HttpStatusCode

Table 6-318 ocnrf_nfHeartBeat_requests_perSnssai_total

Field	Details
Description	The total number of NF HeartBeat requests received at a slice that is identified by SNSSAIs. The attributes considered are snssais, perPlmnSnssaiList, snssaiSmfInfoList, and snssaiUpfInfoList. Note: - Only snssais of NfProfile and xxxInfo are considered for pegging. - The metric will not get pegged if the nfHeartBeat request has an invalid body.
Type	Counter
Service Operation	NfHeartBeat
Dimensions	sNssai

Table 6-319 ocnrf_nfHeartBeat_success_responses_perSnssai_total

Field	Details
Description	The total number of success NF HeartBeat responses with one or more matching NfProfiles sent per slice that is identified by SNSSAIs. The attributes considered are snssais, perPlmnSnssaiList, snssaiSmfInfoList, and snssaiUpfInfoList. Note: Only snssais of NfProfile and xxxInfo are considered for pegging.
Type	Counter

Table 6-319 (Cont.) ocnrf_nfHeartBeat_success_responses_perSnssai_total

Field	Details
Service Operation	NfHeartBeat
Dimensions	sNssai

Table 6-320 ocnrf_nfHeartBeat_failure_responses_perSnssai_total

Field	Details
Description	The total number of failure NF HeartBeat Update responses for slices identified by SNSSAIs. The attributes considered are snssais, perPlmnSnssaiList, sNssaiSmfInfoList, and sNssaiUpfInfoList. Note: - snssais of NfService and NfServiceList are not considered for pegging. - The metric will not get pegged if the nfHeartBeat request has an invalid body.
Type	Counter
Service Operation	NfHeartBeat
Dimensions	sNssai, HttpStatusCode

Table 6-321 ocnrf_nfHeartBeat_requests_perNsi_total

Field	Details
Description	The total number of NF HeartBeat requests received at a slice that is identified by Nsi. The attribute considered is nsiList. Note: - Only nsi of NfProfile and xxxInfo are considered for pegging. - The metric will not get pegged if the nfHeartBeat request has an invalid body.
Type	Counter
Service Operation	NfHeartBeat
Dimensions	Nsi

Table 6-322 ocnrf_nfHeartBeat_success_responses_perNsi_total

Field	Details
Description	The total number of successful NF HeartBeat responses with one or more matching NfProfiles sent per slice that is identified by Nsi. The attribute considered is nsiList. Note: Only nsi of NfProfile and xxxInfo are considered for pegging.
Type	Counter
Service Operation	NfHeartBeat
Dimensions	Nsi

Table 6-323 ocnrf_nfHeartBeat_failure_responses_perNsi_total

Field	Details
Description	The total number of failure NF HeartBeat responses sent per slice that is identified by Nsi. The attribute considered is nsiList.
Type	Counter

Table 6-323 (Cont.) ocnrf_nfHeartBeat_failure_responses_perNsi_total

Field	Details
Service Operation	NfHeartBeat
Dimensions	Nsi, HttpStatusCode

6.1.18 NRF Cache Data Metrics

Table 6-324 ocnrf_cds_rx_requests_total

Field	Details
Description	The number of requests received at Cache Data Service.
Type	Counter
Dimensions	NrfLevel, RequestType Possible values for RequestType are RemoteAndLocalSetProfiles, ProfilesByQueryParam, and RemoteAndLocalSetSubscriptions

Table 6-325 ocnrf_cds_tx_responses_total

Field	Details
Description	The number of responses sent by the Cache Data Service.
Type	Counter
Dimensions	NrfLevel, RequestType, HttpStatusCode. Possible values for RequestType are RemoteAndLocalSetProfiles, ProfilesByQueryParam, and RemoteAndLocalSetSubscriptions

Table 6-326 ocnrf_cds_round_trip_time_seconds_[suffix]

Field	Details
Description	The time taken to process the request at Cache Data Service in 50, 90, 95, and 99 percentiles. Note: *_time_seconds_[suffix] can represent any of the supported formats: *_time_seconds_max *_time_seconds_bucket *_time_seconds_count *_time_seconds_sum
Type	Histogram
Dimensions	NrfLevel, RequestType Possible values for RequestType are RemoteAndLocalSetProfiles, ProfilesByQueryParam, and RemoteAndLocalSetSubscriptions

Table 6-327 ocnrf_query_remote_cds_requests_total

Field	Details
Description	The number of requests sent to the NRF of a remote NRF set by Cache Data Service.
Type	Counter

Table 6-327 (Cont.) ocnrf_query_remote_cds_requests_total

Field	Details
Dimensions	NrfLevel, QueryType, RemoteNrfFqdn, TargetNrfSetId. Possible values of QueryType are NfProfiles and NfSubscriptions.

Table 6-328 ocnrf_query_remote_cds_responses_total

Field	Details
Description	The number of responses received from the NRF of a remote NRF set by Cache Data Service.
Type	Counter
Dimensions	NrfLevel, QueryType, HttpStatusCode, RemoteNrfFqdn, TargetNrfSetId. Possible values of QueryType are NfProfiles and NfSubscriptions.

Table 6-329 ocnrf_query_remote_cds_round_trip_time_seconds_[suffix]

Field	Details
Description	The time taken between the request sent by Cache Data Service towards remote NRF set and response received. It is measured in 50, 90, 95, and 99 percentiles. Note: *_time_seconds_[suffix] can represent any of the supported formats: • *_time_seconds_max • *_time_seconds_bucket • *_time_seconds_count • *_time_seconds_sum
Type	Histogram
Dimensions	NrfLevel, QueryType, HttpStatusCode, RemoteNrfFqdn, TargetNrfSetId. Possible values of QueryType are NfProfiles and NfSubscriptions.

Table 6-330 ocnrf_query_remote_cds_message_size_bytes_[suffix]

Field	Details
Description	The size of the response received by the Cache Data Service from the remote NRF set. The size is pegged in bytes and is published in buckets of 1kB, 5KB, 10KB, 50KB, 100KB, 500KB, and 1MB. Note: *_size_bytes_[suffix] can represent any of the supported formats: • *_size_bytes_max • *_size_bytes_bucket • *_size_bytes_count • *_size_bytes_sum
Type	Histogram
Dimensions	NrfLevel, QueryType, RemoteNrfFqdn, HttpStatusCode, SourceNrfSetId, TargetNrfSetId. Possible values of QueryType are NfProfiles and NfSubscriptions.

Table 6-331 ocnrf_cache_fallback_total

Field	Details
Description	The number of times the request was fulfilled from the in-memory cache of Cache Data Service due to cnDBTier query errors.
Type	Counter
Dimensions	NrfLevel, ErrorReason

Table 6-332 ocnrf_db_fallback_total

Field	Details
Description	The number of times a service request was fulfilled from the cnDBTier using local NRF set data as the query towards the Cache Data Service failed.
Type	Counter
Dimensions	NrfLevel, ServiceOperation Possible values of ServiceOperation are NfProfileRetrieval, NfListRetrieval, NfAccessToken, NfDiscover, NfStatusSubscribe, and NfStatusUnsubscribe

Table 6-333 ocnrf_query_cds_requests_total

Field	Details
Description	The number of requests to the Cache Data Service sent by the local NRF microservices for state data. For the list of local NRF microservices, see the Enhanced NRF Set Based Deployment (NRF Growth) section.
Type	Counter
Dimensions	NrfLevel, ServiceOperation Possible values of ServiceOperation are NfProfileRetrieval, NfListRetrieval, NfAccessToken, NfDiscover, NfSubscribe, NfUnsubscribe, notifyProfileChange, notifyProfileDeregistration, notifyProfileRegistration, FindAllNfSubscription, NfInstanceFetch, CUSTOM_NRF_AUDIT_NF_COUNT, and CUSTOM_NRF_AUDIT_NF_SIZE.

Table 6-334 ocnrf_query_cds_responses_total

Field	Details
Description	The number of responses from the Cache Data Service to the local NRF microservices for state data. For the list of local NRF microservices, see the Enhanced NRF Set Based Deployment (NRF Growth) section.
Type	Counter
Dimensions	NrfLevel, HttpStatusCode, ServiceOperation Possible values of ServiceOperation are NfProfileRetrieval, NfListRetrieval, NfAccessToken, NfDiscover, NfSubscribe, NfUnsubscribe, notifyProfileChange, notifyProfileDeregistration, notifyProfileRegistration, FindAllNfSubscription, NfInstanceFetch, CUSTOM_NRF_AUDIT_NF_COUNT, and CUSTOM_NRF_AUDIT_NF_SIZE.

Table 6-335 ocnrf_query_cds_round_trip_time_seconds_[suffix]

Field	Details
Description	The time taken between the request sent by local NRF set microservices to Cache Data Service and response received. It is measured in 50, 95, and 99 percentiles. Note: *_time_seconds_[suffix] can represent any of the supported formats: *_time_seconds_max *_time_seconds_bucket *_time_seconds_count *_time_seconds_sum
Type	Histogram
Dimensions	NrfLevel, ServiceOperation Possible values of ServiceOperation are NfProfileRetrieval, NfListRetrieval, NfAccessToken, NfDiscover, NfSubscribe, NfUnsubscribe, notifyProfileChange, notifyProfileDeregistration, notifyProfileRegistration, FindAllNfSubscription, NfInstanceFetch, CUSTOM_NRF_AUDIT_NF_COUNT, and CUSTOM_NRF_AUDIT_NF_SIZE.

Table 6-336 ocnrf_dbmetrics_total

Field	Details
Description	The number of database operation counts corresponding to every service operation.
Type	Counter
Dimensions	method, dbOperation, ServiceOperation, NrfLevel, HttpStatusCode Possible values for: - dbOperation: find - ServiceOperation: nrfCacheDataService

Table 6-337 ocnrf_nf_registered_count

Field	Details
Description	The total number of NFs registered in the segment.
Type	Gauge
Dimensions	NrfLevel, RequesterNfType

Table 6-338 ocnrf_cache_sync_count_total

Field	Details
Description	The number of in-memory cache entries synchronized. The metric is pegged at the at the Cache Data Service and Discovery Service.
Type	Counter
Dimensions	NrfLevel, NrfFqdn, SourceNrfSetId, TargetNrfSetId, DataType, CompleteSync Possible values of DataType are NfProfiles and NfSubscriptions Possible values of CompleteSync are true and false

Table 6-339 ocnrf_remote_set_unavailable_total

Field	Details
Description	All the NRFs of a remote NRF set are unavailable for synchronizing state data.

Table 6-339 (Cont.) ocnrf_remote_set_unavailable_total

Field	Details
Type	Counter
Dimensions	NrfLevel,SourceNrfSetId, TargetNrfSetId

Table 6-340 ocnrf_all_remote_sets_unavailable_total

Field	Details
Description	All the NRFs of all remote NRF sets are unavailable for synchronizing state data.
Type	Counter
Dimensions	NrfLevel,SourceNrfSetId, TargetNrfSetId

Table 6-341 ocnrf_cds_rx_remote_requests_total

Field	Details
Description	The number of requests received at Cache Data Service from remote NRFs.
Type	Counter
Dimensions	QueryType

Table 6-342 ocnrf_cds_rx_remote_responses_total

Field	Details
Description	The number of responses sent by the Cache Data Service to the remote NRF.
Type	Counter
Dimensions	QueryType

Table 6-343 ocnrf_cds_remote_rx_request_round_trip_time_seconds_[suffix]

Field	Details
Description	The time taken to process the request received from the Remote NRF at Cache Data Service. Note: *_time_seconds_[suffix] can represent any of the supported formats: *_time_seconds_max *_time_seconds_bucket *_time_seconds_count *_time_seconds_sum
Type	Histogram
Dimensions	QueryType

6.1.19 Overload Control

Table 6-344 load_level

Field	Details
Description	The metric is used to track the load level as per the services. Note: The load_level metric must be considered from the perf-info leader pod only. The leader pod can be determined using the isLeader dimension.
Type	Gauge
Dimensions	service, isLeaderPod

Table 6-345 service_resource_stress

Field	Details
Description	This metric tracks CPU, memory, failure count, and pending requests on the basis of which the overload level of a service is calculated.
Type	Gauge
Dimension	type, service, isLeaderPod

Table 6-346 service_resource_overload_level

Field	Details
Description	This metric tracks an individual resource's overload level that is calculated based on the resource usage and configured threshold.
Type	Gauge
Dimension	type, service, isLeaderPod

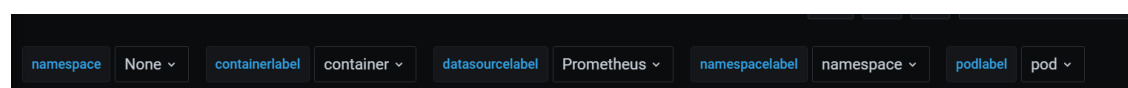
6.2 NRF KPIs

This section includes information about KPIs for Oracle Communications Cloud Native Core, Network Repository Function (NRF).

Sample NRF dashboard for Grafana is delivered to the customer through NRF CSAR package. This package includes the metrics and functions required to compute Key Performance Indicators (KPIs). NRF provides an integrated dashboard that supports both Prom HA (CNE with open-source Prometheus) and non-Prom HA (OSO) deployments, with compatibility ensured through the use of appropriate configuration labels.

Prom HA:

Figure 6-2 Prom HA (CNE with open-source Prometheus)



Non-Prom HA:

Figure 6-3 Non-Prom HA (OSO)

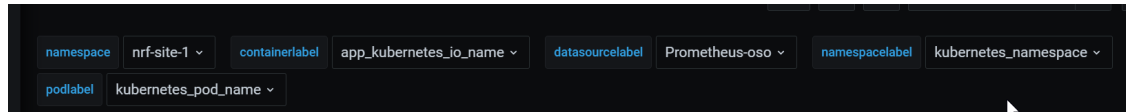


Table 6-347 KPI Legends

Field Name	Description
containerlabel	Indicates the container name to be used. Note: This value varies based on the data source types (Prom HA or Non-Prom HA). - Prom-HA uses container - Non Prom-HA uses app_kubernetes_io_name
datasourcelabel	Indicates the datasource label to be used. Note: This value varies based on the data source types (Prom HA or Non-Prom HA).
namespace	Indicates the namespace for which the metrics should be scraped.
namespacelabel	Indicates the namespace label to be used. Note: This value varies based on the data source types (Prom HA or Non-Prom HA). - Prom-HA uses namespace - Non Prom-HA uses kubernetes_namespace
podlabel	Indicates the pod label to be used. - Prom-HA uses pod - Non Prom-HA uses kubernetes_pod_name

- The field names in the KPI expressions are based on the **datasourcelabel** selected. The below KPI expressions are example for CNE Prometheus datasource.
- Select the appropriate **namespacelabel**, **containerlabel**, and **podlabel** according to the **datasourcelabel** selected. Failure in selecting these fields appropriately leads to no data in the KPIs.

6.2.1 NRF Service KPIs

This section lists the service status, Gateway, Service latency, Database latency KPIs.

Table 6-348 Registration Service Success Ratio (2xx) %

Field	Details
Description	Measures the total number of successful registration service operations at NRF. For more information about metric used, see NRF Gateways Metrics .
Expression	Expression: $\frac{\text{sum}(\text{increase}(\text{oc\_ingressgateway\_http\_responses\_total}\{\text{Status}=\sim\backslash"2.\ast", \text{Route\_path}=\sim\backslash".*\text{nrf-nfm/v1/nf-instances}.\ast", \text{namespace}=\text{"$namespace"}\}[5m]))}{\text{sum}(\text{increase}(\text{oc_ingressgateway_http_responses_total}\{\text{Route_path}=\sim\backslash".*\text{nrf-nfm/v1/nf-instances}.\ast", \text{namespace}=\text{"$namespace"}\}[5m]))} * 100$

Table 6-349 Subscription Service Success Ratio (2xx) %

Field	Details
Description	Measures the total number of successful subscription service operations at NRF. For more information about metric used, see NRF Gateways Metrics .
Expression	$\frac{\text{sum}(\text{increase}(\text{oc\_ingressgateway\_http\_responses\_total}\{\text{Status}=\sim\backslash"2.\ast\backslash",\text{Route\_path}=\sim\backslash".*\text{nnrf-nfm/v1/nf-instances}.\ast\backslash",\text{namespace}=\text{"$namespace"}\}[5\text{m}]))}{\text{sum}(\text{increase}(\text{oc_ingressgateway_http_responses_total}\{\text{Route_path}=\sim\backslash".*\text{nnrf-nfm/v1/nf-instances}.\ast\backslash",\text{namespace}=\text{"$namespace"}\}[5\text{m}]))}*100$

Table 6-350 Discover Service Success Ratio (2xx) %

Field	Details
Description	Measures the total number of successful discover service operations at NRF. For more information about metric used, see NRF Gateways Metrics .
Expression	$\frac{\text{sum}(\text{increase}(\text{oc\_ingressgateway\_http\_responses\_total}\{\text{Status}=\sim\backslash"2.\ast\backslash",\text{Route\_path}=\sim\backslash".*\text{nnrf-disc/v1/nf-instances}.\ast\backslash",\text{namespace}=\text{"$namespace"}\}[5\text{m}]))}{\text{sum}(\text{increase}(\text{oc_ingressgateway_http_responses_total}\{\text{Route_path}=\sim\backslash".*\text{nnrf-disc/v1/nf-instances}.\ast\backslash",\text{namespace}=\text{"$namespace"}\}[5\text{m}]))}*100$

Table 6-351 AccessToken Service Success Ratio (2xx) %

Field	Details
Description	Measures the total number of successful Access Token service operations at NRF. For more information about metric used, see NRF Gateways Metrics .
Expression	$\frac{\text{sum}(\text{increase}(\text{oc\_ingressgateway\_http\_responses\_total}\{\text{Status}=\sim\backslash"2.\ast\backslash",\text{Route\_path}=\sim\backslash".*\text{oauth2/token}.\ast\backslash",\text{namespace}=\text{"$namespace"}\}[5\text{m}]))}{\text{sum}(\text{increase}(\text{oc_ingressgateway_http_responses_total}\{\text{Route_path}=\sim\backslash".*\text{oauth2/token}.\ast\backslash",\text{namespace}=\text{"$namespace"}\}[5\text{m}]))}*100$

Table 6-352 SLF Query Success Ratio (2xx) %

Field	Details
Description	Measures the total number of SLF query response received. For more information about metric used, see NRF SLF Metrics .
Expression	$\frac{\text{sum}(\text{increase}(\text{ocnrf\_SLF\_rx\_responses\_total}\{\text{HttpStatusCode}=\sim\backslash"2.\ast\backslash",\text{namespace}=\text{"$namespace"}\}[5\text{m}]))}{\text{sum}(\text{increase}(\text{ocnrf_SLF_rx_responses_total}\{\text{namespace}=\text{"$namespace"}\}[5\text{m}]))}*100$

Table 6-353 Active Registrations

Field	Details
Description	Measures the total number of active registered NFs at any point of time to indicate that the data comes per NF type. This is based on [NfType :- {{ RequesterNfType }}]
Expression	$\text{sum}(\text{ocnrf\_active\_registrations\_count}\{\text{namespace}=\text{"$namespace"}\})$ by(RequesterNfType)

Table 6-354 Suspended NFs

Field	Details
Description	Measures the difference in number of profiles that have been marked as suspended when a profile has missed nfHeartBeatMissAllowed. This is based on [NfInstance :- {{ NfInstanceId }}]
Expression	increase(ocnrf_nf_suspended_total{namespace="\$namespace"}[5m])

Table 6-355 Total NfSubscriptions expired

Field	Details
Description	Measures the total number of NfSubscriptions whose validityTime has expired.
Expression	increase(ocnrf_nfSubscriptions_expired_total{namespace="\$namespace"}[5m])

Table 6-356 NfDiscoveredProfiles

Field	Details
Description	Measures the rate of number of profiles returned in discovery response. For more information about metric used, see NRF NF Metrics .
Expression	sum(irate(ocnrf_nfDiscover_profiles_discovered_total{namespace="\$namespace"}[2m])) by (Bucket,TargetNfType)

Table 6-357 NfRegister Responses

Field	Details
Description	Measures the rate of successful registration responses sent. This is based on [HttpStatusCode :- {{HttpStatusCode}}, NfFqdn-{{ NfFqdn }}] For more information about metric used, see NRF NF Metrics .
Expression	sum(irate(ocnrf_nfRegister_tx_responses_total{namespace="\$namespace"}[2m])) by (HttpStatusCode, NfFqdn)

Table 6-358 NfUpdate Response (Complete)

Field	Details
Description	Measures the rate of successful updates response sent. This is based on [HttpStatusCode :- {{HttpStatusCode}}, NfFqdn :- {{ NfFqdn }}] For more information about metric used, see NRF NF Metrics .
Expression	sum(irate(ocnrf_nfUpdate_tx_responses_total{namespace="\$namespace",UpdateType="Complete"}[2m])) by (HttpStatusCode, NfFqdn)

Table 6-359 NfUpdate Response (Partial)

Field	Details
Description	Measures the rate of successful updates of an NF Profile which is previously registered at NRF. This is based on [HttpStatusCode :- {{HttpStatusCode}}, NfFqdn :- {{ NfFqdn }}] For more information about metric used, see NRF NF Metrics .

Table 6-359 (Cont.) NfUpdate Response (Partial)

Field	Details
Expression	sum(irate(ocnrf_nfUpdate_tx_responses_total{namespace="\$namespace",UpdateType="Partial"}[2m])) by (HttpStatusCode, NfFqdn)

Table 6-360 NfDeregister Responses

Field	Details
Description	Measures the rate of successful Deregistration of NFs at NRF. This is based on [HttpStatusCode :- {{HttpStatusCode}},NfFqdn :- {{ NfFqdn }}] For more information about metric used, see NRF NF Metrics .
Expression	sum(irate(ocnrf_nfDeregister_tx_responses_total{namespace="\$namespace"}[2m])) by (HttpStatusCode, NfFqdn)

Table 6-361 NfProfileRetrieval Response

Field	Details
Description	Measures the rate at which NfProfileRetrieval service requests that NRF rejects due to various error reasons. This KPI considers all non success error codes. This is based on [HttpStatusCode :- {{HttpStatusCode}}] For more information about metric used, see NRF NF Metrics .
Expression	sum(irate(ocnrf_nfProfileRetrieval_tx_responses_total{namespace="\$namespace"}[2m])) by(HttpStatusCode)

Table 6-362 NfHeartbeat Responses

Field	Details
Description	Measures the rate of Heartbeat Responses sent. This is based on [HttpStatusCode :- {{HttpStatusCode}}] For more information about metric used, see NRF NF Metrics .
Expression	sum(irate(ocnrf_nfHeartBeat_tx_responses_total{namespace="\$namespace"}[2m])) by(HttpStatusCode)

Table 6-363 NFStatusSubscribe

Field	Details
Description	Measures the rate of NfStatusSubscribe responses sent. This is based on [HttpStatusCode :- {{HttpStatusCode}}] For more information about metric used, see NRF NF Metrics .
Expression	sum(irate(ocnrf_nfStatusSubscribe_tx_responses_total{namespace="\$namespace",OperationType="Create"}[2m])) by (HttpStatusCode)

Table 6-364 NFStatusSubscribe (PATCH)

Field	Details
Description	Measures the rate of NfStatusSubscribe update responses sent. This is based on [HttpStatusCode :- {{HttpStatusCode}}] For more information about metric used, see NRF NF Metrics .
Expression	sum(irate(ocnrf_nfStatusSubscribe_tx_responses_total{namespace="\$namespace",OperationType="Update"}[2m])) by (HttpStatusCode)

Table 6-365 NFStatusUnsubscribe [HttpStatusCode :- {{HttpStatusCode}}]

Field	Details
Description	Measures the rate of NfStatusUnsubscribe responses sent. For more information about metric used, see NRF NF Metrics .
Expression	sum(irate(ocnrf_nfStatusUnsubscribe_tx_responses_total{namespace="\$namespace"}[2m])) by (HttpStatusCode)

Table 6-366 NfStatusNotify Response

Field	Details
Description	Measures the rate of NfStatusNotify responses received. This is based on [HttpStatusCode :- {{HttpStatusCode}}] For more information about metric used, see NRF NF Metrics .
Expression	sum(irate(ocnrf_nfStatusNotify_rx_responses_total{namespace="\$namespace"}[2m])) by (HttpStatusCode)

Table 6-367 NfDiscovery Responses

Field	Details
Description	Measures the rate of NfDiscover responses sent. This is based on [HttpStatusCode :- {{HttpStatusCode}}] For more information about metric used, see NRF NF Metrics .
Expression	sum(irate(ocnrf_nfDiscover_tx_responses_total{namespace="\$namespace"}[2m])) by (HttpStatusCode)

Table 6-368 SLF Response

Field	Details
Description	Measures the rate of SLF query response received. This is based on [HttpStatusCode :- {{HttpStatusCode}}, TargetNfType :- {{TargetNfType}}]
Expression	sum(irate(ocnrf_SLF_rx_responses_total{namespace="\$namespace"}[2m])) by (HttpStatusCode,TargetNfType)

Table 6-369 Forwarded Response

Field	Details
Description	Measures the rate of forwarded query response received. This is based on [HttpStatusCode :- {{HttpStatusCode}}]

Table 6-369 (Cont.) Forwarded Response

Field	Details
Expression	sum(irate(ocnrf_forward_nfDiscover_rx_responses_total{namespace="\$namespace"}[2m])) by(HttpStatusCode)

Table 6-370 Access Token Success

Field	Details
Description	Measures the rate of successful Access Token service operations at NRF. For more information about metric used, see NRF Gateways Metrics .
Expression	sum(irate(oc_ingressgateway_http_responses_total{Status="200 OK",Route_path=~".*/oauth2/token.*",Method="POST",namespace="\$namespace"}[5m]))

Table 6-371 4xx Responses (AccessToken)

Field	Details
Description	Measures the rate of successful AccessToken requests with 4xx response at NRF. For more information about metric used, see NRF Gateways Metrics .
Expression	sum(irate(oc_ingressgateway_http_responses_total{Status=~"4.*",Route_path=~".*/oauth2/token.*",namespace="\$namespace"}[5m]))

Table 6-372 5xx Responses (AccessToken)

Field	Details
Description	Measures the rate of successful AccessToken requests with 5xx response at NRF. For more information about metric used, see NRF Gateways Metrics .
Expression	sum(irate(oc_ingressgateway_http_responses_total{Status=~"5.*",Route_path=~".*/oauth2/token.*",namespace="\$namespace"}[5m]))

Table 6-373 Current KeyId Health

Field	Details
Description	Measures the health status of Oauth Token Signing keys. This is based on [KeyId : {{ KeyId }}, KeyType : {{ KeyType }}] For more information about metric used, see NRF NF Metrics .
Expression	ocnrf_oauth_keyData_healthStatus{app_kubernetes_io_name="nrfconfiguration",isCurrentKeyId="true",namespace="\$namespace"}

Table 6-374 NF AccessToken Failures

Field	Details
Description	Measures the rate at which NFAccessToken service requests that NRF rejects due to various error reasons. This KPI considers all non success error codes. For more information about metric used, see NRF Gateways Metrics .
Expression	sum(irate(oc_ingressgateway_http_responses_total{Status!~"2.*",Route_path=~".*/oauth2/token.*",namespace="\$namespace"}[5m]))

Table 6-375 NF Discover Profile Discovered

Field	Details
Description	Measures the rate of Profiles returned in discovery response. Depending on bucket size and corresponding value will tell how many profiles are returned in discovery response. For more information about metric used, see NRF Gateways Metrics .
Expression	sum(irate(ocnrf_nfDiscover_profiles_discovered_total{namespace="\$namespace"}[2m])) by (Bucket,TargetNfType)

Table 6-376 Egress Gateway Response for Nrf Forward Response {{ Status }}

Field	Details
Description	Measures the rate of Nrf forward response received. This is based on {{ Status }} of Nrf Forward Response. For more information about metric used, see NRF Gateways Metrics .
Expression	sum(irate(oc_egressgateway_http_responses_total{namespace="\$namespace",Method="GET",NFServiceType="nnrf-disc"}[2m])) by(Status)

Table 6-377 Egress Gateway Response for SLF Response {{ Status }}

Field	Details
Description	Measures the rate of SLF forward response received. This is based on {{ Status }} of SLF response. For more information about metric used, see NRF Gateways Metrics .
Expression	sum(irate(oc_egressgateway_http_responses_total{namespace="\$namespace",Method="GET",NFServiceType="nudr-group-id-map"}[2m])) by(Status)

Table 6-378 Ingress Request Rate

Field	Details
Description	Measures the rate of incoming requests at NRF. For more information about metric used, see NRF Gateways Metrics .
Expression	sum(irate(oc_ingressgateway_http_requests_total{container="ingressgateway",namespace="\$namespace"}[2m]))

Table 6-379 Response with 2xx status code

Field	Details
Description	Measures the rate of outgoing response with 2xx status code. For more information about metric used, see NRF Gateways Metrics .
Expression	sum(irate(oc_ingressgateway_http_responses_total{Status=~"2.*",container="ingressgateway",namespace="\$namespace"}[5m]))

Table 6-380 Response with 4xx status code

Field	Details
Description	Measures the rate of outgoing response with 4xx status code. For more information about metric used, see NRF Gateways Metrics .
Expression	<code>sum(irate(oc_ingressgateway_http_responses_total{Status=~"4.*",container="ingress gateway",namespace="\$namespace"}[5m]))</code>

Table 6-381 Response with 5xx status code

Field	Details
Description	Measures the rate of outgoing response with 5xx status code. For more information about metric used, see NRF Gateways Metrics .
Expression	<code>sum(irate(oc_ingressgateway_http_responses_total{Status=~"5.*",container="ingress gateway",namespace="\$namespace"}[5m]))</code>

Table 6-382 NRF Outgoing Response

Field	Details
Description	Measures the rate of outgoing requests at NRF. For more information about metric used, see NRF Gateways Metrics .
Expression	<code>sum(irate(oc_ingressgateway_http_responses_total{app_kubernetes_io_name="ingressgateway",namespace="\$namespace"}[5m]))</code>

Table 6-383 Egress Request Rate

Field	Details
Description	Measures the rate of outgoing requests at NRF. For more information about metric used, see NRF Gateways Metrics .
Expression	<code>sum(irate(oc_egressgateway_http_requests_total{namespace="\$namespace",Direction="egressOut"}[5m]))</code>

Table 6-384 Response with 2xx status code

Field	Details
Description	Measures the rate of outgoing response with 2xx status code. For more information about metric used, see NRF Gateways Metrics .
Expression	<code>sum(irate(oc_egressgateway_http_responses_total{Status=~"2.*",namespace="\$namespace",Direction="egressOut"}[5m]))</code>

Table 6-385 Response with 4xx status code

Field	Details
Description	Measures the rate of outgoing response with 4xx status code. For more information about metric used, see NRF Gateways Metrics .
Expression	<code>sum(irate(oc_egressgateway_http_responses_total{Status=~"4.*",namespace="\$namespace",Direction="egressOut"}[5m]))</code>

Table 6-386 Response with 5xx status code

Field	Details
Description	Measures the rate of outgoing response with 5xx status code. For more information about metric used, see NRF Gateways Metrics .
Expression	sum(irate(oc_egressgateway_http_responses_total{Status=~"5.*",namespace="\$namespace",Direction="egressOut"}[5m]))

Table 6-387 Egress Response Rate

Field	Details
Description	Measures the rate of outgoing responses at NRF. For more information about metric used, see NRF Gateways Metrics .
Expression	sum(irate(oc_egressgateway_http_responses_total{namespace="\$namespace",Direction="egressOut"}[5m]))

Table 6-388 Ingress Request Rate

Field	Details
Description	Measures the rate of incoming request events at NRF. This metric is pegged for every event generated when a request is sent to the Ingress Gateway. For more information about metric used, see NRF Gateways Metrics .
Expression	sum(irate(oc_ingressgateway_jetty_request_stat_metrics_total{event="onCommit",app_kubernetes_io_name="ingressgateway",namespace="\$namespace"}[2m])) by (pod)

Table 6-389 Ingress Response Rate

Field	Details
Description	Measures the rate of outgoing response events from NRF Ingress Gateway.. This metric is pegged for every event occurred when a response is received from Ingress Gateway. For more information about metric used, see NRF Gateways Metrics .
Expression	sum(irate(oc_ingressgateway_jetty_response_stat_metrics_total{event="onComplete",app_kubernetes_io_name="ingressgateway",namespace="\$namespace"}[2m])) by (pod)

Table 6-390 Total Incoming Connections at Pod

Field	Details
Description	Measures the total number of active incoming connections per Egress Gateway pod. For more information about metric used, see NRF Gateways Metrics .
Expression	sum by (pod) (oc_egressgateway_incoming_connections{namespace="\$namespace"})

Table 6-391 Total Incoming Connections

Field	Details
Description	Measures the total number of active incoming connections from client to Egress Gateway. For more information about metric used, see NRF Gateways Metrics .
Expression	sum (oc_egressgateway_incoming_connections{namespace="\$namespace"})

Table 6-392 Total Outgoing Connections at pod

Field	Details
Description	Measures the total number of active outgoing connections per Egress Gateway pod. For more information about metric used, see NRF Gateways Metrics .
Expression	sum by (pod) (oc_egressgateway_outgoing_connections{namespace="\$namespace"})

Table 6-393 Total Outgoing Connections

Field	Details
Description	Measures the total number of active outgoing connections from Egress Gateway. For more information about metric used, see NRF Gateways Metrics .
Expression	sum (oc_egressgateway_outgoing_connections{namespace="\$namespace"})

Table 6-394 Total Incoming Connections at Pod

Field	Details
Description	Measures the total number of active incoming connections per Ingress Gateway pod. For more information about metric used, see NRF Gateways Metrics .
Expression	sum by (pod) (oc_ingressgateway_incoming_connections{namespace="\$namespace"})

Table 6-395 Total Incoming Connections

Field	Details
Description	Measures the total number of active incoming connections from client to Ingress Gateway. For more information about metric used, see NRF Gateways Metrics .
Expression	sum (oc_ingressgateway_incoming_connections{namespace="\$namespace"})

Table 6-396 Total Outgoing Connections at pod

Field	Details
Description	Measures the total number of active outgoing connections per Ingress Gateway pod. For more information about metric used, see NRF Gateways Metrics .
Expression	sum by (pod) (oc_ingressgateway_outgoing_connections{namespace="\$namespace"})

Table 6-397 Total Outgoing Connections

Field	Details
Description	Measures the total number of active outgoing connections from Ingress Gateway. For more information about metric used, see NRF Gateways Metrics .
Expression	sum(oc_ingressgateway_outgoing_connections{namespace="\$namespace"})

Table 6-398 SLF Egress Gateway Latency 99%

Field	Details
Description	Measures the rate of SLF time request falling in 99 percentile of the latency value at Egress Gateway.
Expression	histogram_quantile(0.99, sum(rate(oc_egressgateway_request_latency_seconds_bucket{\$namespace_label="\$namespace",Method="GET"}[2m])) by (le))

Table 6-399 SLF Egress Gateway Latency 95%

Field	Details
Description	Measures the rate of SLF request falling in 95 percentile of the latency value at Egress Gateway.
Expression	histogram_quantile(0.95, sum(rate(oc_egressgateway_request_latency_seconds_bucket{\$namespace_label="\$namespace",Method="GET"}[2m])) by (le))

Table 6-400 SLF Egress Gateway Latency 90%

Field	Details
Description	Measures the rate of SLF request falling in 90 percentile of the latency value at Egress Gateway.
Expression	histogram_quantile(0.9, sum(rate(oc_egressgateway_request_latency_seconds_bucket{\$namespace_label="\$namespace",Method="GET"}[2m])) by (le))

Table 6-401 SLF Egress Gateway Latency 50%

Field	Details
Description	Measures the rate of SLF request falling in 50 percentile of the latency value at Egress Gateway.
Expression	histogram_quantile(0.5, sum(rate(oc_egressgateway_request_latency_seconds_bucket{\$namespace_label="\$namespace",Method="GET"}[2m])) by (le))

Table 6-402 NfAccess Token Latency 99%

Field	Details
Description	Measures the rate of time taken for processing NfAccess token latency falling in 99 percentile of the latency value.

Table 6-402 (Cont.) NfAccess Token Latency 99%

Field	Details
Expression	histogram_quantile(0.99, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namespace,acelabel="\$namespace",Route_path="/oauth2/token",Method="POST"}[2m])) by (le))

Table 6-403 NfAccess Token Latency 95%

Field	Details
Description	Measures the rate of time taken for processing NfAccess token latency falling in 95 percentile of the latency value.
Expression	histogram_quantile(0.95, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namespace,acelabel="\$namespace",Route_path="/oauth2/token",Method="POST"}[2m])) by (le))

Table 6-404 NfAccess Token Latency 90%

Field	Details
Description	Measures the rate of time taken for processing NfAccess token latency falling in 90 percentile of the latency value.
Expression	histogram_quantile(0.90, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namespace,acelabel="\$namespace",Route_path="/oauth2/token",Method="POST"}[2m])) by (le))

Table 6-405 NfAccess Token Latency 50%

Field	Details
Description	Measures the rate of time taken for processing NfAccess token latency falling in 50 percentile of the latency value.
Expression	histogram_quantile(0.50, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namespace,acelabel="\$namespace",Route_path="/oauth2/token",Method="POST"}[2m])) by (le))

Table 6-406 Discovery SLF Latency 99%

Field	Details
Description	Measures the rate of SLF discovery request falling in 99 percentile of the latency value.
Expression	histogram_quantile(0.99, sum(rate(ocnrf_slf_jetty_latency_seconds_bucket{kubernetes_namespace=\$namespace,ServiceOperation="NfDiscover"}[2m])) by (le))

Table 6-407 Discovery SLF Latency 95%

Field	Details
Description	Measures the rate of SLF discovery request falling in 95 percentile of the latency value.

Table 6-407 (Cont.) Discovery SLF Latency 95%

Field	Details
Expression	histogram_quantile(0.95, sum(rate(ocnrf_slf_jetty_latency_seconds_bucket{kubernetes_namespace=\"\$namespace\",ServiceOperation=\"\$NfDiscover\"}[2m])) by (le))

Table 6-408 Discovery SLF Latency 90%

Field	Details
Description	Measures the rate of SLF discovery request falling in 90 percentile of the latency value.
Expression	histogram_quantile(0.9, sum(rate(ocnrf_slf_jetty_latency_seconds_bucket{kubernetes_namespace=\"\$namespace\",ServiceOperation=\"\$NfDiscover\"}[2m])) by (le))

Table 6-409 Discovery SLF Latency 50%

Field	Details
Description	Measures the rate of SLF discovery request falling in 50 percentile of the latency value.
Expression	histogram_quantile(0.5, sum(rate(ocnrf_slf_jetty_latency_seconds_bucket{kubernetes_namespace=\"\$namespace\",ServiceOperation=\"\$NfDiscover\"}[2m])) by (le))

Table 6-410 Discovery Latency 99%

Field	Details
Description	Measures the rate of discovery request falling in 99 percentile of the latency value.
Expression	histogram_quantile(0.99, sum(rate(ocnrf_message_processing_time_seconds_bucket{kubernetes_namespace=\"\$namespace\",ServiceOperation=\"\$NfDiscover\"}[2m])) by (le))

Table 6-411 Discovery Latency 90%

Field	Details
Description	Measures the rate of discovery request falling in 90 percentile of the latency value.
Expression	histogram_quantile(0.9, sum(rate(ocnrf_message_processing_time_seconds_bucket{kubernetes_namespace=\"\$namespace\",ServiceOperation=\"\$NfDiscover\"}[2m])) by (le))

Table 6-412 Discovery Latency 50%

Field	Details
Description	Measures the rate of discovery request falling in 50 percentile of the latency value.
Expression	histogram_quantile(0.5, sum(rate(ocnrf_message_processing_time_seconds_bucket{kubernetes_namespace=\"\$namespace\",ServiceOperation=\"\$NfDiscover\"}[2m])) by (le))

Table 6-413 Discovery Latency 95%

Field	Details
Description	Measures the rate of discovery request falling in 95 percentile of the latency value.
Expression	histogram_quantile(0.95, sum(rate(ocnrf_message_processing_time_seconds_bucket{kubernetes_namespace=\"\$namespace\",ServiceOperation=\"\$NfDiscover\"}[2m])) by (le))

Table 6-414 Ingress Gateway Discovery Latency 99%

Field	Details
Description	Measures the rate of discovery request falling in 99 percentile of the latency value at Ingress Gateway.
Expression	histogram_quantile(0.99, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namespace,Route_path="/nnrf-disc/v1/nf-instances/**"}[2m])) by (le))

Table 6-415 Ingress Gateway Discovery Latency 90%

Field	Details
Description	Measures the rate of discovery request falling in 90 percentile of the latency value at Ingress Gateway.
Expression	histogram_quantile(0.90, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namespace,Route_path="/nnrf-disc/v1/nf-instances/**"}[2m])) by (le))

Table 6-416 Ingress Gateway Discovery Latency 50%

Field	Details
Description	Measures the rate of discovery request falling in 50 percentile of the latency value at Ingress Gateway.
Expression	histogram_quantile(0.5, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namespace,Route_path="/nnrf-disc/v1/nf-instances/**"}[2m])) by (le))

Table 6-417 Ingress Gateway Discovery Latency 95%

Field	Details
Description	Measures the rate of discovery request falling in 95 percentile of the latency value at Ingress Gateway.
Expression	histogram_quantile(0.95, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namespace,Route_path="/nnrf-disc/v1/nf-instances/**"}[2m])) by (le))

Table 6-418 Ingress Gateway Backend Latency 99%

Field	Details
Description	Measures the rate of request falling in 99 percentile of the latency value at Ingress Gateway backend.

Table 6-418 (Cont.) Ingress Gateway Backend Latency 99%

Field	Details
Expression	histogram_quantile(0.99, sum(rate(oc_ingressgateway_server_latency_seconds_bucket{\$namespace_label}="\$namespace",Method="GET"}[2m])) by (le))

Table 6-419 Ingress Gateway Backend Latency 95%

Field	Details
Description	Measures the rate of request falling in 95 percentile of the latency value at Ingress Gateway backend.
Expression	histogram_quantile(0.95, sum(rate(oc_ingressgateway_server_latency_seconds_bucket{\$namespace_label}="\$namespace",Method="GET"}[2m])) by (le))

Table 6-420 Ingress Gateway Backend Latency 90%

Field	Details
Description	Measures the rate of request falling in 90 percentile of the latency value at Ingress Gateway backend.
Expression	histogram_quantile(0.90, sum(rate(oc_ingressgateway_server_latency_seconds_bucket{\$namespace_label}="\$namespace",Method="GET"}[2m])) by (le))

Table 6-421 Ingress Gateway Backend Latency 50%

Field	Details
Description	Measures the rate of request falling in 50 percentile of the latency value at Ingress Gateway backend.
Expression	histogram_quantile(0.5, sum(rate(oc_ingressgateway_server_latency_seconds_bucket{\$namespace_label}="\$namespace",Method="GET"}[2m])) by (le))

Table 6-422 Discovery Cache Sync

Field	Details
Description	Measures the rate at which in-memory cache entries in the nfdiscovery are synched with Cache Data Service.
Expression	sum(rate(ocnrf_cache_sync_count_total{namespace="\$namespace",container="nfdiscovery"}[2m]))

Table 6-423 Ingress Gateway Latency 99%

Field	Details
Description	Measures the rate of request falling in 99 percentile of the latency value at Ingress Gateway.

Table 6-423 (Cont.) Ingress Gateway Latency 99%

Field	Details
Expression	histogram_quantile(0.99, sum(rate(oc_ingressgateway_request_latency_seconds_bucket{\$namespace},Method="GET")[2m])) by (le))

Table 6-424 Ingress Gateway Latency 95%

Field	Details
Description	Measures the rate of request falling in 95 percentile of the latency value at Ingress Gateway.
Expression	histogram_quantile(0.95, sum(rate(oc_ingressgateway_request_latency_seconds_bucket{\$namespace},Method="GET")[2m])) by (le))

Table 6-425 Ingress Gateway Latency 90%

Field	Details
Description	Measures the rate of request falling in 90 percentile of the latency value at Ingress Gateway.
Expression	histogram_quantile(0.90, sum(rate(oc_ingressgateway_request_latency_seconds_bucket{\$namespace},Method="GET")[2m])) by (le))

Table 6-426 Ingress Gateway Latency 50%

Field	Details
Description	Measures the rate of request falling in 50 percentile of the latency value at Ingress Gateway.
Expression	histogram_quantile(0.50, sum(rate(oc_ingressgateway_request_latency_seconds_bucket{\$namespace},Method="GET")[2m])) by (le))

Table 6-427 Forward Latency 99%

Field	Details
Description	Measures the rate of forward request falling in 99 percentile of the latency value.
Expression	histogram_quantile(0.99, sum(rate(ocnrf_forward_jetty_latency_seconds_bucket{\$namespace},ServiceOperation="NfDiscover")[2m])) by (le))

Table 6-428 Forward Latency 95%

Field	Details
Description	Measures the rate of forward request falling in 95 percentile of the latency value.
Expression	histogram_quantile(0.95, sum(rate(ocnrf_forward_jetty_latency_seconds_bucket{\$namespace},ServiceOperation="NfDiscover")[2m])) by (le))

Table 6-429 Forward Latency 90%

Field	Details
Description	Measures the rate of forward request falling in 90 percentile of the latency value.
Expression	histogram_quantile(0.90, sum(rate(ocnrf_forward_jetty_latency_seconds_bucket{\$namespacelabel="\$namespace",ServiceOperation="NfDiscover"}[2m])) by (le))

Table 6-430 Forward Latency 50%

Field	Details
Description	Measures the rate of forward request falling in 50 percentile of the latency value.
Expression	histogram_quantile(0.50, sum(rate(ocnrf_forward_jetty_latency_seconds_bucket{\$namespacelabel="\$namespace",ServiceOperation="NfDiscover"}[2m])) by (le))

Table 6-431 NfStatusSubscribe Latency 99%

Field	Details
Description	Measures the rate of NF status subscription request falling in 99 percentile of the latency value.
Expression	histogram_quantile(0.99, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namespacelabel="\$namespace",Route_path="/nnrf-nfm/v1/subscriptions/**",Method="POST"}[2m])) by (le))

Table 6-432 NfStatusSubscribe Latency 95%

Field	Details
Description	Measures the rate of NF status subscription request falling in 95 percentile of the latency value.
Expression	histogram_quantile(0.95, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namespacelabel="\$namespace",Route_path="/nnrf-nfm/v1/subscriptions/**",Method="POST"}[2m])) by (le))

Table 6-433 NfStatusSubscribe Latency 90%

Field	Details
Description	Measures the rate of NF status subscription request falling in 90 percentile of the latency value.
Expression	histogram_quantile(0.90, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namespacelabel="\$namespace",Route_path="/nnrf-nfm/v1/subscriptions/**",Method="POST"}[2m])) by (le))

Table 6-434 NfStatusSubscribe Latency 50%

Field	Details
Description	Measures the rate of NF status subscription request falling in 50 percentile of the latency value.
Expression	histogram_quantile(0.5, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namesp acelabel="\$namespace",Route_path="/nnrf-nfm/v1/subscriptions/**",Method="POST"} [2m])) by (le))

Table 6-435 NfStatusSubscribe Latency (PATCH) 99%

Field	Details
Description	Measures the rate of NF status subscription (PATCH) request falling in 99 percentile of the latency value.
Expression	histogram_quantile(0.99, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namesp acelabel="\$namespace",Route_path="/nnrf-nfm/v1/subscriptions/ **",Method="PATCH"}[2m])) by (le))

Table 6-436 NfStatusSubscribe Latency (PATCH) 95%

Field	Details
Description	Measures the rate of NF status subscription (PATCH) request falling in 95 percentile of the latency value.
Expression	histogram_quantile(0.95, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namesp acelabel="\$namespace",Route_path="/nnrf-nfm/v1/subscriptions/ **",Method="PATCH"}[2m])) by (le))

Table 6-437 NfStatusSubscribe Latency (PATCH) 90%

Field	Details
Description	Measures the rate of NF status subscription (PATCH) request falling in 90 percentile of the latency value.
Expression	histogram_quantile(0.90, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namesp acelabel="\$namespace",Route_path="/nnrf-nfm/v1/subscriptions/ **",Method="PATCH"}[2m])) by (le))

Table 6-438 NfStatusSubscribe Latency (PATCH) 50%

Field	Details
Description	Measures the rate of NF status subscription (PATCH) request falling in 50 percentile of the latency value.
Expression	histogram_quantile(0.50, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namesp acelabel="\$namespace",Route_path="/nnrf-nfm/v1/subscriptions/ **",Method="PATCH"}[2m])) by (le))

Table 6-439 NfStatusUnsubscribe Latency 99%

Field	Details
Description	Measures the rate of status unsubscribe request falling in 99 percentile of the latency value.
Expression	<code> histogram_quantile(0.99, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namesp aceLabel="\$namespace",Route_path="/nnrf-nfm/v1/subscriptions/ **",Method="DELETE"}[2m])) by (le)) </code>

Table 6-440 NfStatusUnsubscribe Latency 95%

Field	Details
Description	Measures the rate of status unsubscribe request falling in 95 percentile of the latency value.
Expression	<code> histogram_quantile(0.95, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namesp aceLabel="\$namespace",Route_path="/nnrf-nfm/v1/subscriptions/ **",Method="DELETE"}[2m])) by (le)) </code>

Table 6-441 NfStatusUnsubscribe Latency 90%

Field	Details
Description	Measures the rate of status unsubscribe request falling in 90 percentile of the latency value.
Expression	<code> histogram_quantile(0.90, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namesp aceLabel="\$namespace",Route_path="/nnrf-nfm/v1/subscriptions/ **",Method="DELETE"}[2m])) by (le)) </code>

Table 6-442 NfStatusUnsubscribe Latency 50%

Field	Details
Description	Measures the rate of status unsubscribe request falling in 50 percentile of the latency value.
Expression	<code> histogram_quantile(0.50, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namesp aceLabel="\$namespace",Route_path="/nnrf-nfm/v1/subscriptions/ **",Method="DELETE"}[2m])) by (le)) </code>

Table 6-443 NfNotification trigger Success

Field	Details
Description	Measures the rate of success notification trigger sent to nfSubscription service from the nfRegistration and nrauditor services.
Expression	<code> sum(rate(ocnrf_nfNotification_trigger_total{errorReason="noError",namespace="\$nam espace"}[2m])) </code>

Table 6-444 NfNotification trigger Failure

Field	Details
Description	Measures the rate of error notification trigger sent to nfSubscription service from the nfregistration and nrauditor services.
Expression	sum(rate(ocnrf_nfNotification_trigger_total{errorReason!="noError",namespace="\$namespace"}[2m]))

Table 6-445 NfUpdate Latency 99%

Field	Details
Description	Measures the rate of update request falling in 99 percentile of the latency value.
Expression	histogram_quantile(0.99, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namespace,acelabel="\$namespace",Route_path="/nnrf-nfm/v1/nf-instances/**",Method="PATCH"}[2m])) by (le))

Table 6-446 NfUpdate Latency 95%

Field	Details
Description	Measures the rate of update request falling in 95 percentile of the latency value.
Expression	histogram_quantile(0.95, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namespace,acelabel="\$namespace",Route_path="/nnrf-nfm/v1/nf-instances/**",Method="PATCH"}[2m])) by (le))

Table 6-447 NfUpdate Latency 90%

Field	Details
Description	Measures the rate of update request falling in 90 percentile of the latency value.
Expression	histogram_quantile(0.90, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namespace,acelabel="\$namespace",Route_path="/nnrf-nfm/v1/nf-instances/**",Method="PATCH"}[2m])) by (le))

Table 6-448 NfUpdate Latency 50%

Field	Details
Description	Measures the rate of update request falling in 50 percentile of the latency value.
Expression	histogram_quantile(0.50, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namespace,acelabel="\$namespace",Route_path="/nnrf-nfm/v1/nf-instances/**",Method="PATCH"}[2m])) by (le))

Table 6-449 NfRegister Latency 99%

Field	Details
Description	Measures the rate of register request falling in 99 percentile of the latency value.

Table 6-449 (Cont.) NfRegister Latency 99%

Field	Details
Expression	histogram_quantile(0.99, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namespace,acelabel="\$namespace",Route_path="/nnrf-nfm/v1/nf-instances/**",Method="PUT"}[2m])) by (le))

Table 6-450 NfRegister Latency 95%

Field	Details
Description	Measures the rate of register request falling in 95 percentile of the latency value.
Expression	histogram_quantile(0.95, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namespace,acelabel="\$namespace",Route_path="/nnrf-nfm/v1/nf-instances/**",Method="PUT"}[2m])) by (le))

Table 6-451 NfRegister Latency 90%

Field	Details
Description	Measures the rate of register request falling in 90 percentile of the latency value.
Expression	histogram_quantile(0.90, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namespace,acelabel="\$namespace",Route_path="/nnrf-nfm/v1/nf-instances/**",Method="PUT"}[2m])) by (le))

Table 6-452 NfRegister Latency 50%

Field	Details
Description	Measures the rate of register request falling in 50 percentile of the latency value.
Expression	histogram_quantile(0.5, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namespace,acelabel="\$namespace",Route_path="/nnrf-nfm/v1/nf-instances/**",Method="PUT"}[2m])) by (le))

Table 6-453 NfDeregister Latency 99%

Field	Details
Description	Measures the rate of deregister request falling in 99 percentile of the latency value.
Expression	histogram_quantile(0.99, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namespace,acelabel="\$namespace",Route_path="/nnrf-nfm/v1/nf-instances/**",Method="DELETE"}[2m])) by (le))

Table 6-454 NfDeregister Latency 95%

Field	Details
Description	Measures the rate of deregister request falling in 95 percentile of the latency value.

Table 6-454 (Cont.) NfDeregister Latency 95%

Field	Details
Expression	<code> histogram_quantile(0.95, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namesp aceLabel="\$namespace",Route_path="/nnrf-nfm/v1/nf-instances/ **",Method="DELETE"}[2m])) by (le)) </code>

Table 6-455 NfDeregister Latency 90%

Field	Details
Description	Measures the rate of deregister request falling in 90 percentile of the latency value.
Expression	<code> histogram_quantile(0.90, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namesp aceLabel="\$namespace",Route_path="/nnrf-nfm/v1/nf-instances/ **",Method="DELETE"}[2m])) by (le)) </code>

Table 6-456 NfDeregister Latency 50%

Field	Details
Description	Measures the rate of deregister request falling in 50 percentile of the latency value.
Expression	<code> histogram_quantile(0.5, sum(rate(oc_ingressgateway_request_processing_latency_seconds_bucket{\$namesp aceLabel="\$namespace",Route_path="/nnrf-nfm/v1/nf-instances/ **",Method="DELETE"}[2m])) by (le)) </code>

Table 6-457 NfDiscovery Database Latency 99%

Field	Details
Description	Measures the rate of discovery request falling in 99 percentile of the latency value.
Expression	<code> histogram_quantile(0.99, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace =\"\$namespace\",tableName=\"NfInstances\",serviceOperation=\"NfDiscover\"}[2m])) by (le)) </code>

Table 6-458 NfDiscovery Database Latency 95%

Field	Details
Description	Measures the rate of discovery request falling in 95 percentile of the latency value.
Expression	<code> histogram_quantile(0.95, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace =\"\$namespace\",tableName=\"NfInstances\",serviceOperation=\"NfDiscover\"}[2m])) by (le)) </code>

Table 6-459 NfDiscovery Database Latency 90%

Field	Details
Description	Measures the rate of discovery request falling in 90 percentile of the latency value.

Table 6-459 (Cont.) NfDiscovery Database Latency 90%

Field	Details
Expression	histogram_quantile(0.9, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace= "\$namespace",tableName="NfInstances",serviceOperation="NfDiscover"}[2m])) by (le))

Table 6-460 NfDiscovery Database Latency 50%

Field	Details
Description	Measures the rate of discovery request falling in 50 percentile of the latency value.
Expression	histogram_quantile(0.5, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace= "\$namespace",tableName="NfInstances",serviceOperation="NfDiscover"}[2m])) by (le))

Table 6-461 NfRegistration Database Latency 99%

Field	Details
Description	Measures the rate of NfRegistration request falling in 99 percentile of the latency value.
Expression	histogram_quantile(0.99, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace= "\$namespace",tableName="NfInstances",serviceOperation="NfRegister"}[2m])) by (le))

Table 6-462 NfRegistration Database Latency 95%

Field	Details
Description	Measures the rate of NfRegistration request falling in 95 percentile of the latency value.
Expression	histogram_quantile(0.95, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace= "\$namespace",tableName="NfInstances",serviceOperation="NfRegister"}[2m])) by (le))

Table 6-463 NfRegistration Database Latency 90%

Field	Details
Description	Measures the rate of NfRegistration request falling in 90 percentile of the latency value.
Expression	histogram_quantile(0.90, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace= "\$namespace",tableName="NfInstances",serviceOperation="NfRegister"}[2m])) by (le))

Table 6-464 NfRegistration Database Latency 50%

Field	Details
Description	Measures the rate of NfRegistration request falling in 50 percentile of the latency value.
Expression	histogram_quantile(0.50, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace= "\$namespace",tableName="NfInstances",serviceOperation="NfRegister"}[2m])) by (le))

Table 6-465 NfUpdate Database Latency 99%

Field	Details
Description	Measures the rate of NfUpdate request falling in 99 percentile of the latency value.
Expression	histogram_quantile(0.99, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace= "\$namespace",tableName="NfInstances",serviceOperation="NfUpdate"}[2m])) by (le))

Table 6-466 NfUpdate Database Latency 95%

Field	Details
Description	Measures the rate of NfUpdate request falling in 95 percentile of the latency value.
Expression	histogram_quantile(0.95, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace= "\$namespace",tableName="NfInstances",serviceOperation="NfUpdate"}[2m])) by (le))

Table 6-467 NfUpdate Database Latency 90%

Field	Details
Description	Measures the rate of NfUpdate request falling in 90 percentile of the latency value.
Expression	histogram_quantile(0.90, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace= "\$namespace",tableName="NfInstances",serviceOperation="NfUpdate"}[2m])) by (le))

Table 6-468 NfUpdate Database Latency 50%

Field	Details
Description	Measures the rate of NfUpdate request falling in 50 percentile of the latency value.
Expression	histogram_quantile(0.50, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace= "\$namespace",tableName="NfInstances",serviceOperation="NfUpdate"}[2m])) by (le))

Table 6-469 NfHeartBeat Database Latency 99%

Field	Details
Description	Measures the rate of NfHeartBeat request falling in 99 percentile of the latency value.
Expression	<code> histogram_quantile(0.99, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace=\\\$namespace\\},tableName=\\NfInstances\\,serviceOperation=\\NfHeartBeat\\}[2m])) by (le)) </code>

Table 6-470 NfHeartBeat Database Latency 95%

Field	Details
Description	Measures the rate of NfHeartBeat request falling in 95 percentile of the latency value.
Expression	<code> histogram_quantile(0.95, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace=\\\$namespace\\},tableName=\\NfInstances\\,serviceOperation=\\NfHeartBeat\\}[2m])) by (le)) </code>

Table 6-471 NfHeartBeat Database Latency 90%

Field	Details
Description	Measures the rate of NfHeartBeat request falling in 90 percentile of the latency value.
Expression	<code> histogram_quantile(0.90, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace=\\\$namespace\\},tableName=\\NfInstances\\,serviceOperation=\\NfHeartBeat\\}[2m])) by (le)) </code>

Table 6-472 NfHeartBeat Database Latency 50%

Field	Details
Description	Measures the rate of NfHeartBeat request falling in 50 percentile of the latency value.
Expression	<code> histogram_quantile(0.50, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace=\\\$namespace\\},tableName=\\NfInstances\\,serviceOperation=\\NfHeartBeat\\}[2m])) by (le)) </code>

Table 6-473 NfDeregister Database Latency 99%

Field	Details
Description	Measures the rate of NfDeregister request falling in 99 percentile of the latency value.
Expression	<code> histogram_quantile(0.99, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace=\\\$namespace\\},tableName=\\NfInstances\\,serviceOperation=\\NfDeregister\\}[2m])) by (le)) </code>

Table 6-474 NfDeregister Database Latency 95%

Field	Details
Description	Measures the rate of NfDeregister request falling in 95 percentile of the latency value.

Table 6-474 (Cont.) NfDeregister Database Latency 95%

Field	Details
Expression	histogram_quantile(0.95, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace =\'\$namespace\',tableName=\'NfInstances\',serviceOperation=\'NfDeregister\'})[2m])) by (le))

Table 6-475 NfDeregister Database Latency 90%

Field	Details
Description	Measures the rate of NfDeregister request falling in 90 percentile of the latency value.
Expression	histogram_quantile(0.9, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace =\'\$namespace\',tableName=\'NfInstances\',serviceOperation=\'NfDeregister\'})[2m])) by (le))

Table 6-476 NfDeregister Database Latency 50%

Field	Details
Description	Measures the rate of NfDeregister request falling in 50 percentile of the latency value.
Expression	histogram_quantile(0.5, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace =\'\$namespace\',tableName=\'NfInstances\',serviceOperation=\'NfDeregister\'})[2m])) by (le))

Table 6-477 NfSubscribe Database Latency 99%

Field	Details
Description	Measures the rate of NfSubscribe request falling in 99 percentile of the latency value.
Expression	histogram_quantile(0.99, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace =\'\$namespace\',tableName=\'NfSubscriptions\',serviceOperation=\'NfSubscribe\'} [2m])) by (le))

Table 6-478 NfSubscribe Database Latency 95%

Field	Details
Description	Measures the rate of NfSubscribe request falling in 95 percentile of the latency value.
Expression	histogram_quantile(0.95, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace =\'\$namespace\',tableName=\'NfSubscriptions\',serviceOperation=\'NfSubscribe\'} [2m])) by (le))

Table 6-479 NfSubscribe Database Latency 90%

Field	Details
Description	Measures the rate of NfSubscribe request falling in 90 percentile of the latency value.

Table 6-479 (Cont.) NfSubscribe Database Latency 90%

Field	Details
Expression	histogram_quantile(0.9, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace= "\$namespace",tableName="NfSubscriptions",serviceOperation="NfSubscribe"} [2m])) by (le))

Table 6-480 NfSubscribe Database Latency 50%

Field	Details
Description	Measures the rate of NfSubscribe request falling in 50 percentile of the latency value.
Expression	histogram_quantile(0.5, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace= "\$namespace",tableName="NfSubscriptions",serviceOperation="NfSubscribe"} [2m])) by (le))

Table 6-481 NfUnsubscribe Database Latency 99%

Field	Details
Description	Measures the rate of NfUnsubscribe request falling in 99 percentile of the latency value.
Expression	histogram_quantile(0.99, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace= "\$namespace",tableName="NfSubscriptions",serviceOperation="NfUnsubscribe"} [2m])) by (le))

Table 6-482 NfUnsubscribe Database Latency 95%

Field	Details
Description	Measures the rate of NfUnsubscribe request falling in 95 percentile of the latency value.
Expression	histogram_quantile(0.95, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace= "\$namespace",tableName="NfSubscriptions",serviceOperation="NfUnsubscribe"} [2m])) by (le))

Table 6-483 NfUnsubscribe Database Latency 90%

Field	Details
Description	Measures the rate of NfUnsubscribe request falling in 90 percentile of the latency value.
Expression	histogram_quantile(0.90, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace= "\$namespace",tableName="NfSubscriptions",serviceOperation="NfUnsubscribe"} [2m])) by (le))

Table 6-484 NfUnsubscribe Database Latency 50%

Field	Details
Description	Measures the rate of NfUnsubscribe request falling in 50 percentile of the latency value.
Expression	histogram_quantile(0.5, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace=\"\$namespace\",tableName=\"NfSubscriptions\",serviceOperation=\"NfUnsubscribe\"}[2m])) by (le))

Table 6-485 NfStatusNotify Database Latency 99%

Field	Details
Description	Measures the rate of NfStatusNotify request falling in 99 percentile of the latency value.
Expression	histogram_quantile(0.99, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace=\"\$namespace\",tableName=\"NfSubscriptions\",serviceOperation=\"NfStatusNotify\"}[2m])) by (le))

Table 6-486 NfStatusNotify Database Latency 95%

Field	Details
Description	Measures the rate of NfStatusNotify request falling in 95 percentile of the latency value.
Expression	histogram_quantile(0.95, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace=\"\$namespace\",tableName=\"NfSubscriptions\",serviceOperation=\"NfStatusNotify\"}[2m])) by (le))

Table 6-487 NfStatusNotify Database Latency 90%

Field	Details
Description	Measures the rate of NfStatusNotify request falling in 90 percentile of the latency value.
Expression	histogram_quantile(0.9, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace=\"\$namespace\",tableName=\"NfSubscriptions\",serviceOperation=\"NfStatusNotify\"}[2m])) by (le))

Table 6-488 NfStatusNotify Database Latency 50%

Field	Details
Description	Measures the rate of NfStatusNotify request falling in 50 percentile of the latency value.
Expression	histogram_quantile(0.9, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace=\"\$namespace\",tableName=\"NfSubscriptions\",serviceOperation=\"NfStatusNotify\"}[2m])) by (le))

Table 6-489 NfAccessToken Database Latency 99%

Field	Details
Description	Measures the rate of NfAccessToken request falling in 99 percentile of the latency value.
Expression	<pre> histogram_quantile(0.99, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace= \"\$namespace\",tableName=\"NfInstances\",serviceOperation=\"NfAccessToken\"} [2m])) by (le)) </pre>

Table 6-490 NfAccessToken Database Latency 95%

Field	Details
Description	Measures the rate of NfAccessToken request falling in 95 percentile of the latency value.
Expression	<pre> histogram_quantile(0.95, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace= \"\$namespace\",tableName=\"NfInstances\",serviceOperation=\"NfAccessToken\"} [2m])) by (le)) </pre>

Table 6-491 NfAccessToken Database Latency 90%

Field	Details
Description	Measures the rate of NfAccessToken request falling in 90 percentile of the latency value.
Expression	<pre> histogram_quantile(0.9, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace= \"\$namespace\",tableName=\"NfInstances\",serviceOperation=\"NfAccessToken\"} [2m])) by (le)) </pre>

Table 6-492 NfAccessToken Database Latency 50%

Field	Details
Description	Measures the rate of NfAccessToken request falling in 50 percentile of the latency value.
Expression	<pre> histogram_quantile(0.5, sum(rate(ocnrf_dbmetrics_round_trip_time_seconds_bucket{kubernetes_namespace= \"\$namespace\",tableName=\"NfInstances\",serviceOperation=\"NfAccessToken\"} [2m])) by (le)) </pre>

Note

For example, if min is 0 and max is 100, the number of request falling in 95 percentile, which is quantile="0.95", is measured in the Latency 95% KPI.

Table 6-493 NF Profile Size Average

Field	Details
Description	Measures the average size of the NF profiles registered at NRF. For more information about metric used, see NRF NF Metrics .
Expression	avg by (NfType) (ocnrf_nf_profile_size{namespace="\$namespace"})

Table 6-494 NF Profile Size Max

Field	Details
Description	Measures the maximum size of the NF profiles registered at NRF. For more information about metric used, see NRF NF Metrics .
Expression	max by (NfType) (ocnrf_nf_profile_size{namespace="\$namespace"})

Table 6-495 Discovery Response Size

Field	Details
Description	Measures the NfDiscovery response size. For more information about metric used, see NRF NF Metrics .
Expression	histogram_quantile(0.99,sum(rate(ocnrf_nfDiscover_tx_response_size_bytes_bucket{namespace="\$namespace",TargetNfType="<NF>"}[2m])) by (TargetNfType,le)) Where, <NF>- Name of Network Function. (For example, AUSF, AMF, CHF) For example, histogram_quantile(0.99, sum(rate(ocnrf_nfDiscover_tx_response_size_bytes_bucket{namespace="\$namespace",TargetNfType="AMF"}[2m])) by (TargetNfType,le))

Table 6-496 NF Profile Size Limit Breached

Field	Details
Description	Measures the rate of requests rejected due to breach in nfProfile size limit.
Expression	sum(rate(ocnrf_nfProfile_size_limit_breached_total{namespace="\$namespace"}[2m])) by (NfInstanceId, ServiceOperation)

6.2.2 Resource Usage KPIs

This section lists the KPIs to measure the CPU, Memory usage, and Kubernetes Horizontal Pod Autoscaling (HPA) counts at NRF. These KPIs are calculated based on Kubernetes metrics.

Table 6-497 nfregistration

Field	Details
Description	Measures the rate of CPU resources consumed by the containers for nfregistration service.
Expression	sum(rate(container_cpu_usage_seconds_total{container="nfregistration",namespace="\$namespace"}[2m]))

Table 6-498 nfsubscription

Field	Details
Description	Measures the rate of CPU resources consumed by the containers for nfsubscription service.
Expression	sum(rate(container_cpu_usage_seconds_total{container="nfsubscription",namespace="\$namespace"}[2m]))

Table 6-499 nfdiscovery

Field	Details
Description	Measures the rate of CPU resources consumed by the containers for nfdiscovery service.
Expression	sum(rate(container_cpu_usage_seconds_total{container="nfdiscovery",namespace="\$namespace"}[2m]))

Table 6-500 nrfauditor

Field	Details
Description	Measures the rate of CPU resources consumed by the containers for nrfauditor service.
Expression	sum(rate(container_cpu_usage_seconds_total{container="nrfauditor",namespace="\$namespace"}[2m]))

Table 6-501 nfaccessstoken

Field	Details
Description	Measures the rate of CPU resources consumed by the containers for nfaccessstoken service.
Expression	sum(rate(container_cpu_usage_seconds_total{container="nfaccessstoken",namespace="\$namespace"}[2m]))

Table 6-502 nrfconfiguration

Field	Details
Description	Measures the rate of CPU resources consumed by the containers for nrfconfiguration service.
Expression	sum(rate(container_cpu_usage_seconds_total{container="nrfconfiguration",namespace="\$namespace"}[2m]))

Table 6-503 ingress-gateway

Field	Details
Description	Measures the rate of CPU resources consumed by the containers for Ingress Gateway service.
Expression	sum(rate(container_cpu_usage_seconds_total{container="ingressgateway",namespace="\$namespace"}[2m]))

Table 6-504 egress-gateway

Field	Details
Description	Measures the rate of CPU resources consumed by the containers for Egress Gateway service.
Expression	sum(rate(container_cpu_usage_seconds_total{container="egressgateway",namespace="\$namespace"}[2m]))

Table 6-505 nfregistration

Field	Details
Description	Measures the amount of memory consumed by the containers for nfregistration service.
Expression	sum(container_memory_usage_bytes{container="nfregistration",namespace="\$namespace"})

Table 6-506 nfsubscription

Field	Details
Description	Measures the amount of memory consumed by the containers for nfsubscription service.
Expression	sum(container_memory_usage_bytes{container="nfsubscription",namespace="\$namespace"})

Table 6-507 nfdiscovery

Field	Details
Description	Measures the amount of memory consumed by the containers for nfdiscovery service.
Expression	sum(container_memory_usage_bytes{container="nfdiscovery",namespace="\$namespace"})

Table 6-508 nrfauditor

Field	Details
Description	Measures the amount of memory consumed by the containers for nrfauditor service.
Expression	sum(container_memory_usage_bytes{container="nrfauditor",namespace="\$namespace"})

Table 6-509 nfaccessstoken

Field	Details
Description	Measures the amount of memory consumed by the containers for nfaccessstoken service.
Expression	sum(container_memory_usage_bytes{container="nfaccessstoken",namespace="\$namespace"})

Table 6-510 nrfconfiguration

Field	Details
Description	Measures the amount of memory consumed by the containers for nrfconfiguration service.
Expression	sum(container_memory_usage_bytes{container="nrfconfiguration",namespace="\$namespace"})

Table 6-511 ingress-gateway

Field	Details
Description	Measures the amount of memory consumed by the containers for Ingress Gateway service.
Expression	sum(container_memory_usage_bytes{container="ingressgateway",namespace="\$namespace"})

Table 6-512 egress-gateway

Field	Details
Description	Measures the amount of memory consumed by the containers for Egress Gateway service.
Expression	sum(container_memory_usage_bytes{container="egressgateway",namespace="\$namespace"})

Table 6-513 ocnrf-ingressgateway

Field	Details
Description	Measures the number of Ingress Gateway replicas currently available and managed by the autoscaler.
Expression	kube_horizontalpodautoscaler_status_current_replicas{namespace="\$namespace",horizontalpodautoscaler=~".*-ingressgateway.*"}

Table 6-514 ocnrf-nfregistration

Field	Details
Description	Measures the number of nfregistration replicas currently available and managed by the autoscaler.
Expression	kube_horizontalpodautoscaler_status_current_replicas{namespace="\$namespace",horizontalpodautoscaler=~".*-nfregistration.*"}

Table 6-515 ocnrf-nfsubscription

Field	Details
Description	Measures the number of nfsubscription replicas currently available and managed by the autoscaler.
Expression	kube_horizontalpodautoscaler_status_current_replicas{namespace="\$namespace",horizontalpodautoscaler=~".*-nfsubscription.*"}

Table 6-516 ocnrf-nfdiscovery

Field	Details
Description	Measures the number of nfdiscovery replicas currently available and managed by the autoscaler.
Expression	kube_horizontalpodautoscaler_status_current_replicas{namespace="\$namespace",horizontalpodautoscaler=~".*-nfdiscovery.*"}

Table 6-517 ocnrf-nfaccess-token

Field	Details
Description	Measures the number of nfaccess-token replicas currently available and managed by the autoscaler.
Expression	kube_horizontalpodautoscaler_status_current_replicas{namespace="\$namespace",horizontalpodautoscaler=~".*-nfaccess-token.*"}

Table 6-518 ocnrf-egressgateway

Field	Details
Description	Measures the number of egressgateway replicas currently available and managed by the autoscaler.
Expression	kube_horizontalpodautoscaler_status_current_replicas{namespace="\$namespace",horizontalpodautoscaler=~".*-egressgateway.*"}

Table 6-519 CPU Usage Percentage (per Ingress Gateway Microservice)

Field	Details
Description	Measure the rate of CPU usage for Ingress Gateway microservice.
Expression	$\frac{(\text{sum}(\text{rate}(\text{cgroup\_cpu\_nanoseconds}\{\text{\$namespace\_label}=\text{"\$namespace"}, \text{\$containerlabel}=\text{"~".*ingressgateway.*"}[5\text{m}]))}{1\text{E}9} / \frac{\text{sum}(\text{system\_cpu\_count}\{\text{\$namespace\_label}=\text{"\$namespace"}, \text{\$containerlabel}=\text{"~".*ingressgateway.*"}))}{100}$

Table 6-520 CPU Usage Percentage (per Egress Gateway Microservice)

Field	Details
Description	Measure the rate of CPU usage for Egress Gateway microservice.
Expression	$\frac{(\text{sum}(\text{rate}(\text{cgroup\_cpu\_nanoseconds}\{\text{\$namespace\_label}=\text{"\$namespace"}, \text{\$containerlabel}=\text{"~".*egressgateway.*"}[5\text{m}]))}{1\text{E}9} / \frac{\text{sum}(\text{system\_cpu\_count}\{\text{\$namespace\_label}=\text{"\$namespace"}, \text{\$containerlabel}=\text{"~".*egressgateway.*"}))}{100}$

Table 6-521 CPU Usage Percentage (per discovery microservice)

Field	Details
Description	Measure the rate of CPU usage for NF Discovery microservice.

Table 6-521 (Cont.) CPU Usage Percentage (per discovery microservice)

Field	Details
Expression	$\frac{(\text{sum}(\text{rate}(\text{cgroup\_cpu\_nanoseconds}\{\$namespace, \$containerlabel=\sim.\text{nfdiscovery.*}\}[5\text{m}])) / 1\text{E9}}{\text{sum}(\text{system\_cpu\_count}\{\$namespace, \$containerlabel=\sim.\text{nfdiscovery.*}\})} * 100$

Table 6-522 CPU Usage Percentage (per nrfcachedata microservice)

Field	Details
Description	Measure the rate of CPU usage NRF cache data microservice.
Expression	$\frac{(\text{sum}(\text{rate}(\text{cgroup\_cpu\_nanoseconds}\{\$namespace, \$containerlabel=\sim.\text{nrfcachedata.*}\}[5\text{m}])) / 1\text{E9}}{\text{sum}(\text{system\_cpu\_count}\{\$namespace, \$containerlabel=\sim.\text{nrfcachedata.*}\})} * 100$

Table 6-523 CPU Usage Percentage (per nrfartisan microservice)

Field	Details
Description	Measure the rate of CPU usage for NRF Artisan microservice.
Expression	$\frac{(\text{sum}(\text{rate}(\text{cgroup\_cpu\_nanoseconds}\{\$namespace, \$containerlabel=\sim.\text{nrfartisan.*}\}[5\text{m}])) / 1\text{E9}}{\text{sum}(\text{system\_cpu\_count}\{\$namespace, \$containerlabel=\sim.\text{nrfartisan.*}\})} * 100$

Table 6-524 CPU Usage Percentage (per nfregistration microservice)

Field	Details
Description	Measure the rate of CPU usage for NF Registration microservice.
Expression	$\frac{(\text{sum}(\text{rate}(\text{cgroup\_cpu\_nanoseconds}\{\$namespace, \$containerlabel=\sim.\text{nfregistration.*}\}[5\text{m}])) / 1\text{E9}}{\text{sum}(\text{system\_cpu\_count}\{\$namespace, \$containerlabel=\sim.\text{nfregistration.*}\})} * 100$

Table 6-525 CPU Usage Percentage (per nfsubscription microservice)

Field	Details
Description	Measure the rate of CPU usage for NF Subscription microservice.
Expression	$\frac{(\text{sum}(\text{rate}(\text{cgroup\_cpu\_nanoseconds}\{\$namespace, \$containerlabel=\sim.\text{nfsubscription.*}\}[5\text{m}])) / 1\text{E9}}{\text{sum}(\text{system\_cpu\_count}\{\$namespace, \$containerlabel=\sim.\text{nfsubscription.*}\})} * 100$

Table 6-526 CPU Usage Percentage (per nfaccess token microservice)

Field	Details
Description	Measure the rate of CPU usage for NF Access Token microservice.

Table 6-526 (Cont.) CPU Usage Percentage (per nfaccess token microservice)

Field	Details
Expression	$\frac{(\text{sum}(\text{rate}(\text{cgroup\_cpu\_nanoseconds}\{\$namespacelabel="\$namespace", \$containerlabel=\sim".*nfaccess token.*"\}[5m])) / 1E9}{\text{sum}(\text{system\_cpu\_count}\{\$namespacelabel="\$namespace", \$containerlabel=\sim".*nfaccess token.*"\})} * 100$

Table 6-527 CPU Usage Percentage (per nrfauditor microservice)

Field	Details
Description	Measure the rate of CPU usage for NRF Auditor microservice.
Expression	$\frac{(\text{sum}(\text{rate}(\text{cgroup\_cpu\_nanoseconds}\{\$namespacelabel="\$namespace", \$containerlabel=\sim".*nrfauditor.*"\}[5m])) / 1E9}{\text{sum}(\text{system\_cpu\_count}\{\$namespacelabel="\$namespace", \$containerlabel=\sim".*nrfauditor.*"\})} * 100$

Table 6-528 CPU Usage Percentage (per nrfconfiguration microservice)

Field	Details
Description	Measure the rate of CPU usage for NRF configuration microservice.
Expression	$\frac{(\text{sum}(\text{rate}(\text{cgroup\_cpu\_nanoseconds}\{\$namespacelabel="\$namespace", \$containerlabel=\sim".*nrfconfiguration.*"\}[5m])) / 1E9}{\text{sum}(\text{system\_cpu\_count}\{\$namespacelabel="\$namespace", \$containerlabel=\sim".*nrfconfiguration.*"\})} * 100$

Table 6-529 Memory Usage (per discovery microservice)

Field	Details
Description	Indicates the memory usage for NF Discovery microservice.
Expression	$\frac{\text{sum}(\text{cgroup\_memory\_bytes}\{\$namespacelabel="\$namespace", \text{microservice}=\sim".*nfdiscovery"\})}{(3*1024*1024*1024*\text{count}(\text{process\_start\_time\_seconds}\{\$namespacelabel="\$namespace", \text{microservice}=\sim".*nfdiscovery"\}))} * 100$

Table 6-530 Memory Usage (per nrfcachedata microservice)

Field	Details
Description	Indicates the memory usage for NRF cache data microservice.
Expression	$\frac{\text{sum}(\text{cgroup\_memory\_bytes}\{\$namespacelabel="\$namespace", \text{microservice}=\sim".*nrfcachedata"\})}{(4*1024*1024*1024*\text{count}(\text{process\_start\_time\_seconds}\{\$namespacelabel="\$namespace", \text{microservice}=\sim".*nrfcachedata"\}))} * 100$

Table 6-531 Memory Usage (per nrfconfiguration microservice)

Field	Details
Description	Indicates the memory usage for NRF configuration microservice.

Table 6-531 (Cont.) Memory Usage (per nrfconfiguration microservice)

Field	Details
Expression	<code>sum(cgroup_memory_bytes{\$namespacelabel="\$namespace", microservice=~".*nrfconfiguration"})/ (2*1024*1024*1024*count(process_start_time_seconds{\$namespacelabel="\$namesp ace",microservice=~".*nrfconfiguration"}))*100</code>

Table 6-532 Memory Usage (per NfAccesstoken microservice)

Field	Details
Description	Indicates the memory usage for NF Access Token microservice.
Expression	<code>sum(cgroup_memory_bytes{\$namespacelabel="\$namespace", microservice=~".*nfaccessstoken"})/ (2*1024*1024*1024*count(process_start_time_seconds{\$namespacelabel="\$namesp ace",microservice=~".*nfaccessstoken"}))*100</code>

Table 6-533 Memory Usage (per NfRegistration microservice)

Field	Details
Description	Indicates the memory usage for NF Registration microservice.
Expression	<code>sum(cgroup_memory_bytes{\$namespacelabel="\$namespace", microservice=~".*nfreistration"})/ (3*1024*1024*1024*count(process_start_time_seconds{\$namespacelabel="\$namesp ace",microservice=~".*nfreistration"}))*100</code>

Table 6-534 Memory Usage (per NfSubscription microservice)

Field	Details
Description	Indicates the memory usage for NF Subscription microservice.
Expression	<code>sum(cgroup_memory_bytes{\$namespacelabel="\$namespace", microservice=~".*nfsubscription"})/ (3*1024*1024*1024*count(process_start_time_seconds{\$namespacelabel="\$namesp ace",microservice=~".*nfsubscription"}))*100</code>

Table 6-535 Memory Usage (per nrfartisan microservice)

Field	Details
Description	Indicates the memory usage for NRF Artisan microservice.
Expression	<code>sum(cgroup_memory_bytes{\$namespacelabel="\$namespace", microservice=~".*nrfartisan"})/ (2*1024*1024*1024*count(process_start_time_seconds{\$namespacelabel="\$namesp ace",microservice=~".*nrfartisan"}))*100</code>

Table 6-536 Memory Usage (per nrfauditor Microservice)

Field	Details
Description	Indicates the memory usage for NRF Auditor microservice.

Table 6-536 (Cont.) Memory Usage (per nrfauditor Microservice)

Field	Details
Expression	<code>sum(cgroup_memory_bytes{\$namespacelabel="\$namespace", microservice=~".*nrfauditor"})/ (3*1024*1024*1024*count(process_start_time_seconds{\$namespacelabel="\$namesp ace",microservice=~".*nrfauditor"}))*100</code>

Table 6-537 Memory Usage (per Egress Gateway Microservice)

Field	Details
Description	Indicates the memory usage for Egress Gateway microservice.
Expression	<code>sum(cgroup_memory_bytes{\$namespacelabel="\$namespace", microservice=~".*egressgateway"})/ (4*1024*1024*1024*count(process_start_time_seconds{\$namespacelabel="\$namespace",microservice=~".*e gressgateway"}))*100</code>

Table 6-538 Memory Usage (per Ingress Gateway Microservice)

Field	Details
Description	Indicates the memory usage for Ingress Gateway microservice.
Expression	<code>sum(cgroup_memory_bytes{\$namespacelabel="\$namespace", microservice=~".*ingressgateway"})/ (4*1024*1024*1024*count(process_start_time_seconds{\$namespacelabel="\$namesp ace",microservice=~".*ingressgateway"}))*100</code>

Pod Count per Microservice**Table 6-539 NF Registration Microservice Pod Count**

Field	Details
Description	Indicates the pod count for NF Registration microservice.
Expression	<code>count(process_start_time_seconds{\$namespacelabel="\$namespace",microservice=~ ".*nfrregistration"})</code>

Table 6-540 NF Discovery Microservice Pod Count

Field	Details
Description	Indicates the pod count for NF Discovery microservice.
Expression	<code>count(process_start_time_seconds{\$namespacelabel="\$namespace",microservice=~ ".*nfdiscovery"})</code>

Table 6-541 NF Subscription Microservice Pod Count

Field	Details
Description	Indicates the pod count for NF Subscription microservice.
Expression	<code>count(process_start_time_seconds{\$namespacelabel="\$namespace",microservice=~ ".*nfsubscription"})</code>

Table 6-542 NF Access Token Microservice Pod Count

Field	Details
Description	Indicates the pod count for NF Access Token microservice.
Expression	<code>count(process_start_time_seconds{\$namespacelabel="\$namespace",microservice=~".*nfaccess token"})</code>

Table 6-543 Ingress Gateway Microservice Pod Count

Field	Details
Description	Indicates the pod count for Ingress Gateway microservice.
Expression	<code>count(process_start_time_seconds{\$namespacelabel="\$namespace",microservice=~".*ingressgateway"})</code>

Table 6-544 Egress Gateway Microservice Pod Count

Field	Details
Description	Indicates the pod count for Egress Gateway microservice.
Expression	<code>count(process_start_time_seconds{\$namespacelabel="\$namespace",microservice=~".*egressgateway"})</code>

6.2.3 Feature Specific KPIs

This section lists the KPIs related to Global Subscription Limit, Pod Protection, NF FQDN validation, Geo redundancy features at NRF, Network Slice Specific Metrics, NRF Growth, Ingress Gateway Pod Protection, and Egress Gateway Pod Throttling features. These KPIs are calculated based on Kubernetes metrics.

6.2.3.1 Global Subscription Limit Feature

6.2.3.1.1 Global Subscription Limit Level

Table 6-545 Active Subscriptions

Field	Details
Description	Measures the total number of active subscriptions.
Expression	<code>ocnrf_nfset_active_subscriptions{namespace="\$namespace"}</code>

Table 6-546 Subscription Limit level

Field	Details
Description	Measures the subscription limit.
Expression	<code>ocnrf_nfset_limit_level{namespace="\$namespace"}</code>

6.2.3.1.2 Subscription Limit Breached

Table 6-547 Total NfStatusSubscribe(Create) Rejected

Field	Details
Description	Measures the rate of create subscription requests that are rejected.
Expression	sum(rate(ocnrf_nfStatusSubscribe_tx_responses_total{namespace="\$namespace",RejectionReason="SubscriptionLimitExceeded",OperationType="Create"}[2m]))

Table 6-548 Total NfStatusSubscribe(Update) Rejected

Field	Details
Description	Measures the rate of update subscription requests that are rejected.
Expression	sum(rate(ocnrf_nfStatusSubscribe_tx_responses_total{namespace="\$namespace",RejectionReason="SubscriptionLimitExceeded",OperationType="Update"}[2m]))

6.2.3.1.3 Efficient Subscription Notification Processing

Table 6-549 Active Subscriptions per Subscriber NF Type

Field	Details
Description	Measures the total number of active subscriptions at the NRF set per subscriber NF type. For more information about the metric used, see NRF NF Metrics .
Expression	sum by (SubscrReqNfType)(max by (SubscrReqNfType, SubscrCondType, nfSetId) (ocnrf_active_subscriptions_count{namespace="\$namespace"}))

Table 6-550 Active Subscriptions per Subscription Condition Type

Field	Details
Description	Measures the total number of active subscriptions at the NRF set per subscription condition type. For more information about the metric used, see NRF NF Metrics .
Expression	sum by (SubscrCondType)(max by (SubscrReqNfType, SubscrCondType, nfSetId) (ocnrf_active_subscriptions_count{namespace="\$namespace"}))

Table 6-551 Active Subscriptions per Subscriber NF Type and Subscription Condition Type

Field	Details
Description	Measures the total number of active subscriptions at the NRF set per subscriber NF type and subscription condition type. For more information about the metric used, see NRF NF Metrics .
Expression	sum by (SubscrReqNfType, SubscrCondType)(max by (SubscrReqNfType, SubscrCondType, nfSetId) (ocnrf_active_subscriptions_count{namespace="\$namespace"}))

6.2.3.2 NF FQDN Validation KPIs

This section lists the network function fully qualified domain name (FQDN) validation KPIs at NRF.

Table 6-552 NfRegister - FQDN Validation Failed

Field	Details
Description	Measures the total number of registration request for which FQDN based authentication failed at NRF. This is based on [NfFqdn :- {{ NfFqdn}}]. For more information about metric used, see NF Authentication Metrics .
Expression	increase(ocnrf_nf_authentication_failure_total{namespace="\$namespace",ServiceOperation="NfRegister"}[5m])

Table 6-553 NfSubscribe - FQDN Validation Failed

Field	Details
Description	Measures the total number of subscription request for which FQDN based authentication failed at NRF. This is based on [NfFqdn :- {{ NfFqdn}}]. For more information about metric used, see NF Authentication Metrics .
Expression	increase(ocnrf_nf_authentication_failure_total{namespace="\$namespace",ServiceOperation="NfStatusSubscribe"}[5m])

Table 6-554 NfDiscover - FQDN Validation Failed

Field	Details
Description	Measures the total number of discovery request for which FQDN based authentication failed at NRF. This is based on [NfFqdn :- {{ NfFqdn}}]. For more information about metric used, see NF Authentication Metrics .
Expression	increase(ocnrf_nf_authentication_failure_total{namespace="\$namespace",ServiceOperation="NfDiscover"}[5m])

Table 6-555 NFAccessToken - FQDN Validation Failed

Field	Details
Description	Measures the total number of access token request for which FQDN based authentication failed at NRF. This is based on [NfFqdn :- {{ NfFqdn}}]. For more information about metric used, see NF Authentication Metrics .
Expression	increase(ocnrf_nf_authentication_failure_total{namespace="\$namespace",ServiceOperation="NFAccessToken"}[5m])

Table 6-556 NFProfileRetrieval - FQDN Validation Failed

Field	Details
Description	Measures the total number of profile retrieval request for which FQDN based authentication failed at NRF. This is based on [NfFqdn :- {{ NfFqdn}}]. For more information about metric used, see NF Authentication Metrics .
Expression	increase(ocnrf_nf_authentication_failure_total{namespace="\$namespace",ServiceOperation="NFProfileRetrieval"}[5m])

Table 6-557 NFListRetrieval - FQDN Validation Failed

Field	Details
Description	Measures the total number of NF list retrieval request for which FQDN based authentication failed at NRF. This is based on [NfFqdn :- {{ NfFqdn }}]. For more information about metric used, see NF Authentication Metrics .
Expression	increase(ocnrf_nf_authentication_failure_total{namespace="\$namespace",ServiceOperation='NFListRetrieval'}[5m])

6.2.3.3 Georedundancy KPIs

This section lists the georedundancy KPIs at NRF.

Table 6-558 Total NFs switch over

Field	Details
Description	Measures the number of NFInstances that got switched over from the mated site. This is based on [ServiceOperation :- {{ Service_Operation }} ,RemoteNrInstanceId :- {{ RemoteNrInstanceId }}]. For more information about metric used, see Georedundancy Metrics .
Expression	increase(ocnrf_nf_switch_over_total{namespace="\$namespace"}[5m])

Table 6-559 Total Subscriptions switch over

Field	Details
Description	Measures the number of NfSubscriptions that got switched over from the mated site. This is based on [ServiceOperation :- {{ ServiceOperation }} RemoteNrInstanceId :- {{ RemoteNrInstanceId }}]. For more information about metric used, see Georedundancy Metrics .
Expression	increase(ocnrf_nfSubscriptions_switch_over_total{namespace="\$namespace"}[5m])

Table 6-560 Total Stale NFs deleted

Field	Details
Description	Measures the number of NFInstances that get deleted by the NrfAuditor when it detects a record to be stale. For more information about metric used, see Georedundancy Metrics .
Expression	increase(ocnrf_stale_nf_deleted_total{namespace="\$namespace"}[5m])

Table 6-561 Total Stale Subscriptions deleted

Field	Details
Description	Measures the number of NfSubscriptions that get deleted by the NrfAuditor when it detects a record to be stale. For more information about metric used, see Georedundancy Metrics .
Expression	increase(ocnrf_stale_nfSubscriptions_deleted_total{namespace="\$namespace"}[5m])

6.2.3.4 Subscription Pod Protection

Table 6-562 Subscription Pod Overall Congestion State

Field	Details
Description	Tracks the overall congestion state per nfSubscription pod.
Expression	sum(ocnrf_pod_congestion_state{namespace="\$namespace"}) by (pod)

Table 6-563 Subscription Pod CPU Congestion state

Field	Details
Description	Tracks the congestion state based on the CPU usage of the subscription pod.
Expression	sum(ocnrf_pod_cpu_congestion_state{namespace="\$namespace"}) by (pod)

Table 6-564 Subscription Pod CPU Usage

Field	Details
Description	Measures the CPU usage of the pod.
Expression	sum(ocnrf_pod_cpu_usage{namespace="\$namespace",container="nfsubscription"}) by (pod)

Table 6-565 Subscription Pod Pending Message Count Congestion state

Field	Details
Description	Tracks the congestion state based on the pending message count of the subscription pod.
Expression	sum(ocnrf_pod_pending_message_count_congestion_state{namespace="\$namespace"}) by (pod)

Table 6-566 Subscription Pod Pending Message Count

Field	Details
Description	Measures the Pending Message Count value of the pod.
Expression	sum(ocnrf_pod_pending_message_count{namespace="\$namespace",container="nfsubscription"}) by (pod)

Table 6-567 Subscription Pod Incoming Connections Rejected

Field	Details
Description	Measures the rate of connections that have been rejected in the DoC or Congested state. This is based on {{pod}}.
Expression	sum(rate(ocnrf_pod_incoming_connection_rejected_total{namespace="\$namespace"}[2m])) by (pod)

Table 6-568 Incoming Connections

Field	Details
Description	Measures the rate of incoming connections. This is based on {{pod}}.
Expression	sum(irate(ocnrf_incoming_connections{namespace="\$namespace"}[2m])) by (pod)

Table 6-569 Max Streams

Field	Details
Description	Tracks the maximum concurrent streams per connection. This is based on {{ pod }} : {{ connectionId }}.
Expression	sum(ocnrf_max_concurrent_streams{namespace="\$namespace"}) by(pod,connectionId)

6.2.3.5 Controlled Shutdown of NRF

This section lists the controlled shutdown KPIs at NRF.

Table 6-570 Operational State {{ pod }}

Field	Details
Description	Measures the Operational State of NRF. The metric is pegged in the NrfAuditor microservice. If any one of the NrfAuditor pod shows the operational state as COMPLETE_SHUTDOWN, then the state shall be considered as Complete Shutdown. For more information about metric used, see NRF NF Metrics .
Expression	sum(ocnrf_operational_state{namespace="\$namespace"}) by (pod)

Table 6-571 NRF Audit status

Field	Details
Description	Measures the audit status of NRF. The metric is pegged in the NrfAuditor microservice. If any one of the NrfAuditor pod shows the audit state as paused then the audit status is considered as paused. For more information about metric used, see NRF NF Metrics .
Expression	sum(ocnrf_audit_status{namespace="\$namespace"})

6.2.3.6 Network Slice Specific KPIs

This section lists the network slice specific KPIs at NRF.

Table 6-572 Request [sNssai: {{ sNssai }}]

Field	Details
Description	Measures the rate of NfRegister requests received at a slice that is identified by specific SNSSAI. For more information about metric used, see Network Slice Specific Metrics .

Table 6-572 (Cont.) Request [sNssai: {{ sNssai }}]

Field	Details
Expression	sum(irate(ocnrf_nfRegister_requests_perSnsai_total{namespace="\$namespace"}[2m])) by(sNssai)

Table 6-573 Success [sNssai:{{ sNssai }}]

Field	Details
Description	Measures the rate of NfRegister successful response sent per slice that is identified by specific SNSSAI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfRegister_success_responses_perSnsai_total{namespace="\$namespace"}[5m])) by (sNssai)

Table 6-574 Failures [sNssai: {{ sNssai }}]

Field	Details
Description	Measures the rate of NfRegister failure response sent per slice that is identified by specific SNSSAI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfRegister_failure_responses_perSnsai_total{namespace="\$namespace"}[2m])) by (sNssai)

Table 6-575 Request [sNssai: {{ sNssai }}]

Field	Details
Description	Measures the rate of NfDeregister requests received at a slice that is identified by specific SNSSAI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfDeregister_requests_perSnsai_total{namespace="\$namespace"}[2m])) by(sNssai)

Table 6-576 Success [sNssai:{{ sNssai }}]

Field	Details
Description	Measures the rate of NfDeregister successful response sent per slice that is identified by specific SNSSAI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfDeregister_success_responses_perSnsai_total{namespace="\$namespace"}[5m])) by (sNssai)

Table 6-577 Failures [sNssai: {{ sNssai }}]

Field	Details
Description	Measures the rate of NfDeregister failure response sent per slice that is identified by specific SNSSAI. For more information about metric used, see Network Slice Specific Metrics .

Table 6-577 (Cont.) Failures [sNssai: {{ sNssai }}]

Field	Details
Expression	sum(irate(ocnrf_nfDeregister_failure_responses_perSnsai_total{namespace="\$namespace"}[2m])) by (sNssai)

Table 6-578 Success [Nsi :{{ Nsi }}]

Field	Details
Description	Measures the rate of NfDeregister successful response sent per slice that is identified by specific NSI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfDeregister_success_responses_perNsi_total{namespace="\$namespace"}[5m])) by (Nsi)

Table 6-579 Failures [Nsi :{{ Nsi }}]

Field	Details
Description	Measures the rate of NfDeregister failure response sent per slice that is identified by specific NSI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfDeregister_failure_responses_perNsi_total{namespace="\$namespace"}[2m])) by (Nsi)

Table 6-580 Requests [sNssai: {{ sNssai }}]

Field	Details
Description	Measures the rate of NfUpdate requests received at a slice that is identified by specific SNSSAI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfUpdate_requests_perSnsai_total{namespace="\$namespace"}[2m])) by(sNssai)

Table 6-581 Success [sNssai:{{ sNssai }}]

Field	Details
Description	Measures the rate of NfUpdate successful response sent per slice that is identified by specific SNSSAI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfUpdate_success_responses_perSnsai_total{namespace="\$namespace"}[5m])) by (sNssai)

Table 6-582 Failures [sNssai: {{ sNssai }}]

Field	Details
Description	Measures the rate of NfUpdate failure response sent per slice that is identified by specific SNSSAI. For more information about metric used, see Network Slice Specific Metrics .

Table 6-582 (Cont.) Failures [sNssai: {{ sNssai }}]

Field	Details
Expression	sum(irate(ocnrf_nfUpdate_failure_responses_perSnsai_total{namespace="\$namespace"}[2m])) by (sNssai)

Table 6-583 Requests [Nsi: {{ Nsi }}]

Field	Details
Description	Measures the rate of NfUpdate requests received at a slice that is identified by specific NSI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfUpdate_requests_perNsi_total{namespace="\$namespace"}[2m])) by (Nsi)

Table 6-584 Success [Nsi :{{ Nsi }}]

Field	Details
Description	Measures the rate of NfUpdate successful response sent per slice that is identified by specific NSI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfUpdate_success_responses_perNsi_total{namespace="\$namespace"}[5m])) by (Nsi)

Table 6-585 Failures [Nsi :{{ Nsi }}]

Field	Details
Description	Measures the rate of NfUpdate failure response sent per slice that is identified by specific NSI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfUpdate_failure_responses_perNsi_total{namespace="\$namespace"}[2m])) by (Nsi)

Table 6-586 Requests [sNssai: {{ sNssai }}]

Field	Details
Description	Measures the rate of NF HeartBeat requests received at a slice that is identified by specific SNSSAI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfHeartBeat_requests_perSnsai_total{namespace="\$namespace"}[2m])) by(sNssai)

Table 6-587 Success [sNssai:{{ sNssai }}]

Field	Details
Description	Measures the rate of NF HeartBeat successful response sent per slice that is identified by specific SNSSAI. For more information about metric used, see Network Slice Specific Metrics .

Table 6-587 (Cont.) Success [sNssai:{{ sNssai }}]

Field	Details
Expression	sum(irate(ocnrf_nfHeartBeat_success_responses_perSnsai_total{namespace="\$namespace"}[5m])) by (sNssai)

Table 6-588 Failures [sNssai: {{ sNssai }}]

Field	Details
Description	Measures the rate of NF HeartBeat failure response sent per slice that is identified by specific SNSSAI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfHeartBeat_failure_responses_perSnsai_total{namespace="\$namespace"}[2m])) by (sNssai)

Table 6-589 Requests [Nsi: {{ Nsi }}]

Field	Details
Description	Measures the rate of NF HeartBeat requests received at a slice that is identified by specific NSI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfHeartBeat_requests_perNsi_total{namespace="\$namespace"}[2m])) by (Nsi)

Table 6-590 Success [Nsi :{{ Nsi }}]

Field	Details
Description	Measures the rate of NF HeartBeat successful response sent per slice that is identified by specific NSI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfHeartBeat_success_responses_perNsi_total{namespace="\$namespace"}[5m])) by (Nsi)

Table 6-591 Failures [Nsi :{{ Nsi }}]

Field	Details
Description	Measures the rate of NF HeartBeat failure response sent per slice that is identified by specific NSI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfHeartBeat_failure_responses_perNsi_total{namespace="\$namespace"}[2m])) by (Nsi)

Table 6-592 Requests [sNssai: {{ sNssai }}]

Field	Details
Description	Measures the rate of NfDiscovery requests received at a slice that is identified by specific SNSSAI. For more information about metric used, see Network Slice Specific Metrics .

Table 6-592 (Cont.) Requests [sNssai: {{ sNssai }}]

Field	Details
Expression	sum(irate(ocnrf_nfDiscover_rx_requests_perSnsai_total{namespace="\$namespace"}[2m])) by(sNssai)

Table 6-593 Success [sNssai:{{ sNssai }}]

Field	Details
Description	Measures the rate of NfDiscovery successful response sent per slice that is identified by specific SNSSAI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfDiscover_tx_success_response_perSnsai_total{namespace="\$namespace"}[5m])) by (sNssai)

Table 6-594 Failures [sNssai: {{ sNssai }}]

Field	Details
Description	Measures the rate of NfDiscovery failure response sent per slice that is identified by specific SNSSAI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfDiscover_tx_failure_response_perSnsai_total{namespace="\$namespace"}[2m])) by (sNssai)

Table 6-595 Empty [sNssai: {{ sNssai }}]

Field	Details
Description	Measures the rate of NfDiscovery empty response sent per slice that is identified by specific SNSSAI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfDiscover_tx_empty_response_perSnsai_total{namespace="\$namespace"}[2m])) by (sNssai)

Table 6-596 Requests [Nsi: {{ Nsi }}]

Field	Details
Description	Measures the rate of NfDiscovery requests received at a slice that is identified by specific NSI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfDiscover_rx_requests_perNsi_total{namespace="\$namespace"}[2m])) by(Nsi)

Table 6-597 Success [Nsi :{{ Nsi }}]

Field	Details
Description	Measures the rate of nfDiscovery successful response sent per slice that is identified by specific NSI. For more information about metric used, see Network Slice Specific Metrics .

Table 6-597 (Cont.) Success [Nsi :{{ Nsi }}]

Field	Details
Expression	sum(irate(ocnrf_nfDiscover_tx_success_response_perNsi_total{namespace="\$namespace"}[5m])) by (Nsi)

Table 6-598 Failures [Nsi :{{ Nsi }}]

Field	Details
Description	Measures the rate of NfDiscovery failure response sent per slice that is identified by specific NSI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfDiscover_tx_failure_response_perNsi_total{namespace="\$namespace"}[2m])) by (Nsi)

Table 6-599 Empty [Nsi: {{ Nsi }}]

Field	Details
Description	Measures the rate of NfDiscovery empty response sent per slice that is identified by specific NSI. For more information about metric used, see Network Slice Specific Metrics .
Expression	sum(irate(ocnrf_nfDiscover_tx_empty_response_perNsi_total{namespace="\$namespace"}[2m])) by (Nsi)

6.2.3.7 SCP Health Status

This section lists the controlled shutdown KPIs at NRF.

Table 6-600 Available Peers {{peerset}}

Field	Details
Description	Measures the total number of available peers in a peerset. For more information about metric used, see NRF Gateways Metrics .
Expression	sum(oc_egressgateway_peer_available_count{namespace="\$namespace"}) by (peerset)

Table 6-601 Ping Request

Field	Details
Description	Measures the rate of Ping Requests to the peers. For more information about metric used, see NRF Gateways Metrics .
Expression	sum(irate(oc_egressgateway_peer_health_ping_request_total{namespace="\$namespace"}[2m]))

Table 6-602 Ping Response {{ status }}

Field	Details
Description	Measures the rate of Ping Responses to the peers. For more information about metric used, see NRF Gateways Metrics .
Expression	sum(irate(oc_egressgateway_peer_health_ping_response_total{namespace="\$namespace"}[2m])) by (status)

Table 6-603 SCP health status {{ peer }}

Field	Details
Description	Measures the health status of the peer. For more information about metric used, see NRF Gateways Metrics .
Expression	sum(oc_egressgateway_peer_health_status{namespace="\$namespace"}) by (peer)

Table 6-604 Total Peers {{peerset}}

Field	Details
Description	Measures the total number of peers in a peerset. For more information about metric used, see NRF Gateways Metrics .
Expression	sum(oc_egressgateway_peer_count{namespace="\$namespace"}) by (peerset)

6.2.3.8 Ingress Gateway Pod Protection

Table 6-605 OCNRF Ingress-Gateway Pod Overall Congestion State

Field	Details
Description	Indicates the current state of the Ingress Gateway pod.
Expression	sum(oc_ingressgateway_pod_congestion_state{namespace="\$namespace"}) by (pod)

Table 6-606 OCNRF Ingress-Gateway Pod CPU Congestion State

Field	Details
Description	Tracks the CPU utilization based on which Ingress Gateway pod is calculating its congestion state.
Expression	sum(oc_ingressgateway_pod_resource_state{type="CPU",namespace="\$namespace"}) by (pod)

Table 6-607 OCNRF Ingress-Gateway Pod CPU Usage

Field	Details
Description	Tracks the CPU utilization based on which Ingress Gateway pod is calculating its congestion state.
Expression	sum(oc_ingressgateway_pod_resource_stress{type="CPU",namespace="\$namespace"}) by (pod)

Table 6-608 OCNRF Ingress-Gateway Incoming Pod Connections Rejected

Field	Details
Description	Tracks the rate of connections dropped at Congested or DOC state.
Expression	sum(rate(oc_ingressgateway_incoming_pod_connections_rejected_total{namespace="\$namespace"}[5m])) by (pod)

Table 6-609 OCNRF Ingress-Gateway Pod Pending Message Congestion State

Field	Details
Description	Tracks the congestion state based on the pending message count of the Ingress Gateway pod.
Expression	sum(oc_ingressgateway_pod_resource_state{type="PENDING_REQUEST",namespace="\$namespace"}) by (pod)

Table 6-610 OCNRF Ingress Gateway Pod Pending Messages

Field	Details
Description	Measures the pending message count usage of the Ingress Gateway pod.
Expression	sum(oc_ingressgateway_pod_resource_stress{type="PENDING_REQUEST",namespace="\$namespace"}) by (pod)

6.2.3.9 NRF Growth Specific KPIs

Table 6-611 Total Number of CDS Requests

Field	Details
Description	Measures the rate of incoming requests at Cache Data Service.
Expression	sum(rate(ocnrf_cds_rx_requests_total{namespace="\$namespace"}[2m]))

Table 6-612 Total Number of CDS Responses

Field	Details
Description	Measures the rate of responses from Cache Data Service.
Expression	sum(rate(ocnrf_cds_tx_responses_total{namespace="\$namespace"}[2m])) by (HttpStatusCode)

Table 6-613 Total Number of CDS Requests per Service Operation

Field	Details
Description	Measures the rate of outgoing requests by local NRF microservices to Cache Data Service for state data.
Expression	sum(rate(ocnrf_query_cds_requests_total{namespace="\$namespace"}[2m])) by (ServiceOperation)

Table 6-614 Total Number of CDS Responses per Service Operation

Field	Details
Description	Measures the rate of response received by local NRF microservices from Cache Data Service for state data.
Expression	<code>sum(rate(ocnrf_query_cds_responses_total{namespace="\$namespace"}[2m])) by (ServiceOperation,HttpStatusCode)</code>

Table 6-615 CDS Latency 50%

Field	Details
Description	Measures the rate of time taken to process the requests by Cache Data Service at the 50 percentile of the latency value.
Expression	<code>histogram_quantile(0.5, sum(rate(ocnrf_cds_round_trip_time_seconds_bucket{kubernetes_namespace="\$namespace"}[2m])) by (le))</code>

Table 6-616 CDS Latency 90%

Field	Details
Description	Measures the rate of time taken to process the requests by Cache Data Service at the 90 percentile of the latency value.
Expression	<code>histogram_quantile(0.9, sum(rate(ocnrf_cds_round_trip_time_seconds_bucket{kubernetes_namespace="\$namespace"}[2m])) by (le))</code>

Table 6-617 CDS Latency 95%

Field	Details
Description	Measures the rate of time taken to process the requests by Cache Data Service at the 95 percentile of the latency value.
Expression	<code>histogram_quantile(0.95, sum(rate(ocnrf_cds_round_trip_time_seconds_bucket{kubernetes_namespace="\$namespace"}[2m])) by (le))</code>

Table 6-618 CDS Latency 99%

Field	Details
Description	Measures the rate of time taken to process the requests by Cache Data Service at the 99 percentile of the latency value.
Expression	<code>histogram_quantile(0.99, sum(rate(ocnrf_cds_round_trip_time_seconds_bucket{kubernetes_namespace="\$namespace"}[2m])) by (le))</code>

Table 6-619 CDS Request Latency 99% for NfAccessToken Service Operation

Field	Details
Description	Measures the rate of time taken for querying state data from Cache Data Service for NfAccessToken service operation at the 99 percentile of the latency value.
Expression	<pre> histogram_quantile(0.99, sum(rate(ocnrf_query_cds_round_trip_time_seconds_bucket{\$namespace label="\$namespace",ServiceOperation="NfAccessToken"}[2m])) by (le)) </pre>

Table 6-620 CDS Request Latency 99% for NfDiscover Service Operation

Field	Details
Description	Measures the rate of time taken for querying state data from Cache Data Service for NfDiscover service operation at the 99 percentile of the latency value.
Expression	<pre> histogram_quantile(0.99, sum(rate(ocnrf_query_cds_round_trip_time_seconds_bucket{\$namespace label="\$namespace",ServiceOperation="NfDiscover"}[2m])) by (le)) </pre>

Table 6-621 CDS Request Latency 99% for NfListRetrieval Service Operation

Field	Details
Description	Measures the rate of time taken for querying state data from Cache Data Service for NfListRetrieval service operation at the 99 percentile of the latency value.
Expression	<pre> histogram_quantile(0.99, sum(rate(ocnrf_query_cds_round_trip_time_seconds_bucket{\$namespace label="\$namespace",ServiceOperation="NfListRetrieval"}[2m])) by (le)) </pre>

Table 6-622 CDS Request Latency 99% for NfProfileRetrieval Service Operation

Field	Details
Description	Measures the rate of time taken for querying state data from Cache Data Service for NfProfileRetrieval service operation at the 99 percentile of the latency value.
Expression	<pre> histogram_quantile(0.99, sum(rate(ocnrf_query_cds_round_trip_time_seconds_bucket{\$namespace label="\$namespace",ServiceOperation="NfProfileRetrieval"}[2m])) by (le)) </pre>

Table 6-623 CDS Request Latency 99% for NfSubscribe Service Operation

Field	Details
Description	Measures the rate of time taken for querying state data from Cache Data Service for NfSubscribe service operation at the 99 percentile of the latency value.
Expression	<pre> histogram_quantile(0.99, sum(rate(ocnrf_query_cds_round_trip_time_seconds_bucket{\$namespace label="\$namespace",ServiceOperation="NfSubscribe"}[2m])) by (le)) </pre>

Table 6-624 CDS Request Latency 99% for NfUnsubscribe Service Operation

Field	Details
Description	Measures the rate of time taken for querying state data from Cache Data Service for NfUnsubscribe service operation at the 99 percentile of the latency value.
Expression	<pre> histogram_quantile(0.99, sum(rate(ocnrf_query_cds_round_trip_time_seconds_bucket{\$namespace label="\$namespace",ServiceOperation="NfUnsubscribe"}[2m])) by (le))) </pre>

Table 6-625 CDS Request Latency 99% for notifyProfileDeregistration Service Operation

Field	Details
Description	Measures the rate of time taken for querying state data from Cache Data Service for notifyProfileDeregistration service operation at the 99 percentile of the latency value.
Expression	<pre> histogram_quantile(0.99, sum(rate(ocnrf_query_cds_round_trip_time_seconds_bucket{\$namespace label="\$namespace",ServiceOperation="notifyProfileDeregistration"} [2m])) by (le)) </pre>

Table 6-626 CDS Request Latency 99% for notifyProfileRegistration Service Operation

Field	Details
Description	Measures the rate of time taken for querying state data from Cache Data Service for notifyProfileRegistration service operation at the 99 percentile of the latency value.
Expression	<pre> histogram_quantile(0.99, sum(rate(ocnrf_query_cds_round_trip_time_seconds_bucket{\$namespace label="\$namespace",ServiceOperation="notifyProfileRegistration"} [2m])) by (le)) </pre>

Table 6-627 CDS Request Latency 99% for notifyProfileChange Service Operation

Field	Details
Description	Measures the rate of time taken for querying state data from Cache Data Service for notifyProfileChange service operation at the 99 percentile of the latency value.
Expression	<pre> histogram_quantile(0.99, sum(rate(ocnrf_query_cds_round_trip_time_seconds_bucket{\$namespace label="\$namespace",ServiceOperation="notifyProfileChange"}[2m])) by (le)) </pre>

Table 6-628 CDS Request Latency 99% for nrfauditor Service Operation

Field	Details
Description	Measures the rate of time taken for querying state data from Cache Data Service for nrfauditor service operation at the 99 percentile of the latency value.
Expression	<pre> histogram_quantile(0.99, sum(rate(ocnrf_query_cds_round_trip_time_seconds_bucket{\$namespace label="\$namespace",app_kubernetes_io_name="nrfauditor"}[2m])) by (le)) </pre>

Table 6-629 Total Number of CDS Requests per Request Type

Field	Details
Description	Measures the rate of incoming requests at Cache Data Service per request type.
Expression	sum(rate(ocnrf_cds_rx_requests_total{namespace="\$namespace"}[2m])) by (RequestType)

Table 6-630 Total Number of CDS Responses per Request Type

Field	Details
Description	Measures the rate of responses from Cache Data Service per request type.
Expression	sum(rate(ocnrf_cds_tx_responses_total{namespace="\$namespace"}[2m])) by (RequestType, HttpStatusCode)

Table 6-631 Total Number of Remote CDS Requests

Field	Details
Description	Measures the rate of requests sent to the NRF of a remote NRF set by Cache Data Service.
Expression	sum(rate(ocnrf_query_remote_cds_requests_total{namespace="\$namespace"}[2m])) by (TargetNrfSetId)

Table 6-632 Total Number of Remote CDS Responses

Field	Details
Description	Measures the rate of responses received from the NRF in the remote set.
Expression	sum(rate(ocnrf_query_remote_cds_responses_total{namespace="\$namespace"}[2m])) by (TargetNrfSetId, HttpStatusCode)

Table 6-633 Remote CDS Query Latency 50%

Field	Details
Description	Measures the rate of time taken to process the requests sent by Cache Data Service towards remote NRF set and response received at the 50 percentile of the latency value.
Expression	histogram_quantile(0.5, sum(rate(ocnrf_query_remote_cds_round_trip_time_seconds_bucket{\$namespace_label}[2m])) by (le))

Table 6-634 Remote CDS Query Latency 90%

Field	Details
Description	Measures the rate of time taken to process the requests sent by Cache Data Service towards remote NRF set and response received at the 90 percentile of the latency value.
Expression	histogram_quantile(0.9, sum(rate(ocnrf_query_remote_cds_round_trip_time_seconds_bucket{\$namespace_label}[2m])) by (le))

Table 6-635 Remote CDS Query Latency 95%

Field	Details
Description	Measures the rate of time taken to process the requests sent by Cache Data Service towards remote NRF set and response received at the 95 percentile of the latency value.
Expression	histogram_quantile(0.95, sum(rate(ocnrf_query_remote_cds_round_trip_time_seconds_bucket{\$namespace_label="\$namespace"}[2m])) by (le))

Table 6-636 Remote CDS Query Latency 99%

Field	Details
Description	Measures the rate of time taken to process the requests sent by Cache Data Service towards remote NRF set and response received at the 99 percentile of the latency value.
Expression	histogram_quantile(0.99, sum(rate(ocnrf_query_remote_cds_round_trip_time_seconds_bucket{\$namespace_label="\$namespace"}[2m])) by (le))

Table 6-637 Database Fallback

Field	Details
Description	Measures the rate at which the service request was fulfilled from the database by the NRF microservices as the query towards the Cache Data Service failed.
Expression	sum(rate(ocnrf_db_fallback_total{namespace="\$namespace"}[2m])) by (ServiceOperation)

Table 6-638 CDS Cache Sync

Field	Details
Description	Measures the rate at which state data entries are synched from the local database at CDS.
Expression	sum(rate(ocnrf_cache_sync_count_total{namespace="\$namespace", container="nrfcachedata"}[2m]))

6.2.3.10 Egress Gateway Pod Throttling

Table 6-639 Egress Gateway Discards Due To Rate Limit

Field	Details
Description	Measures the rate of requests discarded by Egress Gateway due to Egress Gateway Pod Throttling feature. For more information about metric used, see Egress Gateway Metrics .
Expression	sum(rate(oc_egressgateway_podlevel_throttling_discarded_total{namespace="\$namespace"}[2m])) by (pod)

6.2.3.11 Ingress Gateway Pod Protection Using Rate Limiting

Table 6-640 Allowed Request Rate Per Route Id

Field	Details
Description	Measures the request rate allowed per Route Id. For more information about metric used, see Ingress Gateway Metrics .
Expression	sum(irate(oc_ingressgateway_http_request_ratelimit_values_total{Allowed="true", namespace="\$namespace"}[2m])) by (Id)

Table 6-641 Total Rejections Chain Length

Field	Details
Description	Measures the rate of consecutive rejects before a successful accept. The metric indicates rejections due to traffic burst. For more information about metric used, see Ingress Gateway Metrics .
Expression	sum(rate(oc_ingressgateway_http_request_ratelimit_reject_chain_length_histogram_bucket{namespace="\$namespace"}[2m])) by (le)

Table 6-642 Discard Request Action Traffic Rate

Field	Details
Description	Measures the rate of requests rejected or processed based on the discard request action. For more information about metric used, see Ingress Gateway Metrics .
Expression	sum(irate(oc_ingressgateway_http_request_ratelimit_denied_count_total{namespace="\$namespace"}[2m])) by (Action)

Table 6-643 Congestion Level Bucket

Field	Details
Description	Measures the congestion level of the Ingress Gateway pod. For more information about metric used, see Ingress Gateway Metrics .
Expression	sum(increase(oc_ingressgateway_congestion_level_group_total{namespace="\$namespace"}[2m])) by (le)

Table 6-644 Congestion Level

Field	Details
Description	Indicates the congestion state of the Ingress Gateway pod. Values: 1 - Normal 2 - DOC 3 -Congested For more information about metric used, see Ingress Gateway Metrics .
Expression	oc_ingressgateway_congestion_system_state{namespace="\$namespace"}

6.2.3.12 Egress Gateway Pod Protection Using Rate Limiting

Table 6-645 Allowed Requests

Field	Details
Description	Measures the request rate allowed per Id defined in the routes under Pod Protection By Rate Limiting. For more information about metric used, see Egress Gateway Metrics .
Expression	sum(rate(oc_egressgateway_http_request_ratelimit_values_total{Allowed="true",namespace="\$namespace"}[2m])) by (Id)

Table 6-646 Reject Chain Length

Field	Details
Description	Measures the rate of consecutive rejects before a successful accept. The metric indicates rejections due to traffic burst. For more information about metric used, see Egress Gateway Metrics .
Expression	sum(rate(oc_egressgateway_http_request_ratelimit_reject_chain_length_histogram_bucket{namespace="\$namespace"}[2m])) by (le)

Table 6-647 Discard Action

Field	Details
Description	Measures the rate of requests rejected or processed based on the discard request action. For more information about metric used, see Egress Gateway Metrics .
Expression	sum(rate(oc_egressgateway_http_request_ratelimit_denied_count_total{namespace="\$namespace"}[2m])) by (Action)

Table 6-648 Congestion Level Bucket

Field	Details
Description	Measures the congestion level of the Egress Gateway pod. For more information about metric used, see Egress Gateway Metrics .
Expression	sum(increase(oc_egressgateway_congestion_level_group_total{namespace="\$namespace"}[2m])) by (le)

Table 6-649 Congestion Level

Field	Details
Description	Indicates the congestion state of the Egress Gateway pod. Values: 1 - Normal 2 - DOC 3 -Congested For more information about metric used, see Egress Gateway Metrics .
Expression	oc_egressgateway_congestion_system_state{namespace="\$namespace"}

6.3 NRF Alerts

This section includes information about the NRF alerts.

The following table describes the various alert levels generated by NRF:

Table 6-650 Alerts Levels or Severity Types

Alerts Levels/Severity Types	Definition
Critical	Indicates a severe issue that poses a significant risk to safety, security, or operational integrity. It requires immediate response to address the situation and prevent serious consequences. Raised for conditions may affect the service of NRF.
Major	Indicates a more significant issue that has an impact on operations or poses a moderate risk. It requires prompt attention and action to mitigate potential escalation. Raised for conditions may affect the service of NRF.
Minor	Indicates a situation that is low in severity and does not pose an immediate risk to safety, security, or operations. It requires attention but does not demand urgent action. Raised for conditions may affect the service of NRF.
Info or Warn (Informational)	Provides general information or updates that are not related to immediate risks or actions. These alerts are for awareness and do not typically require any specific response. WARN and INFO alerts may not impact the service of NRF.

Note

- Summary or dimensions may vary based on deployment.
- The alert triggering time varies as per the environment in which it is deployed.
- The performance and capacity of the NRF system may vary based on the call model, Feature or Interface configuration, and underlying CNE and hardware environment.

6.3.1 Alert Configuration

This section describes how to configure alert rules for the NRF in both Prometheus and OCI environments. It provides guidance on setting up measurement-based alert rules, where the alerting system evaluates metrics reported by NRF microservices against specified rule conditions to generate alerts as needed.

Prometheus Alert Configuration

In a Prometheus environment, NRF alert rules are configured based on metrics reported by NRF components. The alerting workflow monitors these metrics and issues notifications when the defined conditions are met.

For more information about configuring NRF alerts in Prometheus, see the “Alert Configuration” section in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

OCI Alert Configuration

In OCI environments, NRF alert rules are defined using Metric Query Language (MQL). Configuring these alerts requires creating a dedicated NRF alert file for use with the OCI observability platform.

For more information about configuring NRF alerts in OCI, see the “Alert Configuration in OCI” section in *Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide*.

6.3.2 System Level Alerts

This section lists the system level alerts.

6.3.2.1 OcnrfNfStatusUnavailable

Table 6-651 OcnrfNfStatusUnavailable

Field	Details
Description	'OCNRF services unavailable'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : All OCNRF services are unavailable.'
Severity	Critical
Condition	When all the NRF services are unavailable, either because the NRF is getting deployed or purged. The NRF services considered are nfregistration, nfsubscription, nrfauditor, nrfconfiguration, nfaccess token, nrfdiscovery, appinfo, ingressgateway, and egressgateway.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7016
Metric Used	'up' Note: This is a Prometheus metric used for instance availability monitoring. If this metric is not available, use a similar metric as exposed by the monitoring system.

Table 6-651 (Cont.) OcnrfNfStatusUnavailable

Field	Details
Recommended Actions	The alert is cleared automatically when the NRF services restart. Steps: 1. Check for service-specific alerts which may be causing the issues with service exposure. 2. Run the following command to check the pod status: <pre>\$ kubectl get po -n <namespace></pre> a. Run the following command to analyze the error condition of the pod that is not in the <i>Running</i> state: <pre>\$ kubectl describe pod <pod name not in Running state> -n <namespace></pre> Where <pod name not in Running state> indicates the pod that is not in the <i>Running</i> state. 3. Refer to the application logs on Kibana and check for database related failures such as connectivity and invalid secrets. The logs can be filtered based on the services. 4. Check for helm status to make sure there are no errors: <pre>\$ helm status <helm release name of the desired NF> -n <namespace></pre> If it is not in "STATUS : DEPLOYED", then capture logs and event again. 5. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on the Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	No

6.3.2.2 OcnrfPodsRestart

Table 6-652 OcnrfPodsRestart

Field	Details
Description	'Pod <Pod Name> has restarted.
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : A Pod has restarted'
Severity	Major
Condition	A pod belonging to any of the NRF services have restarted.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7017

Table 6-652 (Cont.) OcnrfPodsRestart

Field	Details
Metric Used	'kube_pod_container_status_restarts_total' Note: This is a Kubernetes metric. If this metric is not available, use a similar metric as exposed by the monitoring system.
Recommended Actions	The alert is cleared automatically if the specific pod is up. Steps: 1. Refer to the application logs on Kibana and filter based on pod name, check for database related failures such as connectivity and Kubernetes secrets. 2. To check the orchestration logs for liveness or readiness probe failures, do the following: a. Run the following command to check the pod status: <pre>\$ kubectl get po -n <namespace></pre> b. Run the following command to analyze the error condition of the pod that is not in the <i>Running</i> state: <pre>\$ kubectl describe pod <pod name not in Running state> -n <namespace></pre> Where <pod name not in Running state> indicates the pod that is not in the <i>Running</i> state. 3. Check the database status. For more information, see <i>Oracle Communications Cloud Native Core, cnDBTier User Guide</i>. 4. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on the Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	No

6.3.2.3 NnrfNFManagementServiceDown

Table 6-653 NnrfNFManagementServiceDown

Field	Details
Description	'OCNRF Nnrf_Management service <nfregration nfsubscription nrfauditor> is down'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : NFManagement service is down'
Severity	Critical
Condition	This alert is raised when either NFRegistration, NFSubscription, or NrfAuditor services are unavailable.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7018

Table 6-653 (Cont.) NnrfNFManagementServiceDown

Field	Details
Metric Used	"up" Note: This is a Prometheus metric used for instance availability monitoring. If this metric is not available, use a similar metric as exposed by the monitoring system.

Table 6-653 (Cont.) NnrfNFManagementServiceDown

Field	Details
Recommended Actions	The alert is cleared when all the Nnrf_NFManagement services nfregistration, nfsubscription, and nrfauditor are available. Steps: 1. Check if NfService specific alerts are generated to understand which service is down. Either some or all of the following alerts are generated based on which services are down • OcnrfRegistrationServiceDown • OcnrfSubscriptionServiceDown • OcnrfAuditorServiceDown 2. To check the orchestration logs for liveness or readiness probe failures, do the following: a. Run the following command to check the pod status: <pre>\$ kubectl get po -n <namespace></pre> b. Run the following command to analyze the error condition of the pod that is not in the <i>Running</i> state: <pre>\$ kubectl describe pod <pod name not in Running state> -n <namespace></pre> Where <pod name not in Running state> indicates the pod that is not in the <i>Running</i> state. 3. Check for the POD's status if they are in "Running" state using the following command: <pre>\$ kubectl get pod -n <namespace></pre> If it is not in "Running" state, capture the pod logs and events by running the following command: <pre>\$ kubectl get events --sort-by=.metadata.creationTimestamp -n <namespace></pre> 4. Refer to the application logs on Kibana and filter based on aforementioned service names. Check for ERROR WARNING logs for each of these services. 5. Check the database status. For more information on how to check the database status, see <i>Oracle Communications Cloud Native Core, cnDBTier User Guide</i>. 6. Refer to the application logs on Kibana and filter the service appinfo, check for the service status of the nfregistration, nfsubscription, and nrfauditor services. 7. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see

Table 6-653 (Cont.) NnrfNfManagementServiceDown

Field	Details
	<i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide.</i>
Available in OCI	No

6.3.2.4 NnrfAccessTokenServiceDown

Table 6-654 NnrfAccessTokenServiceDown

Field	Details
Description	'OCNRF Nnrf_NFAccessToken service nfaccess token is down'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : NFAccessToken service down'
Severity	Critical
Condition	This alert is raised when NFAccessToken service is unavailable.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7020
Metric Used	"up" Note: This is a Prometheus metric used for instance availability monitoring. If this metric is not available use a similar metric as exposed by the monitoring system.

Table 6-654 (Cont.) NnrfAccessTokenServiceDown

Field	Details
Recommended Actions	The alert is cleared when the Nnrf_AccessToken service is available. Steps: - To check the orchestration logs of nfaccess token service and check for liveness or readiness probe failures, do the following: - Run the following command to check the pod status: <pre>\$ kubectl get po -n <namespace></pre> - Run the following command to analyze the error condition of the pod that is not in the <i>Running</i> state: <pre>\$ kubectl describe pod <pod name not in Running state> -n <namespace></pre> Where <pod name not in Running state> indicates the pod that is not in the <i>Running</i> state. - Refer to the application logs on Kibana and filter based on nfaccess token service names. Check for ERROR WARNING logs. - Check the DB status. For more information on how to check the DB status, see <i>Oracle Communications Cloud Native Core, cnDBTier User Guide</i>. - Depending on the failure reason, take the resolution steps. - In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	No

6.3.2.5 NnrfNFDDiscoveryServiceDown

Table 6-655 NnrfNFDDiscoveryServiceDown

Field	Details
Description	'OCNRF Nnrf_NFDDiscovery service <i>nfdiscovery</i> is down'
Applicable in OCI	No
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : NFDDiscovery service down'
Severity	Critical
Condition	NFDDiscovery is unavailable.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7019

Table 6-655 (Cont.) NnrfNFDISCOVERYServiceDown

Field	Details
Metric Used	'up' Note: This is a Prometheus metric used for instance availability monitoring. If this metric is not available, use a similar metric as exposed by the monitoring system.
Recommended Actions	The alert is cleared when the Nnrf_NFDISCOVERY service is available. Steps: - To check the orchestration logs of nfdiscovery service and check for liveness or readiness probe failures, do the following: - Run the following command to check the pod status: <pre>\$ kubectl get po -n <namespace></pre> - Run the following command to analyze the error condition of the pod that is not in the <i>Running</i> state: <pre>\$ kubectl describe pod <pod name not in Running state> -n <namespace></pre> Where <pod name not in Running state> indicates the pod that is not in the <i>Running</i> state. - Refer to the application logs on Kibana and filter based on nfdiscovery service names. Check for ERROR WARNING logs. - Check the DB status. For more information on how to check the DB status, see <i>Oracle Communications Cloud Native Core, cnDBTier User Guide</i>. - Depending on the failure reason, take the resolution steps. - In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	No

6.3.2.6 OcnrfRegistrationServiceDown

Table 6-656 OcnrfRegistrationServiceDown

Field	Details
Description	'OCNRF NFRegistration service <i>nfdiscovery</i> is down'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : NFRegistration service is down'
Severity	Critical
Condition	None of the pods of the NFRegistration microservice is available.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7021

Table 6-656 (Cont.) OcnrfRegistrationServiceDown

Field	Details
Metric Used	'up' Note: This is a Prometheus metric used for instance availability monitoring. If this metric is not available, use a similar metric as exposed by the monitoring system.
Recommended Actions	The alert is cleared when the nfregration service is available. Steps: - To check the orchestration logs of nfregration service and check for liveness or readiness probe failures, do the following: - Run the following command to check the pod status: <pre>\$ kubectl get po -n <namespace></pre> - Run the following command to analyze the error condition of the pod that is not in the <i>Running</i> state: <pre>\$ kubectl describe pod <pod name not in Running state> -n <namespace></pre> Where <pod name not in Running state> indicates the pod that is not in the <i>Running</i> state. - Refer to the application logs on Kibana and filter based on nfregration service names. Check for ERROR WARNING logs. - Check the DB status. For more information on how to check the DB status, see <i>Oracle Communications Cloud Native Core, cnDBTier User Guide</i>. Depending on the failure reason, take the resolution steps. - In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	No

6.3.2.7 OcnrfSubscriptionServiceDown

Table 6-657 OcnrfSubscriptionServiceDown

Field	Details
Description	'OCNRF NFSubscription service <i>nfsubscription</i> is down.'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }} : NFSubscription service is down'
Severity	Critical
Condition	None of the pods of the NFSubscription microservice is available.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7022

Table 6-657 (Cont.) OcnrfSubscriptionServiceDown

Field	Details
Metric Used	'up' Note: This is a Prometheus metric used for instance availability monitoring. If this metric is not available, use a similar metric as exposed by the monitoring system.
Recommended Actions	The alert is cleared when the nfservice subscription service is available. Steps: - To check the orchestration logs of nfservice subscription service and check for liveness or readiness probe failures, do the following: - Run the following command to check the pod status: <pre>\$ kubectl get po -n <namespace></pre> - Run the following command to analyze the error condition of the pod that is not in the <i>Running</i> state: <pre>\$ kubectl describe pod <pod name not in Running state> -n <namespace></pre> Where <pod name not in Running state> indicates the pod that is not in the <i>Running</i> state. - Refer to the application logs on Kibana and filter based on nfservice subscription service names. Check for ERROR WARNING logs. - Check the DB status. For more information on how to check the DB status, see <i>Oracle Communications Cloud Native Core, cnDBTier User Guide</i>. - Depending on the failure reason, take the resolution steps. - In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	No

6.3.2.8 OcnrfDiscoveryServiceDown

Table 6-658 OcnrfDiscoveryServiceDown

Field	Details
Description	'OCNRF NFDDiscovery service <i>nfdiscovery</i> is down'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : NFDDiscovery service down'
Severity	Critical
Condition	None of the pods of the NFDDiscovery microservice is available.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7023

Table 6-658 (Cont.) OcnrfDiscoveryServiceDown

Field	Details
Metric Used	'up' Note: This is a Prometheus metric used for instance availability monitoring. If this metric is not available, use a similar metric as exposed by the monitoring system.
Recommended Actions	The alert is cleared when the nfdiscovery service is available. Steps: - To check the orchestration logs of nfdiscovery service and check for liveness or readiness probe failures, do the following: - Run the following command to check the pod status: <pre>\$ kubectl get po -n <namespace></pre> - Run the following command to analyze the error condition of the pod that is not in the <i>Running</i> state: <pre>\$ kubectl describe pod <pod name not in Running state> -n <namespace></pre> Where <pod name not in Running state> indicates the pod that is not in the <i>Running</i> state. - Refer to the application logs on Kibana and filter based on nfdiscovery service names. Check for ERROR WARNING logs. - Check the DB status. For more information on how to check the DB status, see <i>Oracle Communications Cloud Native Core, cnDBTier User Guide</i>. - In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	No

6.3.2.9 OcnrfAccessTokenServiceDown

Table 6-659 OcnrfAccessTokenServiceDown

Field	Details
Description	'OCNRF NFAccessToken service <i>nfaccess token</i> is down
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : NFAccess token service down'
Severity	Critical
Condition	None of the pods of the NFAccessToken microservice is available.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7024

Table 6-659 (Cont.) OcnrfAccessTokenServiceDown

Field	Details
Metric Used	'up' Note: This is a Prometheus metric used for instance availability monitoring. If this metric is not available, use a similar metric as exposed by the monitoring system.
Recommended Actions	The alert is cleared when the nfaccessstoken service is available. Steps: - To check the orchestration logs of nfaccessstoken service and check for liveness or readiness probe failures, do the following: - Run the following command to check the pod status: <pre>\$ kubectl get po -n <namespace></pre> - Run the following command to analyze the error condition of the pod that is not in the <i>Running</i> state: <pre>\$ kubectl describe pod <pod name not in Running state> -n <namespace></pre> Where <pod name not in Running state> indicates the pod that is not in the <i>Running</i> state. - Refer to the application logs on Kibana and filter based on nfaccessstoken service names. Check for ERROR WARNING logs. - Check the DB status. For more information on how to check the DB status, see <i>Oracle Communications Cloud Native Core, cnDBTier User Guide</i>. - Depending on the failure reason, take the resolution steps. - In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	No

6.3.2.10 OcnrfAuditorServiceDown

Table 6-660 OcnrfAuditorServiceDown

Field	Details
Description	'OCNRF NrfAuditor service <i>nrfauditor</i> is down'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : NrfAuditor service down'
Severity	Critical
Condition	None of the pods of the NrfAuditor microservice is available.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7026

Table 6-660 (Cont.) OcnrfAuditorServiceDown

Field	Details
Metric Used	'up' Note: This is a Prometheus metric used for instance availability monitoring. If this metric is not available, use a similar metric as exposed by the monitoring system.
Recommended Actions	The alert is cleared when the nrfauditor service is available. Steps: - To check the orchestration logs of nrfauditor service and check for liveness or readiness probe failures, do the following: - Run the following command to check the pod status: <pre>\$ kubectl get po -n <namespace></pre> - Run the following command to analyze the error condition of the pod that is not in the <i>Running</i> state: <pre>\$ kubectl describe pod <pod name not in Running state> -n <namespace></pre> Where <pod name not in Running state> indicates the pod that is not in the <i>Running</i> state. - Refer to the application logs on Kibana and filter based on nrfauditor service names. Check for ERROR WARNING logs related to thread exceptions. - Check the DB status. For more information on how to check the DB status, see <i>Oracle Communications Cloud Native Core, cnDBTier User Guide</i>. - Depending on the failure reason, take the resolution steps. - In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	No

6.3.2.11 OcnrfConfigurationServiceDown

Table 6-661 OcnrfConfigurationServiceDown

Field	Details
Description	'OCNRF NrfConfiguration service <i>nrfconfiguration</i> is down'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : NrfConfiguration service down'
Severity	Critical
Condition	None of the pods of the NrfConfiguration microservice is available.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7025

Table 6-661 (Cont.) OcnrfConfigurationServiceDown

Field	Details
Metric Used	'up' Note: This is a Prometheus metric used for instance availability monitoring. If this metric is not available, use a similar metric as exposed by the monitoring system.
Recommended Actions	The alert is cleared when the nrconfiguration service is available. Steps: - To check the orchestration logs of nrconfiguration service and check for liveness or readiness probe failures, do the following: - Run the following command to check the pod status: <pre>\$ kubectl get po -n <namespace></pre> - Run the following command to analyze the error condition of the pod that is not in the <i>Running</i> state: <pre>\$ kubectl describe pod <pod name not in Running state> -n <namespace></pre> Where <pod name not in Running state> indicates the pod that is not in the <i>Running</i> state. - Refer to the application logs on Kibana and filter based on nrconfiguration service names. Check for ERROR WARNING logs. - Check the DB status. For more information on how to check the DB status, see <i>Oracle Communications Cloud Native Core, cnDBTier User Guide</i>. - Depending on the failure reason, take the resolution steps. - In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	No

6.3.2.12 OcnrfAppInfoServiceDown

Table 6-662 OcnrfAppInfoServiceDown

Field	Details
Description	'OCNRF Appinfo service <i>appinfo</i> is down'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : Appinfo service down'
Severity	Critical
Condition	None of the pods of the appinfo microservice is available.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7027

Table 6-662 (Cont.) OcnrfAppInfoServiceDown

Field	Details
Metric Used	'up' Note: This is a Prometheus metric used for instance availability monitoring. If this metric is not available, use a similar metric as exposed by the monitoring system.
Recommended Actions	The alert is cleared when the appinfo service is available. Steps: - To check the orchestration logs of appinfo service and check for liveness or readiness probe failures, do the following: - Run the following command to check the pod status: <pre>\$ kubectl get po -n <namespace></pre> - Run the following command to analyze the error condition of the pod that is not in the <i>Running</i> state: <pre>\$ kubectl describe pod <pod name not in Running state> -n <namespace></pre> Where <pod name not in Running state> indicates the pod that is not in the <i>Running</i> state. - Refer to the application logs on Kibana and filter based on appinfo service names. Check for ERROR WARNING logs related to thread exceptions. - Depending on the failure reason, take the resolution steps. - In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	No

6.3.2.13 OcnrfArtisanServiceDown

Table 6-663 OcnrfArtisanServiceDown

Field	Details
Description	'OCNRF NrfArtisan service {{\$labels.app_kubernetes_io_name}} is down'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }} : NrfArtisan service is down'
Severity	Critical
Condition	NrfArtisan is unavailable.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7056

Table 6-663 (Cont.) OcnrfArtisanServiceDown

Field	Details
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 NrfArtisan service is available. Steps: - To check the orchestration logs of NrfArtisan service and check for liveness or readiness probe failures, do the following: - Run the following command to check the pod status: <pre>\$ kubectl get pod -n <namespace></pre> - Run the following command to analyze the error condition of the pod that is not in the <i>Running</i> state: <pre>\$ kubectl describe pod <pod name not in Running state> -n <namespace></pre> Where <pod name not in Running state> indicates the pod that is not in the <i>Running</i> state. - Refer to the application logs on Kibana and filter the logs based on NrfArtisan service names. Check for ERROR and WARNING logs related to thread exceptions. - Check the database status. For more information, see the <i>Oracle Communications Cloud Native Core, cnDBTier User Guide</i>. - In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	No

6.3.2.14 OcnrfAlternateRouteServiceDown

Table 6-664 OcnrfAlternateRouteServiceDown

Field	Details
Description	'OCNRF AlternateRoute service {{\$labels.app_kubernetes_io_name}} is down'
Applicable in OCI	No
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : AlternateRoute service is down'
Severity	Critical
Condition	AlternateRoute is unavailable.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7057

Table 6-664 (Cont.) OcnrfAlternateRouteServiceDown

Field	Details
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 alternate-route service is available. Steps: - To check the orchestration logs of alternate-route service and check for liveness or readiness probe failures, do the following: - Run the following command to check the pod status: <pre>\$ kubectl get pod -n <namespace></pre> - Run the following command to analyze the error condition of the pod that is not in the <i>Running</i> state: <pre>\$ kubectl describe pod <pod name not in Running state> -n <namespace></pre> Where <pod name not in Running state> indicates the pod that is not in the <i>Running</i> state. - Refer to the application logs on Kibana and filter the logs based on Alternate-Route service names. Check for ERROR and WARNING logs related to thread exceptions. - Check the database status. For more information, see the <i>Oracle Communications Cloud Native Core, cnDBTier User Guide</i>. - In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.

6.3.2.15 OcnrfPerfInfoServiceDown

Table 6-665 OcnrfPerfInfoServiceDown

Field	Details
Description	'OCNRF Perfinfo service {{\$labels.app_kubernetes_io_name}} is down'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }} : Perfinfo service down'
Severity	Critical
Condition	Perfinfo is unavailable.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7058
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.

Table 6-665 (Cont.) OcnrfPerfInfoServiceDown

Field	Details
Recommended Actions	The alert is cleared when the Perfinfo service is available. Steps: - To check the orchestration logs of Perfinfo service and check for liveness or readiness probe failures, do the following: - Run the following command to check the pod status: <pre>\$ kubectl get pod -n <namespace></pre> - Run the following command to analyze the error condition of the pod that is not in the <i>Running</i> state: <pre>\$ kubectl describe pod <pod name not in Running state> -n <namespace></pre> Where <pod name not in Running state> indicates the pod that is not in the <i>Running</i> state. - Refer to the application logs on Kibana and filter the logs based on Perf-Info service names. Check for ERROR and WARNING logs related to thread exceptions. - Check the database status. For more information, see the <i>Oracle Communications Cloud Native Core, cnDBTier User Guide</i>. - In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	No

6.3.2.16 OcnrfIngressGatewayServiceDown

Table 6-666 OcnrfIngressGatewayServiceDown

Field	Details
Description	'OCNRF Ingress-Gateway service <i>ingressgateway</i> is down'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }} : Ingress-gateway service down'
Severity	Critical
Condition	None of the pods of the Ingress Gateway microservice is available.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7028
Metric Used	'up' Note: This is a Prometheus metric used for instance availability monitoring. If this metric is not available, use a similar metric as exposed by the monitoring system.

Table 6-666 (Cont.) OcnrflngressGatewayServiceDown

Field	Details
Recommended Actions	The alert is cleared when the Ingress Gateway service is available. Steps: 1. To check the orchestration logs of Ingress Gateway service and check for liveness or readiness probe failures, do the following: a. Run the following command to check the pod status: <pre>\$ kubectl get po -n <namespace></pre> b. Run the following command to analyze the error condition of the pod that is not in the <i>Running</i> state: <pre>\$ kubectl describe pod <pod name not in Running state> -n <namespace></pre> Where <pod name not in Running state> indicates the pod that is not in the <i>Running</i> state. 2. Refer to the application logs on Kibana and filter based on Ingress Gateway 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, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	No

6.3.2.17 OcnrfEgressGatewayServiceDown

Table 6-667 OcnrfEgressGatewayServiceDown

Field	Details
Description	'OCNRF Egress-Gateway service <i>egressgateway</i> is down'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : Egress-Gateway service down'
Severity	Critical
Condition	None of the pods of the Egress Gateway microservice is available.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7029
Metric Used	'up' Note: This is a Prometheus metric used for instance availability monitoring. If this metric is not available, use a similar metric as exposed by the monitoring system.

Table 6-667 (Cont.) OcnrfEgressGatewayServiceDown

Field	Details
Recommended Actions	The alert is cleared when the Egress Gateway service is available. Steps: - To check the orchestration logs of Egress Gateway service and check for liveness or readiness probe failures, do the following: - Run the following command to check the pod status: <pre>\$ kubectl get po -n <namespace></pre> - Run the following command to analyze the error condition of the pod that is not in the <i>Running</i> state: <pre>\$ kubectl describe pod <pod name not in Running state> -n <namespace></pre> Where <pod name not in Running state> indicates the pod that is not in the <i>Running</i> state. - Refer to the application logs on Kibana and filter based on Egress Gateway service names. Check for ERROR WARNING logs related to thread exceptions. - Depending on the failure reason, take the resolution steps. - In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	No

6.3.2.18 OcnrfTotalIngressTrafficRateAboveMinorThreshold

Table 6-668 OcnrfTotalIngressTrafficRateAboveMinorThreshold

Field	Details
Description	'Total Ingress traffic Rate is above configured minor threshold. (current value is: {{ \$value }})'
Summary	'timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }}: Traffic Rate is above 80 Percent of Max requests per second'
Severity	Minor
Condition	The total NRF Ingress Message rate has crossed the configured minor threshold of 800 TPS. Default value of this alert trigger point in alert file is when NRF Ingress Rate crosses 80 % of 1000 (Maximum ingress request rate).
OID	1.3.6.1.4.1.323.5.3.36.1.2.7001
Metric Used	'oc_ingressgateway_http_requests_total'

Table 6-668 (Cont.) OcnrfTotalIngressTrafficRateAboveMinorThreshold

Field	Details
Recommended Actions	The alert is cleared either when the total Ingress Traffic rate falls below the minor threshold or when the total traffic rate crosses the major threshold, in which case the OcnrfTotalIngressTrafficRateAboveMajorThreshold alert is raised. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional traffic (for example, Mated site NRF is unavailable in georedundancy scenario). If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer Grafana to determine which service is receiving high traffic. 2. Refer Ingress gateway section in Grafana to determine the increase in 4xx and 5xx error codes. 3. Check Ingress gateway logs on Kibana to determine the reason for the errors.
Available in OCI	No

6.3.2.19 OcnrfTotalIngressTrafficRateAboveMajorThreshold

Table 6-669 OcnrfTotalIngressTrafficRateAboveMajorThreshold

Field	Details
Description	'Total Ingress traffic Rate is above major threshold. (current value is: {{ \$value }})'
Summary	'timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }}: Traffic Rate is above 90 Percent of Max requests per second'
Severity	Major
Condition	The total NRF Ingress Message rate has crossed the configured major threshold of 900 TPS. Default value of this alert trigger point in the alert file is when NRF Ingress Rate crosses 90 % of 1000 (Maximum ingress request rate).
OID	1.3.6.1.4.1.323.5.3.36.1.2.7002
Metric Used	'oc_ingressgateway_http_requests_total'

Table 6-669 (Cont.) OcnrfTotalIngressTrafficRateAboveMajorThreshold

Field	Details
Recommended Actions	The alert is cleared when the total Ingress Traffic rate falls below the major threshold or when the total traffic rate crosses the critical threshold, in which case the OcnrfTotalIngressTrafficRateAboveCriticalThreshold alert is raised. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional traffic (for example, Mated site NRF is unavailable in georedundancy scenario). If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer Grafana to determine which service is receiving high traffic. 2. Refer Ingress gateway section in Grafana to determine the increase in 4xx and 5xx error codes. 3. Check Ingress gateway logs on Kibana to determine the reason for the errors.
Available in OCI	No

6.3.2.20 OcnrfTotalIngressTrafficRateAboveCriticalThreshold

Table 6-670 OcnrfTotalIngressTrafficRateAboveCriticalThreshold

Field	Details
Description	'Total Ingress traffic Rate is above critical threshold.(current value is: {{ \$value }})'
Summary	'timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }}: Traffic Rate is more than 53069 requests per second'
Severity	Critical
Condition	The total NRF Ingress Message rate has crossed the configured critical threshold of 53069 TPS. Default value of this alert trigger point in the alert file is when NRF Ingress Rate crosses 53069 TPS.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7003
Metric Used	'oc_ingressgateway_http_requests_total'
Recommended Actions	The alert is cleared when the Ingress traffic rate falls below the critical threshold. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional traffic (for example, Mated site NRF is unavailable in georedundancy scenario). If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer Grafana to determine which service is receiving high traffic. 2. Refer Ingress gateway section in Grafana to determine the increase in 4xx and 5xx error codes. 3. Check Ingress gateway logs on Kibana to determine the reason for the errors.

Table 6-670 (Cont.) OcnrfTotalIngressTrafficRateAboveCriticalThreshold

Field	Details
Available in OCI	No

6.3.2.21 OcnrfTransactionErrorRateAbove0Dot1Percent

Table 6-671 OcnrfTransactionErrorRateAbove0Dot1Percent

Field	Details
Description	'Transaction Error rate is above 0.1 Percent of Total Transactions (current value is {{ \$value }})'
Summary	'timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }}: Transaction Error Rate detected above 0.1 Percent of Total Transactions'
Severity	Warning
Condition	The number of failed transactions is above 0.1 percent of the total transactions.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7004
Metric Used	'oc_ingressgateway_http_responses_total'
Recommended Actions	The alert is cleared when the number of failure transactions is below 0.1 percent of the total transactions or when the number of failed transactions crosses the 1% threshold, in which case the OcnrfTransactionErrorRateAbove1Percent is raised. Steps: 1. Check the service specific metrics to understand the specific service request errors. For example: ocnrf_nfDiscover_tx_responses_total with statusCode ~= 2xx. 2. Check metrics per service, per method: For example, discovery requests can be determined from the following metrics: Metrics="oc_ingressgateway_http_responses_total" Method="GET" NFServiceType="nnrf-disc" Route_path="/nnrf-disc/v1/nf-instances/**" Status="503 SERVICE_UNAVAILABLE" 3. If guidance is required, contact My Oracle Support.
Available in OCI	No

6.3.2.22 OcnrfTransactionErrorRateAbove1Percent

Table 6-672 OcnrfTransactionErrorRateAbove1Percent

Field	Details
Description	'Transaction Error rate is above 1 Percent of Total Transactions (current value is {{ \$value }})'

Table 6-672 (Cont.) OcnrfTransactionErrorRateAbove1Percent

Field	Details
Summary	'timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }}: Transaction Error Rate detected above 1 Percent of Total Transactions'
Severity	Warning
Condition	When the number of failed transactions is above 1 percent of the total transactions.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7005
Metric Used	'oc_ingressgateway_http_responses_total'
Recommended Actions	The alert is cleared when the number of failure transactions is below 1% of the total transactions or when the number of failed transactions crosses the 10% threshold, in which case the OcnrfTransactionErrorRateAbove10Percent is raised. Steps: 1. Check the service specific metrics to understand the specific service request errors. For example: ocnrf_nfDiscover_tx_responses_total with statusCode ~= 2xx. 2. Check metrics per service, per method: For example, discovery requests can be determined from the following metrics: Metrics="oc_ingressgateway_http_responses_total" Method="GET" NFServiceType="nnrf-disc" Route_path="/nnrf-disc/v1/nf-instances/**" Status="503 SERVICE_UNAVAILABLE" 3. If guidance is required, contact My Oracle Support.
Available in OCI	No

6.3.2.23 OcnrfTransactionErrorRateAbove10Percent

Table 6-673 OcnrfTransactionErrorRateAbove10Percent

Field	Details
Description	'Transaction Error rate is above 10 Percent of Total Transactions (current value is {{ \$value }})'
Summary	'timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }}: Transaction Error Rate detected above 10 Percent of Total Transactions'
Severity	Minor
Condition	The number of failed transactions has crossed the minor threshold of 10 percent of the total transactions.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7006
Metric Used	'oc_ingressgateway_http_responses_total'

Table 6-673 (Cont.) OcnrfTransactionErrorRateAbove10Percent

Field	Details
Recommended Actions	The alert is cleared when the number of failure transactions is below 10 percent of the total transactions or when the number of failed transactions crosses the 25 percent threshold, in which case the OcnrfTransactionErrorRateAbove25Percent is raised. Steps: 1. Check the service specific metrics to understand the specific service request errors. For example: ocnrf_nfDiscover_tx_responses_total with statusCode ~= 2xx. 2. Check metrics per service, per method: For example, discovery requests can be determined from the following metrics: Metrics="oc_ingressgateway_http_responses_total" Method="GET" NFServiceType="nnrf-disc" Route_path="/nnrf-disc/v1/nf-instances/**" Status="503 SERVICE_UNAVAILABLE" 3. If guidance is required, contact My Oracle Support.
Available in OCI	No

6.3.2.24 OcnrfTransactionErrorRateAbove25Percent

Table 6-674 OcnrfTransactionErrorRateAbove25Percent

Field	Details
Description	'Transaction Error rate is above 25 Percent of Total Transactions (current value is {{ \$value }})'
Summary	'timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }}: Transaction Error Rate detected above 25 Percent of Total Transactions'
Severity	Major
Condition	The number of failed transactions has crossed the minor threshold of 25 percent of the total transactions.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7007
Metric Used	'oc_ingressgateway_http_responses_total'

Table 6-674 (Cont.) OcnrfTransactionErrorRateAbove25Percent

Field	Details
Recommended Actions	The alert is cleared when the number of failure transactions is below 25 percent of the total transactions or when the number of failed transactions crosses the 50 percent threshold, in which case the OcnrfTransactionErrorRateAbove50Percent is raised. Steps: 1. Check the service specific metrics to understand the specific service request errors. For example: ocnrf_nfDiscover_tx_responses_total with statusCode ~= 2xx. 2. Check metrics per service, per method: For example, discovery requests can be determined from the following metrics: Metrics="oc_ingressgateway_http_responses_total" Method="GET" NFServiceType="nnrf-disc" Route_path="/nnrf-disc/v1/nf-instances/**" Status="503 SERVICE_UNAVAILABLE" 3. If guidance is required, contact My Oracle Support.
Available in OCI	No

6.3.2.25 OcnrfTransactionErrorRateAbove50Percent

Table 6-675 OcnrfTransactionErrorRateAbove50Percent

Field	Details
Description	'Transaction Error rate is above 50 Percent of Total Transactions (current value is {{ \$value }})'
Summary	'timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }}: Transaction Error Rate detected above 50 Percent of Total Transactions'
Severity	Critical
Condition	The number of failed transactions has crossed the minor threshold of 50 percent of the total transactions.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7008
Metric Used	'oc_ingressgateway_http_responses_total'

Table 6-675 (Cont.) OcnrfTransactionErrorRateAbove50Percent

Field	Details
Recommended Actions	The alert is cleared when the number of failure transactions is below 50 percent of the total transactions. Steps: 1. Check the service specific metrics to understand the specific service request errors. For example: ocnrf_nfDiscover_tx_responses_total with statusCode ~= 2xx. 2. Check metrics per service, per method: For example, discovery requests can be determined from the following metrics: Metrics="oc_ingressgateway_http_responses_total" Method="GET" NFServiceType="nnrf-disc" Route_path="/nnrf-disc/v1/nf-instances/**" Status="503 SERVICE_UNAVAILABLE" 3. If guidance is required, contact My Oracle Support.
Available in OCI	No

6.3.2.26 OcnrfTotalEgressTrafficRateAboveCriticalThreshold

Table 6-676 OcnrfTotalEgressTrafficRateAboveCriticalThreshold

Field	Details
Description	'Egress traffic rate is above the configured critical threshold. (current value is: {{ \$value }})'
Summary	"kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{{ end }}: Traffic Rate is above 55095 requests per second"
Severity	Critical
Condition	This alarm is raised when the Egress traffic rate is greater than the critical configured threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7109
Metric Used	oc_egressgateway_http_requests_total
Recommended Actions	The alert is cleared either when the total discovery rate falls below the critical threshold. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional traffic (for example, Mated site NRF is unavailable in georedundancy scenario). If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer Grafana to determine which service is receiving high traffic. 2. Refer Egress Gateway section in Grafana to determine the increase in 4xx and 5xx error codes. 3. Check Egress Gateway logs on Kibana to determine the reason for the errors.
Available in OCI	No

6.3.2.27 OcnrfTotalForwardingTrafficRateAboveCriticalThreshold

Table 6-677 OcnrfTotalForwardingTrafficRateAboveCriticalThreshold

Field	Details
Description	'NRF-NRF Forwarding Rate is above the configured critical threshold. (current value is: {{ \$value }})'
Summary	'kubernetes_namespace: \$labels.kubernetes_namespace, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }}: Traffic Rate is above 7740 requests per second.'
Severity	Critical
Condition	This alarm is raised when the rate between NRF and NRF Forwarding is greater than the critical configured threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7110
Metric Used	ocnrf_forward_nfDiscover_tx_requests_total
Recommended Actions	The alert is cleared either when the total NRF Forwarding rate falls below the critical threshold. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional traffic (for example, Mated site NRF is unavailable in georedundancy scenario). If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer Grafana to determine which service is receiving high traffic. 2. Refer NRF Forwarding section in Grafana to determine the increase in 4xx and 5xx error codes. 3. Check NRF Forwarding logs on Kibana to determine the reason for the errors.
Available in OCI	No

6.3.2.28 OcnrfHeapUsageCrossedMinorThreshold

Table 6-678 OcnrfHeapUsageCrossedMinorThreshold

Field	Details
Description	'OCNRF Heap Usage for pod {{ \$labels.pod }} has crossed the configured minor threshold (50%) (value={{ \$value }}) of its limit.'
Summary	'kubernetes_namespace: {{ \$labels.kubernetes_namespace }}, podname: {{ \$labels.pod }}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : Heap Usage of pod exceeded 50% of its limit.'
Severity	Minor
Condition	This alert is raised when the Java memory heap usage of pods exceeds the configured minor threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7126
Metric Used	jvm_memory_used_bytes

Table 6-678 (Cont.) OcnrfHeapUsageCrossedMinorThreshold

Field	Details
Recommended Actions	The alert is cleared when the heap usage of pods falls below the minor threshold. Note: The threshold is configurable in the alert file. If this alert is unexpected, contact My Oracle Support. Steps: 1. Identify the pods which are raised in the alert. 2. Refer Resource usage in Grafana dashboard to get the memory usage. 3. Collect the pod logs and top output of the pods. 4. Contact My Oracle Support.
Available in OCI	No

6.3.2.29 OcnrfHeapUsageCrossedMajorThreshold

Table 6-679 OcnrfHeapUsageCrossedMajorThreshold

Field	Details
Description	'OCNRF Heap Usage for pod {{ \$labels.pod }} has crossed the configured major threshold (60%) (value={{ \$value }}) of its limit.'
Summary	'kubernetes_namespace: {{ \$labels.kubernetes_namespace }}, podname: {{ \$labels.pod }}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }} : Heap Usage of pod is more than or equal to 60% and less than 70% of its limit.'
Severity	Major
Condition	This alert is raised when the Java memory heap usage of pods exceeds the configured major threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7127
Metric Used	jvm_memory_used_bytes
Recommended Actions	The alert is cleared when the heap usage of pods falls below the major threshold. Note: The threshold is configurable in the alert file. If this alert is unexpected, contact My Oracle Support. Steps: 1. Identify the pods which are raised in the alert. 2. Refer Resource usage in Grafana dashboard to get the memory usage. 3. Collect the pod logs and top output of the pods. 4. Contact My Oracle Support.
Available in OCI	No

6.3.2.30 OcnrfHeapUsageCrossedCriticalThreshold

Table 6-680 OcnrfHeapUsageCrossedCriticalThreshold

Field	Details
Description	'OCNRF Heap Usage for pod {{ \$labels.pod }} has crossed the configured critical threshold (70%) (value={{ \$value }}) of its limit.'
Summary	'kubernetes_namespace: {{ \$labels.kubernetes_namespace }}, podname: {{ \$labels.pod }}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }} : Heap Usage of pod is more than 70% of its limit.'
Severity	Critical
Condition	This alert is raised when the Java memory heap usage of pods exceeds the configured critical threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7128
Metric Used	jvm_memory_used_bytes
Recommended Actions	The alert is cleared when the heap usage of pods falls below the critical threshold. Note: The threshold is configurable in the alert file. If this alert is unexpected, contact My Oracle Support. Steps: 1. Identify the pods which are raised in the alert. 2. Refer Resource usage in Grafana dashboard to get the memory usage. 3. Collect the pod logs and top output of the pods. 4. Contact My Oracle Support.
Available in OCI	No

6.3.2.31 OcnrfServicesFetchFailureForDestinationIPAddresses

Table 6-681 OcnrfServicesFetchFailureForDestinationIPAddresses

Field	Details
Description	'OCNRF services are unable to fetch the destination IP addresses of services from the Kubernetes API server'
Summary	'kubernetes_namespace: {{ \$labels.kubernetes_namespace }}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }}: OCNRF services are unable to fetch the destination IP addresses of services from the Kubernetes API server'
Severity	Critical
Condition	This alert is raised when OCNRF microservices are unable to fetch the destination IP addresses of services from the Kubernetes API server.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7136
Metric Used	oc_cnc_jetty_service_discovery_up
Recommended Actions	The alert is automatically cleared once the pods can fetch IP addresses from the Kubernetes API server.
Available in OCI	No

6.3.3 Service Level Alerts

This section lists the service level alerts.

6.3.3.1 OcnrfAccessTokenRequestsRejected

Table 6-682 OcnrfAccessTokenRequestsRejected

Field	Details
Description	'AccessToken request(s) have been rejected by OCNRF (current value is: {{ \$value }})'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}},nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} AccessToken Request has been rejected by OCNRF.'
Severity	Warning
Condition	NRF rejected an AccessToken Request
OID	1.3.6.1.4.1.323.5.3.36.1.2.7014
Metric Used	'ocnrf_accessToken_tx_responses_total'
Recommended Actions	The alert is cleared automatically. Steps: 1. The Rejection Reason is present in the alert. 2. In case the RejectionReason is AuthScreeningFailed/ ClientNotAuthorized, either the configurations need to be reevaluated or check the consumer NF that has requested for unauthorized token. For more information about token information, see <i>Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide</i>. 3. For other reasons, follow the RejectionReason.
Available in OCI	No

6.3.3.2 OcnrfAuditorMultiplePodUnavailable

Table 6-683 OcnrfAuditorMultiplePodUnavailable

Field	Details
Description	Ocnrf Auditor Multiple Pods are Unavailable in deployment
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : Ocnrf Auditor Multiple Pods are Unavailable'
Severity	Critical
Condition	Ocnrf Auditor Multiple Pods are Unavailable.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7075
Metric Used	NA
Recommended Actions	This alert is raised due to auditor multiple pods are unavailable. This alert is cleared automatically when the pods are available.
Available in OCI	No

6.3.3.3 OcnrfAppInfoMultiplePodUnavailable

Table 6-684 OcnrfAppInfoMultiplePodUnavailable

Field	Details
Description	Ocnrf AppInfo Multiple Pods are Unavailable in deployment
Summary	'kubernetes_namespace: {{labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : Ocnrf AppInfo Multiple Pods are Unavailable'
Severity	Critical
Condition	Ocnrf Auditor Multiple Pods are Unavailable.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7076
Metric Used	NA
Recommended Actions	This alert is raised due to App-Info multiple pods are unavailable. This alert is cleared automatically when the pods are available.
Available in OCI	No

6.3.3.4 OcnrfPerfInfoMultiplePodUnavailable

Table 6-685 OcnrfPerfInfoMultiplePodUnavailable

Field	Details
Description	Ocnrf PerfInfo Multiple Pods are Unavailable in deployment
Summary	'kubernetes_namespace: {{labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : Ocnrf PerfInfo Multiple Pods are Unavailable'
Severity	Critical
Condition	Ocnrf PerfInfo Multiple Pods are Unavailable.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7077
Metric Used	NA
Recommended Actions	This alert is raised due to perf-Info multiple pods are unavailable. This alert is cleared automatically when the pods are available.
Available in OCI	No

6.3.3.5 OcnrfTotalSLFRateAboveCriticalThreshold

Table 6-686 OcnrfTotalSLFRateAboveCriticalThreshold

Field	Details
Description	'NRF-SLF Rate is above the configured critical threshold. (current value is: {{ \$value }})'
Summary	'kubernetes_namespace: \$labels.kubernetes_namespace, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }}: Traffic Rate is above 45200 requests per second.'
Severity	Critical
Condition	This alarm is raised when the rate between NRF and SLF reaches is greater than the critical configured threshold.

Table 6-686 (Cont.) OcnrfTotalSLFRateAboveCriticalThreshold

Field	Details
OID	1.3.6.1.4.1.323.5.3.36.1.2.7111
Metric Used	ocnrf_SLF_tx_requests_total
Recommended Actions	The alert is cleared either when the total SLF rate falls below the critical threshold. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional traffic (for example, Mated site NRF is unavailable in georedundancy scenario). If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer Grafana to determine which service is receiving high traffic. 2. Refer SLF section in Grafana to determine the increase in 4xx and 5xx error codes. 3. Check SLF logs on Kibana to determine the reason for the errors.
Available in OCI	No

6.3.3.6 OcnrfTotalDiscoveryRateAboveCriticalThreshold

Table 6-687 OcnrfTotalDiscoveryRateAboveCriticalThreshold

Field	Details
Description	'Total Discovery Rate is above the configured critical threshold. (current value is: {{ \$value }})'
Summary	'kubernetes_namespace: \$labels.kubernetes_namespace, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{{ end }}: Traffic Rate is above 51600 requests per second.'
Severity	Critical
Condition	This alarm is raised when the total discovery rate is greater than the critical configured threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7112
Metric Used	ocnrf_nfDiscover_rx_requests_total
Recommended Actions	The alert is cleared when the total discovery rate falls below the critical threshold. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional traffic (for example, Mated site NRF is unavailable in georedundancy scenario). If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer Grafana to determine which service is receiving high traffic. 2. Refer Discovery section in Grafana to determine the increase in 4xx and 5xx error codes. 3. Check Discovery logs on Kibana to determine the reason for the errors.
Available in OCI	No

6.3.3.7 OcnrfAccessTokenRequestsAboveThreshold

Table 6-688 OcnrfAccessTokenRequestsAboveThreshold

Field	Details
Description	'Total Access token request rate is above the configured critical threshold. (current value is: {{ \$value }})'
Summary	'namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }} {{ . first value humanizeTimestamp }}{{ end }}: Total Access token request rate is above 10'
Severity	Critical
Condition	The alert is raised when the rate of Access Token requests is greater than the configured threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7115
Metric Used	ocnrf_accessToken_rx_requests_total
Recommended Actions	The alert is cleared when the total number of access token request rate falls below the critical threshold. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional traffic (for example, Mated site NRF is unavailable in georedundancy scenario). If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer the NfAccessToken Section in Grafana to determine increase in TPS. 2. Refer the Grafana to determine increase in failure responses.
Available in OCI	No

6.3.3.8 OcnrfNfUpdateRequestsAboveThreshold

Table 6-689 OcnrfNfUpdateRequestsAboveThreshold

Field	Details
Description	'Total NfUpdate request rate is above the configured critical threshold. (current value is: {{ \$value }})'
Summary	'namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }} {{ . first value humanizeTimestamp }}{{ end }}: Total NfUpdate request rate is above 43'
Severity	Critical
Condition	This alert is raised when the total number of NfUpdate requests is greater than the configured threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7116
Metric Used	ocnrf_nfUpdate_rx_requests_total
Recommended Actions	The alert is cleared when the total number of NfUpdate request falls below the critical threshold. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional traffic (for example, Mated site NRF is unavailable in georedundancy scenario). If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer the NfRegister Section in Grafana to determine increase in TPS. 2. Refer the Grafana to determine increase in failure responses.

Table 6-689 (Cont.) OcnrfNfUpdateRequestsAboveThreshold

Field	Details
Available in OCI	No

6.3.3.9 OcnrfNfHeartBeatRequestsAboveThreshold

Table 6-690 OcnrfNfHeartBeatRequestsAboveThreshold

Field	Details
Description	'Total NfHeartBeat request rate is above the configured critical threshold. (current value is: {{ \$value }})'
Summary	'namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }} {{ . first value humanizeTimestamp }}{{ end }}: Total NfHeartBeat request rate is above 155'
Severity	Critical
Condition	This alert is raised when the total number of NfHeartBeat requests is greater than the configured threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7117
Metric Used	ocnrf_nfHeartBeat_rx_requests_total
Recommended Actions	The alert is cleared when the total number of NfHeartBeat request falls below the critical threshold. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional traffic (for example, Mated site NRF is unavailable in georedundancy scenario). If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer the NfRegister Section in Grafana to determine increase in TPS. 2. Refer the Grafana to determine increase in failure responses.
Available in OCI	No

6.3.3.10 OcnrfRegisteredNfCountAboveThreshold

Table 6-691 OcnrfRegisteredNfCountAboveThreshold

Field	Details
Description	'Total Number of active registrations in OCNRF is above critical threshold. (current value is: {{ \$value }})'
Summary	'namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }} {{ . first value humanizeTimestamp }}{{ end }}: Total Number of active registrations in OCNRF is above 300'
Severity	Critical
Condition	The alert is raised when the total number of NFs registered in the set is greater than the configured threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7118
Metric Used	ocnrf_nf_registered_count

Table 6-691 (Cont.) OcnrfRegisteredNfCountAboveThreshold

Field	Details
Recommended Actions	The alert is cleared when the total number active registrations in NRF falls below the critical threshold. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional registrations. If this alert is unexpected, contact My Oracle Support. Step: 1. Refer Grafana to determine the number of NFs per nfType.
Available in OCI	No

6.3.3.11 OcnrfTotalSubscriptionsAboveThreshold

Table 6-692 OcnrfTotalSubscriptionsAboveThreshold

Field	Details
Description	'Total Number of active subscriptions in OCNRF is above the critical threshold. (current value is: {{ \$value }})'
Summary	'namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }} {{ . first value humanizeTimestamp }}{{ end }}: Total Number of active subscriptions in OCNRF is above 1500.'
Severity	Critical
Condition	This alert is raised when the total number of active subscriptions in NRF is greater than the configured threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7121
Metric Used	ocnrf_nfset_active_subscriptions
Recommended Actions	The alert is cleared when the total number active subscriptions in NRF is less than the critical threshold. Note: The threshold is configurable in the alert file. Reassess why the NRF has received additional subscriptions (for example, Mated site NRF is unavailable in georedundancy scenario). If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer Grafana to determine the total number of subscriptions created. 2. Verify if Subscription Limit feature has been enabled using subscriptionLimit.featureStatus parameter. For more information, see <i>Oracle Communications Cloud Native Core, Network Repository Function User Guide</i>. 3. Assess which NFs are creating the additional subscriptions.
Available in OCI	No

6.3.3.12 OcnrfDiscoveryRequestsForUDRAboveThreshold

Table 6-693 OcnrfDiscoveryRequestsForUDRAboveThreshold

Field	Details
Description	'Total NfDiscover request rate for nfType UDR is above the configured critical threshold. (current value is: {{ \$value }})'

Table 6-693 (Cont.) OcnrfDiscoveryRequestsForUDRAboveThreshold

Field	Details
Summary	'namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }} {{ . first value humanizeTimestamp }}{{ end }}: Total NfDiscover request rate for nfType UDR is above above 200'
Severity	Critical
Condition	This alert is raised when the rate of nfDiscover requests for nfType UDR is greater than the configured threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7122
Metric Used	ocnrf_nfDiscover_rx_requests_total
Recommended Actions	The alert is cleared when the rate of nfDiscover requests for nfType UDR is below than the critical threshold. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional traffic for UDR. If this alert is unexpected, contact My Oracle Support .
Available in OCI	No

6.3.3.13 OcnrfDiscoveryRequestsForUDMAboveThreshold

Table 6-694 OcnrfDiscoveryRequestsForUDMAboveThreshold

Field	Details
Description	'Total NfDiscover request rate for nfType UDM is above the configured critical threshold. (current value is: {{ \$value }})'
Summary	'namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }} {{ . first value humanizeTimestamp }}{{ end }}: Total NfDiscover request rate for nfType UDM is above above 43200'
Severity	Critical
Condition	This alert is raised when the rate of nfDiscover requests for nfType UDM is greater than the configured threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7123
Metric Used	ocnrf_nfDiscover_rx_requests_total
Recommended Actions	The alert is cleared when the rate of nfDiscover requests for nfType UDM is below than the critical threshold. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional traffic for UDM. If this alert is unexpected, contact My Oracle Support .
Available in OCI	No

6.3.3.14 OcnrfDiscoveryRequestsForAMFAboveThreshold

Table 6-695 OcnrfDiscoveryRequestsForAMFAboveThreshold

Field	Details
Description	'Total NfDiscover request rate for nfType AMF is above the configured critical threshold. (current value is: {{ \$value }})'

Table 6-695 (Cont.) OcnrfDiscoveryRequestsForAMFAboveThreshold

Field	Details
Summary	'namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }} {{ . first value humanizeTimestamp }}{{ end }}: Total NfDiscover request rate for nfType AMF is above 1300'
Severity	Critical
Condition	This alert is raised when the rate of nfDiscover requests for nfType AMF is greater than the configured threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7124
Metric Used	ocnrf_nfDiscover_rx_requests_total
Recommended Actions	The alert is cleared when the rate of nfDiscover requests for nfType AMF is below than the critical threshold. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional traffic for AMF. If this alert is unexpected, contact My Oracle Support .
Available in OCI	No

6.3.3.15 OcnrfDiscoveryRequestsForSMFAboveThreshold

Table 6-696 OcnrfDiscoveryRequestsForSMFAboveThreshold

Field	Details
Description	'Total NfDiscover request rate for nfType SMF is above the configured critical threshold. (current value is: {{ \$value }})'
Summary	'namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }} {{ . first value humanizeTimestamp }}{{ end }}: Total NfDiscover request rate for nfType SMF is above 1900'
Severity	Critical
Condition	This alert is raised when the rate of nfDiscover requests for nfType SMF is greater than the configured threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7125
Metric Used	ocnrf_nfDiscover_rx_requests_total
Recommended Actions	The alert is cleared when the rate of nfDiscover requests for nfType SMF is below than the critical threshold. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional traffic for SMF. If this alert is unexpected, contact My Oracle Support .
Available in OCI	No

6.3.4 NfProfile Status Change Alerts

This section lists the alerts raised when there is status change in NfProfile.

6.3.4.1 OcnrfRegisteredPCFsBelowCriticalThreshold

Table 6-697 OcnrfRegisteredPCFsBelowCriticalThreshold

Field	Details
Description	'The number of registered NFs detected below critical threshold (current value is: {{ \$value }})'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, nftype: {{\$labels.RequesterNfType}}, nrflevel:{{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }}: The number of registered NFs detected below critical threshold.'
Severity	Critical
Condition	The number of NFs of the given NFType PCF currently registered with NRF is below the critical threshold. Note: Operator can add similar alerts for each NfType and configure the corresponding thresholds as required. Default value of this alert trigger point in the alert file is when registered PCFs count with NRF is below 2.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7009
Metric Used	'ocnrf_active_registrations_count'
Recommended Actions	The alert is cleared when the number of registered PCFs is above the critical threshold. Steps: 1. Check if there is traffic for requests other than registration (for example, discovery requests). This ensures that NRF FQDN is reachable from other NFs and Ingress Gateway is up and running. 2. Check if ingress gateway pod is up and running: <pre>kubectl get po -n <namespace></pre> 3. Check for registration pod logs on Kibana for ERROR WARN logs. 4. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Notes	1. Operator can configure the threshold values to the number of NFs of type PCF expected within the network. 2. PCFs with NFStatus as 'SUSPENDED' or 'UNDISCOVERABLE' are considered as unregistered. 3. Operator can configure the RequesterNfType expected within the network. 4. Operator can add similar alerts for each NfType and configure the corresponding thresholds as required.
Available in OCI	No

6.3.4.2 OcnrfRegisteredPCFsBelowMajorThreshold

Table 6-698 OcnrfRegisteredPCFsBelowMajorThreshold

Field	Details
Description	'The number of registered NFs detected below major threshold (current value is: {{ \$value }})'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, nftype: {{\$labels.NfType}}, nrflabel:{{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }}: The number of registered NFs detected below major threshold.'
Severity	Major
Condition	The number of NFs of the given NfType PCF currently registered with NRF is below the major threshold. Note: Operator can add similar alerts for each NfType and configure the corresponding thresholds as required. Default value of this alert trigger point in the alert file is when Registered PCFs count with NRF is greater than or equal to 2 and below 10.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7010
Metric Used	'ocnrf_active_registrations_count'
Recommended Actions	The alert is cleared when the number of registered PCFs is above the major threshold. Steps: 1. Check if there is traffic for requests other than registration (for example, discovery requests). This ensures that NRF FQDN is reachable from other NFs and Ingress Gateway is up and running. 2. Check if Ingress Gateway pod is up and running: <pre>kubectl get po -n <namespace></pre> 3. Check for registration pod logs on Kibana for ERROR WARN logs. 4. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Notes	1. Operator can configure the threshold values with respect to the number of NFs of type PCF expected within the network. 2. PCFs with NFStatus as 'SUSPENDED' or 'UNDISCOVERABLE' are considered as unregistered. 3. Operator can configure the RequesterNfType expected within the network. 4. Operator can add similar alerts for each NfType and configure the corresponding thresholds as required.
Available in OCI	No

6.3.4.3 OcnrfRegisteredPCFsBelowMinorThreshold

Table 6-699 OcnrfRegisteredPCFsBelowMinorThreshold

Field	Details
Description	'The number of registered NFs detected below minor threshold (current value is: {{ \$value }})'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, nftype: {{\$labels.NfType}}, nrflvel:{{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }}: The number of registered NFs detected below minor threshold.'
Severity	Minor
Condition	The number of NFs of the given NfType PCF currently registered with NRF is below the minor threshold. Note: Operator can add similar alerts for each NfType and configure the corresponding thresholds as required. Default value of this alert trigger point in the alert file is when registered PCFs count with NRF is greater than or equal to 10 and below 20.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7011
Metric Used	'ocnrf_active_registrations_count'
Recommended Actions	The alert is cleared when the number of registered PCFs is above the minor threshold. Steps: 1. Check if there is traffic for requests other than registration (for example, discovery requests). This ensures that NRF FQDN is reachable from other NFs and Ingress Gateway is up and running. 2. Check if ingress gateway pod is up and running: <pre>kubectl get po -n <namespace></pre> 3. Check for Registration pod logs on Kibana for ERROR WARN logs. 4. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Notes	1. Operator can configure the threshold values with respect to the number of NFs of type PCF expected within the network. 2. PCFs with NFStatus as 'SUSPENDED' or 'UNDISCOVERABLE' are considered as unregistered. 3. Operator can configure the RequesterNfType expected within the network. 4. Operator can add similar alerts for each NfType and configure the corresponding thresholds as required.
Available in OCI	No

6.3.4.4 OcnrfRegisteredPCFsBelowThreshold

Table 6-700 OcnrfRegisteredPCFsBelowThreshold

Field	Details
Description	'The number of registered NFs is approaching minor threshold (current value is: {{ \$value }})'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, nftype: {{\$labels.NfType}}, nrflabel:{{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }}: The number of registered NFs approaching minor threshold.'
Severity	Warning
Condition	The number of NFs of the given NfType PCF currently registered with NRF is approaching minor threshold. Note: Operator can add similar alerts for each NfType and configure the corresponding thresholds as required. Default value of this alert trigger point in the alert file is when registered PCFs count with NRF is greater than or equal to 20 and below 30.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7012
Metric Used	'ocnrf_active_registrations_count'
Recommended Actions	The alert is cleared when the number of registered PCFs is approaching minor threshold. Steps: 1. Check if there is traffic for requests other than registration (for example, discovery requests). This ensures that NRF FQDN is reachable from other NFs and Ingress Gateway is up and running. 2. Check if Ingress Gateway pod is up and running: <pre>kubectl get po -n <namespace></pre> 3. Check for Registration pod logs on Kibana for ERROR WARN logs. 4. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Notes	1. Operator can configure the threshold values with respect to the number of NFs of type PCF expected within the network. 2. PCFs with NFStatus as 'SUSPENDED' or 'UNDISCOVERABLE' are considered as unregistered. 3. Operator can configure the RequesterNfType expected within the network. 4. Operator can add similar alerts for each NfType and configure the corresponding thresholds as required.
Available in OCI	No

6.3.4.5 OcnrfTotalNFsRegisteredBelowCriticalThreshold

Table 6-701 OcnrfTotalNFsRegisteredBelowCriticalThreshold

Field	Details
Description	'Number of active registrations in OCNRF (current value is: {{ \$value }}) is below critical threshold'
Summary	kubernetes_namespace: {{\$labels.kubernetes_namespace}},nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{{ end }} : Active registrations count.
Severity	Critical
Condition	The total number of NFs currently in "REGISTERED" state with the NRF is below the critical threshold. Note: The threshold values are provided as an example. User can configure the threshold value as per the requirement.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7042
Metric Used	'ocnrf_active_registrations_count'
Recommended Actions	The alert is cleared when the number of registered NFs is above the critical threshold. Steps: 1. Check if there is traffic for requests other than registration (for example, discovery requests). This ensures that NRF FQDN is reachable from other NFs and Ingress Gateway is up and running. 2. Check if Ingress Gateway pod is up and running: kubect1 get po -n <namespace> 3. Check for registration pod logs on Kibana for ERROR WARN logs. 4. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, cnDBTier User Guide</i>.
Notes	1. Operator can configure the threshold values with respect to the number of NFs expected within the network. 2. NFs with NFStatus as 'SUSPENDED' or 'UNDISCOVERABLE' are not considered as registered.
Available in OCI	Yes

6.3.4.6 OcnrfTotalNFsRegisteredBelowMajorThreshold

Table 6-702 OcnrfTotalNFsRegisteredBelowMajorThreshold

Field	Details
Description	'Number of active registrations in OCNRF (current value is: {{ \$value }}) is below major threshold'

Table 6-702 (Cont.) OcnrfTotalNFsRegisteredBelowMajorThreshold

Field	Details
Summary	kubernetes_namespace: {{\$labels.kubernetes_namespace}},nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{{ end }} : Active registrations count.
Severity	Major
Condition	The total number of NFs currently in "REGISTERED" state with the NRF is below the major threshold. Note: The threshold values are provided as an example. The user can configure the threshold value as per the requirement.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7043
Metric Used	'ocnrf_active_registrations_count'
Recommended Actions	The alert is cleared when the number of registered NFs is above the major threshold. Steps: 1. Check if there is traffic for requests other than registration (for example, discovery requests). This ensures that NRF FQDN is reachable from other NFs and Ingress Gateway is up and running. 2. Check if Ingress Gateway pod is up and running: kubect1 get po -n <namespace> 3. Check for Registration pod logs on Kibana for ERROR WARN logs. 4. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on capturing logs, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Notes	1. Operator can configure the threshold values with respect to the number of NFs expected within the network. 2. NFs with NFStatus as 'SUSPENDED' or 'UNDISCOVERABLE' are not considered as registered.
Available in OCI	Yes

6.3.4.7 OcnrfTotalNFsRegisteredBelowMinorThreshold

Table 6-703 OcnrfTotalNFsRegisteredBelowMinorThreshold

Field	Details
Description	'Number of active registrations in OCNRF (current value is: {{ \$value }}) is below minor threshold'
Summary	kubernetes_namespace: {{\$labels.kubernetes_namespace}},nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{{ end }} : Active registrations count.
Severity	Minor

Table 6-703 (Cont.) OcnrfTotalNFsRegisteredBelowMinorThreshold

Field	Details
Condition	The total number of NFs currently in "REGISTERED" state with the NRF is below the minor threshold. Note: The threshold values are provided as an example. The user can configure the threshold value as per the requirement.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7044
Metric Used	'ocnrf_active_registrations_count'
Recommended Actions	The alert is cleared when the number of registered NFs is above the minor threshold. Steps: 1. Check if there is traffic for requests other than registration (for example, discovery requests). This ensures that NRF FQDN is reachable from other NFs and Ingress Gateway is up and running. 2. Check if Ingress Gateway pod is up and running: kubect1 get po -n <namespace> 3. Check for registration pod logs on Kibana for ERROR WARN logs. 4. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on capturing logs, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Notes	1. Operator can configure the threshold values with respect to the number of NFs expected within the network. 2. NFs with NFStatus as 'SUSPENDED' or 'UNDISCOVERABLE' are not considered as registered.
Available in OCI	Yes

6.3.4.8 OcnrfTotalNFsRegisteredApproachingMinorThreshold

Table 6-704 OcnrfTotalNFsRegisteredApproachingMinorThreshold

Field	Details
Description	'Number of active registrations in OCNRF (current value is: {{ \$value }}) is approaching minor threshold'
Summary	kubernetes_namespace: {{\$labels.kubernetes_namespace}},nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : Active registrations count.
Severity	Info
Condition	The total number of NFs currently in "REGISTERED" state with the NRF is approaching minor threshold. Note: The threshold values provided as an example. The user can configure the threshold as per need.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7045
Metric Used	'ocnrf_active_registrations_count'

Table 6-704 (Cont.) OcnrfTotalNFsRegisteredApproachingMinorThreshold

Field	Details
Recommended Actions	The alert is cleared when the number of registered NFs are approaching minor threshold. Steps: No action is required. This is an information alert.
Notes	- Operator can configure the threshold values with respect to the number of NFs expected within the network. - NFs with NFStatus as 'SUSPENDED' or 'UNDISCOVERABLE' are not considered as registered.
Available in OCI	Yes

6.3.4.9 OcnrfNFStatusTransitionToRegistered

Table 6-705 OcnrfNFStatusTransitionToRegistered

Field	Details
Description	'NF with NF profile fqdn {{\$labels.NfProfileFqdn}} NF instance id {{\$labels.NfInstanceId}} NF type {{\$labels.NfType}} is REGISTERED , previous status was {{\$labels.PreviousStatus}}'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}},nrflevel: {{\$labels.NrfLevel}},podname: {{\$labels.kubernetes_pod_name}},NfInstanceId: {{\$labels.NfInstanceId}},NfProfileFqdn: {{\$labels.NfProfileFqdn}},NfType: {{\$labels.NfType}},PreviousStatus: {{\$labels.PreviousStatus}},NewStatus: {{\$labels.NewStatus}},timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} NF is REGISTERED.'
Severity	Info
Condition	NF Instance's status transitions to REGISTERED. Note: When multiple alerts are present for a given NF, the latest alert is always considered. The timestamp can also be seen in the "Active Since" field of the alert in Prometheus.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7046
Metric Used	ocnrf_nflnstance_status_change_total
Recommended Actions	The alert is cleared automatically after a window of 5 minutes. Steps: No action is required. This is an information alert.
Available in OCI	Yes

6.3.4.10 OcnrfNFServiceStatusTransitionToRegistered

Table 6-706 OcnrfNFServiceStatusTransitionToRegistered

Field	Details
Description	'NF service {{\$labels.NfServiceName}} and service instance id {{\$labels.NfServiceInstanceId}} of NF profile fqdn {{\$labels.NfProfileFqdn}} and instance id {{\$labels.NfInstanceId}} is REGISTERED, previous status was {{\$labels.PreviousStatus}}'

Table 6-706 (Cont.) OcnrfNFServiceStatusTransitionToRegistered

Field	Details
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}},nrflevel: {{\$labels.NrfLevel}},podname: {{\$labels.kubernetes_pod_name}},NfInstanceId: {{\$labels.NfInstanceId}},NfServiceName: {{\$labels.NfServiceName}},NfServiceInstanceId: {{\$labels.NfServiceInstanceId}},NfProfileFqdn: {{\$labels.NfProfileFqdn}},NfServiceFqdn: {{\$labels.NfServiceFqdn}},PreviousStatus: {{\$labels.PreviousStatus}},NewStatus: {{\$labels.NewStatus}},timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} NF service is REGISTERED.'
Severity	Info
Condition	Status of an NF Instance's service transitions to REGISTERED. Note: When multiple alerts are present for a given NF, the latest alert is always considered. The timestamp can also be seen in the "Active Since" field of the alert in Prometheus.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7047
Metric Used	ocnrf_nfService_status_change_total
Recommended Actions	The alert is cleared automatically after a window of 5 minutes. Steps: No action is required. This is an information alert.
Available in OCI	Yes

6.3.4.11 OcnrfNFStatusTransitionToSuspended

Table 6-707 OcnrfNFStatusTransitionToSuspended

Field	Details
Description	'NF with NF profile fqdn {{\$labels.NfProfileFqdn}} NF instance id {{\$labels.NfInstanceId}} NF type {{\$labels.NfType}} is SUSPENDED, previous status was {{\$labels.PreviousStatus}}'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}},nrflevel: {{\$labels.NrfLevel}},podname: {{\$labels.kubernetes_pod_name}},NfInstanceId: {{\$labels.NfInstanceId}},NfProfileFqdn: {{\$labels.NfProfileFqdn}},NfType: {{\$labels.NfType}},PreviousStatus: {{\$labels.PreviousStatus}},NewStatus: {{\$labels.NewStatus}},timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} NF is SUSPENDED.'
Severity	Major
Condition	NF Instance's status transitions to SUSPENDED. Note: When multiple alerts are present for a given NF, the latest alert is always considered. The timestamp can also be seen in the "Active Since" field of the alert in Prometheus.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7048
Metric Used	ocnrf_nfInstance_status_change_total

Table 6-707 (Cont.) OcnrfNFStatusTransitionToSuspended

Field	Details
Recommended Actions	The alert is cleared automatically after a window of 5 minutes. Steps: 1. Check logs in NRF registration pod for failing patch requests or check Jaeger traces to see traces for incoming requests. 2. Check Ingress Gateway logs to see if the requests are coming. 3. Check if the NRF pods are UP. 4. Check for the Ingress Gateway metrics in Prometheus for PATCH requests or responses in this time frame. Confirm if the responses have any non-2xx error codes. 5. Depending on the failure reason, take the resolution steps. 6. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on capturing logs, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	Yes

6.3.4.12 OcnrfNFServiceStatusTransitionToSuspended

Table 6-708 OcnrfNFServiceStatusTransitionToSuspended

Field	Details
Description	'NF service {{ \$labels.NfServiceName }} and service instance id {{ \$labels.NfServiceInstanceId }} of NF profile fqdn {{ \$labels.NfProfileFqdn }} and instance id {{ \$labels.NfInstanceId }} is SUSPENDED, previous status was {{ \$labels.PreviousStatus }}'
Summary	'kubernetes_namespace: {{ \$labels.kubernetes_namespace }},nrflevel: {{ \$labels.NrfLevel }},podname: {{ \$labels.kubernetes_pod_name }},NfInstanceId: {{ \$labels.NfInstanceId }},NfServiceName: {{ \$labels.NfServiceName }},NfServiceInstanceId: {{ \$labels.NfServiceInstanceId }},NfProfileFqdn: {{ \$labels.NfProfileFqdn }},NfServiceFqdn: {{ \$labels.NfServiceFqdn }},PreviousStatus: {{ \$labels.PreviousStatus }},NewStatus: {{ \$labels.NewStatus }},timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end } NF service is SUSPENDED.'
Severity	Minor
Condition	Status of an NF Instance's service transitions to SUSPENDED. Note: When multiple alerts are present for a given NF, the latest alert is always considered. The timestamp can also be seen in the "Active Since" field of the alert in Prometheus.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7049
Metric Used	ocnrf_nfService_status_change_total

Table 6-708 (Cont.) OcnrfNFServiceStatusTransitionToSuspended

Field	Details
Recommended Actions	The alert is cleared automatically after a window of 5 minutes. Steps: 1. Check logs in NRF registration pod for failing patch requests or check Jaeger traces to see traces for incoming requests. 2. Check Ingress Gateway logs to see if the requests are coming. 3. Check if the NRF pods are UP. 4. Check for the Ingress Gateway metrics in Prometheus for PATCH requests or responses in this time frame. Confirm if the responses have any non-2xx error codes. 5. Depending on the failure reason, take the resolution steps. 6. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on capturing logs, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	Yes

6.3.4.13 OcnrfNFStatusTransitionToUndiscoverable

Table 6-709 OcnrfNFStatusTransitionToUndiscoverable

Field	Details
Description	'NF with NF profile fqdn {{ \$labels.NfProfileFqdn }} NF instance id {{ \$labels.NfInstanceId }} NF type {{ \$labels.NfType }} is UNDISCOVERABLE, previous status was {{ \$labels.PreviousStatus }}'
Summary	'kubernetes_namespace: {{ \$labels.kubernetes_namespace }},nrflevel: {{ \$labels.NrfLevel }},podname: {{ \$labels.kubernetes_pod_name }},NfInstanceId: {{ \$labels.NfInstanceId }},NfProfileFqdn: {{ \$labels.NfProfileFqdn }},NfType: {{ \$labels.NfType }},PreviousStatus: {{ \$labels.PreviousStatus }},NewStatus: {{ \$labels.NewStatus }},timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} NF is UNDISCOVERABLE.'
Severity	Info
Condition	NF Instance's status transitions to UNDISCOVERABLE. Note: When multiple alerts are present for a given NF, the latest alert is always considered. The timestamp can also be seen in the "Active Since" field of the alert in Prometheus.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7050
Metric Used	ocnrf_nfInstance_status_change_total

Table 6-709 (Cont.) OcnrfNFStatusTransitionToUndiscoverable

Field	Details
Recommended Actions	The alert is cleared automatically after a window of 5 minutes. Steps: 1. Check logs in NRF registration pod to verify if the NF has sent UNDISCOVERABLE status in NFRegister or NfUpdate requests or check Jaeger traces to see traces for incoming requests. 2. If there is no such incoming request, collect the logs and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on capturing logs, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	Yes

6.3.4.14 OcnrfNFServiceStatusTransitionToUndiscoverable

Table 6-710 OcnrfNFServiceStatusTransitionToUndiscoverable

Field	Details
Description	'NF service {{labels.NfServiceName}} and service instance id {{labels.NfServiceInstanceId}} of NF profile fqdn {{labels.NfProfileFqdn}} and instance id {{labels.NfInstanceId}} is UNDISCOVERABLE, previous status was {{labels.PreviousStatus}}'
Summary	'kubernetes_namespace: {{labels.kubernetes_namespace}},nrflevel: {{labels.NrfLevel}},podname: {{labels.kubernetes_pod_name}},NfInstanceId: {{labels.NfInstanceId}},NfServiceName: {{labels.NfServiceName}},NfServiceInstanceId: {{labels.NfServiceInstanceId}},NfProfileFqdn: {{labels.NfProfileFqdn}},NfServiceFqdn: {{labels.NfServiceFqdn}},PreviousStatus: {{labels.PreviousStatus}},NewStatus: {{labels.NewStatus}},timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} NF service is UNDISCOVERABLE.'
Severity	Info
Condition	Status of an NF Instance's service transitions to UNDISCOVERABLE. Note: When multiple alerts are present for a given NF, the latest alert is always considered. The timestamp can also be seen in the "Active Since" field of the alert in Prometheus.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7051
Metric Used	ocnrf_nfService_status_change_total

Table 6-710 (Cont.) OcnrfNFServiceStatusTransitionToUndiscoverable

Field	Details
Recommended Actions	The alert is cleared automatically after a window of 5 minutes. Steps: 1. Check logs in NRF registration pod to verify if the NF has sent UNDISCOVERABLE status in NFRegister or NfUpdate requests or check Jaeger traces to see traces for incoming requests. 2. If there is no such incoming request, collect the logs and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on capturing logs, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	Yes

6.3.4.15 OcnrfNFStatusTransitionToDeregistered

Table 6-711 OcnrfNFStatusTransitionToDeregistered

Field	Details
Description	'NF with NF profile fqdn {{\$labels.NfProfileFqdn}} NF instance id {{\$labels.NfInstanceId}} NF type {{\$labels.NfType}} is DEREGISTERED, previous status was {{\$labels.PreviousStatus}}'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}},nrflevel: {{\$labels.NrfLevel}},podname: {{\$labels.kubernetes_pod_name}},NfInstanceId: {{\$labels.NfInstanceId}},NfProfileFqdn: {{\$labels.NfProfileFqdn}},NfType: {{\$labels.NfType}},PreviousStatus: {{\$labels.PreviousStatus}},NewStatus: {{\$labels.NewStatus}},timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} NF is DEREGISTERED.'
Severity	Info
Condition	NF Instance's status transitions to DEREGISTERED. Note: When multiple alerts are present for a given NF, the latest alert is always considered. The timestamp can also be seen in the "Active Since" field of the alert in Prometheus.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7052
Metric Used	ocnrf_nflInstance_status_change_total

Table 6-711 (Cont.) OcnrfNFStatusTransitionToDeregistered

Field	Details
Recommended Actions	The alert is cleared automatically after a window of 5 minutes. Steps: 1. Check logs in NRF registration pod for failing patch requests or check Jaeger traces to see traces for incoming requests. 2. Check Ingress Gateway logs to see if the requests are coming. 3. Check if the NRF pods are UP. 4. Check for the Ingress Gateway metrics in Prometheus for PATCH requests or responses in this time frame. Confirm if the responses have any non 2xx error codes. 5. Depending on the failure reason, take the resolution steps. 6. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on capturing logs, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	Yes

6.3.4.16 OcnrfNFServiceStatusTransitionToDeregistered

Table 6-712 OcnrfNFServiceStatusTransitionToDeregistered

Field	Details
Description	'NF service {{ \$labels.NfServiceName }} and service instance id {{ \$labels.NfServiceInstanceId }} of NF profile fqdn {{ \$labels.NfProfileFqdn }} and instance id {{ \$labels.NfInstanceId }} is DEREGISTERED, previous status was {{ \$labels.PreviousStatus }}'
Summary	'kubernetes_namespace: {{ \$labels.kubernetes_namespace }},nrflevel: {{ \$labels.NrfLevel }},podname: {{ \$labels.kubernetes_pod_name }},NfInstanceId: {{ \$labels.NfInstanceId }},NfServiceName: {{ \$labels.NfServiceName }},NfServiceInstanceId: {{ \$labels.NfServiceInstanceId }},NfProfileFqdn: {{ \$labels.NfProfileFqdn }},NfServiceFqdn: {{ \$labels.NfServiceFqdn }},PreviousStatus: {{ \$labels.PreviousStatus }},NewStatus: {{ \$labels.NewStatus }},timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }'NF service is DEREGISTERED.'
Severity	Info
Condition	Status of an NF Instance's service transitions to DEREGISTERED. Note: When multiple alerts are present for a given NF, the latest alert is always considered. The timestamp can also be seen in the "Active Since" field of the alert in Prometheus.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7053
Metric Used	ocnrf_nfService_status_change_total

Table 6-712 (Cont.) OcnrfNFServiceStatusTransitionToDeregistered

Field	Details
Recommended Actions	The alert is cleared automatically after a window of 5 minutes. Steps: 1. Check logs in NRF registration pod for failing patch requests or check Jaeger traces to see traces for incoming requests. 2. Check Ingress Gateway logs to see if the requests are coming. 3. Check if the NRF pods are UP. 4. Check for the Ingress Gateway metrics in Prometheus for PATCH requests or responses in this time frame. Confirm if the responses have any non 2xx error codes. 5. Depending on the failure reason, take the resolution steps. 6. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on capturing logs, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	Yes

6.3.4.17 OcnrfNfProfileSizeAboveThreshold

Table 6-713 OcnrfNfProfileSizeAboveThreshold

Field	Details
Description	'The size of the NF profile is above the critical threshold. (current value is: {{ \$value }})'
Summary	"namespace: {{labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }} {{ . first value humanizeTimestamp }}{{ end }}: The size of the NF profile is above 12kB threshold"
Severity	Critical
Condition	This alert is raised when the size of the NF profile is greater than the configured threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7119
Metric Used	ocnrf_nf_profile_size
Recommended Actions	The alert is cleared when the size of the NF profile is less than the critical threshold. Note: The threshold is configurable in the alert file. Step: Verify which NF has registered a nfProfile above the threshold size, using the nfInstanceId in the ocnrf_nf_profile_size metric.
Available in OCI	No

6.3.4.18 OcnrfDiscoveryResponseSizeAboveThreshold

Table 6-714 OcnrfDiscoveryResponseSizeAboveThreshold

Field	Details
Description	'The size of nfDiscover response is above the critical threshold. (current value is: {{ \$value }})'

Table 6-714 (Cont.) OcnrfDiscoveryResponseSizeAboveThreshold

Field	Details
Summary	'namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }}: The size of nfDiscover response is above 124kB threshold'
Severity	Critical
Condition	This alert is raised when the size of the nfDiscover response is greater than the configured threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7120
Metric Used	ocnrf_nfDiscover_tx_response_size_bytes_max
Recommended Actions	The alert is cleared when the size of the nfDiscover response is less than the critical threshold. Note: The threshold is configurable in the alert file. Step: 1. Refer Grafana to check for which targetNfType triggers discovery response with size greater than the threshold. Higher discovery response may impact NRF discovery performance. If the alert is unexpected, contact My Oracle Support.
Available in OCI	No

6.3.5 Feature Specific Alerts

This section lists the feature specific alerts.

6.3.5.1 KeyID for AccessToken Feature

This section lists the alerts that are specific to KeyID for AccessToken feature. For more information about the feature, see the [Key-ID for Access Token](#) section.

6.3.5.1.1 OcnrfAccessTokenCurrentKeyIdNotConfigured

Table 6-715 OcnrfAccessTokenCurrentKeyIdNotConfigured

Field	Details
Description	'AccessToken request(s) have been rejected by OCNRF (current value is: {{ \$value }})'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}},nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} Access Token Request has been rejected by OCNRF as Current Key Id is not configured.'
Severity	Critical
Condition	NRF Access Token Rejected due to CurrentKeyId not configured
OID	1.3.6.1.4.1.323.5.3.36.1.2.7033
Metric Used	'ocnrf_accessToken_tx_responses_total'
Recommended Actions	The alert is automatically cleared as it is raised when NRF receives Access Token Request, and at that point, Current Key Id is not selected. For more information about configuring currentKeyId parameter, see <i>Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide</i>.

Table 6-715 (Cont.) OcnrfAccessTokenCurrentKeyIdNotConfigured

Field	Details
Available in OCI	No

6.3.5.1.2 OcnrfAccessTokenCurrentKeyIdInvalidDetails

Table 6-716 OcnrfAccessTokenCurrentKeyIdInvalidDetails

Field	Details
Description	'AccessToken request(s) have been rejected by OCNRF (current value is: {{ \$value }})'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}},nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, KeyType: {{\$labels.KeyType}}, RejectionReason: {{\$labels.RejectionReason}},timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} AccessToken Request has been rejected by OCNRF as CurrentKeyId details are invalid.'
Severity	Critical
Condition	NRF Access Token Rejected due to token signing details corresponding to CurrentKeyId are invalid.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7034
Metric Used	'ocnrf_accessToken_tx_responses_total'
Recommended Actions	The alert is automatically cleared when NRF receives Access Token Request, and at that point, Current Key Id details are invalid. For more information about configuring currentKeyId parameter, see <i>Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide</i> .
Available in OCI	No

6.3.5.1.3 OcnrfOauthCurrentKeyNotConfigured

Table 6-717 OcnrfOauthCurrentKeyNotConfigured

Field	Details
Description	'OCNRF Oauth Access token Current Key Id is not configured'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}},nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} OCNRF Oauth Access token Current Key Id is not configured.'
Severity	Critical
Condition	Oauth Current Key ID is not configured
OID	1.3.6.1.4.1.323.5.3.36.1.2.7035
Metric Used	ocnrf_oauth_currentKeyId_configuredStatus

Table 6-717 (Cont.) OcnrfOauthCurrentKeyNotConfigured

Field	Details
Recommended Actions	The alert is cleared when the current key ID is configured. Steps: Configure valid current key ID in Access Token Configuration. For more information about configuring currentKeyID parameter, see <i>Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide</i> .
Available in OCI	No

6.3.5.1.4 OcnrfOauthCurrentKeyDataHealthStatus

Table 6-718 OcnrfOauthCurrentKeyDataHealthStatus

Field	Details
Description	'OCNRF Oauth Access token Current Key Id status is not healthy'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}},nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, KeyId: {{\$labels.KeyId}}, KeyType: {{\$labels.KeyType}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} OCNRF Oauth Access token Current Key Id status is not healthy.'
Severity	Critical
Condition	Oauth Current Key ID details health is not good.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7036
Metric Used	ocnrf_oauth_keyData_healthStatus
Recommended Actions	The alert is cleared when the current key ID status is healthy. Steps: Rectify the condition by checking ErrorCondition For example: For ErrorCondition Invalid_Key_Details, check if the k8SecretName, k8SecretNameSpace, and filename combination exists correctly for both privateKey and certificate. Make sure that the pem file data is not corrupt or the certificate has not expired.
Available in OCI	No

6.3.5.1.5 OcnrfOauthNonCurrentKeyDataHealthStatus

Table 6-719 OcnrfOauthNonCurrentKeyDataHealthStatus

Field	Details
Description	'OCNRF Oauth Access token Non current Key Id status is not healthy'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}},nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, KeyId: {{\$labels.KeyId}}, KeyType: {{\$labels.KeyType}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} OCNRF Oauth Access token non current Key Id status is not healthy.'
Severity	Info
Condition	Oauth Non Current Key details health is not good
OID	1.3.6.1.4.1.323.5.3.36.1.2.7037
Metric Used	ocnrf_oauth_keyData_healthStatus

Table 6-719 (Cont.) OcnrfOauthNonCurrentKeyDataHealthStatus

Field	Details
Recommended Actions	The alert is cleared when the current key ID status is healthy. Steps: Rectify the condition by checking ErrorCondition For example: For ErrorCondition Invalid_Key_Details, check if the k8SecretName, k8SecretNameSpace, and filename combination exists correctly for both privateKey and certificate. Make sure that the pem file data is not corrupt or the certificate has not expired.
Available in OCI	No

6.3.5.1.6 OcnrfOauthCurrentCertificateExpiringIn1Week

Table 6-720 OcnrfOauthCurrentCertificateExpiringIn1Week

Field	Details
Description	'OCNRF Oauth Access token current Key Id certificate is expiring in less than 1 week'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}},nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, KeyId: {{\$labels.KeyId}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} OCNRF Oauth Access token current Key Id certificate is expiring in less than 1 week.'
Severity	Critical
Condition	Oauth Current Key ID details are expiring in less than 1 week
OID	1.3.6.1.4.1.323.5.3.36.1.2.7038
Metric Used	ocnrf_oauth_keyData_expiryStatus
Recommended Actions	The alert is cleared when the key expiry time is more than 1 week. Steps: Replace expiring certificate key pair with new ones. For more information on creating certificate key pair, see <i>Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide</i> .
Available in OCI	No

6.3.5.1.7 OcnrfOauthNonCurrentCertificateExpiringIn1Week

Table 6-721 OcnrfOauthNonCurrentCertificateExpiringIn1Week

Field	Details
Description	'OCNRF Oauth Access token non current Key Id certificate is expiring in less than 1 week'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}},nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, KeyId: {{\$labels.KeyId}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} OCNRF Oauth Access token non current Key Id certificate is expiring in less than 1 week.'
Severity	Info
Condition	Oauth Non Current Key ID details are expiring in less than 1 week

Table 6-721 (Cont.) OcnrfOauthNonCurrentCertificateExpiringIn1Week

Field	Details
OID	1.3.6.1.4.1.323.5.3.36.1.2.7039
Metric Used	ocnrf_oauth_keyData_expiryStatus
Recommended Actions	The alert is cleared when the key expiry time is more than 1 week. Steps: Replace expiring certificate key pair with new ones. For more information on creating certificate key pair, see <i>Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide</i> .
Available in OCI	No

6.3.5.1.8 OcnrfOauthCurrentCertificateExpiringIn30days

Table 6-722 OcnrfOauthCurrentCertificateExpiringIn30days

Field	Details
Description	'OCNRF Oauth Access token current Key Id certificate is expiring in less than 30 days'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}},nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, KeyId: {{\$labels.KeyId}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} OCNRF Oauth Access token current Key Id certificate is expiring in less than 30 days.'
Severity	Major
Condition	Oauth Current Key ID details are expiring in more than 24 hours and less than 30 days
OID	1.3.6.1.4.1.323.5.3.36.1.2.7040
Metric Used	ocnrf_oauth_keyData_expiryStatus
Recommended Actions	The alert is cleared when certificate for the current key id's expiry time is more than 30 days. Steps: Replace expiring certificate key pair with new ones. For more information on creating certificate key pair, see <i>Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide</i> .
Available in OCI	No

6.3.5.1.9 OcnrfOauthNonCurrentCertificateExpiringIn30days

Table 6-723 OcnrfOauthNonCurrentCertificateExpiringIn30days

Field	Details
Description	'OCNRF Oauth Access token non current Key Id certificate is expiring in less than 30 days'

Table 6-723 (Cont.) OcnrfOauthNonCurrentCertificateExpiringIn30days

Field	Details
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}},nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, KeyId: {{\$labels.KeyId}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} OCNRF Oauth Access token non current Key Id certificate is expiring in less than 30 days.'
Severity	Info
Condition	Oauth Non Current Key ID details are expiring in more than 24 hours and less than 30 days
OID	1.3.6.1.4.1.323.5.3.36.1.2.7041
Metric Used	ocnrf_oauth_keyData_expiryStatus
Recommended Actions	The alert is cleared when certificate for the non-current key id's certificate expiry time is more than 30 days. Steps: Replace expiring certificate key pair with new ones. For more information on creating certificate key pair, see <i>Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide</i> .
Available in OCI	No

6.3.5.2 Overload Control Based on Percentage Discards Feature

This section lists the alerts that are specific to Overload Control Based on Percentage Discards feature. For more information about the feature, see the [Overload Control](#) section.

6.3.5.2.1 OcnrfMemoryUsageCrossedMinorThreshold

Table 6-724 OcnrfMemoryUsageCrossedMinorThreshold

Field	Details
Description	'OCNRF Memory Usage for pod <Pod name> has crossed the configured minor threshold (50 %) (value={{ \$value }}) of its limit.'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : Memory Usage of pod exceeded 50% of its limit.'
Severity	Minor
Condition	A pod has reached the configured minor threshold (50%) of its memory resource limits.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7030
Metric Used	'container_memory_usage_bytes' and 'container_spec_memory_limit_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 6-724 (Cont.) OcnrfMemoryUsageCrossedMinorThreshold

Field	Details
Recommended Actions	The alert gets cleared when the memory utilization falls below the minor threshold or crosses the major threshold, in which case OcnrfMemoryUsageCrossedMajorThreshold alert is raised. Note: The threshold is configurable in the alerts file. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	Yes

6.3.5.2.2 OcnrfMemoryUsageCrossedMajorThreshold

Table 6-725 OcnrfMemoryUsageCrossedMajorThreshold

Field	Details
Description	'OCNRF Memory Usage for pod <Pod name> has crossed the major threshold (60%) (value = {{ \$value }}) of its limit.'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : Memory Usage of pod exceeded 60% of its limit.'
Severity	Major
Condition	A pod has reached the configured major threshold (60%) of its memory resource limits.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7031
Metric Used	'container_memory_usage_bytes' and 'container_spec_memory_limit_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 major threshold or crosses the critical threshold, in which case OcnrfMemoryUsageCrossedCriticalThreshold alert is raised. Note: The threshold is configurable in the alert file. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	Yes

6.3.5.2.3 OcnrfMemoryUsageCrossedCriticalThreshold

Table 6-726 OcnrfMemoryUsageCrossedCriticalThreshold

Field	Details
Description	'OCNRF Memory Usage for pod <Pod name> has crossed the configured critical threshold (70%) (value = {{ \$value }}) of its limit.'
Summary	'kubernetes_namespace: {{labels.kubernetes_namespace}}, podname: {{labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : Memory Usage of pod exceeded 70% of its limit.'
Severity	Critical
Condition	A pod has reached the configured critical threshold (70%) of its memory resource limits.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7032
Metric Used	'container_memory_usage_bytes' and 'container_spec_memory_limit_bytes' Note: This is a Kubernetes metric used for instance availability monitoring. If the metric is not available, use a 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 alert file. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support . Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i> .
Available in OCI	Yes

6.3.5.2.4 OcnrfOverloadThresholdBreachedL1

Table 6-727 OcnrfOverloadThresholdBreachedL1

Field	Details
Description	'Overload Level of {{labels.app_kubernetes_io_name}} service is L1'
Summary	'kubernetes_namespace: {{labels.kubernetes_namespace}}, podname: {{labels.kubernetes_pod_name}}: Overload Level of {{labels.app_kubernetes_io_name}} service is L1'
Severity	Warning
Condition	NRF Services have breached its configured threshold of Level L1 for any of the aforementioned metrics. Thresholds are configured for CPU, svc_failure_count, svc_pending_count, and memory.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7059
Metric Used	load_level

Table 6-727 (Cont.) OcnrfOverloadThresholdBreachedL1

Field	Details
Recommended Actions	The alert is cleared when the Ingress Traffic rate falls below the configured L1 threshold. Note: The thresholds can be configured using REST API. Steps: 1. Reassess the reasons leading to NRF receiving additional traffic. 2. Refer to alert to determine which service is receiving high traffic. It may be due to a sudden spike in traffic. For example: When one mated site goes down, the NFs move to the given site. 3. Check the service pod logs on Kibana to determine the reason for the errors. 4. If this is expected traffic, then the thresholds levels may be reevaluated as per the call rate and reconfigured as mentioned in <i>Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide</i>. 5. If this is the unexpected traffic, contact My Oracle Support.
Available in OCI	Yes

6.3.5.2.5 OcnrfOverloadThresholdBreachedL2

Table 6-728 OcnrfOverloadThresholdBreachedL2

Field	Details
Description	'Overload Level of {{\$labels.app_kubernetes_io_name}} service is L2'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, podname: {{\$labels.kubernetes_pod_name}}: Overload Level of {{\$labels.app_kubernetes_io_name}} service is L2'
Severity	Warning
Condition	NRF Services have breached its configured threshold of Level L2 for any of the aforementioned metrics. Thresholds are configured for CPU, svc_failure_count, svc_pending_count, and memory.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7060
Metric Used	load_level
Recommended Actions	The alert is cleared when the Ingress Traffic rate falls below the configured L2 threshold. Note: The thresholds can be configured using REST API. Steps: 1. Reassess the reasons leading to NRF receiving additional traffic. 2. Refer to alert to determine which service is receiving high traffic. It may be due to a sudden spike in traffic. For example: When one mated site goes down, the NFs move to the given site. 3. Check the service pod logs on Kibana to determine the reason for the errors. 4. If this is expected traffic, then the thresholds levels may be reevaluated as per the call rate and reconfigured as mentioned in <i>Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide</i>. 5. If this is the unexpected traffic, contact My Oracle Support.

Table 6-728 (Cont.) OcnrfOverloadThresholdBreachedL2

Field	Details
Available in OCI	Yes

6.3.5.2.6 OcnrfOverloadThresholdBreachedL3

Table 6-729 OcnrfOverloadThresholdBreachedL3

Field	Details
Description	'Overload Level of {{\$labels.app_kubernetes_io_name}} service is L3'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, podname: {{\$labels.kubernetes_pod_name}}: Overload Level of {{\$labels.app_kubernetes_io_name}} service is L3'
Severity	Warning
Condition	NRF Services have breached its configured threshold of Level L3 for any of the aforementioned metrics. Thresholds are configured for CPU, svc_failure_count, svc_pending_count, and memory.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7061
Metric Used	load_level
Recommended Actions	The alert is cleared when the Ingress Traffic rate falls below the configured L3 threshold. Note: The thresholds can be configured using REST API. Steps: 1. Reassess the reasons leading to NRF receiving additional traffic. 2. Refer to alert to determine which service is receiving high traffic. It may be due to a sudden spike in traffic. For example: When one mated site goes down, the NFs move to the given site. 3. Check the service pod logs on Kibana to determine the reason for the errors. 4. If this is expected traffic, then the thresholds levels may be reevaluated as per the call rate and reconfigured as mentioned in <i>Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide</i>. 5. If this is the unexpected traffic, contact My Oracle Support.
Available in OCI	Yes

6.3.5.2.7 OcnrfOverloadThresholdBreachedL4

Table 6-730 OcnrfOverloadThresholdBreachedL4

Field	Details
Description	'Overload Level of {{\$labels.app_kubernetes_io_name}} service is L4'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, podname: {{\$labels.kubernetes_pod_name}}: Overload Level of {{\$labels.app_kubernetes_io_name}} service is L4'
Severity	Warning

Table 6-730 (Cont.) OcnrfOverloadThresholdBreachedL4

Field	Details
Condition	NRF Services have breached its configured threshold of Level L4 for any of the aforementioned metrics. Thresholds are configured for CPU, svc_failure_count, svc_pending_count, and memory.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7062
Metric Used	load_level
Recommended Actions	The alert is cleared when the Ingress Traffic rate falls below the configured L4 threshold. Note: The thresholds can be configured using REST API. Steps: 1. Reassess the reasons leading to NRF receiving additional traffic. 2. Refer to alert to determine which service is receiving high traffic. It may be due to a sudden spike in traffic. For example: When one mated site goes down, the NFs move to the given site. 3. Check the service pod logs on Kibana to determine the reason for the errors. 4. If this is expected traffic, then the thresholds levels may be reevaluated as per the call rate and reconfigured as mentioned in <i>Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide</i>. 5. If this is the unexpected traffic, contact My Oracle Support.
Available in OCI	Yes

6.3.5.3 DNS NAPTR Update Feature

This section lists the alerts that are specific to DNS NAPTR Update feature. For more information about the feature, see the [DNS NAPTR Update](#) section.

6.3.5.3.1 OcnrfDnsNaptrFailureResponseStatus

Table 6-731 OcnrfDnsNaptrFailureResponseStatus

Field	Details
Description	OCNRF DNS NAPTR Response status is not healthy
Summary	"kubernetes_namespace: {{\$labels.kubernetes_namespace}},nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, NfInstanceId: {{\$labels.NfInstanceId}}, NfSetFqdn: {{\$labels.NfSetFqdn}}, Replacement: {{\$labels.Replacement}},timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} OCNRF Dns Naptr Response status is not healthy."
Severity	Major
Condition	The DNS NAPTR response towards DNS Server is not successful.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7063
Metric Used	ocnrf_dns_naptr_failure_rx_response
Recommended Actions	This alert is cleared when DNS NAPTR response is successful either automatic through service operations, or manual trigger for update and delete NAPTR requests.

6.3.5.3.2 OcnrfAlternateRouteUpstreamDnsRetryExhausted

Table 6-732 OcnrfAlternateRouteUpstreamDnsRetryExhausted

Field	Details
Description	OCNRF alternate route upstream DNS retry exhausted
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, podname: {{\$labels.kubernetes_pod_name}}, FQDNS_Name: {{\$labels.FQDNS_Name}}, Replacement_Name: {{\$labels.Replacement_Name}},timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{{ end }} OCNRF alternate route upstream dns retry exhausted'
Severity	Major
Condition	The DNS NAPTR retry is exhausted.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7064
Metric Used	oc_alternate_route_upstream_dns_retry_exhausted
Recommended Actions	This alert is cleared automatically in 2 minutes.
Available in OCI	No

6.3.5.4 Notification Retry Feature

This section lists the alerts that are specific to Notification Retry feature. For more information about the feature, see the [Notification Retry](#) section.

6.3.5.4.1 OcnrfNotificationRetryExhausted

Table 6-733 OcnrfNotificationRetryExhausted

Field	Details
Description	'OCNRF NotificationRetry Exhausted'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, podname: {{\$labels.kubernetes_pod_name}}, SubscriptionId: {{\$labels.SubscriptionId}}, NotificationHostPort: {{\$labels.NotificationHostPort}}'
Severity	Major
Condition	This alarm is raised when number of retries are exhausted.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7065
Metric Used	ocnrf_nfStatusNotify_rx_responses_total
Recommended Actions	The alert is cleared automatically after 5 minutes. Steps: Check logs in NF management pod to check the reason for retry query failures. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	Yes

6.3.5.4.2 OcnrfNotificationFailureOtherThanRetryExhausted

Table 6-734 OcnrfNotificationFailureOtherThanRetryExhausted

Field	Details
Description	'OCNRF notification failure other than retry exhausted'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, podname: {{\$labels.kubernetes_pod_name}}, SubscriptionId: {{\$labels.SubscriptionId}}, NotificationHostPort: {{\$labels.NotificationHostPort}}, NumberOfRetriesAttempted: {{\$labels.NumberOfRetriesAttempted}}'
Severity	Major
Condition	This alarm is raised when notification failure occurs with reason other than retry count exhausted.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7066
Metric Used	ocnrf_nfStatusNotify_rx_responses_total
Recommended Actions	The alert is cleared automatically after 5 minutes. Steps: Check logs in NF management pod to check the reason for retry query failures. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i> .
Available in OCI	Yes

6.3.5.5 NRF Message Feed Feature

This section lists the alerts that are specific to NRF Message Feed feature. For more information about the feature, see the [NRF Message Feed](#) section.

6.3.5.5.1 OcnrfIngressGatewayDDUnreachable

Table 6-735 OcnrfIngressGatewayDDUnreachable

Field	Details
Description	OCNRF Ingress Gateway Data Director unreachable
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }} OCNRF Ingress Gateway Data Director unreachable'
Severity	Major
Condition	This alarm is raised when data director is not reachable from Ingress Gateway.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7067
Metric Used	oc_ingressgateway_dd_unreachable
Recommended Actions	Alert gets cleared automatically when the connection with data director is established.
Available in OCI	No

6.3.5.5.2 OcnrfEgressGatewayDDUnreachable

Table 6-736 OcnrfEgressGatewayDDUnreachable

Field	Details
Description	OCNRF Egress Gateway Data Director unreachable
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{{ end }} OCNRF Egress Gateway Data Director unreachable'
Severity	Major
Condition	This alarm is raised when data director is not reachable from Egress Gateway.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7068
Metric Used	oc_egressgateway_dd_unreachable
Recommended Actions	Alert gets cleared automatically when the connection with data director is established.
Available in OCI	No

6.3.5.6 Subscription Limit Feature

This section lists the alerts that are specific to Subscription Limit feature. For more information about the feature, see the [Subscription Limit](#) section.

6.3.5.6.1 OcnrfSubscriptionGlobalCountWarnThresholdBreached

Table 6-737 OcnrfSubscriptionGlobalCountWarnThresholdBreached

Field	Details
Description	The total number of subscriptions has breached the configured WARN level threshold.
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}: The total number of subscriptions has breached the configured WARN level threshold'
Severity	Warning
Condition	This alarm is raised when the total number of subscriptions has breached the configured WARN level threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7069
Metric Used	ocnrf_nfset_limit_level
Recommended Actions	The alert is cleared automatically when the count comes down due to unsubscription. Note: The thresholds can be configured using REST API. Steps: 1. Reassess the reasons for new or renewal of subscription. 2. If this is expected subscription, then the subscription limit may be reevaluated as mentioned in <i>Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide</i>. 3. If this is the unexpected subscription, contact My Oracle Support.
Available in OCI	Yes

6.3.5.6.2 OcnrfSubscriptionGlobalCountMinorThresholdBreached

Table 6-738 OcnrfSubscriptionGlobalCountMinorThresholdBreached

Field	Details
Description	The total number of subscriptions has breached the configured MINOR level threshold
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}: The total number of subscriptions has breached the configured MINOR level threshold'
Severity	Minor
Condition	This alarm is raised when the total number of subscriptions has breached the configured MINOR level threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7070
Metric Used	ocnrf_nfset_limit_level
Recommended Actions	The alert is cleared automatically when the count comes down due to unsubscription. Note: The thresholds can be configured using REST API. Steps: 1. Reassess the reasons for new or renewal of subscription. 2. If this is expected subscription, then the subscription limit may be reevaluated as mentioned in <i>Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide</i>. 3. If this is the unexpected subscription, contact My Oracle Support.
Available in OCI	Yes

6.3.5.6.3 OcnrfSubscriptionGlobalCountMajorThresholdBreached

Table 6-739 OcnrfSubscriptionGlobalCountMajorThresholdBreached

Field	Details
Description	The total number of subscriptions has breached the configured MAJOR level threshold
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}: The total number of subscriptions has breached the configured MAJOR level threshold'
Severity	MAJOR
Condition	This alarm is raised when the total number of subscriptions has breached the configured MAJOR level threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7071
Metric Used	ocnrf_nfset_limit_level

Table 6-739 (Cont.) OcnrfSubscriptionGlobalCountMajorThresholdBreached

Field	Details
Recommended Actions	The alert is cleared automatically when the count comes down due to unsubscription. Note: The thresholds can be configured using REST API. Steps: 1. Reassess the reasons for new or renewal of subscription. 2. If this is expected subscription, then the subscription limit may be reevaluated as mentioned in <i>Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide</i>. 3. If this is the unexpected subscription, contact My Oracle Support.
Available in OCI	Yes

6.3.5.6.4 OcnrfSubscriptionGlobalCountCriticalThresholdBreached

Table 6-740 OcnrfSubscriptionGlobalCountCriticalThresholdBreached

Field	Details
Description	The total number of subscriptions has breached the configured CRITICAL level threshold
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}: The total number of subscriptions has breached the configured CRITICAL level threshold'
Severity	Critical
Condition	This alarm is raised when the total number of subscriptions has breached the configured CRITICAL level threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7072
Metric Used	ocnrf_nfset_limit_level
Recommended Actions	The alert is cleared automatically when the count comes down due to unsubscription. Note: The thresholds can be configured using REST API. Steps: 1. Reassess the reasons for new or renewal of subscription. 2. If this is expected subscription, then the subscription limit may be reevaluated as mentioned in <i>Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide</i>. 3. If this is the unexpected subscription, contact My Oracle Support.
Available in OCI	Yes

6.3.5.7 Pod Protection Support for NRF Subscription Microservice

This section lists the alerts that are specific to Pod Protection Support for NRF Subscription Microservice feature. For more information about the feature, see the [Pod Protection Support for NRF Subscription Microservice](#) section.

6.3.5.7.1 OcnrfPodInDangerOfCongestionState

Table 6-741 OcnrfPodInDangerOfCongestionState

Field	Details
Description	'The pod {{\$labels.kubernetes_pod_name}} of service {{\$labels.app_kubernetes_io_name}} is in Danger of Congestion state'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }} : The pod is in Danger of Congestion state'
Severity	Major
Condition	A pod of a service is in Danger Of Congestion state. This could be due to CPU Usage or Pending Message Count above configured thresholds. This alert is raised when the Pod Protection feature is enabled for nfSubscription service. Currently this is applicable for NfSubscription service only.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7079
Metric Used	ocnrf_pod_congestion_state
Recommended Actions	The alert is cleared when the CPU or Pending Message Count goes below the configured thresholds for the Danger of Congested state. Note: The thresholds can be viewed using REST API. Reassess if the NRF is receiving additional traffic. If this is unexpected, contact My Oracle Support. Steps: 1. Refer to alert to determine which pod is receiving high traffic. It may due to a sudden spike in traffic. For example: When one mated site goes down, the NFs move to the given site. Check if NF is sending high number of updates, register or deregister. 2. Check for the corresponding congestion alert for CPU and Pending Message Count to understand the reason for pod congestion. 3. Check the service pod logs on Kibana to determine the reason for the errors. 4. If this is expected traffic, then the thresholds levels may need to be re-evaluated as per the call rate and reconfigured as mentioned in Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide.
Available in OCI	No

6.3.5.7.2 OcnrfPodPendingMessageCountInDangerOfCongestionState

Table 6-742 OcnrfPodPendingMessageCountInDangerOfCongestionState

Field	Details
Description	'The pod {{\$labels.kubernetes_pod_name}} of service {{\$labels.app_kubernetes_io_name}} is in Danger of Congestion state due to Pending Message Count above threshold'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }} : The pod is in Danger of Congestion state due to Pending Message Count above threshold'
Severity	Major

Table 6-742 (Cont.) OcnrfPodPendingMessageCountInDangerOfCongestionState

Field	Details
Condition	A pod of a service is in Danger Of Congestion state due to its Pending Message Count above configured thresholds. Currently this is applicable for NfSubscription service only.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7081
Metric Used	ocnrf_pod_pending_message_count_congestion_state
Recommended Actions	The alert is cleared when the pending message count goes below the configured thresholds for the Danger of Congested state. Note: The thresholds can be viewed using REST API. Steps: Reassess if the NRF is receiving additional traffic. If this is unexpected, contact My Oracle Support. 1. Refer to alert to determine which pod is receiving high traffic. It may due to a sudden spike in traffic. For example: When one mated site goes down, the NFs move to the given site. Check if NF is sending high number of updates, register, or deregister. 2. Check the service pod logs on Kibana to determine the reason for the errors. 3. If this is expected traffic, then the thresholds levels may need to be re-evaluated as per the call rate and reconfigured as mentioned in Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide.

6.3.5.7.3 OcnrfPodInCongestedState

Table 6-743 OcnrfPodInCongestedState

Field	Details
Description	'The pod {{\$labels.kubernetes_pod_name}} of service {{\$labels.app_kubernetes_io_name}} is in Congested state'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : The pod is in Congested state'
Severity	Major
Condition	One or more pods of a service are in congested state. This could be due to CPU usage or Pending Message Count above configured thresholds. Currently this is applicable for NfSubscription service only.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7082
Metric Used	ocnrf_pod_congested_state

Table 6-743 (Cont.) OcnrfPodInCongestedState

Field	Details
Recommended Actions	The alert is cleared when the CPU usage or Pending Message Count goes below the configured thresholds for the congested state. Note: The thresholds can be viewed using REST API. Steps: Reassess if the NRF is receiving additional traffic. If this is unexpected, contact My Oracle Support. 1. Refer to alert to determine which pod is receiving high traffic. It may due to a sudden spike in traffic. For example: When one mated site goes down, the NFs move to the given site. Check if NF is sending high number of updates, register, or deregister. 2. Check the service pod logs on Kibana to determine the reason for the errors. 3. If this is expected traffic, then the thresholds levels may need to be re-evaluated as per the call rate and reconfigured as mentioned in <i>Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide</i>.
Available in OCI	No

6.3.5.7.4 OcnrfPodCpuUsageInCongestedState

Table 6-744 OcnrfPodCpuUsageInCongestedState

Field	Details
Description	'The pod {{\$labels.kubernetes_pod_name}} of service {{\$labels.app_kubernetes_io_name}} is in Congested state due to CPU usage above threshold'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : The pod is in Congested state due to CPU usage above threshold'
Severity	Major
Condition	A pod of a service is in Congested state due to its CPU Usage above configured thresholds. Currently this is applicable for NfSubscription service only.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7083
Metric Used	ocnrf_pod_cpu_congestion_state

Table 6-744 (Cont.) OcnrfPodCpuUsageInCongestedState

Field	Details
Recommended Actions	The alert is cleared when the CPU usage goes below the configured thresholds for the congested state. Note: The thresholds can be viewed using REST API. Steps: Reassess if the NRF is receiving additional traffic. If this is unexpected, contact My Oracle Support. 1. Refer to alert to determine which pod is receiving high traffic. It may due to a sudden spike in traffic. For example: When one mated site goes down, the NFs move to the given site. Check if NF is sending high number of updates, register or deregister. 2. Check the service pod logs on Kibana to determine the reason for the errors. 3. If this is expected traffic, then the thresholds levels may need to be re-evaluated as per the call rate and reconfigured as mentioned in <i>Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide</i>.
Available in OCI	No

6.3.5.7.5 OcnrfPodCpuUsageInDangerOfCongestionState

Table 6-745 OcnrfPodCpuUsageInDangerOfCongestionState

Field	Details
Description	'The pod {{\$labels.kubernetes_pod_name}} of service {{\$labels.app_kubernetes_io_name}} is in Danger of Congestion state due to CPU usage above threshold'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : The pod is in Danger of Congestion state due to CPU usage above threshold'
Severity	Major
Condition	A pod of a service is in Danger Of Congestion state due to its CPU above configured thresholds. This alert is raised when the Pod Pretoectoin feature is enabled for nfSubscription service. Currently this is applicable for NfSubscription service only.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7080
Metric Used	ocnrf_pod_cpu_congestion_state

Table 6-745 (Cont.) OcnrfPodCpuUsageInDangerOfCongestionState

Field	Details
Recommended Actions	The alert is cleared when the CPU goes below the configured thresholds for the Danger of Congested state. Note: The thresholds can be viewed using REST API. Steps: Reassess if the NRF is receiving additional traffic. If this is unexpected, contact My Oracle Support. 1. Refer to alert to determine which pod is receiving high traffic. It may due to a sudden spike in traffic. For example: When one mated site goes down, the NFs move to the given site. Check if NF is sending high number of updates, register or deregister. 2. Check the service pod logs on Kibana to determine the reason for the errors. 3. If this is expected traffic, then the thresholds levels may need to be re-evaluated as per the call rate and reconfigured as mentioned in <i>Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide</i>.
Available in OCI	No

6.3.5.7.6 OcnrfPodPendingMessageCountInCongestedState

Table 6-746 OcnrfPodPendingMessageCountInCongestedState

Field	Details
Description	'The pod {{\$labels.kubernetes_pod_name}} of service {{\$labels.app_kubernetes_io_name}} is in Congested state due to Pending Message Count above threshold'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end } : The pod is in Congested state due to Pending Message Count above threshold'
Severity	Major
Condition	A pod of a service is in Congested state due to its Pending Message Count above configured thresholds. Currently this is applicable for NfSubscription service only.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7084
Metric Used	ocnrf_pod_pending_message_count_congestion_state

Table 6-746 (Cont.) OcnrfPodPendingMessageCountInCongestedState

Field	Details
Recommended Actions	The alert is cleared when the pending message count goes below the configured thresholds for the congested state. Note: The thresholds can be viewed using REST API. Steps: Reassess if the NRF is receiving additional traffic. If this is unexpected, contact My Oracle Support. 1. Refer to alert to determine which pod is receiving high traffic. It may due to a sudden spike in traffic. For example: When one mated site goes down, the NFs move to the given site. Check if NF is sending high number of updates, register or deregister. 2. Check the service pod logs on Kibana to determine the reason for the errors. 3. If this is expected traffic, then the thresholds levels may need to be re-evaluated as per the call rate and reconfigured as mentioned in <i>Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide</i>.
Available in OCI	No

6.3.5.8 Controlled Shutdown of NRF Feature

This section lists the alerts that are specific to Controlled Shutdown of NRF feature. For more information about the feature, see the [Controlled Shutdown of NRF](#) section.

6.3.5.8.1 OcnrfOperationalStateCompleteShutdown

Table 6-747 OcnrfOperationalStateCompleteShutdown

Field	Details
Description	'The operational state of NRF is Complete Shutdown.'
Summary	'kubernetes_namespace: {{labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : The Operational state of NRF is Complete Shutdown'
Severity	Warning
Condition	The operator has changed the operational state of NRF to Complete Shutdown.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7085
Metric Used	ocnrf_operational_state
Recommended Actions	The alert is cleared when the user changes the operational state to NORMAL • If the alert is not cleared automatically after the operational state changes to NORMAL, collect the following: – all the logs as mentioned in the NrfConfiguration, Ingress Gateway, Egress Gateway, NrfAuditor microservices – the database dump from the site – REST output of operationalState, operationalStateHistory, and controlledShutdownOptions • Contact My Oracle Support.
Available in OCI	No

6.3.5.8.2 OcnrfAuditOperationsPaused

Table 6-748 OcnrfAuditOperationsPaused

Field	Details
Description	'The Audit procedures at NRF have been paused.'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }} : The Audit procedures at NRF has been paused'
Severity	Warning
Condition	The NrfAuditor microservice has paused all audit procedures. This occurs during any of the following scenarios: 1. The NRF is in COMPLETE_SHUTDOWN operational state or just transitioned from COMPLETE_SHUTDOWN to a NORMAL operational state. 2. The database has been down for a prolonged period of time. To restore the database, see section "Database Corruption" in <i>Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide</i>. 3. If the NrfAuditor pod has transitioned from READY to NOT_READY state.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7086
Metric Used	ocnrf_audit_status
Recommended Actions	The alert is expected to clear automatically, after the waiting period, and once all the above conditions are resolved. • If the alert is not cleared automatically, collect the following: – all the logs as mentioned in the NrfConfiguration microservice, and NrfAuditor pod logs, – the database dump from the site, – REST output of operationalState, operationalStateHistory, and controlledShutdownOptions • Contact My Oracle Support.
Notes	NrfAuditor continues to remain in the paused state for some time, even after OcnrfOperationalStateCompleteShutdown alarm is cleared. For more information, see From CONTROLLED_SHUTDOWN to NORMAL subsection under "Controlled Shutdown of NRF" section in <i>Oracle Communications Cloud Native Core, Network Repository Function User Guide</i> .
Available in OCI	No

6.3.5.9 Monitoring the Availability of SCP Using SCP Health APIs Feature

This section lists the alerts that are specific to Monitoring the Availability of SCP Using SCP Health APIs feature. For more information about the feature, see the [Monitoring the Availability of SCP Using SCP Health APIs](#) section.

6.3.5.9.1 OcnrfAllSCPsMarkedAsUnavailable

Table 6-749 OcnrfAllSCPsMarkedAsUnavailable

Field	Details
Description	'All SCPs have been marked unavailable.'

Table 6-749 (Cont.) OcnrfAllSCPsMarkedAsUnavailable

Field	Details
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }} : All SCPs have been marked as unavailable'
Severity	Critical
Condition	All SCPs have been marked unavailable.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7088
Metric Used	'oc_egressgateway_peer_count and oc_egressgateway_peer_available_count'
Recommended Actions	NF clears the critical alarm when atleast 1 SCP peer in a peerset becomes available such that all other SCP peers in the given peerset are still unavailable.
Available in OCI	Yes

6.3.5.9.2 OcnrfSCPMarkedAsUnavailable

Table 6-750 OcnrfSCPMarkedAsUnavailable

Field	Details
Description	'An SCP has been marked unavailable.'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }} : One of the SCP has been marked unavailable'
Severity	Major
Condition	One of the SCPs has been marked unhealthy.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7087
Metric Used	oc_egressgateway_peer_health_status
Recommended Actions	This alert gets cleared when unavailable SCPs become available.
Available in OCI	Yes

6.3.5.10 CCA Header Validation in NRF for Access Token Service Operation Feature

This section lists the alerts that are specific to CCA Header Validation in NRF for Access Token Service Operation feature. For more information about the feature, see the [CCA Header Validation in NRF for Access Token Service Operation](#) section.

6.3.5.10.1 OcnrfCcaRootCertificateExpiringIn4Hours

Table 6-751 OcnrfCcaRootCertificateExpiringIn4Hours

Field	Details
Description	'The CCA Root Certificates expiring in 4 hours'.
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }} : CCA Root Certificate is expiring in 4 Hours'
Severity	Critical

Table 6-751 (Cont.) OcnrfCcaRootCertificateExpiringIn4Hours

Field	Details
Condition	Indicates the expiry dates of the CCA Root certificates that are expiring in four hours.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7091
Metric Used	'oc_ingressgateway_cca_certificate'
Recommended Actions	The alert is cleared when the expiring CCA root certificates are replaced with new ones. Steps: Replace expiring certificate key pair with new ones. For more information on creating certificate key pair, see <i>Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide</i> .
Available in OCI	No

6.3.5.10.2 OcnrfCcaRootCertificateExpiringIn1Day

Table 6-752 OcnrfCcaRootCertificateExpiringIn1Day

Field	Details
Description	'The CCA Root Certificates expiring in 1 day'.
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : CCA Root Certificate is expiring in 1 Day'
Severity	Major
Condition	Indicates the expiry dates of the CCA Root certificates that are expiring in one day.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7090
Metric Used	'oc_ingressgateway_cca_certificate'
Recommended Actions	The alert is cleared when the expiring CCA root certificates are replaced with new ones. Steps: Replace expiring certificate key pair with new ones. For more information on creating certificate key pair, see <i>Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide</i> .
Available in OCI	No

6.3.5.10.3 OcnrfCcaRootCertificateExpiringIn5Days

Table 6-753 OcnrfCcaRootCertificateExpiringIn5Days

Field	Details
Description	'The CCA Root Certificates expiring in 5 days.'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : CCA Root Certificate is expiring in 5 Days'
Severity	Minor
Condition	Indicates the expiry dates of the CCA Root certificates that are expiring in five days.

Table 6-753 (Cont.) OcnrfCcaRootCertificateExpiringIn5Days

Field	Details
OID	1.3.6.1.4.1.323.5.3.36.1.2.7089
Metric Used	'oc_ingressgateway_cca_certificate'
Recommended Actions	The alert is cleared when the expiring CCA root certificates are replaced with new ones. Steps: Replace expiring certificate key pair with new ones. For more information on creating certificate key pair, see <i>Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide</i> .
Available in OCI	No

6.3.5.11 NRF Georedundancy Feature

This section lists the alerts that are specific to NRF Georedundancy feature. For more information about the feature, see the [NRF Georedundancy](#) section.

6.3.5.11.1 OcnrfDbReplicationStatusInactive

Table 6-754 OcnrfDbReplicationStatusInactive

Field	Details
Description	'The Database Replication Status is currently INACTIVE.'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, nftype: {{\$labels.NfType}}, nrflvel:{{\$labels.NrfLevel}}, remoteNrfInstanceld: {{\$labels.nrfInstanceld}}, remoteSiteName: {{\$labels.siteName}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{{ end }}: The database replication status is INACTIVE.'
Severity	Critical
Condition	The database replication channel status between the given site and the georedundant site(s) is inactive. The alert is raised per replication channel. The alarm is raised or cleared only if the georedundancy feature is enabled.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7013
Metric Used	'ocnrf_dbreplication_status'
Recommended Actions	The alert is cleared when the database channel replication status between the given site and the georedundant site(s) is up. For more information on how to check the database replication status, see <i>Oracle Communications Cloud Native Core, cnDBTier User Guide</i> .
Notes	The alarm is included only if the georedundancy feature is enabled.
Available in OCI	No

6.3.5.11.2 OcnrfReplicationStatusMonitoringInactive

Table 6-755 OcnrfReplicationStatusMonitoringInactive

Field	Details
Description	'OCNRF Replication Status Monitoring Inactive'

Table 6-755 (Cont.) OcnrfReplicationStatusMonitoringInactive

Field	Details
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : Pod {{\$labels.kubernetes_pod_name}} are not monitoring the replication status'
Severity	Critical
Condition	This alarm is raised when one or more pods are not monitoring the replication status.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7078
Metric Used	ocnrf_replication_status_monitoring_inactive
Recommended Actions	Resolution Steps: 1. Identify the pod for which the alert is raised. 2. Run the following command to restart the pod: kubect1 delete pod <pod_name> -n <namespace>

6.3.5.12 XFCC Header Validation Feature

This section lists the alert that is specific to XFCC Header Validation feature. For more information about the feature, see the [XFCC Header Validation](#) section.

6.3.5.12.1 OcnrfNfAuthenticationFailureRequestsRejected

Table 6-756 OcnrfNfAuthenticationFailureRequestsRejected

Field	Details
Description	'Service request(s) received from NF have been rejected by OCNRF (current value is: {{\$value}}')
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}},nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : Request rejected for Nf FQDN based Authentication failure.'
Severity	Warning
Condition	NRF rejected a service request due to NF authentication failure
OID	1.3.6.1.4.1.323.5.3.36.1.2.7015
Metric Used	'ocnrf_nf_authentication_failure_total'
Recommended Actions	The alert is cleared automatically. Steps: Filter out nfAccessToken application ERROR logs on Kibana for more details.
Available in OCI	No

6.3.5.13 Enhanced NRF Set Based Deployment (NRF Growth) Feature

This section lists the alert that is specific to Enhanced NRF Set Based Deployment (NRF Growth) feature. For more information about the feature, see the [Enhanced NRF Set Based Deployment \(NRF Growth\)](#) section.

6.3.5.13.1 OcnrfRemoteSetNrfSyncFailed

Table 6-757 OcnrfRemoteSetNrfSyncFailed

Field	Details
Description	'A sync request to the NRF in the remote set has failed.' Note: The alert must be configured only if the NRF Growth feature is enabled.
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }} : A sync request to the NRF in the remote set has failed.'
Severity	Minor
Condition	Sync request to the NRF in the remote NRF set has failed.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7098
Metric Used	ocnrf_query_remote_cds_responses_total
Recommended Actions	The alert is cleared when the synchronization with the remote NRF set is successful. Steps: 1. Verify the remote NRF set is up. 2. Verify the connectivity between the local NRF set and remote NRF set. 3. Collect logs from local NRF and remote NRF(s). Contact My Oracle Support.
Available in OCI	No

6.3.5.13.2 OcnrfSyncFailureFromAllNrfOfAnyRemoteSet

Table 6-758 OcnrfSyncFailureFromAllNrfOfAnyRemoteSet

Field	Details
Description	'Sync requests to all the NRFs of a remote set has failed.' Note: The alert must be configured only if the NRF Growth feature is enabled.
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }} : Sync requests to all the NRFs in any of the remote sets have failed'
Severity	Major
Condition	The sync requests to all the NRFs in the remote sets has failed.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7099
Metric Used	ocnrf_remote_set_unavailable_total

Table 6-758 (Cont.) OcnrfSyncFailureFromAllNrfOfAnyRemoteSet

Field	Details
Recommended Actions	The alert is cleared when synchronization is successful with at least one NRF of the remote NRF set. Steps: 1. Verify the remote NRF sets are up. 2. Verify the host details configured in the nrfHostConfig attribute using REST API. For more information about the attribute, see <i>Oracle Communications, Cloud Native Core Network Repository Function REST Specifications Guide</i>. 3. Verify the connectivity between the local NRF set and remote NRF set. 4. Collect logs from local NRF and remote NRF(s). Contact My Oracle Support.
Available in OCI	No

6.3.5.13.3 OcnrfSyncFailureFromAllNrfOfAllRemoteSets

Table 6-759 OcnrfSyncFailureFromAllNrfOfAllRemoteSets

Field	Details
Description	'Sync request to all the NRFs in all the remote sets have failed.' Note: The alert must be configured only if the NRF Growth feature is enabled.
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }} : Sync request to all the NRFs in all the remote sets have failed'
Severity	critical
Condition	Sync requests to all the NRFs in all the remote sets have failed.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7100
Metric Used	ocnrf_all_remote_sets_unavailable_total

Table 6-759 (Cont.) OcnrfSyncFailureFromAllNrfOfAllRemoteSets

Field	Details
Recommended Actions	The alert is cleared when synchronization is successful with at least one NRF of the remote set(s). Steps: 1. Verify the remote NRF sets are up. 2. Verify the host details configured in the <code>nrfHostConfig</code> attribute using REST API. For more information about the attribute, see <i>Oracle Communications, Cloud Native Core Network Repository Function REST Specifications Guide</i>. 3. Verify the connectivity between the local NRF set and remote NRF set. 4. In case, an NRF instance cannot synchronize NF Profiles or Subscription from the NRFs in its remote set (that is., CDS-to-CDS communication is down), it is considered that the NRF is working with limited capacity. For more details, see "Error Handling and Expected Outcomes for NRF Growth Feature" section in <i>Oracle Communications Cloud Native Core, Network Repository Function User Guide</i>. If the fault persists for a prolonged period of time, the operator should explore diverting the traffic to an alternate NRF within the same NRF Set, provided the alternate NRFs are not having similar fault and having necessary capacity to handle the additional traffic. 5. Collect logs from local NRF and remote NRF(s). Contact My Oracle Support.
Available in OCI	No

6.3.5.13.4 OcnrfCacheDataServiceDown

Table 6-760 OcnrfCacheDataServiceDown

Field	Details
Description	'OCNRF NrfCacheData service {{\$labels.app_kubernetes_io_name}} is down'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }} : Cache Data Service is down'
Severity	Critical
Condition	Cache Data Service is unavailable.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7101
Metric Used	up

Table 6-760 (Cont.) OcnrfCacheDataServiceDown

Field	Details
Recommended Actions	The alert is cleared when the Cache Data Service (CDS) is available. Steps: 1. To check the orchestration logs of the CDS and check for liveness or readiness probe failures, do the following: a. Run the following command to check the pod status: <pre>\$ kubectl get po -n <namespace></pre> b. Run the following command to analyze the error condition of the pod that is not in the running state: <pre>\$ kubectl describe pod <pod name not in Running state> -n <namespace></pre> Where <pod name not in Running state> indicates the pod that is not in the Running state. 2. Refer to the application logs on Kibana and filter based on service names. Check for ERROR WARNING logs. 3. Check the DB status. For more information on how to check the DB status, see <i>Oracle Communications Cloud Native Core, cnDBTier User Guide</i>. Depending on the failure reason, take the resolution steps. 4. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use the CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using the Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	No

6.3.5.13.5 OcnrfDatabaseFallbackUsed

Table 6-761 OcnrfDatabaseFallbackUsed

Field	Details
Description	'A service operation is unable to get data from the Cache Data Service, and hence gets the data from the cnDBTier to fulfill the service operation'
Summary	"kubernetes_namespace: {{ \$labels.kubernetes_namespace }}, timestamp: {{ with query \"time()\" }}{{ . first value humanizeTimestamp }}{{ end }} : A service Operation is unable to get data from the Cache Data Service, so falling back to DB'
Severity	Major
Condition	When a service operation is unable to get data from the Cache Data Service, and hence gets the data from the database to fulfill the service operation.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7102
Metric Used	ocnrf_db_fallback_total

Table 6-761 (Cont.) OcnrfDatabaseFallbackUsed

Field	Details
Recommended Actions	The alert is cleared automatically. Steps: 1. To check the orchestration logs of the CDS and check for liveness or readiness probe failures, do the following: a. Run the following command to check the pod status: <pre>\$ kubectl get po -n <namespace></pre> b. Run the following command to analyze the error condition of the pod that is not in the running state: <pre>\$ kubectl describe pod <pod name not in Running state> -n <namespace></pre> Where <pod name not in Running state> indicates the pod that is not in the Running state. 2. Refer to the application logs on Kibana and filter based on service names. Check for ERROR WARNING logs. 3. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support.
Available in OCI	No

6.3.5.13.6 OcnrfTotalNFsRegisteredAtSegmentBelowMinorThreshold

Table 6-762 OcnrfTotalNFsRegisteredAtSegmentBelowMinorThreshold

Field	Details
Description	The alert is raised when the number of NFs registered at the segment is below the configured minor threshold.
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }} : The number of NFs registered at the segment is below minor threshold'
Severity	Minor
Condition	The number of NFs registered at the segment is below minor threshold. Note: This alert is triggered when the registered NF count is greater than or equal to 10 and below 20. This default value can be modified in the ocnrf_alertrules_26.1.201.yaml or ocnrf_alertrules_promha_26.1.201.yaml file depending on Prometheus version.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7103
Metric Used	ocnrf_nf_registered_count

Table 6-762 (Cont.) OcnrfTotalNFsRegisteredAtSegmentBelowMinorThreshold

Field	Details
Recommended Actions	The alert is cleared when the number of registered NFs in the segment is above the minor threshold. Steps: 1. Check if there is traffic for requests other than registration (for example, discovery requests). This ensures that NRF FQDN is reachable from other NFs and Ingress Gateway is up and running in all NRF Sets. 2. Check if the Ingress Gateway pod is up and running in all NRF sets. <pre>kubect1 get po -n <namespace></pre> 3. Validate that the CDS synchronization with remote NRF sets is successful. Validate below alerts are not present in the system: a. OcnrfSyncFailureFromAllNrfOfAnyRemoteSet b. OcnrfSyncFailureFromAllNrfOfAllRemoteSets 4. Check for registration pod logs on Kibana for ERROR WARN logs. 5. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use the CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using the Data Collector tool, see <i>Oracle Communications Cloud Native Core, cnDBTier User Guide</i>.
Available in OCI	No

6.3.5.13.7 OcnrfTotalNFsRegisteredAtSegmentBelowMajorThreshold

Table 6-763 OcnrfTotalNFsRegisteredAtSegmentBelowMajorThreshold

Field	Details
Description	The alert is raised when the number of NFs registered at the segment is below the configured major threshold.
Summary	"kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{ end }} : The number of NFs registered at the segment is below major threshold
Severity	Major
Condition	The number of NFs registered at the segment is below major threshold. Note: This alert is triggered when the registered NF count is greater than or equal to 2 and below 10. This default value can be modified in the <code>ocnrf_alertrules_26.1.201.yaml</code> or <code>ocnrf_alertrules_promha_26.1.201.yaml</code> file depending on Prometheus version.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7104
Metric Used	ocnrf_nf_registered_count

Table 6-763 (Cont.) OcnrfTotalNFsRegisteredAtSegmentBelowMajorThreshold

Field	Details
Recommended Actions	The alert is cleared when the number of registered NFs in the segment is above the major threshold. Steps: 1. Check if there is traffic for requests other than registration (for example, discovery requests). This ensures that NRF FQDN is reachable from other NFs and Ingress Gateway is up and running in all NRF sets. 2. Check if the Ingress Gateway pod is up and running in all NRF sets. <pre>kubectl get po -n <namespace></pre> 3. Validate that the CDS synchronization with remote NRF sets is successful. Validate below alerts are not present in the system: a. OcnrfSyncFailureFromAllNrfOfAnyRemoteSet b. OcnrfSyncFailureFromAllNrfOfAllRemoteSets 4. Check for registration pod logs on Kibana for ERROR WARN logs. 5. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use the CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using the Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	No

6.3.5.13.8 OcnrfTotalNFsRegisteredAtSegmentBelowCriticalThreshold

Table 6-764 OcnrfTotalNFsRegisteredAtSegmentBelowCriticalThreshold

Field	Details
Description	The alert is raised when the number of NFs registered at the segment is below the configured critical threshold.
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : The number of NFs registered at the segment is below critical threshold'
Severity	Critical
Condition	The number of NFs registered at the segment is below critical threshold. Note: This alert is triggered when the registered NF count is below 2. This default value can be modified in the <code>ocnrf_alertrules_26.1.201.yaml</code> or <code>ocnrf_alertrules_promha_26.1.201.yaml</code> file depending on Prometheus version.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7105
Metric Used	ocnrf_nf_registered_count

Table 6-764 (Cont.) OcnrfTotalNFsRegisteredAtSegmentBelowCriticalThreshold

Field	Details
Recommended Actions	The alert is cleared when the number of registered NFs in the segment is above the critical threshold. Steps: 1. Check if there is traffic for requests other than registration (for example, discovery requests). This ensures that NRF FQDN is reachable from other NFs and Ingress Gateway is up and running in all NRF sets. 2. Check if the Ingress Gateway pod is up and running in all NRF sets. <pre>kubectl get po -n <namespace></pre> 3. Validate that the CDS synchronization with remote NRF sets is successful. Validate below alerts are not present in the system: a. OcnrfSyncFailureFromAllNrfOfAnyRemoteSet b. OcnrfSyncFailureFromAllNrfOfAllRemoteSets 4. Check for registration pod logs on Kibana for ERROR WARN logs. 5. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. Note: Use the CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using the Data Collector tool, see <i>Oracle Communications Cloud Native Core, cnDBTier User Guide</i>.

6.3.5.14 Ingress Gateway Pod Protection Feature

This section lists the alerts that are specific to Ingress Gateway Pod Protection feature. For more information about the feature, see the [Ingress Gateway Pod Protection](#) section.

6.3.5.14.1 OcnrfIngressGatewayPodInDangerOfCongestionState

Table 6-765 OcnrfIngressGatewayPodInDangerOfCongestionState

Field	Details
Description	'The pod {{\$labels.kubernetes_pod_name}} is in Danger of Congestion state'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{{ end }} : The pod is in Danger of Congestion state'
Severity	Major
Condition	When Ingress Gateway pod is in Danger Of Congestion state.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7092
Metric Used	oc_ingressgateway_pod_congestion_state

Table 6-765 (Cont.) OcnrflngressGatewayPodInDangerOfCongestionState

Field	Details
Recommended Actions	The alert is cleared when the pod is out of Danger Of Congestion (DoC) state. Note: The thresholds can be viewed using REST API. Steps: Reassess if the NRF is receiving additional traffic. If this is unexpected, contact My Oracle Support. 1. Refer to alert to determine which pod is receiving high traffic. It may due to a sudden spike in traffic. For example: When one mated site goes down, the NFs move to the given site. Check if NF is sending high number of updates, register, or deregister. 2. Check the service pod logs on Kibana to determine the reason for the errors. 3. If this is expected traffic, then the thresholds levels may need to be re-evaluated as per the call rate and reconfigured as mentioned in Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide.
Available in OCI	No

6.3.5.14.2 OcnrflngressGatewayPodInCongestedState

Table 6-766 OcnrflngressGatewayPodInCongestedState

Field	Details
Description	'The pod {{\$labels.kubernetes_pod_name}} is in Congested state'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : The pod is in Congested state'
Severity	Critical
Condition	When Ingress Gateway pod is in Congested state.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7093
Metric Used	oc_ingressgateway_pod_congestion_state
Recommended Actions	The alert is cleared when the pod is out of Congested state. Note: The thresholds can be viewed using REST API. Steps: Reassess if the NRF is receiving additional traffic. If this is unexpected, contact My Oracle Support. 1. Refer to alert to determine which pod is receiving high traffic. It may due to a sudden spike in traffic. For example: When one mated site goes down, the NFs move to the given site. Check if NF is sending high number of updates, register, or deregister. 2. Check the service pod logs on Kibana to determine the reason for the errors. 3. If this is expected traffic, then the thresholds levels may need to be re-evaluated as per the call rate and reconfigured as mentioned in Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide.
Available in OCI	No

6.3.5.14.3 OcnrflIngressGatewayPodCpuUsageInCongestedState

Table 6-767 OcnrflIngressGatewayPodCpuUsageInCongestedState

Field	Details
Description	'The pod {{\$labels.kubernetes_pod_name}} is in Congested state'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}},podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : The pod is in Congested state'
Severity	Critical
Condition	Ingress Gateway pod is in Congested state due to CPU consumption above the configured thresholds.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7094
Metric Used	oc_ingressgateway_pod_resource_state
Recommended Actions	The alert is cleared when the CPU consumption goes below the configured thresholds for the Congested state. Note: The thresholds can be viewed using REST API. Steps: Reassess if the NRF is receiving additional traffic. If this is unexpected, contact My Oracle Support. 1. Refer to alert to determine which pod is receiving high traffic. It may due to a sudden spike in traffic. For example: When one mated site goes down, the NFs move to the given site. Check if NF is sending high number of updates, register, or deregister. 2. Check the service pod logs on Kibana to determine the reason for the errors. 3. If this is expected traffic, then the thresholds levels may need to be re-evaluated as per the call rate and reconfigured as mentioned in Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide.
Available in OCI	No

6.3.5.14.4 OcnrflIngressGatewayPodCpuUsageInDangerOfCongestionState

Table 6-768 OcnrflIngressGatewayPodCpuUsageInDangerOfCongestionState

Field	Details
Description	'The pod {{\$labels.kubernetes_pod_name}} is in Danger of Congestion state due to CPU usage above threshold'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}},podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : The pod is in Danger of Congestion state due to CPU usage above threshold'
Severity	Major
Condition	Ingress Gateway pod is in Danger of Congestion state due to CPU consumption above the configured thresholds.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7095
Metric Used	oc_ingressgateway_pod_resource_state

Table 6-768 (Cont.) OcnrflngressGatewayPodCpuUsageInDangerOfCongestionState

Field	Details
Recommended Actions	The alert is cleared when the CPU consumption is not as per the configured thresholds value for the Danger of Congestion state. Note: The thresholds can be viewed using REST API. Steps: Reassess if the NRF is receiving additional traffic. If this is unexpected, contact My Oracle Support. 1. Refer to alert to determine which pod is receiving high traffic. It may due to a sudden spike in traffic. For example: When one mated site goes down, the NFs move to the given site. Check if NF is sending high number of updates, register, or deregister. 2. Check the service pod logs on Kibana to determine the reason for the errors. 3. If this is expected traffic, then the thresholds levels may need to be re-evaluated as per the call rate and reconfigured as mentioned in Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide.
Available in OCI	No

6.3.5.14.5 OcnrflngressGatewayPodPendingMessageInCongestedState

Table 6-769 OcnrflngressGatewayPodPendingMessageInCongestedState

Field	Details
Description	'The pod {{\$labels.kubernetes_pod_name}} is in Congested state'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}},podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{{ end }} : The pod is in Congested state'
Severity	Critical
Condition	Ingress Gateway pod is in Congested state due to pending message count above the configured thresholds.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7096
Metric Used	oc_ingressgateway_pod_resource_state
Recommended Actions	The alert is cleared when the pending message count is not as per the configured thresholds value for the Congested state. Note: The thresholds can be viewed using REST API. Steps: Reassess if the NRF is receiving additional traffic. If this is unexpected, contact My Oracle Support. 1. Refer to alert to determine which pod is receiving high traffic. It may due to a sudden spike in traffic. For example: When one mated site goes down, the NFs move to the given site. Check if NF is sending high number of updates, register, or deregister. 2. Check the service pod logs on Kibana to determine the reason for the errors. 3. If this is expected traffic, then the thresholds levels may need to be re-evaluated as per the call rate and reconfigured as mentioned in Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide.
Available in OCI	No

6.3.5.14.6 OcnrfIngressGatewayPodPendingMessageInDangerOfCongestionState

Table 6-770 OcnrfIngressGatewayPodPendingMessageInDangerOfCongestionState

Field	Details
Description	'The pod {{\$labels.kubernetes_pod_name}} is in Danger of Congestion state due to Pending Message above threshold'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : The pod is in Danger of Congestion state due to Pending Message above threshold'
Severity	Major
Condition	Ingress Gateway pod is in Danger of Congestion state due to pending message count above the configured thresholds.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7097
Metric Used	oc_ingressgateway_pod_resource_state
Recommended Actions	The alert is cleared when the pending message count is not as per the configured thresholds value for the Danger of Congestion state. Note: The thresholds can be viewed using REST API. Steps: Reassess if the NRF is receiving additional traffic. If this is unexpected, contact My Oracle Support. 1. Refer to alert to determine which pod is receiving high traffic. It may due to a sudden spike in traffic. For example: When one mated site goes down, the NFs move to the given site. Check if NF is sending high number of updates, register, or deregister. 2. Check the service pod logs on Kibana to determine the reason for the errors. 3. If this is expected traffic, then the thresholds levels may need to be re-evaluated as per the call rate and reconfigured as mentioned in Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide.
Available in OCI	No

6.3.5.15 Subscriber Location Function Feature

This section lists the alert that is specific to Subscriber Location Function feature. For more information about the feature, see the [Subscriber Location Function](#) section.

6.3.5.15.1 OcnrfMaxSlfAttemptsExhausted

Table 6-771 OcnrfMaxSlfAttemptsExhausted

Field	Details
Description	'NF discovery request with fqdn {{\$labels.NfProfileFqdn}} NF type {{\$labels.NfType}} has exhausted maximum SLF attempts'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, nrflevel: {{\$labels.NrfLevel}}, podname: {{\$labels.kubernetes_pod_name}}, NfProfileFqdn: {{\$labels.NfProfileFqdn}}, NfType: {{\$labels.NfType}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }}: The maximum slf attempts have exhausted.'

Table 6-771 (Cont.) OcnrfMaxSlfAttemptsExhausted

Field	Details
Severity	Critical
Condition	NF discovery request with FQDN of the given NFType UDR has exhausted maximum SLF attempts. This alert is raised when the ocnrf_max_slf_attempts_exhausted_total metric is pegged. Note: This alert is included if SLF selection from registered profiles is enabled.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7054
Metric Used	'ocnrf_max_slf_attempts_exhausted_total'
Recommended Actions	The alert is cleared automatically after 5 minutes. Steps: 1. Check logs in NF discovery pod to check the reason for SLF query failures. 2. In DISCOVERED_SLF_CONFIG_MODE, make sure that SLFs are registered with valid IPV4, PV6, or FQDN information. Verify the same in the slfDiscoveredCandidateList from the slfOptions. 3. In STATIC_SLF_CONFIG_MODE, verify if slfHostConfig details are configured correctly. Note: Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i> .
Available in OCI	Yes

6.3.5.16 EmptyList in Discovery Response Feature

This section lists the alert that is specific to EmptyList in Discovery Response feature. For more information about the feature, see the [EmptyList in Discovery Response](#) section.

6.3.5.16.1 OcnrfNFDiscoveryEmptyListObservedNotification

Table 6-772 OcnrfNFDiscoveryEmptyListObservedNotification

Field	Details
Description	'Empty List observed with received discovery request with NFType \$labels.NFType Feature Status \$labels.FeatureStatus'
Summary	'namespace: \$labels.namespace, nrflevel:\$labels.NrfLevel, podname: \$labels.pod, NFType: \$labels.NFType, FeatureStatus: \$labels.FeatureStatus: Empty List observed with received discovery request'
Severity	Critical
Condition	This alarm is raised when profiles do not match the discovery request. Also, this alarm is raised when the SUSPENDED profile is in response to incoming request and Empty List feature is enabled.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7055
Metric Used	ocnrf_nfDiscover_emptyList_total

Table 6-772 (Cont.) OcnrfNFDDiscoveryEmptyListObservedNotification

Field	Details
Recommended Actions	The alert is cleared automatically after a duration of 5 minutes. Steps: 1. Collect the logs. 2. Check logs for the following conditions: • Verify if the NF has sent Empty List in response in NRF Discovery. • Check if NF has sent SUSPENDED profiles in response for incoming requests when EmptyList feature is ENABLED. • If the response is not Empty List or does not contain SUSPENDED profiles. 3. If the alert still persists, contact My Oracle Support. Note: Use CNC NF Data Collector tool for capturing logs. For more details, see <i>Oracle Communications Cloud Native Core, Network Function Data Collector User Guide</i>.
Available in OCI	No

6.3.5.17 Support for TLS

This section lists the alert that is specific to Support for TLS feature. For more information about the feature, see the [Support for TLS](#) section.

6.3.5.17.1 OcnrfTLSCertificateExpireMinor

Table 6-773 OcnrfTLSCertificateExpireMinor

Field	Details
Description	'TLS certificate to expire in 6 months'.
Summary	'namespace: {{\$labels.namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : TLS certificate to expire in 6 months'
Severity	Minor
Condition	This alert is raised when the TLS certificate is about to expire in six months.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7106
Metric Used	security_cert_x509_expiration_seconds
Recommended Actions	The alert is cleared when the TLS certificate is renewed. For more information about certificate renewal, see "Creating Private Keys and Certificate " section in the <i>Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide</i>.
Available in OCI	No

6.3.5.17.2 OcnrfTLSCertificateExpireMajor

Table 6-774 OcnrfTLSCertificateExpireMajor

Field	Details
Description	'TLS certificate to expire in 3 months.'
Summary	'namespace: {{\$labels.namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : TLS certificate to expire in 3 months'
Severity	Major
Condition	This alert is raised when the TLS certificate is about to expire in three months.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7107
Metric Used	security_cert_x509_expiration_seconds
Recommended Actions	The alert is cleared when the TLS certificate is renewed. For more information about certificate renewal, see "Creating Private Keys and Certificate" section in the <i>Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide</i> .
Available in OCI	No

6.3.5.17.3 OcnrfTLSCertificateExpireCritical

Table 6-775 OcnrfTLSCertificateExpireCritical

Field	Details
Description	'TLS certificate to expire in one month.'
Summary	'namespace: {{\$labels.namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : TLS certificate to expire in 1 month'
Severity	Critical
Condition	This alert is raised when the TLS certificate is about to expire in one month.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7108
Metric Used	security_cert_x509_expiration_seconds
Recommended Actions	The alert is cleared when the TLS certificate is renewed. For more information about certificate renewal, see "Creating Private Keys and Certificate" section in the <i>Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide</i> .
Available in OCI	No

6.3.5.18 Egress Gateway Pod Throttling

6.3.5.18.1 OcnrfEgressPerPodDiscardRateAboveMajorThreshold

Table 6-776 OcnrfEgressPerPodDiscardRateAboveMajorThreshold

Field	Details
Description	'Egressgateway PerPod Discard Rate is greater than the configured major threshold. (current value is: {{ \$value }})'
Summary	'kubernetes_namespace: {{\$labels.namespace}}, timestamp: {{ with query "time()" }} {{ . first value humanizeTimestamp }}{{ end }}: Egressgateway PerPod Discard Rate is more than 1 request per second.'
Severity	Major
Condition	This alert is raised when the Egress Gateway pods discard traffic due to its request limit is greater than the configured threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7113
Metric Used	oc_egressgateway_podlevel_throttling_discarded_total
Recommended Actions	The alert is cleared when the Egress Gateway pods discard traffic rate falls below the major threshold. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional traffic (for example, Mated site NRF is unavailable in georedundancy scenario). If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer Egress Gateway section in Grafana to determine which service is sending high traffic. 2. Refer Egress Gateway section in Grafana to determine the increase in 4xx and 5xx error codes. 3. Check Egress Gateway logs on Kibana to determine the reason for the errors.
Available in OCI	No

6.3.5.18.2 OcnrfEgressPerPodDiscardRateAboveCriticalThreshold

Table 6-777 OcnrfEgressPerPodDiscardRateAboveCriticalThreshold

Field	Details
Description	'Egressgateway PerPod Discard Rate is greater than the configured critical threshold. (current value is: {{ \$value }})'
Summary	'kubernetes_namespace: {{\$labels.namespace}}, timestamp: {{ with query "time()" }} {{ . first value humanizeTimestamp }}{{ end }}: Egressgateway PerPod Discard Rate is more than 100 requests per second.'
Severity	Critical
Condition	This alert is raised when the Egress Gateway pods discard traffic due to its request limit is greater than the configured threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7114
Metric Used	oc_egressgateway_podlevel_throttling_discarded_total

Table 6-777 (Cont.) OcnrfEgressPerPodDiscardRateAboveCriticalThreshold

Field	Details
Recommended Actions	The alert is cleared when the Egress Gateway pods discard traffic rate falls below the critical threshold. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional traffic (for example, Mated site NRF is unavailable in georedundancy scenario). If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer Egress Gateway section in Grafana to determine which service is sending high traffic. 2. Refer Egress Gateway section in Grafana to determine the increase in 4xx and 5xx error codes. 3. Check Egress Gateway logs on Kibana to determine the reason for the errors.
Available in OCI	No

6.3.5.19 Ingress Gateway Pod Protection Using Rate Limiting

6.3.5.19.1 OcnrfIngressDiscardDueToRateLimitMajorThreshold

Table 6-778 OcnrfIngressDiscardDueToRateLimitMajorThreshold

Field	Details
Description	'Ingress Gateway discards due to rate limit exceeds the configured major threshold. (current value is: {{ \$value }})'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }}: Ingressgateway Discard due to Rate Limit is more than or equal to 1 requests per second and less than 100 requests per second.'
Severity	Major
Condition	This alert is raised when Ingress Gateway discard requests as rate limit exceeds the configured major threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7129
Metric Used	oc_ingressgateway_http_request_ratelimit_denied_count_total
Recommended Actions	The alert is cleared when the Ingress Gateway pods discard traffic rate falls below the major threshold or exceeds the critical threshold. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional traffic (for example, Mated site NRF is unavailable in georedundancy scenario). If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer Ingress Gateway Pod Protection By Rate Limit section in Grafana to determine which pods are overloaded and the rate of traffic received. 2. Refer Ingress Gateway section in Grafana to determine the increase in 4xx and 5xx error codes. 3. Refer the Grafana dashboard to determine which service traffic is above expectation.
Available in OCI	No

6.3.5.19.2 OcnrfIngressDiscardDueToRateLimitCriticalThreshold

Table 6-779 OcnrfIngressDiscardDueToRateLimitCriticalThreshold

Field	Details
Description	'Ingress gateway discards due to rate limit exceeds the configured critical threshold. (current value is: {{ \$value }})'
Summary	'kubernetes_namespace: {{ \$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{{ end }}: Ingressgateway Discard due to Rate Limit is more than or equal to 100 requests per second.'
Severity	Critical
Condition	This alert is raised when Ingress Gateway discard requests as rate limit exceeds the configured critical threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7130
Metric Used	oc_ingressgateway_http_request_ratelimit_denied_count_total
Recommended Actions	The alert is cleared when the Ingress Gateway pods discard traffic rate falls below the critical threshold. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional traffic (for example, Mated site NRF is unavailable in georedundancy scenario). If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer Ingress Gateway Pod Protection By Rate Limit section in Grafana to determine which pods are overloaded and the rate of traffic received. 2. Refer Ingress Gateway section in Grafana to determine the increase in 4xx and 5xx error codes. 3. Refer the Grafana dashboard to determine which service traffic is above expectation.
Available in OCI	No

6.3.5.19.3 OcnrfIngressGatewayPodStateInDangerOfCongestion

Table 6-780 OcnrfIngressGatewayPodStateInDangerOfCongestion

Field	Details
Description	'Ingress Gateway Pod Protection due to rate limiting; The pod {{ \$labels.kubernetes_pod_name }} is in danger of congestion state'
Summary	'kubernetes_namespace: {{ \$labels.kubernetes_namespace}}, podname: {{ \$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{ . first value humanizeTimestamp }}{{ end }} : The pod is in danger of congestion state'
Severity	Major
Condition	This alert is raised when Ingress Gateway pods are in danger of congestion state.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7139
Metric Used	oc_ingressgateway_congestion_system_state

Table 6-780 (Cont.) OcnrflIngressGatewayPodStateInDangerOfCongestion

Field	Details
Recommended Actions	The alert is cleared when the Ingress Gateway congestion level of the pod falls below the Danger of Congestion state or exceeds the congested state. If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer Ingress Gateway Pod Protection By Rate Limit section in Grafana to determine which pods are in Danger of congested state.
Available in OCI	No

6.3.5.19.4 OcnrflIngressGatewayPodStateInCongested

Table 6-781 OcnrflIngressGatewayPodStateInCongested

Field	Details
Description	'Ingress Gateway Pod Protection due to rate limiting; The pod {{ \$labels.kubernetes_pod_name }} is in congestion state'
Summary	'kubernetes_namespace: {{ \$labels.kubernetes_namespace }}, podname: {{ \$labels.kubernetes_pod_name }}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : The pod is in congested state'
Severity	Critical
Condition	This alert is raised when Ingress Gateway pods are in congested state.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7140
Metric Used	oc_ingressgateway_congestion_system_state
Recommended Actions	The alert is cleared when the Ingress Gateway congestion level of the pod falls below the congested state. If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer Ingress Gateway Pod Protection By Rate Limit section in Grafana to determine which pods are in congested state.
Available in OCI	No

6.3.5.20 Egress Gateway Pod Protection Using Rate Limiting

6.3.5.20.1 OcnrfEgressDiscardDueToRateLimitMajorThreshold

Table 6-782 OcnrfEgressDiscardDueToRateLimitMajorThreshold

Field	Details
Description	'Egress Gateway discards due to rate limit exceeds the configured major threshold. (current value is: {{ \$value }}'
Summary	'kubernetes_namespace: {{ \$labels.kubernetes_namespace }}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }}: Egressgateway Discard due to Rate Limit is more than or equal to 1 requests per second and less than 100 requests per second.'
Severity	Major

Table 6-782 (Cont.) OcnrfEgressDiscardDueToRateLimitMajorThreshold

Field	Details
Condition	This alert is raised when Egress Gateway discard requests as rate limit exceeds the configured major threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7131
Metric Used	oc_egressgateway_http_request_ratelimit_denied_count_total
Recommended Actions	The alert is cleared when the Egress Gateway pods discard traffic rate falls below the major threshold or exceeds the critical threshold. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional traffic (for example, Mated site NRF is unavailable in georedundancy scenario). If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer Egress Gateway Pod Protection By Rate Limit section in Grafana to determine which pods are overloaded and the rate of traffic received. 2. Refer Egress Gateway section in Grafana to determine the increase in 4xx and 5xx error codes. 3. Refer the Grafana dashboard to determine which service traffic is above expectation.
Available in OCI	No

6.3.5.20.2 OcnrfEgressDiscardDueToRateLimitCriticalThreshold

Table 6-783 OcnrfEgressDiscardDueToRateLimitCriticalThreshold

Field	Details
Description	'Egress gateway discards due to rate limit exceeds the configured critical threshold. (current value is: {{ \$value }})'
Summary	'kubernetes_namespace: {{ \$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }}: Egressgateway Discard due to Rate Limit is more than or equal to 100 requests per second.'
Severity	Critical
Condition	This alert is raised when Egress Gateway discard requests as rate limit exceeds the configured critical threshold.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7132
Metric Used	oc_egressgateway_http_request_ratelimit_denied_count_total
Recommended Actions	The alert is cleared when the Egress Gateway pods discard traffic rate falls below the critical threshold. Note: The threshold is configurable in the alert file. Reassess why the NRF is receiving additional traffic (for example, Mated site NRF is unavailable in georedundancy scenario). If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer Egress Gateway Pod Protection By Rate Limit section in Grafana to determine which pods are overloaded and the rate of traffic received. 2. Refer Egress Gateway section in Grafana to determine the increase in 4xx and 5xx error codes. 3. Refer the Grafana dashboard to determine which service traffic is above expectation.

Table 6-783 (Cont.) OcnrfEgressDiscardDueToRateLimitCriticalThreshold

Field	Details
Available in OCI	No

6.3.5.20.3 OcnrfEgressGatewayPodStateInDangerOfCongestion

Table 6-784 OcnrfEgressGatewayPodStateInDangerOfCongestion

Field	Details
Description	'Egress Gateway Pod Protection due to rate limiting; The pod {{\$labels.kubernetes_pod_name}} is in danger of congestion state'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : The pod is in danger of congestion state'
Severity	Major
Condition	This alert is raised when Egress Gateway pods are in danger of congestion state.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7137
Metric Used	oc_egressgateway_congestion_system_state
Recommended Actions	The alert is cleared when the Egress Gateway congestion level of the pod falls below the Danger of Congestion state or exceeds the congested state. If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer Egress Gateway Pod Protection By Rate Limit section in Grafana to determine which pods are in Danger of congested state.
Available in OCI	No

6.3.5.20.4 OcnrfEgressGatewayPodStateInCongested

Table 6-785 OcnrfEgressGatewayPodStateInCongested

Field	Details
Description	'Egress Gateway Pod Protection due to rate limiting; The pod {{\$labels.kubernetes_pod_name}} is in congestion state'
Summary	'kubernetes_namespace: {{\$labels.kubernetes_namespace}}, podname: {{\$labels.kubernetes_pod_name}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : The pod is in congested state'
Severity	Critical
Condition	This alert is raised when Egress Gateway pods are in congested state.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7138
Metric Used	oc_egressgateway_congestion_system_state
Recommended Actions	The alert is cleared when the Egress Gateway congestion level of the pod falls below the congested state. If this alert is unexpected, contact My Oracle Support. Steps: 1. Refer Egress Gateway Pod Protection By Rate Limit section in Grafana to determine which pods are in congested state.

Table 6-785 (Cont.) OcnrfEgressGatewayPodStateInCongested

Field	Details
Available in OCI	No

6.3.5.21 Simultaneous Support for HTTP and HTTPS Connections

6.3.5.21.1 OcnrfEgressGatewayFailureForHTTPRequests

Table 6-786 OcnrfEgressGatewayFailureForHTTPRequests

Field	Details
Description	'Invalid HTTP Request Received at Egress Gateway (current value is: {{ \$value }})'
Summary	'kubernetes_namespace:{{ \$labels.kubernetes_namespace}}, timestamp:{{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : Invalid HTTP Request Received at Egress Gateway'
Severity	Critical
Condition	An invalid HTTP request is received at Egress Gateway microservice. HTTPs scheme based request received from NRF backend microservices is rejected by Egress gateway as HTTP scheme based only messages are allowed by NRF Egress gateway. An increase in the counter metric <code>oc_egressgateway_request_failure_total</code> raises this alert.
OID	1.3.6.1.4.1.323.5.3.36.1.2.7133
Metric Used	<code>oc_egressgateway_request_failure_total</code>
Recommended Actions	This alert gets automatically cleared after 5 minutes. Perform the following recommended actions to correct the condition for the forthcoming traffic: - Check the Egress Gateway configuration in <code>custom_values.yaml</code> file. - The value of <code>egressGateway.enableOutgoingHttps</code> parameter should be set to true to allow both the schemes HTTP and HTTPS through Egress Gateway for outgoing connections.
Available in OCI	No

6.3.5.21.2 OcnrfIngressGatewayFailureForIncomingConnections

Table 6-787 OcnrfIngressGatewayFailureForIncomingConnections

Field	Details
Description	'Incoming Connection Failure at Ingress Gateway (current value is: {{ \$value }})'
Summary	'kubernetes_namespace: {{ \$labels.kubernetes_namespace}}, timestamp: {{ with query "time()" }}{{ . first value humanizeTimestamp }}{{ end }} : Incoming Connection Failure at Ingress Gateway'
Severity	Critical
Condition	Incoming connection failure at Ingress Gateway microservice
OID	1.3.6.1.4.1.323.5.3.36.1.2.7134
Metric Used	<code>oc_ingressgateway_connection_failure_total</code>

Table 6-787 (Cont.) OcnrfIngressGatewayFailureForIncomingConnections

Field	Details
Recommended Actions	This alert gets automatically cleared after 5 minutes. Perform the following recommended action to correct the condition for the forthcoming traffic: • Check the Ingress Gateway configuration in the <code>custom_values.yaml</code> file. • Check the values of <code>ingress-gateway.enableIncomingHttp</code> or <code>ingress-gateway.enableIncomingHttps</code> parameters should be set to true to allow both the schemes HTTP and HTTPS through Ingress Gateway for incoming connections.
Available in OCI	No

A

NRF Recommended Features

This section details the recommended features that are to be enabled mandatorily during the deployment of NRF at the production-level.

Table A-1 NRF Recommended Features

Feature Name	Sub Features	Overview
Limiting Number of NFProfiles in NFDDiscover Response	NA	This feature controls the count of NFProfiles in the NFDDiscover service operation response. For more information, see Limiting Number of NFProfiles in NFDDiscover Response .
Network Policies	NA	This feature allows to specify how a pod is allowed to communicate with various network entities. For more information, see Network Policies . Note: Should be enabled.
Pod Protection Support for NRF Subscription Microservice	NA	NRF Subscription microservice is responsible for the NfStatusSubscribe, NfStatusUnsubscribe, and NfStatusNotify service operations. During processing of these service operations, Subscription microservice may get into congested or overload conditions. This feature protects the Subscription microservice from overload situations and maintains the overall health of the microservice. For more information, see Pod Protection Support for NRF Subscription Microservice .
Pre and Post Install/Upgrade Validations	NRF Infrastructure Validation	This feature helps in validating the infrastructure specific details such as NRF version, Kubernetes version, cnDBTier version, replication status, and alerts during NRF install and upgrade procedure. For more information, see NRF Infrastructure Validation .
Overload Control Based on Percentage Discards	Pod Level Traffic Rejections	NRF supports overload control to protect the nfregistration, nfdiscovery, nfsubscription, and nfaccess token services from overload situations and maintain the overall health of the services. This feature helps you to protect, mitigate, avoid entering into an overload condition, detect overload conditions, and take necessary actions to recover from overload. For more information, see Overload Control .

Table A-1 (Cont.) NRF Recommended Features

Feature Name	Sub Features	Overview
Subscription Limit	NA	NRF restricts the maximum number of allowed subscriptions to avoid the overload condition at NRF subscription microservice. NRF regulates the total number of allowed subscriptions using a configurable Global Subscription Limit. In case of georedundant NRFs, the limit is applied across all of the mated sites. For more information, see Subscription Limit .
Error Log Messages Enhancements	NA	NRF adds additional information to the existing ERROR log messages. This additional information can provide more details about the error which can help to identify the problem details, error generating entity, and subscriber information. For more information, see Error Log Messages Enhancement .
User-Agent Header for Outgoing Requests	NA	NRF supports the addition of User-Agent header for outgoing messages such as NFStatusNotify and SLF query requests. If the User-Agent header value is configured, then NRF adds the User-Agent header with the configured value to the mentioned outgoing messages. For more information, see User-Agent Header for Outgoing Requests .
NRF Georedundancy	NA	NRF supports georedundancy to ensure high availability and redundancy. It offers a two, three, or four-sites georedundancy to ensure service availability when one of the NRF site is down. When NRF is deployed as georedundant site, all the sites work in an active state and the same data is available at all the sites. For more information, see NRF Georedundancy . Note: If the Georedundancy feature is enabled, NRF Last Known Response feature must be enabled. NRF Last Known Response: When NRF detects that the replication channel with its georedundant NRF(s) is down, it stops considering the NFs registered in the georedundant NRF(s) for any service operations. For more information, see NRF Last Known Response .
Controlled Shutdown of NRF	NA	NRF supports isolating an NRF from the current network at a particular site. This isolation helps to perform any maintenance activities or recovery procedures as required without uninstalling the NRF at the particular site. For more information, see Controlled Shutdown of NRF .

Table A-1 (Cont.) NRF Recommended Features

Feature Name	Sub Features	Overview
Ingress Gateway Pod Protection Using Rate Limiting	NA	With this feature, the Ingress Gateway pods are protected by restricting the pods to process only a defined number of requests. The Ingress Gateway pods calculate the rate of the incoming requests and evaluate if it has breached the defined threshold. If breached, the pods reject the additional requests with the defined error code. If the rate of incoming requests has not breached the defined threshold, the pod allows the requests for further processing. For more information, see Ingress Gateway Pod Protection Using Rate Limiting .
Egress Gateway Pod Protection Using Rate Limiting	NA	With this feature, the Egress Gateway pods are protected by restricting the pods to process only a defined number of requests. The Egress Gateway pods calculate the rate of the incoming requests and evaluate if it has breached the defined threshold. If breached, the pods reject the additional requests with the defined error code. If the rate of incoming requests has not breached the defined threshold, the pod allows the requests for further processing. For more information, see Egress Gateway Pod Protection Using Rate Limiting .
NF Profile Size Limit	NA	With this feature, a configurable limit is enforced on the size of NF Profiles to ensure optimal NRF performance and efficient resource utilization. NRF processes NF Profiles as part of NFRegister, NFUpdate, NFDDiscover, and NFProfileRetrieval operations. Oversized NF Profiles can increase processing time, memory usage, and latency, which may impact overall system performance. This feature validates the size of NF Profiles during registration and update operations and rejects requests that exceed the configured threshold. For more information, see NF Profile Size Limit .
Gzip Compression For Cache Data Microservice	NA	With this feature, Gzip-based compression is supported for communication between NRF microservices and the Cache Data Service (CDS) to reduce response payload sizes. Compression is applied only when enabled on both the client and server (CDS). For more information, see Gzip Compression for Cache Data Microservice .

Table A-1 (Cont.) NRF Recommended Features

Feature Name	Sub Features	Overview
Security Context Hardening	NA	NRF supports Kubernetes Pod Security Context and Container Security Context configurations for Ingress Gateway, Egress Gateway, and application microservices. These settings provide workload hardening by enforcing pod-level and container-level security controls, reducing privilege exposure, and supporting secure deployment practices. The Installation Guide recommends enabling Pod Security Context when configuring secure HTTPS communication for both Ingress Gateway and Egress Gateway. NRF uses the following parameters: <code>ingress-gateway.securityContext.enable</code>, <code>ingress-gateway.enablePodSecurityContext</code>, <code>egress-gateway.securityContext.enable</code>, <code>egress-gateway.enablePodSecurityContext</code>, <code>enablePodSecurityContext</code>, <code>enableContainerSecurityContext</code> for all the NRF microservices. For more details about the parameters, see <i>Oracle Communications Cloud Native Core, Network Repository Function Installation, Upgrade, and Fault Recovery Guide</i>.

B

Supported Headers

The following tables list the headers supported by NRF.

Supported 3GPP Custom Headers

Table B-1 Supported 3GPP Custom Headers

Custom Header Name	Description
3gpp-Sbi-Message-Priority	This header is used to specify the HTTP/2 message priority for 3GPP service-based interfaces. NRF supports this header for ingress requests, egress requests, forwarding scenarios, and roaming scenarios. NRF validates the priority value and applies configured priority mapping rules before forwarding or responding to requests.
3gpp-Sbi-Callback	This header is used to identify a particular type of callback, for example, notification. NRF uses this header while routing NFStatusNotify requests through SCP and Egress Gateway.
3gpp-Sbi-Target-apiRoot	This header contains the apiRoot of the target URI in a message request sent during indirect communication scenarios such as forwarding, roaming, and SCP routing procedures. NRF uses this header while routing egress requests through SCP, SLF, forwarding, and roaming flows.
3gpp-Sbi-Discovery-target-nf-set-id	This header identifies the target NF Set that the NRF should use as a filter during NF discovery. It limits the discovery result to NF instances that belong to the specified NF Set, enabling scoped and topology-aware selection.
3gpp-Sbi-Client-Credentials	This header is used by a consumer NF to send a Client Credential Assertion (CCA) to NRF during Access Token service operation. NRF validates JWT claims, X.509 certificate chains, NF instance identity, audience, and token expiry before issuing OAuth2 access tokens.
3gpp-Sbi-Correlation-Info	This header may contain correlation information, for example UE identity, SUPI, or GPSI, that may be used by operators for network management, troubleshooting, performance analysis, and subscriber tracing. NRF uses this header in enhanced error logging, NFDDiscover procedures, and troubleshooting flows.

NRF also supports the HTTP standard headers. For more information, see 3GPP TS 29.500, Table 5.2.2.2-1.

Standard Headers Supported by NRF

Table B-2 Standard Headers Supported by NRF

Header Name	Description
Mandatory to Support HTTP Request Standard Headers	
Accept	This header specifies acceptable response media types. If NRF receives this header in a request, it forwards it as is and does not perform any action on it.

Table B-2 (Cont.) Standard Headers Supported by NRF

Header Name	Description
Accept-Encoding	This header indicates the type of response content encoding, for example, GZIP, is acceptable in the response. If the received data is in GZIP format, NRF decompresses it if required and then compresses it to GZIP before forwarding it.
Content-Length	This header provides the anticipated size, as a decimal number of octets, for potential content.
Content-Type	This header indicates the media type of the associated representation.
User-Agent	This header identifies the NF type of the HTTP/2 client.
Cache-Control	This header is used in some HTTP/2 requests to provide the HTTP cache-control directives that the client can accept from the server. If NRF receives this header in a request, it forwards it as is and does not perform any action on it.
If-Modified-Since	This header is used in a conditional GET request to re-validate the server. This is used in conjunction with the LastModified server response header to retrieve content if the content has been modified from the cached version. If NRF receives this header in a request, it forwards it as is and does not perform any action on it.
If-None-Match	This header is used in a conditional GET request. This is used in conjunction with the ETag server response header to retrieve content if the tag value of the resource on the server differs from the tag value in the <i>If-None-Match</i> header. If NRF receives this header in a request, it forwards it as is and does not perform any action on it.
If-Match	This header is used in a conditional POST, PUT, DELETE, or PATCH request. This is used in conjunction with the ETag server response header to update or remove content if the tag value of the resource on the server matches the tag value in the <i>If-Match</i> header. If NRF receives this header in a request, it forwards it as is and does not perform any action on it.
Via	This header is inserted by HTTP proxies. NRF adds its own information in this header while forwarding.
Authorization	This header is used if OAuth 2.0 based access authorization with "Client Credentials" grant type is used as specified in subclause 13.4.1 of 3GPP TS 33.501 [17], clause 7 of IETF RFC 6749 [22] and IETF RFC 6750 [23].
Mandatory to Support HTTP Response Standard Headers	
Content-Length	This header provides the anticipated size, as a decimal number of octets, for a potential content.
Content-Type	This header indicates the media type of the associated representation.
Retry-After	This header indicates the waiting period for the user agent before making a follow-up request.
Content-Encoding	This header indicates to the HTTP/2 client the content encodings, for example, gzip, applied to the resource representation beyond those inherent in the media type.
Location	This header is used in some responses to refer to a specific resource pertaining to the response. It is updated by NRF to an absolute URI if the location header in the response has a relative URI.

Table B-2 (Cont.) Standard Headers Supported by NRF

Header Name	Description
Cache-Control	This header is used in some responses, such as NRF responses to queries, to provide HTTP response cache control directives. The cache directives " <i>no-cache</i> ", " <i>no-store</i> ", " <i>maxage</i> ", and " <i>must-revalidate</i> " values are supported. It is not supported by NRF and is forwarded as it is.
Age	This header is inserted by HTTP proxies when returning a cached response. This header conveys the sender's estimate of the amount of time since the response was generated or successfully validated at the origin server. It is not supported by NRF.
Last-Modified	This header is sent to allow for conditional GET with the <i>IfModified-Since</i> header. If NRF receives this header in a response, it forwards it as is and does not perform any action on it.
ETag	This header is sent to allow for a conditional GET with the <i>If-None-Match</i> header or a conditional POST, PUT, PATCH, or DELETE with the <i>If-Match</i> header. If NRF receives this header in a response, it forwards it as is and does not perform any action on it.
Via	This header is inserted by HTTP proxies.
Allow	This header is used to indicate methods supported by the target resource. If NRF receives this header in a response, it forwards it as is and does not perform any action on it.
WWW-Authenticate	This header is included when a producer NF rejects a request with a " <i>401 Unauthorized</i> " status code, for example, when a request is sent without an OAuth 2.0 access token or with an invalid OAuth 2.0 access token.

C

HTTP Status Code Details

C.1 HTTP Status Code details

This section describes the HTTP status codes usage on SBI. The ":status" pseudo header field in HTTP/2 indicates the HTTP status codes. The status codes are defined in subclause 8.1.2.4 in IETF RFC 7540.

The following table specifies HTTP status codes per HTTP method that is supported on SBI. The support of HTTP status code is categorized as:

- mandatory, which is marked in table as "**M**". This means that all 3GPP NFs supports the processing of the specific HTTP status code for the specific HTTP method, when received in an HTTP response message. In such cases the 3GPP NF also supports the handling of the "ProblemDetails" JSON object with the content-type header field set to the value "application/problem+json" for HTTP status codes 4xx and 5xx, if the corresponding API definition in the related technical specification does not specify another response body for the corresponding status code.
- service specific, which is marked in table as "**SS**" and means that the requirement to process the HTTP status code depends on the definition of the specific API.
- not applicable, which is marked in table as "**N/A**". This means that the specific HTTP status code is not used for the specific HTTP method within the 3GPP NFs.

HTTP Status Code Supported on SBI

Table C-1 HTTP Status Codes

HTTP Status Code	HTTP Method				
	DELETE	GET	PATCH	POST	PUT
-					
100 Continue	N/A	N/A	N/A	N/A	N/A
200 OK (NOTE 1)	SS	M	SS	SS	SS
201 Created	N/A	N/A	N/A	SS	SS
202 Accepted	SS	N/A	SS	SS	SS
204 No Content (NOTE 2)	M	N/A	SS	SS	SS
300 Multiple Choices	N/A	N/A	N/A	N/A	N/A
303 See Other	SS	SS	N/A	SS	SS
307 Temporary Redirect	SS	SS	SS	SS	SS
308 Permanent Redirect	SS	SS	SS	SS	SS
400 Bad Request	M	M	M	M	M
401 Unauthorized	M	M	M	M	M
403 Forbidden	SS	SS	SS	SS	SS
404 Not Found	SS	SS	SS	SS	SS
405 Method Not Allowed	SS	SS	SS	SS	SS
406 Not Acceptable	N/A	N/A	N/A	N/A	N/A

Table C-1 (Cont.) HTTP Status Codes

HTTP Status Code	HTTP Method				
408 Request Timeout	SS	SS	SS	SS	SS
409 Conflict	N/A	N/A	SS	SS	SS
410 Gone	SS	SS	SS	SS	SS
411 Length Required	N/A	N/A	M	M	M
412 Precondition Failed	SS	SS	SS	SS	SS
413 Payload Too Large	N/A	N/A	M	M	M
414 URI Too Long	N/A	M	N/A	N/A	N/A
415 Unsupported Media Type	N/A	N/A	M	M	M
422 Unprocessable Entity	N/A	N/A	SS	N/A	N/A
500 Internal Server Error	M	M	M	M	M
501 Not Implemented	SS	SS	SS	SS	SS
503 Service Unavailable	M	M	M	M	M
504 Gateway Timeout	SS	SS	SS	SS	SS

Note

"200 OK" response used on SBI contains body.

If the NF acting as an HTTP Client receives 2xx response code not appearing in table, the NF shall treat the received 2xx response:

- as "204 No Content" if 2xx response does not contain body; and
- as "200 OK" if 2xx response contains body.

NF as HTTP Client

An NF acting as an HTTP server generates HTTP status codes specified in the above table per indicated HTTP method.

An HTTP method which is not supported by 5GC SBI API specification is rejected with the HTTP status code "501 Not Implemented".

Note

In this case, the NF does not need to include in the HTTP response the "cause" attribute indicating corresponding error since the HTTP status code "501 Not Implemented" itself provides enough information of the error, that is, the NF does not recognize the HTTP method.

If the specified target resource does not exist, the NF rejects the HTTP method with the HTTP status code "404 Not Found".

If the NF supports the HTTP method but not by a target resource, the NF rejects the HTTP method with the HTTP status code "405 Method Not Allowed" and includes in the response an Allow header field containing the supported method(s) for that resource.

Note

In this case, the NF does not need to include in the HTTP response the "cause" attribute indicating corresponding error since the HTTP status code "405 Method Not Allowed" itself provides enough information of the error and hence the Allow header field lists HTTP method(s) supported by the target resource.

If received HTTP request contains incorrect optional IE, the NF discards the incorrect IE.

If the NF supports the HTTP method by a target resource but the NF cannot successfully fulfill the received request, the following requirements applies:

- The NF as HTTP Server must map application errors to the most similar 3xx/4xx/5xx HTTP status code specified in [Table C-2](#). If no such code is applicable, it should use "400 Bad Request" status code for errors caused by client side or "500 Server Internal Error" status code for errors caused on server side.
- If the received HTTP request contains an unsupported payload format, the NF rejects the HTTP request with the HTTP status code "415 Unsupported Media Type". If the HTTP PATCH method is rejected, the NF includes the Accept-Patch header field set to the value of supported patch document media types for a target resource. That is, either "application/merge-patch+json" if the NF supports "JSON Merge Patch" or "application/json-patch+json" if the NF supports "JSON Patch". If the HTTP PATCH request received contains "JSON Merge Patch" and "JSON Patch" documents, and the NF supports only one document, the NF ignores the unsupported patch document.

Note

The format problem might be due to the request's indicated Content-Type or Content-Encoding header fields, or as a result of inspecting the payload body directly.

- If the received HTTP request contains payload body larger than the NF is able to process, the NF rejects the HTTP request with the HTTP status code "413 Payload Too Large".
- If the result of the received HTTP POST request used for resource creation is as same as the existing resource, the NF rejects the HTTP request with the HTTP status code "303 See Other" and includes a location header field set to the URI of the existing resource in the HTTP response.

HTTP Status Code support in NRF as Server**Table C-2 HTTP Status Code support in NRF as Server**

HTTP Status Code	Service Operation											
-	NFRegister (PUT)	NFUpdate - Full Replacement (PUT)	NFUpdate Partial Replacement (PATCH)	NFUpdate Partial Replacement - Heartbeat (PATCH)	NFDeRegister (DELETE)	NFListRetrieval (GET)	NFProfileRetrieval (GET)	NFStatusSubscribe (POST)	NFStatusSubscribe (PATCH)	NFStatusUnsubscribe (DELETE)	NFDiscover (GET)	Access Token Request (POST)

Table C-2 (Cont.) HTTP Status Code support in NRF as Server

HTTP Status Code	Service Operation											
100 Continue	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
200 OK	N/A	Supported	Supported	Supported	N/A	Supported	Supported	N/A	Supported	N/A	Supported	Supported
201 Created	Supported	N/A	N/A	N/A	N/A	N/A	N/A	Supported	N/A	N/A	N/A	N/A
202 Accepted	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
204 No Content	N/A	N/A	N/A	Supported	Supported	N/A	N/A	N/A	N/A	Supported	N/A	N/A
300 Multiple Choices	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
303 See Other	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
307 Temporary Redirect	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported
308 Permanent Redirect	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported
400 Bad Request	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported
401 Unauthorized	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported
403 Forbidden	N/A	N/A	N/A	N/A	N/A	NotSupported	NotSupported	Supported	N/A	N/A	Supported	N/A
404 Not Found	N/A	N/A	Supported	Supported	Supported	Supported	Supported	N/A	Supported	Supported	N/A	N/A

Table C-2 (Cont.) HTTP Status Code support in NRF as Server

HTTP Status Code	Service Operation											
405 Method Not Allowed	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported
406 Not Acceptable	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
408 Request Timeout	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported	NotSupported
409 Conflict	N/A	N/A	Supported	Supported	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
410 Gone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
411 Length Required	NotSupported	NotSupported	NotSupported	NotSupported	N/A	N/A	N/A	NotSupported	NotSupported	N/A	N/A	NotSupported
412 Precondition Failed	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
413 Payload Too Large	NotSupported	NotSupported	NotSupported	NotSupported	N/A	N/A	N/A	NotSupported	NotSupported	N/A	N/A	NotSupported
414 URI Too Long	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NotSupported	N/A
415 Unsupported Media Type	Supported	Supported	Supported	Supported	N/A	N/A	N/A	NotSupported	NotSupported	N/A	N/A	N/A
422 Unprocessable Entity	N/A	N/A	Supported	Supported	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
500 Internal Server Error	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported
501 Not Implemented	Supported	Supported	Supported	Supported	N/A	N/A	N/A	Supported	N/A	N/A	N/A	N/A

Table C-2 (Cont.) HTTP Status Code support in NRF as Server

HTTP Status Code	Service Operation											
503 Service Unavailable	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported
504 Gateway Timeout	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported

D

Handling 3GPP Attributes

D.1 vsmf-support-ind

NRF supports vsmf-support-ind attribute in the NF Discover service operation query as per the 3GPP standards. For more information about the attribute, see *NRF Compliance Matrix*.

The discovery query is processed as follows:

- If vsmf-support-ind attribute is present in the NFDiscover query and the value of targetNFType is other than SMF, NRF does not reject the discovery query. In this case, NF profiles are not returned.
- When the requester-feature attribute is present or its value does not have any impact on the processing of vsmf-support-ind in the discovery query.
- When SMF profile contains SMFInfoList attribute and if one of the SMFInfo element in it doesn't have vsmf-support-ind, then NRF can consider such SMF profile as "V-SMF Capability Support of the SMF is not specified".

D.2 nrfSupportedFeatures

As per 3GPP TS 29.510, nrfSupportedFeatures attribute indicates the features supported by NRF for the NFDiscovery service. This attribute is included in the discovery response if at least one feature is supported by NRF. From release 23.4.0, the value of this attribute is 172 (in hexadecimal and 101110010 in binary), by reading the bits from left to right it indicates that it supports the 2, 5, 6, 7, and 9 Feature Number as per the following table:

Table D-1 nrfSupportedFeatures List

Feature Number	Feature	Details	nrfSupportedFeatures by NRF
1	Complex-Query	This is an optional parameter. Support of Complex Query expression (see clause 6.2.3.2.3.1)	NRF does not support this feature.
2	Query-Params-Ext1	This is an optional parameter. Support of the following query parameters: - limit - max-payload-size - required-features - pdu-session-types	NRF supports the following query parameters: • <i>limit</i> • <i>max-payload-size</i> • <i>required-features</i> • <i>pdu-session-types</i>

Table D-1 (Cont.) nrfSupportedFeatures List

Feature Number	Feature	Details	nrfSupportedFeatures by NRF
3	Query-Param-Analytics	This is an optional parameter. Support of the query parameters for Analytics identifier: - event-id-list - nwdaf-event-list	NRF does not support this feature.
4	MAPDU	This is an optional parameter. This feature indicates whether the NRF supports selection of UPF with Access Traffic Steering, Switching and Splitting (ATSSS) capability.	NRF does not support this feature.

Table D-1 (Cont.) nrfSupportedFeatures List

Feature Number	Feature	Details	nrfSupportedFeatures by NRF
5	Query-Params-Ext2	This is an optional parameter. Support of the following query parameters: - requester-nf-instance-id - upf-ue-ip-addr-ind - pfd-data - target-snpn - af-ee-data - w-agf-info - tngf-info - twif-info - target-nf-set-id - target-nf-service-set-id - preferred-tai - nef-id - preferred-nf-instances - notification-type - serving-scope - internal-group-identity - preferred-api-versions - v2x-support-ind - redundant-gtpu - redundant-transport - lmf-id - an-node-type - rat-type - ipups - scp-domain-list - address-domain - ipv4-addr - ipv6-prefix - served-nf-set-id - remote-plmn-id - data-forwarding - preferred-full-plmn - requester-snpn-list - max-payload-size-ext	NRF supports the following query parameters: • <i>target-nf-set-id</i> • <i>preferred-tai</i> • <i>notification-type</i> • <i>serving-scope</i>
6	Service-Map	This is a mandatory parameter. This feature indicates whether it is supported to identify the list of NF Service Instances as a map (that is, the "nfServiceList" attribute of NFProfile is supported).	NRF supports the <i>nfServiceList</i> attribute in NFProfile.

Table D-1 (Cont.) nrfSupportedFeatures List

Feature Number	Feature	Details	nrfSupportedFeatures by NRF
7	Query-Params-Ext3	This is an optional parameter. Support of the following query parameters: - ims-private-identity - ims-public-identity - msisdn - requester-plmn-specific-snsai-list - n1-msg-class - n2-info-class	NRF supports the following query parameters: • <i>n1-msg-class</i> • <i>n2-info-class</i>
8	Query-Params-Ext4	This is an optional parameter. Support of the following query parameters: - realm-id - storage-id	NRF does not support this feature.
9	Query-Param-vSmf-Capability	This is an optional parameter. Support of the query parameters for V-SMF capability: - vsmf-support-ind	NRF supports <i>vsmf-support-ind</i> query parameter for V-SMF capability.

The value of nrfSupportedFeatures attribute in the discovery response varies based on the value of the requester - features attribute sent by the Consumer NF. The requester - features attribute indicates the features that are supported by the Consumer NF.

The value of the nrfSupportedFeatures attribute is calculated based on the following scenarios:

- value of nrfSupportedFeatures attribute when there are common supported features between consumer NF and NRF
If the requester - features attribute has the value of 12 (this is hexadecimal value) in the discovery search query, the corresponding binary value is 00010010. It indicates that the 2nd and 5th bit are enabled and Consumer NF supports the Feature Number 2 and 5. As per the current support at NRF, the common supported features between Consumer NF and NRF are 2 and 5. Hence, the value of nrfSupportedFeatures attribute in the discovery response is 12.
- value of nrfSupportedFeatures attribute when there are partial common supported features between consumer NF and NRF
If the requester - features attribute has the value of 6 (this is hexadecimal value) in the discovery search query, the corresponding binary value is 0110. It indicates that the 2nd and 3rd bit are enabled and Consumer NF supports Feature Number 2 and 3. As per the current support at NRF, the common supported feature between Consumer NF and NRF is 2. Hence, the value of the nrfSupportedFeatures attribute in the discovery response is 2.
- value of nrfSupportedFeatures attribute when there is no common supported features between consumer NF and NRF
If the requester - features attribute has the value of 8 (this is hexadecimal value) in the discovery search query, the corresponding binary value is 1000. It indicates that no common features are available between the Consumer NF and NRF. Hence, the value of the nrfSupportedFeatures attribute in the discovery response is 0.

- value of nrfSupportedFeatures attribute is 172
When the requester - features attribute is unavailable in the discovery search query of Consumer NF, the value of the nrfSupportedFeatures attribute in the discovery response is 172.

D.3 DataSetId Enhancements

As per 3GPP TS 29.510 v17.7, NRF supports the following enumeration (ENUM) values within DataSetId enumeration.

Table D-2 Additional DataSetId Enumerations

ENUM Value	Description
"A_PFD"	ApplicationData subset: Packet Flow Descriptions
"A_AFTI"	ApplicationData subset: AF Traffic Influence Data
"A_IPTV"	ApplicationData subset: IPTV Config Data
"A_BDT"	ApplicationData subset: Background Data Transfer
"A_SPD"	ApplicationData subset: Service Parameter Data
"A_EASD"	ApplicationData subset: EAS Deployment Information
"A_AMI"	ApplicationData subset: AM Influence Data
"P_UE"	PolicyData subset: UE Specific Data
"P_SCD"	PolicyData subset: Sponsored Connectivity Data
"P_BDT"	PolicyData subset: Background Data Transfer
"P_PLMNUE"	PolicyData subset: PLMN-specific UE policy data
"P_NSSCD"	PolicyData subset: Network Slice Specific Control Data
"P_MBSCD"	PolicyData subset: MBS Session Policy Control Data

NRF supports the additional ENUM values added in the DataSetId attribute in the following service operations as per the 3GPP TS 29.510 v17 standards:

- NFRegister
- NFProfileRetrieval
- NFUpdate (Partial/Complete)
- NFStatusNotify
- NFDdiscover

If UDR registers with DataSetId attribute, only the following enums are allowed:

- SUBSCRIPTION
- POLICY
- EXPOSURE
- APPLICATION
- A_PFD
- A_AFTI
- A_IPTV
- A_BDT
- A_SPD

- A_EASD
- A_AMI
- P_UE
- P_SCD
- P_BDT
- P_PLMNUE
- P_NSSCD
- P_MBSCD

However, in case of NFRegister service operation, the following validations are not supported:

- If UDR registers with DataSetId attribute with "**APPLICATION**", it is required to register with all **A_***** enumerations in addition.
- If UDR registers with all the above defined **A_***** enumerations, it should register with "**APPLICATION**" enumeration in addition.
- If UDR registers with DataSetId attribute with "**POLICY**", it is required to register with all **P_***** enumerations in addition.
- If UDR registers with all the above defined **P_***** enumerations, it should register with "**POLICY**" enumeration in addition.

For more information about the attribute, see *NRF Compliance Matrix*.

Note

The DataSetId parameter is ignored in the following scenarios for the NF Profiles (if the discovery query contains the DataSetId parameter):

- supportedDataSets attribute is missing: If the UdrInfo profile does not contain the supportedDataSets attribute, the data-set parameter in the discovery request should be ignored.
- UdrInfo JSON object is empty: If the UdrInfo JSON object is provided and it is empty, the data-set parameter should be ignored.
- UdrInfo JSON object is missing: If the entire UdrInfo JSON object is not included in the request, the data-set parameter should be ignored.

D.4 Support for servingClientTypes in LmfInfo and GmlcInfo

As per 3GPP TS 29.510 v16.7, NRF supports servingClientTypes attribute in NF Profiles for Location Management Function (LMF) (LmfInfo) and Gateway Mobile Location Center (GMLC) (GmlcInfo). NRF supports client-type discovery query parameter to discover NFs based on servingClientTypes attribute. servingClientTypes attribute is supported for GMLC and LMF NF Types. If the above mentioned attribute is present in the NF Profile then the GMLC and LMF NFs are dedicated to serve the listed external client type. The listed external client types are mentioned in 3GPP TS 29.572 v16.7. If this attribute is not present in the NF Profile for the mentioned NFTypes then NFs are not dedicated to serve any external client type.

Possible values for servingClientTypes for both LmfInfo and GmlcInfo are as follows:

Table D-3 Possible Values for servingClientTypes

Enumeration value	Description
"EMERGENCY_SERVICES"	External client for emergency services
"VALUE_ADDED_SERVICES"	External client for value added services
"PLMN_OPERATOR_SERVICES"	External client for PLMN operator services
"LAWFUL_INTERCEPT_SERVICES"	External client for Lawful Intercept services
"PLMN_OPERATOR_BROADCAST_SERVICES"	External client for PLMN Operator Broadcast services
"PLMN_OPERATOR_OM"	External client for PLMN Operator O&M
"PLMN_OPERATOR_ANONYMOUS_STATISTICS"	External client for PLMN Operator anonymous statistics
"PLMN_OPERATOR_TARGET_MS_SERVICE_SUPPORT"	External client for PLMN Operator target MS service support

Note

If the servingClientTypes attribute is present in the respective LmfInfo or GmlcInfo attributes indicates NF are dedicated to serve the mentioned external client type. Hence absence of the respective LmfInfo or GmlcInfo attribute is also considered as NFs are not dedicated to serve any external client type.

If servingClientTypes attribute is present in LmfInfo or GmlcInfo attributes, it indicates that LMF or GMLC is dedicated to serve the listed external client type(s). For example, EMERGENCY_SERVICES.

If servingClientTypes attribute is not present in LmfInfo or GmlcInfo attributes or if LmfInfo and GmlcInfo attributes are absent, it indicates that the LMF or GMLC is not dedicated to serve the listed external client type.

For NFManagement service operations, NRF checks the servingClientTypes value matches with the supported values for servingClientTypes as mentioned in 3GPP TS 29.572 v16.7. If this value matches then NRF processes the requests. If the value does not match, NRF rejects the request.

For NFDISCOVER service operation, the client-type query parameter is received in the incoming NFDISCOVERY query. NRF checks the client-type value with the supported values for servingClientTypes as mentioned in 3GPP TS 29.572 v16.7.

- If the servingClientTypes value matches with the supported servingClientTypes values as mentioned in 3GPP TS 29.572 v16.7:
 - NRF checks the value of client-type query parameter with the values in the servingClientTypes list from the corresponding NfInfo of the registered NFProfiles.
 - * If these values matches, that NFProfile is considered for the discovery response.
 - * If the value does not match, NRF does not include that NFProfile in the response.
- If the servingClientTypes value is not matching with the supported values for servingClientTypes as mentioned in 3GPP TS 29.572 v16.7, NRF rejects the request.

Note

- In case, there are no NFProfiles of GMLC and LMF types registered in NRF with the matching servingClientTypes, it means none of the NF Profiles are dedicated to serve the servingClientTypes. Hence, NFProfiles which are not dedicated (where servingClientTypes attribute is absent or the respective NfInfo attribute is absent) are returned in the NFDiscovery response.
- In case, in any NRF deployment, nfdiscovery.searchQueryIgnoreList (Helm parameter) is configured with value client-type, searchQueryIgnoreList parameter shall not contain the client-type. So that NRF can process this attribute in the NFDiscover service operation.

Examples

- One instance of LMF is registered with NRF with LmfInfo present with servingClientTypes value as EMERGENCY_SERVICES and another instance of LMF is registered with NRF with LmfInfo present with servingClientTypes value as VALUE_ADDED_SERVICES.
NFDiscover service operation query is received with client-type query parameter as EMERGENCY_SERVICES. In this scenario, first instance of LMF is returned by NRF in NFDiscover service operation response.
- One instance of LMF is registered with NRF with LmfInfo present with servingClientTypes value as EMERGENCY_SERVICES and another instance of LMF is registered with NRF with LmfInfo present with servingClientTypes value as VALUE_ADDED_SERVICES.
NFDiscover service operation query is received with client-type query parameter as PLMN_OPERATOR_SERVICES. In this scenario, none of the LMF NF profiles are returned by NRF in NFDiscover service operation response.
- One instance of LMF is registered with NRF with LmfInfo present with servingClientTypes attribute is absent and another instance of LMF is registered with NRF with LmfInfo present with servingClientTypes value as VALUE_ADDED_SERVICES.
NFDiscover service operation query is received with client-type query parameter as PLMN_OPERATOR_SERVICES. In this scenario, as there is no matching NFProfile with dedicated servingClientTypes value, hence NFProfile with non-dedicated servingClientTypes, that is the first instance of LMF is returned by NRF in NFDiscover service operation response.
- One instance of LMF is registered with NRF with LmfInfo present with servingClientTypes attribute is absent and another instance of LMF is registered with NRF with LmfInfo present with servingClientTypes value as PLMN_OPERATOR_SERVICES.
NFDiscover service operation query is received with client-type query parameter as PLMN_OPERATOR_SERVICES. In this scenario, second instance of LMF is returned by NRF in NFDiscover service operation response.
- One instance of LMF is registered with NRF with LmfInfo is absent and another instance of LMF is registered with NRF with LmfInfo present with servingClientTypes value as VALUE_ADDED_SERVICES.
NFDiscover service operation query is received with client-type query parameter as PLMN_OPERATOR_SERVICES. In this scenario, as there is no matching NFProfile with dedicated servingClientTypes value, hence NFProfile with non-dedicated

servingClientTypes, that is the first instance of LMF is returned by NRF in NFDDiscover service operation response.

- One instance of LMF is registered with NRFF with LmfInfo is absent and another instance of LMF is registered with NRF with LmfInfo present with servingClientTypes value as VALUE_ADDED_SERVICES.
NFDDiscover service operation query is received with client-type query parameter as VALUE_ADDED_SERVICES. In this scenario, second instance of LMF is returned by NRF in NFDDiscover service operation response.

All these examples are also applicable to GMLC NF Type.

D.5 Enhancements for dnn NFProfile Attribute and Discovery Query Parameter

NRF supports dnn attribute that represents the Data Network Name (DNN). DNN comprises of the Network Identifier and Operator Identifier.

Until 24.2.x release, when dnn attribute was provided during NFManagement and NFDDiscover service operations, NRF performed validations for null or empty values. NRF also supported exact matching of dnn query attribute value with the dnn attribute present in the registered NFProfile for NFDDiscover service operations.

From 24.3.x releases, NRF performs the validations for the dnn attribute, as per 3GPP TS 29.571 v16.7. These validations are added for the NF Types SMF, UPF, PCF, and BSF (that is, smfInfo, smfInfoList, upfInfo, pcfInfo, and bsfInfo).

① Note

The attributes for upfInfoList, pcfInfoList, and bsfInfoList are not supported by NRF.

- Maximum length of DNN is 100 Octets.
- DNN Structure = <Label>.<Label>.<Label>. Label should only contain (A-Z), (a-z), (0-9), '-'.
- Network Identifier structure is mandatory in DNN.
Validations for Network Identifier:
 - maximum length can be 63 Octets
 - cannot start with {"rac","lac","sgsn","rnc"}
 - cannot end with {"gprs"}
 - cannot take value {"*"}
- Operator Identifier structure is optional in DNN.
Validations for Operator Identifier:
 - The Access Point Name (APN) Operator Identifier is composed of three labels. The last label (= domain) shall be "gprs".
 - The first and second labels together identifies the PLMN.
Format: "mnc<MNC>.mcc<MCC>.gprs", <MNC> of 3 digits , <MCC> of 3 digits.
 - * The format should be strictly followed. Any change in the formatted value will result in considering the whole dnn value as Network Identifier.

- * Any other value of mcc and mnc comprising of anything else like alphabets, negative value, or hyphen(-) will be rejected.
Consumer NF should send the MNC in 3 digits to NRF.

Note: If there are only 2 significant digits in the MNC, one "0" digit must be added at the left side by Consumer NF to fill the 3 digits coding of MNC in the APN Operator Identifier.

For example: If the APN Operator Identifier for MCC 345 and MNC 12, then Consumer NF sends MNC as 012 in the DNS "mnc012.mcc345.gprs" to NRF.

Examples:

- Following are the examples of valid dnn values:
 - province1.mnc012.mcc345.gprs
Here, province1 is Network Identifier and mnc012.mcc345.gprs is Operator Identifier.
 - ggsn-cluster-A.provinceB.mnc012.mcc345.gprs
Here, ggsn-cluster-A.provinceB is Network Identifier and mnc012.mcc345.gprs is Operator Identifier.
- Following are the examples of invalid dnn values along with their rejection reasons:
 - province_A, provinc*A.mnc012.mcc345.gprs
Here, these would be rejected as both the values contain a label having a character (_ and * respectively) that is not in permissible list of characters (A-Z), (a-z), (0-9), '-'.
 - province1.gprs, province-A.gprs.mnc012.mcc345.gprs
Here, these would be rejected as all the values have their network identifier part ending with gprs.
 - lac.province.mnc012.mcc345.gprs, race-province, rncabc.provinceA.mnc012.mcc345.gprs, and sgsn
Here, these would be rejected as all of the values have their network identifier starting with one of the following {"rac", "lac", "sgsn", "rnc"}.

As per 3GPP TS 29.510 v16.7, the dnn attribute present in the discovery query is considered as a match with a dnn attribute present in the registered NFProfile during the following scenarios:

- Both the dnn attributes contain the same Network Identifier and Operator Identifier.
- Both the dnn attributes contain the same Network Identifier and none contains an Operator Identifier.
- The dnn attribute in the discovery query contains only the Network Identifier and the DNN value in the registered NF Profile contains both the Network Identifier and Operator Identifier, and both contain the same Network Identifier.
- The dnn attribute in the discovery query contains both the Network Identifier and Operator Identifier, the dnn value in the NF Profile contains the Network Identifier only, both contain the same Network Identifier and the Operator Identifier matches one PLMN of the NF (that is, plmnList of the NF Profile).

Note

Prior to 24.3.0 release, NRF was not performing dnn validations. From 24.3.0 release, dnn validations are added for NFManagement and NFDDiscover service operations as per 3GPP defined format. The following points should be considered while performing the validations:

- Prior upgrading NRF to 24.3.x, in case NRF database contains NFProfiles with dnn attribute and dnn attribute value is not as per 3GPP defined format, NFs should update their NFProfiles with correct dnn format (as defined in 3GPP TS 23.003 v16.8 Section 9A). NFProfiles can be updated using NFRegister or NFUpdate (PUT or PATCH) service operations.
- Post upgrading NRF to release 24.3.x, in case there are still NFProfiles with dnn attribute value not as per 3GPP defined format, then NFProfile processing is performed for NRF service operations as follows:
 - NFRegister (PUT): NFs are allowed to re-register with dnn attribute value as per 3GPP defined format.
 - NFUpdate (PUT): NFs are allowed to update the dnn attribute value as per 3GPP defined format.
 - NFUpdate (PATCH): NFs are not allowed to update the dnn attribute value. NRF rejects the request with status code as 400 bad request.
 - NFUpdate (Heartbeat): NFs are allowed to do heartbeat for such NFProfiles as per 3GPP specifications.
 - NFDDiscover:
 - * NFDDiscover query with dnn attribute value if not as per 3GPP defined format, is rejected by NRF.
 - * The NFProfiles in the database having invalid dnn value format will be ignored while filtering NFProfiles based on dnn query attribute.
 - * The NFProfiles in the database having invalid dnn value format will be included in the NFDDiscover response if dnn is not present in the discovery query if other attributes present in the query matches as per 3GPP NRF specifications.
 - * The NFProfiles in the database having invalid dnn value format for Operator Identifier but Network Identifier value is in correct format. dnn attribute is present in the discovery query with matching network identifier and no operator identifier. In this case, such NFProfiles will be included in the NFDDiscover response.
 - NFStatusNotify: NRF sends notifications for NFUpdate and NFRegister PUT service operations with the updated NFProfiles. As NFUpdate (Patch) request is rejected, NRF does not send notifications for the service operation.

D.6 Content-Encoding Header

NRF does not accept incoming request messages in gzipped format for NFManagement service operations such as NFRegister, NFUpdate (Complete/Patch Replacement, Heartbeat), and NFStatusSubscribe (both New and Update Subscriptions).

If the Content-Encoding header is present and has an unsupported value, NRF rejects the HTTP request with 415 Unsupported Media Type error, NRF only accepts the Content-Encoding header value set to "identity". In such error cases, NRF will include an Accept-Encoding header with the value set to "identity."

If the Content-Encoding header is missing but the payload is still compressed, NRF rejects the HTTP request with a 400 Bad Request error due to the invalid message.

However, NRF supports gzipped encoding for response messages for JSON body in NFManagement service operations such as NFRegister, NFUpdate (Complete/Patch Replacement, Heartbeat), NFListRetrieval, and NFProfileRetrieval, provided that the client (NF) specifies the gzip format in the Accept-Encoding header when requesting response.

If the client includes the Accept-Encoding: gzip header but gzip response compression is disabled, NRF returns the response uncompressed.

E

Error Response Code Details

This section lists the available error response codes in NRF categorized according to the NRF microservices. For more information, on these error response codes with their details, see the following sections:

- [NF Registration Microservice](#)
- [NF Subscription Microservice](#)
- [NF Discovery Microservice](#)
- [NF Access Token Microservice](#)
- [NRF Cache Data Microservice](#)
- [NRF Configuration Microservice](#)
- [NRF Auditor Microservice](#)
- [NRF Artisan Microservice](#)
- [Ingress Gateway Service](#)
- [Egress Gateway Service](#)
- [Alternate Route Service](#)
- [Common Configuration](#)

E.1 NF Registration Microservice

The following table lists the error codes and its problem details for the NF Registration microservices.

Table E-1 REGN - NFRegister Service Operation

Error Code	Details	Action
ONRF-REG-REGN-E0002	This error code indicates that an invalid message format received for NFRegister service operation message.	Validate the message body and attributes are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0007	This error code indicates that a mandatory attribute is incorrect for NFRegister service operation message.	Validate the message body and attributes are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0008	This error code indicates that an optional attribute is incorrect for NFRegister service operation message.	Validate the message body and attributes are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support .

Table E-1 (Cont.) REGN - NFRegister Service Operation

Error Code	Details	Action
ONRF-REG-REGN-E0009	This error code indicates that a mandatory attribute is missing for NFRegister service operation message.	Validate the message body and attributes are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0021	This error code indicates that multiple attributes are missing or incorrect in NFRegister service operation message.	Validate the message body and attributes are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0023	This error code indicates that NF profile size limit breached exception occurred while processing of NFRegister service operation message.	The maximum allowed NF Profile size at the NRF is as per nfProfileLimit feature. If feature is enabled then the maximum allowed NF Profile size will be checked against the configured value. The received NF Profile exceeds this limit and must be reduced. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0100	This error code indicates that message failure occurred generic in nature while processing the NFRegister service operation message.	Validate the message body and attributes are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0104	This error code indicates that NF FQDN Authentication failure occurred while processing the NFRegister service operation message.	XFCC-based FQDN authentication is enabled on the NRF. Verify whether this is intended in this deployment. If not, disable the feature. If yes, correct the XFCC header value in the request to resolve the FQDN authentication error. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0108	This error code indicates that NRF PLMN is not configured while processing the NFRegister service operation message.	Validate and configure NRF with the PLMN IDs it serves. Further, ensure that the PLMN IDs in the NF profile(s) received at NRF are identical to or a subset of those configured on the NRF. Verify and correct any mismatched PLMN IDs. Review problem details and application logs to identify the reported error. Contact My Oracle Support .

Table E-1 (Cont.) REGN - NFRegister Service Operation

Error Code	Details	Action
ONRF-REG-REGN-E0109	This error code indicates that NF Management Service is unavailable while processing the NFRegister service operation message.	Review CNE infrastructure logs to identify why the microservice is down (for example, vCPU, memory, storage shortages, or server unavailability). Resolve any infrastructure issues and verify service recovery. If no infrastructure issue is found or the issue persists. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0110	This error code indicates that OC-XFCC-DNS header is not present while processing the NFRegister service operation message.	XFCC-based FQDN authentication is enabled on the NRF. Verify whether this is intended in this deployment. If not, disable the feature. If yes, make sure XFCC header value is included in the request to resolve the FQDN authentication error. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0111	This error code indicates that NF Screening failed while processing the NFRegister service operation message.	Review and validate NRF screening rule configuration against message attributes to determine the cause of rejection. Check logs to identify the exact NRF error. Correct the screening rules or the message as per network requirements. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0112	This error code indicates that Foreign PLMN is not supported while processing the NFRegister service operation message.	Ensure that the PLMN IDs in the NF profile(s) received at NRF are either identical to or a subset of those configured on the NRF. Review logs to identify the exact NRF error. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0801	This error code indicates that database access exception occurred while processing the NFRegister service operation message.	Review CNE infrastructure logs to determine why the database connection is unavailable, including potential cnDBTier microservice failures (for example, vCPU, memory, storage shortages, or server unavailability). Resolve any infrastructure issues and verify service and database connectivity recovery. If the issue persists, share application logs with My Oracle Support .

Table E-1 (Cont.) REGN - NFRegister Service Operation

Error Code	Details	Action
ONRF-REG-REGN-E0802	This error code indicates that pessimistic locking exception occurred while processing the NFRegister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0803	This error code indicates that database access resource failure exception occurred while processing the NFRegister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0804	This error code indicates that database insertion failure occurred while processing the NFRegister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0807	This error code indicates that database read failure occurred while processing the NFRegister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0808	This error code indicates that SQL exception occurred while processing the NFRegister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0899	This error code indicates that general database exception occurred while processing the NFRegister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0901	This error code indicates that an IO exception occurred while processing the NFRegister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0902	This error code indicates that JSON processing exception occurred while processing the NFRegister service operation message.	Validate that the JSON payload is in the right format and compliant with the specified JSON schema. Fix any JSON errors. Review logs to identify the NRF-reported error further. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0903	This error code indicates that an interrupted exception occurred while processing the NFRegister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support .

Table E-1 (Cont.) REGN - NFRegister Service Operation

Error Code	Details	Action
ONRF-REG-REGN-E0904	This error code indicates that class cast exception occurred while processing the NFRegister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0905	This error code indicates that decoding exception occurred while processing the NFRegister service operation message.	Validate that the JSON payload is well-formed and compliant with the specified JSON schema. Fix any JSON errors. Review logs to identify the NRF-reported error further. Review problem details and application logs to identify the reported error. Contact My Oracle Support .
ONRF-REG-REGN-E0999	This error code indicates that any other exception occurred while processing the NFRegister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support .

E.1.1 NFUpdate with Full Replacement (PUT)

The following table lists the error codes and its problem details for the NF Registration microservices for the NFUpdate with Full Replacement (PUT) service operation.

Table E-2 FULLUPD - NFUpdate with Full Replacement (PUT) Service Operation

Error Code	Details	Action
ONRF-REG-FULLUPD-E0023	This error code indicates that NF profile size limit breached exception occurred while processing of NFUpdate Full replacement service operation message.	The maximum allowed NF Profile size at the NRF is as per nfProfileLimit feature. If feature is enabled then the maximum allowed NF Profile size will be checked against the configured value. The received NF Profile exceeds this limit and must be reduced. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-FULLUPD-E0100	This error code indicates that message failure occurred generic in nature while processing the NFUpdate Full replacement service operation message.	An internal error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-2 (Cont.) FULLUPD - NFUpdate with Full Replacement (PUT) Service Operation

Error Code	Details	Action
ONRF-REG-FULLUPD-E0108	This error code indicates that NRF PLMN is not configured while processing the NFUpdate Full replacement service operation message.	Validate and configure NRF with the PLMN IDs it serves. Further, ensure that the PLMN IDs in the NF profile(s) received at NRF are identical to or a subset of those configured on the NRF. Verify and correct any mismatched PLMN IDs. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-FULLUPD-E0109	This error code indicates that NF Management Service is unavailable while processing the NFUpdate Full replacement service operation message.	Review CNE infrastructure logs to identify why the microservice is down (for example, vCPU, memory, storage shortages, or server unavailability). Resolve any infrastructure issues and verify service recovery. If no infrastructure issue is found or the issue persists, share application logs with My Oracle Support .
ONRF-REG-FULLUPD-E0110	This error code indicates that OC-XFCC-DNS header is not present while processing the NFUpdate Full replacement service operation message.	XFCC-based FQDN authentication is enabled on the NRF. Verify whether this is intended in this deployment. If not, disable the feature. If yes, make sure XFCC header value is included in the request to resolve the FQDN authentication error. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-FULLUPD-E0111	This error code indicates that NF Screening failed while processing the NFUpdate Full replacement service operation message.	Review and validate NRF screening rule configuration against message attributes to determine the cause of rejection. Check logs to identify the exact NRF error. Correct the screening rules or the message as per network requirements. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-FULLUPD-E0801	This error code indicates that database access exception occurred while processing the NFUpdate Full replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-FULLUPD-E0802	This error code indicates that when pessimistic locking exception occurred while processing the NFUpdate Full replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-2 (Cont.) FULLUPD - NFUpdate with Full Replacement (PUT) Service Operation

Error Code	Details	Action
ONRF-REG-FULLUPD-E0803	This error code indicates that database access resource failure exception occurred while processing the NFUpdate Full replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-FULLUPD-E0805	This error code indicates that database update exception occurred while processing the NFUpdate Full replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-FULLUPD-E0807	This error code indicates that database read failure occurred while processing the NFUpdate Full replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-FULLUPD-E0808	This error code indicates that SQL exception occurred while processing the NFUpdate Full replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-FULLUPD-E0899	This error code indicates that general database exception occurred while processing the NFUpdate Full replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-FULLUPD-E0901	This error code indicates that IO exception occurred while processing the NFUpdate Full replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-FULLUPD-E0902	This error code indicates that JSON processing exception occurred while processing the NFUpdate Full replacement service operation message.	Validate that the JSON payload is well-formed and compliant with the specified JSON schema. Fix any JSON errors. Review logs to identify the NRF-reported error further. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-FULLUPD-E0903	This error code indicates that an interrupted exception occurred while processing the NFUpdate Full replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-FULLUPD-E0904	This error code indicates that class cast exception occurred while processing the NFUpdate Full replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-2 (Cont.) FULLUPD - NFUpdate with Full Replacement (PUT) Service Operation

Error Code	Details	Action
ONRF-REG-FULLUPD-E0905	This error code indicates that decoding exception occurred while processing the NFUpdate Full replacement service operation message.	Validate the message body and attributes are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-FULLUPD-E0999	This error code indicates that any other exception occurred while processing the NFUpdate Full replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.1.2 NFUpdate with Partial Replacement (PATCH)

The following table lists the error codes and its problem details for the NF Registration microservices for the NFUpdate with Partial Replacement (PATCH) service operation.

Table E-3 PARTUPD - NFUpdate with Partial Replacement (PATCH) service operation

Error Code	Details	Action
ONRF-REG-PARTUPD-E0002	This error code indicates an invalid message format for NFUpdate Partial replacement service operation message.	Validate the message body and attributes are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0007	This error code indicates that a mandatory attribute is incorrect for NFUpdate Partial replacement service operation message.	Validate the message body and attributes are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0008	This error code indicates that an optional attribute is incorrect for NFUpdate Partial replacement service operation message.	Validate the message body and attributes are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0009	This error code indicates that a mandatory attribute is missing for NFUpdate Partial replacement service operation message.	Validate the message body and attributes are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0010	The error code indicates that an unspecified message failure occurred during the processing of the NF update partial replacement service operation message.	Validate the message body and attributes are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-3 (Cont.) PARTUPD - NFUpdate with Partial Replacement (PATCH) service operation

Error Code	Details	Action
ONRF-REG-PARTUPD-E0023	This error code indicates that NF profile size limit breached exception occurred while processing of NFUpdate Partial replacement service operation message.	The maximum allowed NF Profile size at the NRF is as per nfProfileLimit feature. If feature is enabled then the maximum allowed NF Profile size will be checked against the configured value. Due to incoming patch request, final NF Profile size is exceeding this limit and must be reduced. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0100	This error code indicates that message failure occurred generic in nature while processing the NFUpdate Partial replacement service operation message.	An internal error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0104	This error code indicates that NF FQDN Authentication failure occurred while processing of NFUpdate Partial replacement service operation message.	XFCC-based FQDN authentication is enabled on the NRF. Verify whether this is intended in this deployment. If not, disable the feature. If yes, correct the XFCC header value in the request to resolve the FQDN authentication error. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0108	This error code indicates that NRF PLMN is not configured while processing the NFUpdate Partial replacement service operation message.	Validate and configure NRF with the PLMN IDs it serves. Further, ensure that the PLMN IDs in the NF profile(s) received at NRF are identical to or a subset of those configured on the NRF. Verify and correct any mismatched PLMN IDs. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0109	This error code indicates that NF Management Service is unavailable while processing the NFUpdate Partial replacement service operation message.	Review CNE infrastructure logs to identify why the microservice is down (e.g., vCPU, memory, storage shortages, or server unavailability). Resolve any infrastructure issues and verify service recovery. If no infrastructure issue is found or the issue persists. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-3 (Cont.) PARTUPD - NFUpdate with Partial Replacement (PATCH) service operation

Error Code	Details	Action
ONRF-REG-PARTUPD-E0110	This error code indicates that OC-XFCC-DNS header is not present while processing the NFUpdate Partial replacement service operation message.	XFCC-based FQDN authentication is enabled on the NRF. Verify whether this is intended in this deployment. If not, disable the feature. If yes, make sure XFCC header value is included in the request to resolve the FQDN authentication error. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0111	This error code indicates that NF Screening failed while processing the NFUpdate Partial replacement service operation message.	Review and validate NRF screening rule configuration against message attributes to determine the cause of rejection. Check logs to identify the exact NRF error. Correct the screening rules or the message as per network requirements. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0801	This error code indicates that database access exception occurred while processing the NFUpdate Partial replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0802	This error code indicates that when pessimistic locking exception occurred while processing the NFUpdate Partial replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0803	This error code indicates that database access resource failure exception occurred while processing the NFUpdate Partial replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0805	This error code indicates that database update exception occurred while processing the NFUpdate Partial replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0807	This error code indicates that database read failure occurred while processing the NFUpdate Partial replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-3 (Cont.) PARTUPD - NFUpdate with Partial Replacement (PATCH) service operation

Error Code	Details	Action
ONRF-REG-PARTUPD-E0808	This error code indicates that SQL exception occurred while processing the NFUpdate Partial replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0899	This error code indicates that general database exception occurred while processing the NFUpdate Partial replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0901	This error code indicates that IO exception occurred while processing the NFUpdate Partial replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0902	This error code indicates that JSON processing exception occurred while processing the NFUpdate Partial replacement service operation message.	Validate that the JSON payload is in the right format and compliant with the specified JSON schema. Fix any JSON errors. Review logs to identify the NRF-reported error further. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0903	This error code indicates that an interrupted exception occurred while processing the NFUpdate Partial replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0904	This error code indicates that class cast exception occurred while processing the NFUpdate Partial replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0905	This error code indicates that decoding exception occurred while processing the NFUpdate Partial replacement service operation message.	Validate that Content-Encoding and Content-Type are supported. Ensure the JSON payload is in the right format and schema-compliant. Fix any JSON errors, review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-REG-PARTUPD-E0999	This error code indicates that any other exception occurred while processing the NFUpdate Partial replacement service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-3 (Cont.) PARTUPD - NFUpdate with Partial Replacement (PATCH) service operation

Error Code	Details	Action
ONRF-REG-PARTUPD-E1004	This error code indicates that specific NF Instance ID record not found while processing the NFUpdate Partial service operation message.	Verify that the NF Instance ID exists in NRF STATE data. If present, share application logs with My Oracle Support . If not present, perform NF registration with this instance ID before retrying the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.1.3 NFHeartbeat Service Operation

The following table lists the error codes and its problem details for the NF Registration microservices for the NFHeartbeat service operation.

Table E-4 HB - NFHeartbeat Service Operation

Error Code	Details	Action
ONRF-REG-HB-E0002	This error code indicates an invalid message format for the NFHeartbeat service operation message.	Validate the message body and attributes are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-HB-E0109	This error code indicates that NF Management Service is unavailable while processing the NFHeartbeat service operation message.	Review CNE infrastructure logs to identify why the microservice is down (for example, vCPU, memory, storage shortages, or server unavailability). Resolve any infrastructure issues and verify service recovery. If no infrastructure issue is found or the issue persists, share application logs with My Oracle Support .
ONRF-REG-HB-E0110	This error code indicates that OC-XFCC-DNS header is not present while processing the NFHeartbeat service operation message.	XFCC-based FQDN authentication is enabled on the NRF. Verify whether this is intended in this deployment. If not, disable the feature. If yes, make sure XFCC header value is included in the request to resolve the FQDN authentication error.
ONRF-REG-HB-E0801	This error code indicates that database access exception occurred while processing the NFHeartbeat service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-HB-E0802	This error code indicates that when pessimistic locking exception occurred while processing the NFHeartbeat service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-4 (Cont.) HB - NFHeartbeat Service Operation

Error Code	Details	Action
ONRF-REG-HB-E0803	This error code indicates that database access resource failure exception occurred while processing the NFHeartbeat service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-HB-E0805	This error code indicates that database update exception occurred while processing the NFHeartbeat service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-HB-E0807	This error code indicates that database read failure occurred while processing the NFHeartbeat service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-HB-E0808	This error code indicates that SQL exception occurred while processing the NFHeartbeat service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-HB-E0899	This error code indicates that general database exception occurred while processing the NFHeartbeat service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-HB-E0901	This error code indicates that an IO exception occurred while processing the NFHeartbeat service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-HB-E0902	This error code indicates that JSON processing exception occurred while processing the NFHeartbeat service operation message.	Validate that the JSON payload is in the right format and compliant with the specified JSON schema. Fix any JSON errors. Review logs to identify the NRF-reported error further. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-HB-E0903	This error code indicates that an interrupted exception occurred while processing the NFHeartbeat service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-HB-E0904	This error code indicates that class cast exception occurred while processing the NFHeartbeat service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-4 (Cont.) HB - NFHeartbeat Service Operation

Error Code	Details	Action
ONRF-REG-HB-E0905	This error code indicates that decoding exception occurred while processing the NFHeartbeat service operation message.	Validate that Content-Encoding and Content-Type are supported. Ensure the JSON payload is in the right format and schema-compliant. Fix any JSON errors, review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-REG-HB-E0999	This error code indicates that any other exception occurred while processing the NFHeartbeat service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-HB-E1004	This error code indicates that specific NF Instance ID record not found while processing the NFHeartbeat service operation message.	Verify that the NF Instance ID exists in NRF STATE data. If present, share application logs with My Oracle Support . If not present, perform NF registration with this instance ID before retrying the request.

E.1.4 NFDeregister Service Operation

The following table lists the error codes and its problem details for the NF Registration microservices for the NF Deregistration service operation category.

Table E-5 Dereg - NFDeregister Service Operation

Error Code	Details	Action
ONRF-REG-DEREG-E0002	This error code indicates an invalid message format for NFDeregister service operation message.	Validate the message body and attributes are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-DEREG-E0104	This error code indicates that NF FQDN Authentication failure occurred while processing the NFDeregister service operation message.	XFCC-based FQDN authentication is enabled on the NRF. Verify whether this is intended in this deployment. If not, disable the feature. If yes, correct the XFCC header value in the request to resolve the FQDN authentication error. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-5 (Cont.) Dereg - NFDeregister Service Operation

Error Code	Details	Action
ONRF-REG-DEREG-E0109	This error code indicates that NF Management Service is unavailable while processing the NFDeregister service operation message.	Review CNE infrastructure logs to identify why the microservice is down (for example, vCPU, memory, storage shortages, or server unavailability). Resolve any infrastructure issues and verify service recovery. If no infrastructure issue is found or the issue persists, review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-DEREG-E0801	This error code indicates that database access exception occurred while processing the NFDeregister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-DEREG-E0802	This error code indicates that pessimistic locking exception occurred while processing the NFDeregister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-DEREG-E0803	This error code indicates that database access resource failure exception occurred while processing the NFDeregister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-DEREG-E0806	This error code indicates that database delete failure occurred while processing the NFDeregister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-DEREG-E0807	This error code indicates that database read failure occurred while processing the NFDeregister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-DEREG-E0808	This error code indicates that SQL exception occurred while processing the NFDeregister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-DEREG-E0899	This error code indicates that general database exception occurred while processing the NFDeregister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-5 (Cont.) Dereg - NFDeregister Service Operation

Error Code	Details	Action
ONRF-REG-DEREG-E0901	This error code indicates that IO exception occurred while processing the NFDeregister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-DEREG-E0902	This error code indicates that JSON processing exception occurred while processing the NFDeregister service operation message.	Validate that the JSON payload is in the right format and compliant with the specified JSON schema. Fix any JSON errors. Review logs to identify the NRF-reported error further. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-DEREG-E0903	This error code indicates that an interrupted exception occurred while processing the NFDeregister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-DEREG-E0904	This error code indicates that class cast exception occurred while processing the NFDeregister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-DEREG-E0999	This error code indicates that any other exception occurred while processing the NFDeregister service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-DEREG-E1004	This error code indicates that specific NF Instance ID record not found while processing the NFDeregister service operation message.	Verify that the NF Instance ID exists in NRF STATE data. If present, share application logs with My Oracle Support . If not present, perform NF registration with this instance ID before retrying the request.

E.1.5 NFProfileRetrieval Service Operation

The following table lists the error codes and its problem details for the NF Registration microservices for the NFProfileRetrieval service operation.

Table E-6 NFPR - NFProfileRetrieval Service Operation

Error Code	Details	Action
ONRF-REG-NFPR-E0002	This error code indicates that message format is invalid while processing the NFProfile retrieval service operation message.	Validate the message body and attributes are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-6 (Cont.) NFPR - NFProfileRetrieval Service Operation

Error Code	Details	Action
ONRF-REG-NFPR-E0003	This error code indicates that query parameter is invalid while processing the NFProfile retrieval service operation message.	Validate the attributes are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFPR-E0104	This error code indicates that NF FQDN Authentication failure occurred while processing the NFProfile retrieval service operation message.	XFCC-based FQDN authentication is enabled on the NRF. Verify whether this is intended in this deployment. If not, disable the feature. If yes, correct the XFCC header value in the request to resolve the FQDN authentication error. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFPR-E0109	This error code indicates that NF Management Service is unavailable while processing the NFProfile retrieval service operation message.	Review CNE infrastructure logs to identify why the microservice is down (for example, vCPU, memory, storage shortages, or server unavailability). Resolve any infrastructure issues and verify service recovery. If no infrastructure issue is found or the issue persists, review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-REG-NFPR-E0110	This error code indicates that OC-XFCC-DNS header is not present while processing the NFProfile retrieval service operation message.	XFCC-based FQDN authentication is enabled on the NRF. Verify whether this is intended in this deployment. If not, disable the feature. If yes, make sure XFCC header value is included in the request to resolve the FQDN authentication error. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFPR-E0801	This error code indicates that database access exception occurred while processing the NFProfile retrieval service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFPR-E0802	This error code indicates that pessimistic locking exception occurred while processing the NFProfile retrieval service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFPR-E0803	This error code indicates that database access resource failure exception occurred while processing the NFProfile retrieval service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-6 (Cont.) NFPR - NFProfileRetrieval Service Operation

Error Code	Details	Action
ONRF-REG-NFPR-E0807	This error code indicates that database read failure occurred while processing the NFProfile retrieval service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFPR-E0808	This error code indicates that SQL exception occurred while processing the NFProfile retrieval service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFPR-E0899	This error code indicates that database access exception occurred while processing the NFProfile retrieval service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFPR-E0901	This error code indicates that IO exception occurred while processing the NFProfile retrieval service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFPR-E0902	This error code indicates that JSON processing exception occurred while processing the NFProfile retrieval service operation message.	Validate that the JSON payload is in the right format and compliant with the specified JSON schema. Fix any JSON errors. Review logs to identify the NRF-reported error further. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFPR-E0903	This error code indicates that an interrupted exception occurred while processing the NFProfile retrieval service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFPR-E0904	This error code indicates that class cast exception occurred while processing the NFProfile retrieval service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFPR-E0905	This error code indicates that decoding exception occurred while processing the NFProfile retrieval service operation message.	Validate that Content-Encoding and Content-Type are supported. Ensure the JSON payload is in the right format and schema-compliant. Fix any JSON errors. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.

Table E-6 (Cont.) NFPR - NFProfileRetrieval Service Operation

Error Code	Details	Action
ONRF-REG-NFPR-E0999	This error code indicates that any other exception occurred while processing the NFProfile retrieval service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFPR-E1004	This error code indicates that specific NF Instance ID record was not found while processing the NFProfile retrieval service operation message.	Verify that the NF Instance ID exists in NRF STATE data. If present, share application logs with My Oracle Support . If not present, perform NF registration with this instance ID before retrying the request.

E.1.6 NFListRetrieval Service Operation

The following table lists the error codes and its problem details for the NF Registration microservices for the NF List Retrieval service operation category.

Table E-7 NFLR - NFListRetrieval Service Operation

Error Code	Details	Action
ONRF-REG-NFLR-E0002	This error code indicates that message format is invalid while processing the NFListRetrieval service operation message.	Validate the message body and attributes are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFLR-E0003	This error code indicates that query parameter is invalid while processing the NFListRetrieval service operation message.	Validate the message for invalid format of search parameters are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFLR-E0109	This error code indicates that NF Management Service is unavailable while processing the NFListRetrieval service operation message.	Review CNE infrastructure logs to determine why the database connection is unavailable, including potential cnDBTier microservice failures (for example, vCPU, memory, storage shortages, or server unavailability). Resolve any infrastructure issues and verify service and database connectivity recovery. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-7 (Cont.) NFLR - NFListRetrieval Service Operation

Error Code	Details	Action
ONRF-REG-NFLR-E0110	This error code indicates that OC-XFCC-DNS header is not present while processing the NFListRetrieval service operation message.	XFCC-based FQDN authentication is enabled on the NRF. Verify whether this is intended in this deployment. If not, disable the feature. If yes, make sure XFCC header value is included in the request to resolve the FQDN authentication error. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFLR-E0801	This error code indicates that database access exception occurred while processing the NFListRetrieval service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFLR-E0802	This error code indicates that pessimistic locking exception occurred while processing the NFListRetrieval service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFLR-E0803	This error code indicates that database access resource failure exception occurred while processing the NFListRetrieval service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFLR-E0807	This error code indicates that database read failure occurred while processing the NFListRetrieval service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFLR-E0808	This error code indicates that SQL exception occurred while processing the NFListRetrieval service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFLR-E0899	This error code indicates that database access exception occurred while processing the NFListRetrieval service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFLR-E0901	This error code indicates that IO exception occurred while processing the NFListRetrieval service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-7 (Cont.) NFLR - NFListRetrieval Service Operation

Error Code	Details	Action
ONRF-REG-NFLR-E0902	This error code indicates that JSON processing exception occurred while processing the NFListRetrieval service operation message.	Validate that the JSON payload is in the right format and compliant with the specified JSON schema. Fix any JSON errors. Review logs to identify the NRF-reported error further. If the issue persists, share application logs with My Oracle Support .
ONRF-REG-NFLR-E0903	This error code indicates that an interrupted exception occurred while processing the NFListRetrieval service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFLR-E0904	This error code indicates that class cast exception occurred while processing the NFListRetrieval service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-REG-NFLR-E0905	This error code indicates that decoding exception occurred while processing the NFListRetrieval service operation message.	Validate that Content-Encoding and Content-Type are supported. Ensure the JSON payload is in the right format and schema-compliant. Fix any JSON errors. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-REG-NFLR-E0999	This error code indicates that any other exception occurred while processing the NFListRetrieval service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.1.7 NFProfileRetrieval Service Operation During Forwarding

The following table lists the error codes and its problem details for the NF Registration microservices for the NFProfileRetrieval service operation during forwarding.

Table E-8 NFPRFWD - NF Profile Retrieval Service Operation During Forwarding

Error Code	Details	Action
ONRF-REG-NFPRFWD-E0103	This error code indicates that egress gateway error occurred while forwarding the NFProfile retrieval service operation message.	Review Egress Gateway configuration and logs to identify and fix any misconfiguration. If the configuration is correct and the issue persists, review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.

Table E-8 (Cont.) NFPRFWD - NF Profile Retrieval Service Operation During Forwarding

Error Code	Details	Action
ONRF-REG-NFPRFWD-E0201	This error code indicates that NRF forwarding configuration is missing while forwarding the NFProfile retrieval service operation message.	If the NF Profile for the instance ID is not found in local STATE data, the request can be forwarded to another local NRF. Ensure that NRF forwarding is enabled and the NRF configuration is done as per NRF documentation. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-REG-NFPRFWD-E0202	This error code indicates that NRF is not reachable while forwarding the NFProfile retrieval service operation message.	Verify and restore reachability to the peer NRF, and check the peer NRF details in the forwarding configuration. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-REG-NFPRFWD-E0203	This error code indicates that NRF forwarding loop is detected while forwarding the NFProfile retrieval service operation message.	NRF detected a forwarding loop. Review NRF forwarding configuration and routing rules at subsequent NFs or nodes to ensure the message is not routed back to NRF. If the issue persists, share application logs with My Oracle Support .
ONRF-REG-NFPRFWD-E0204	This error code indicates that another NRF returns an incorrect response for the NFProfile retrieval service operation message.	An unexpected error is received from the peer NRF. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-REG-NFPRFWD-E0299	This error code indicates that some unknown internal error occurred while forwarding the NFProfile retrieval service operation message.	Review NRF forwarding configuration, verify reachability between backend microservices and the egress gateway microservice, confirm services are in-service, and check CNE logs to resolve the issue. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.

E.1.8 UnSupported Media Type

The following table lists the error codes and its problem details for the NF Registration microservices for the NF UnSupported Media Type service operation category.

Table E-9 UNKSROP - UnSupported Media Type

Error Code	Details	Action
ONRF-REG-UNKSROP-E0002	This error code indicates that an unknown service operation is received.	Ensure that HTTP operation getting used in the request is aligned to specifications and Accept header value is aligned to the specification. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-REG-UNKSROP-E0902	This error code indicates that JSON processing error for unknown service operation is received.	Validate that the JSON payload is in the right format and compliant with the specified JSON schema. Fix any JSON errors. Review logs to identify the NRF-reported error further. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.

E.2 NF Subscription Microservice

This section lists the error codes and its problem details for the NF Subscription microservice.

E.2.1 NFStatusSubscribe Service Operation

The following table lists the error codes and its problem details for the NF Subscription microservices for the NFStatusSubscribe service operation.

Table E-10 SUBSCR-NFStatusSubscribe Service Operation

Error Code	Details	Action
ONRF-SUB-SUBSCR-E0007	This error code indicates that mandatory attribute is incorrect while processing the NFStatusSubscribe service operation message.	Validate the message body and the attribute formats are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-SUBSCR-E0009	This error code indicates that a mandatory attribute is missing while processing the NFStatusSubscribe service operation message.	Verify that mandatory attributes are present as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-SUBSCR-E0100	This error code indicates that generic bad request occurred while processing the NFStatusSubscribe service operation message.	Validate the message structure and formats of mandatory and optional attributes are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-10 (Cont.) SUBSCR-NFStatusSubscribe Service Operation

Error Code	Details	Action
ONRF-SUB-SUBSCR-E0104	This error code indicates that NF FQDN Authentication Failure occurred while processing the NFStatusSubscribe service operation message.	XFCC-based FQDN authentication is enabled on the NRF. Verify whether this is intended in this deployment. If not, disable the feature. If yes, correct the XFCC header value in the request to resolve the FQDN authentication error. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-SUBSCR-E0108	This error code indicates that NRF PLMN is not configured while processing the NFStatusSubscribe service operation message.	Configure nrfPlmnList with the PLMN IDs served by this NRF. Requests are rejected when NRF PLMN is not configured. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-SUBSCR-E0109	This error code indicates that NF Management Service is unavailable while processing the NFStatusSubscribe service operation message.	Review CNE infrastructure logs to identify why the microservice is down (for example, vCPU, memory, storage shortages, or server unavailability). Resolve any infrastructure issues and verify service recovery. If no infrastructure issue is found or the issue persists, review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-SUBSCR-E0110	This error code indicates that OC-XFCC-DNS header is not present while processing the NFStatusSubscribe service operation message.	XFCC-based FQDN authentication is enabled on the NRF. Verify whether this is intended in this deployment. If not, disable the feature. If yes, make sure XFCC header value is included in the request to resolve the FQDN authentication error. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-SUBSCR-E0111	This error code indicates that NF screening rule fails while processing the NFStatusSubscribe service operation message.	Review and validate NRF screening rule configuration against message attributes to determine the cause of rejection. Check logs to identify the exact NRF error. Correct the screening rules or the message as per network requirements. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-10 (Cont.) SUBSCR-NFStatusSubscribe Service Operation

Error Code	Details	Action
ONRF-SUB-SUBSCR-E0112	This error code indicates that Foreign PLMN is not supported while processing the NFStatusSubscribe service operation message.	Ensure that the PLMN IDs in the NF profile(s) received at NRF are either identical to or a subset of those configured on the NRF. Review logs to identify the exact NRF error. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-SUBSCR-E0801	This error code indicates that database access exception occurred while processing the NFStatusSubscribe service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-SUBSCR-E0802	This error code indicates that pessimistic locking exception occurred while processing the NFStatusSubscribe service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-SUBSCR-E0803	This error code indicates that database access resource failure exception occurred while processing the NFStatusSubscribe service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-SUBSCR-E0899	This error code indicates that generic database exception occurred while processing the NFStatusSubscribe service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-SUBSCR-E0902	This error code indicates that json processing exception occurred while processing the NFStatusSubscribe service operation message.	Validate that the JSON payload is in right format and compliant with the specified JSON schema. Fix any JSON errors. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-SUBSCR-E0903	This error code indicates that an interrupted exception occurred while processing the NFStatusSubscribe service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-SUBSCR-E0904	This error code indicates that class cast exception occurred while processing the NFStatusSubscribe service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-10 (Cont.) SUBSCR-NFStatusSubscribe Service Operation

Error Code	Details	Action
ONRF-SUB-SUBSCR-E0999	This error code indicates that any generic exception occurred while processing the NFStatusSubscribe service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-SUBSCR-E2001	This error code indicates that create Subscription based on NfInstanceId condition, the relevant NFProfiles not found for NfInstanceId while processing the NFStatusSubscribe service operation message.	NfInstance need to be registered with NfInstanceId value from Subscription Data. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-SUBSCR-E2002	This error code indicates that Subscription is not authorized for NfInstanceId present in subscrCond while processing the NFStatusSubscribe service operation message.	Subscriber NF is not allowed to take subscription on specific nfInstanceId as allowedXXX attributes of target NFInstance are not allowing subscriber requester attributes. Target NFInstance need to allow the requester subscriber. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-SUBSCR-E2003	This error code indicates that Subscription limit is breached and new subscriptions are not allowed while processing the NFStatusSubscribe service operation message.	Check current count in metric <code>ocnrf_nfset_active_subscriptions</code> and compare against <code>NrfSystemOptions.nfManagementOptions.subscriptionLimit.globalMaxLimit</code> . Confirm the overall database replication status is UP. When the replication is DOWN, nfSubscription applies an effective cap lower than <code>globalMaxLimit</code> , and requests may be rejected even if <code>ocnrf_nfset_active_subscriptions < globalMaxLimit</code> . Restore replication health, then retry. If the limit has not been reached (considering the effective cap) and replication is UP, collect and share logs with My Oracle Support . Otherwise, unsubscribe active subscriptions until <code>ocnrf_nfset_active_subscriptions</code> is below the effective cap, and capacity planning, then retry.
ONRF-SUB-SUBSCR-E2004	This error code indicates that failure occurred while adding, deleting, updating records in NFSubscription table while processing the NFStatusSubscribe service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.2.1.1 NFStatusSubscribe Update (PATCH) Service Operation

The following table lists the error codes and its problem details for the NF Subscription microservices for the NFStatusSubscribe Update (PATCH) service operation.

Table E-11 UPDSUBS - NFStatusSubscribe Update (PATCH) Service Operation

Error Code	Details	Action
ONRF-SUB-UPDSUBS-E0007	This error code indicates that mandatory attribute is incorrect while processing the NFStatusSubscribe Update service operation message.	Validate the format of mandatory attributes are as per specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UPDSUBS-E0012	This error code indicates that specific subscription not found while processing the NFStatusSubscribe Update service operation message.	Verify that the Subscription ID exists in NRF STATE data. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UPDSUBS-E0022	This error code indicates that unsupported media type comes while processing the NFStatusSubscribe Update service operation message.	Validate that Content-Encoding and Content-Type are supported. Ensure the JSON payload is in the right format and schema-compliant. Fix any JSON errors, review logs for NRF-reported error further. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UPDSUBS-E0100	This error code indicates that generic bad request occurred while processing the NFStatusSubscribe Update service operation message.	Validate the message structure and formats of mandatory and optional attributes are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UPDSUBS-E0104	This error code indicates that NF FQDN Authentication Failure occurred while processing the NFStatusSubscribe Update service operation message.	XFCC-based FQDN authentication is enabled on the NRF. Verify whether this is intended in this deployment. If not, disable the feature. If yes, correct the XFCC header value in the request to resolve the FQDN authentication error. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UPDSUBS-E0108	This error code indicates that NRF PLMN is not configured while processing the NFStatusSubscribe Update service operation message.	Validate and configure the NRF with the PLMN IDs it serves to ensure NFStatusSubscribe requests with plmnId (that is, PLMN ID of target network) are correctly classified as local or roaming and processed accordingly. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-11 (Cont.) UPDSUBS - NFStatusSubscribe Update (PATCH) Service Operation

Error Code	Details	Action
ONRF-SUB-UPDSUBS-E0109	This error code indicates that NF Management Service is unavailable while processing the NFStatusSubscribe Update service operation message.	Review CNE infrastructure logs to identify why the microservice is down (for example, vCPU, memory, storage shortages, or server unavailability). Resolve any infrastructure issues and verify service recovery. If no infrastructure issue is found or the issue persists, review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-SUB-UPDSUBS-E0110	This error code indicates that OC-XFCC-DNS header is not present while processing the NFStatusSubscribe Update service operation message.	XFCC-based FQDN authentication is enabled on the NRF. Verify whether this is intended in this deployment. If not, disable the feature. If yes, correct the XFCC header value in the request to resolve the FQDN authentication error. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UPDSUBS-E0801	This error code indicates that database access exception occurred while processing the NFStatusSubscribe Update service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UPDSUBS-E0802	This error code indicates that pessimistic locking exception occurred while processing the NFStatusSubscribe Update service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UPDSUBS-E0803	This error code indicates that database access resource failure exception occurred while processing the NFStatusSubscribe Update service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UPDSUBS-E0805	This error code indicates that update database exception occurred while processing the NFStatusSubscribe Update service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UPDSUBS-E0902	This error code indicates that json processing exception occurred while processing the NFStatusSubscribe Update service operation message.	Validate that the JSON payload is in right format and compliant with the specified JSON schema. Fix any JSON errors. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-11 (Cont.) UPDSUBS - NFStatusSubscribe Update (PATCH) Service Operation

Error Code	Details	Action
ONRF-SUB-UPDSUBS-E0999	This error code indicates that any generic exception occurred while processing the NFStatusSubscribe Update service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UPDSUBS-E2003	This error code indicates that subscription limit is breached and subscriptions are not allowed to update while processing the NFStatusSubscribe Update service operation message.	Check current count in metric <code>ocnrf_nfset_active_subscriptions</code> and compare against <code>NrfSystemOptions.nfManagementOptions.subscriptionLimit.globalMaxLimit</code> . Confirm overall database replication status is UP. When replication is DOWN, <code>nfSubscription</code> applies an effective cap lower than <code>globalMaxLimit</code> , and requests may be rejected even if <code>ocnrf_nfset_active_subscriptions < globalMaxLimit</code> . Restore the replication health and then retry. If the limit has not been reached (considering the effective cap) and replication is UP, collect and share logs with My Oracle Support . Otherwise, unsubscribe the active subscriptions until <code>ocnrf_nfset_active_subscriptions</code> is below the effective cap, and capacity planning, then retry.

E.2.1.2 NFStatusSubscribe Service Operation During Forwarding

The following table lists the error codes and its problem details for the NF Subscription microservices for the NFStatusSubscribe service operation during forwarding.

Table E-12 SUBFWD-NFStatusSubscribe Service Operation During Forwarding

Error Code	Details	Action
ONRF-SUB-SUBFWD-E0103	This error code indicates that egress gateway error occurred for NFStatusSubscribe service operation message targeted for forwarding to another NRF.	Review Egress gateway configuration and logs to identify and fix any misconfiguration. If the configuration is correct and the issue persists, share application logs with My Oracle Support .
ONRF-SUB-SUBFWD-E0201	This error code indicates that NRF forwarding configuration is missing while forwarding the NFStatusSubscribe service operation message.	Validate that forwarding feature is configured as per NRF Forwarding documentation. In case, NRF forwarding configuration exists already. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-12 (Cont.) SUBFWD-NFStatusSubscribe Service Operation During Forwarding

Error Code	Details	Action
ONRF-SUB-SUBFWD-E0202	This error code indicates that NRF is not reachable while forwarding the NFStatusSubscribe service operation message.	Verify and restore reachability to the peer NRF. If reachability is confirmed and the issue persists, share application logs with My Oracle Support .
ONRF-SUB-SUBFWD-E0203	This error code indicates that NRF forwarding loop is detected for NFStatusSubscribe service operation message being forwarded.	NRF detected a forwarding loop. Review NRF forwarding configuration and routing rules at subsequent NFs or nodes to ensure the message is not routed back to NRF. If the issue persists, share application logs with My Oracle Support .
ONRF-SUB-SUBFWD-E0204	This error code indicates that another NRF returned incorrect response for NFStatusSubscribe service operation message.	An unexpected error is received from the peer NRF. Review problem details and application logs of both NRFs to identify the reported error further. Contact My Oracle Support if required.
ONRF-SUB-SUBFWD-E0205	This error code indicates that egress gateway is not reachable while trying to forward the NFStatusSubscribe service operation message to another NRF.	Verify reachability between NRF backend microservices and the Egress gateway microservice, confirm the gateway service is in-service, and review CNE logs to resolve the issue. If it persists, share application logs with My Oracle Support .
ONRF-SUB-SUBFWD-E0206	This error code indicates that some unexpected error occurred while forwarding the NFStatusSubscribe service operation message.	Review NRF forwarding configuration, verify reachability between backend microservices and the egress gateway microservice, confirm services are in-service, and check CNE logs to resolve the issue. If it persists, share application logs with My Oracle Support .
ONRF-SUB-SUBFWD-E0299	This error code indicates that some unknown internal error occurred while forwarding the NFStatusSubscribe service operation message.	Review NRF forwarding configuration, verify reachability between NRF backend microservices and the Egress gateway microservice, confirm services are in-service, and check CNE logs to resolve the issue. If it persists, share application logs with My Oracle Support .

E.2.1.3 NFStatusSubscribe Update (PATCH) Service Operation During Forwarding

The following table lists the error codes and its problem details for the NF Subscription microservices for the NFStatusSubscribe update (PATCH) service operation during forwarding.

Table E-13 UPSFWD - NFStatusSubscribe Update (PATCH) Service Operation During Forwarding

Error Code	Details	Action
ONRF-SUB-UPSFWD-E0012	This error code indicates that subscription is not found for specific subscriptionId for NFStatusSubscribe Update service operation being forwarded.	Verify that the Subscription ID exists in NRF STATE data. If present, share the application logs with My Oracle Support . If absent, the request is correctly rejected; re-validate that the subscription ID is the intended one.
ONRF-SUB-UPSFWD-E0103	This error code indicates that egress gateway error occurred for NFStatusSubscribe Update service operation message targeted for forwarding to another NRF.	Review Egress gateway configuration and logs to identify and fix any misconfiguration. If the configuration is correct and the issue persists, share application logs with My Oracle Support .
ONRF-SUB-UPSFWD-E0201	This error code indicates that NRF forwarding configuration is missing while forwarding the NFStatusSubscribe Update service operation message.	Validate that forwarding feature is configured as per NRF Forwarding documentation. In case, NRF forwarding configuration exists already. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UPSFWD-E0202	This error code indicates that NRF is not reachable while forwarding the NFStatusSubscribe Update service operation message.	Verify and restore reachability to the peer NRF. If reachability is confirmed and the issue persists, share application logs with My Oracle Support .
ONRF-SUB-UPSFWD-E0203	This error code indicates that NRF forwarding loop is detected for NFStatusSubscribe Update service operation message being forwarded.	NRF detected a forwarding loop. Review NRF forwarding configuration and routing rules at subsequent NFs or nodes to ensure the message is not routed back to NRF. If the issue persists, share application logs with My Oracle Support .
ONRF-SUB-UPSFWD-E0204	This error code indicates that another NRF returned incorrect response for NFStatusSubscribe Update service operation message.	An unexpected error is received from the peer NRF. If the peer NRF is an Oracle deployment, share application logs with My Oracle Support .
ONRF-SUB-UPSFWD-E0205	This error code indicates that egress gateway is not reachable while trying to forward the NFStatusSubscribe Update service operation message to another NRF.	Verify reachability between NRF backend microservices and the Egress gateway microservice, confirm the gateway service is in-service, and review CNE logs to resolve the issue. If it persists, share application logs with My Oracle Support .
ONRF-SUB-UPSFWD-E0206	This error code indicates that some unexpected error occurred while forwarding the NFStatusSubscribe Update service operation message.	Review NRF forwarding configuration, verify reachability between NRF backend microservices and the Egress gateway microservice, confirm services are in-service, and check CNE logs to resolve the issue. If it persists, share application logs with My Oracle Support .

Table E-13 (Cont.) UPSFWD - NFStatusSubscribe Update (PATCH) Service Operation During Forwarding

Error Code	Details	Action
ONRF-SUB-UPSFWD-E0299	This error code indicates that some unknown internal error occurred while forwarding the NFStatusSubscribe Update service operation message.	Review NRF forwarding configuration, verify reachability between NRF backend microservices and the Egress gateway microservice, confirm services are in-service, and check CNE logs to resolve the issue. If it persists, share application logs with My Oracle Support .

E.2.1.4 NFStatusSubscribe Update (PATCH) Service Operation During Roaming

The following table lists the error codes and its problem details for the NF Subscription microservices for the NFStatusSubscribe update (PATCH) service operation during roaming.

Table E-14 UPSROAM - NFStatusSubscribe Update (PATCH) Service Operation During Roaming Scenarios

Error Code	Details	Action
ONRF-SUB-UPSROAM-E0301	This error code indicates that 5xx error response is received for roaming scenarios.	A 5xx error was received from the peer NRF. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UPSROAM-E0302	This error code indicates that 4xx error response is received for roaming scenarios.	A 4xx error was received from the peer NRF. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UPSROAM-E0303	This error code indicates that 3xx error response is received for roaming scenarios.	A 3xx error was received from the peer NRF. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UPSROAM-E0304	This error code indicates that 5xx error response is received from egress gateway for roaming scenarios.	Egress Gateway failed to process or route the request to the peer entity. Verify NRF roaming configuration and peer reachability. If the issue persists, share application logs with My Oracle Support .
ONRF-SUB-UPSROAM-E0305	This error code indicates that 4xx error response is received from egress gateway for roaming scenarios.	Egress Gateway failed to process or route the request to the peer entity. Verify NRF roaming configuration and peer reachability. If the issue persists, share application logs with My Oracle Support .

Table E-14 (Cont.) UPSROAM - NFStatusSubscribe Update (PATCH) Service Operation During Roaming Scenarios

Error Code	Details	Action
ONRF-SUB-UPSROAM-E0306	This error code indicates that 3xx error response is received from egress gateway for roaming scenarios.	Egress Gateway failed to process or route the request to the peer entity. Verify NRF roaming configuration and peer reachability. If the issue persists, share application logs with My Oracle Support .
ONRF-SUB-UPSROAM-E0308	This error code indicates that loop is detected for roaming scenarios.	NRF detected a forwarding loop. Review NRF roaming configuration and routing rules at subsequent NFs or nodes to ensure the message is not routed back to NRF. If the issue persists, share application logs with My Oracle Support .
ONRF-SUB-UPSROAM-E0399	This error code indicates that generic internal error occurred for roaming scenarios.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UPSROAM-E0205	This error code indicates that egress gateway is not reachable for roaming scenarios.	Verify reachability between NRF backend microservices and the Egress gateway microservice, confirm the gateway service is in-service, and review CNE logs to resolve the issue. If it persists, share application logs with My Oracle Support .
ONRF-SUB-UPSROAM-E0206	This error code indicates that some unexpected error occurred for roaming scenarios.	Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.2.2 NFStatusUnsubscribe Service Operation

The following table lists the error codes and its problem details for the NF Subscription microservices for the NFStatusUnsubscribe service operation.

Table E-15 UNSUBSC - NFStatusUnSubscribe Service Operation

Error Code	Details	Action
ONRF-SUB-UNSUBSC-E0012	This error code indicates that specific subscription not found while processing the NFStatusUnSubscribe service operation message.	Verify that the Subscription ID exists in NRF State data. If present, share application logs with My Oracle Support . If not present, the request is correctly rejected; re-validate that the subscription ID is the intended one.
ONRF-SUB-UNSUBSC-E0104	This error code indicates that NF FQDN Authentication Failure occurred while processing the NFStatusUnSubscribe service operation message.	XFCC-based FQDN authentication is enabled on the NRF. Verify whether this is intended in this deployment. If not, disable the feature. If yes, correct the XFCC header value in the request to resolve the FQDN authentication error.

Table E-15 (Cont.) UNSUBSC - NFStatusUnSubscribe Service Operation

Error Code	Details	Action
ONRF-SUB-UNSUBSC-E0108	This error code indicates that NRF PLMN is not configured is not found while processing the NFStatusUnSubscribe service operation message.	Validate and configure the NRF with the PLMN IDs it serves to ensure NF Status subscribe requests with plmnId (that is, PLMN ID of target network) are correctly classified as local or roaming and processed accordingly. Configure nrfPlmnList with the PLMN IDs served by this NRF. Requests are rejected when NRF PLMN is not configured. If issue persists, collect and share NRF logs with My Oracle Support for further analysis.
ONRF-SUB-UNSUBSC-E0109	This error code indicates that NF Management Service is unavailable while processing the NFStatusUnSubscribe service operation message.	Review CNE infrastructure logs to identify why the microservice is down (for example, vCPU, memory, storage shortages, or server unavailability). Resolve any infrastructure issues and verify service recovery. If no infrastructure issue is found or the issue persists, review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UNSUBSC-E0110	This error code indicates that OC-XFCC-DNS header is not present while processing the NFStatusUnSubscribe service operation message.	XFCC-based FQDN authentication is enabled on the NRF. Verify whether this is intended in this deployment. If not, disable the feature. If yes, make sure XFCC header value is included in the request to resolve the FQDN authentication error. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UNSUBSC-E0801	This error code indicates that database access exception occurred while processing the NFStatusUnSubscribe service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UNSUBSC-E0802	This error code indicates that pessimistic locking exception occurred while processing the NFStatusUnSubscribe service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UNSUBSC-E0803	This error code indicates that database access resource failure exception occurred while processing the NFStatusUnSubscribe service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-15 (Cont.) UNSUBSC - NFStatusUnSubscribe Service Operation

Error Code	Details	Action
ONRF-SUB-UNSUBSC-E0805	This error code indicates that update database exception occurred while processing the NFStatusUnSubscribe service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UNSUBSC-E0903	This error code indicates that interrupted exception occurred while processing the NFStatusUnSubscribe service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UNSUBSC-E0904	This error code indicates that class cast exception occurred while processing the NFStatusUnSubscribe service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-SUB-UNSUBSC-E0999	This error code indicates that generic exception occurred while processing the NFStatusUnSubscribe service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.2.2.1 NFStatusUnsubscribe Service Operation During Forwarding

The following table lists the error codes and its problem details for the NF Subscription microservices for the NFStatusUnsubscribe service operation during forwarding.

Table E-16 UNSFWD - NFStatusUnsubscribe Service Operation During Forwarding

Error Code	Details	Action
ONRF-SUB-UNSFWD-E0012	This error code indicates that subscription is not found for specific subscriptionId for NFStatusUnsubscribe service operation being forwarded.	Verify that the Subscription ID exists in NRF STATE data. If present, share application logs with My Oracle Support . If not present, the request is correctly rejected; re-validate that the subscription ID is the intended one.
ONRF-SUB-UNSFWD-E0103	This error code indicates that egress gateway error occurred for NFStatusUnsubscribe service operation message. targeted for forwarding to another NRF.	Review egress gateway configuration and logs to identify and fix any misconfiguration. If the configuration is correct and the issue persists, share application logs with My Oracle Support .
ONRF-SUB-UNSFWD-E0201	This error code indicates that NRF forwarding configuration is missing while forwarding the NFStatusUnsubscribe service operation message.	Validate that forwarding feature is configured as per NRF Forwarding documentation. In case, NRF forwarding configuration exists already. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.

Table E-16 (Cont.) UNSFWD - NFStatusUnsubscribe Service Operation During Forwarding

Error Code	Details	Action
ONRF-SUB-UNSFWD-E0202	This error code indicates that NRF is not reachable while forwarding the NFStatusUnsubscribe service operation message.	Verify and restore reachability to the peer NRF. If reachability is confirmed and the issue persists, share application logs with My Oracle Support .
ONRF-SUB-UNSFWD-E0203	This error code indicates that NRF forwarding loop is detected for NFStatusUnsubscribe service operation message. being forwarded	NRF detected a forwarding loop. Review NRF forwarding configuration and routing rules at subsequent NFs or nodes to ensure the message is not routed back to NRF. If the issue persists, share application logs with My Oracle Support .
ONRF-SUB-UNSFWD-E0204	This error code indicates that another NRF returned incorrect response for NFStatusUnsubscribe service operation message.	An unexpected error is received from the peer NRF. If the peer NRF is an Oracle deployment, share application logs with My Oracle Support .
ONRF-SUB-UNSFWD-E0205	This error code indicates that egress gateway is not reachable while trying to forward the NFStatusUnsubscribe service operation message to another NRF.	Verify reachability between NRF backend microservices and the Egress gateway microservice, confirm the gateway service is in-service, and review CNE logs to resolve the issue. If it persists, share application logs with My Oracle Support .
ONRF-SUB-UNSFWD-E0206	This error code indicates that some unexpected error occurred while forwarding the NFStatusUnsubscribe service operation message.	Review NRF forwarding configuration, verify reachability between NRF backend microservices and the Egress gateway microservice, confirm services are in-service, and check CNE logs to resolve the issue. If it persists, share application logs with My Oracle Support .
ONRF-SUB-UNSFWD-E0299	This error code indicates that some unknown internal error occurred while forwarding the NFStatusUnsubscribe service operation message.	Review NRF forwarding configuration, verify reachability between NRF backend microservices and the egress gateway microservice, confirm services are in-service, and check CNE logs to resolve the issue. If it persists, share application logs with My Oracle Support .

E.2.3 NFStatusSubscribe Service Operation During Roaming

The following table lists the error codes and its problem details for the NF Subscription microservices for the NFStatusSubscribe service operation during roaming.

Table E-17 SUBROAM - NFStatusSubscribe Service Operation During Roaming

Error Code	Details	Action
ONRF-SUB-SUBROAM-E0301	This error code indicates that 5xx error response is received for roaming scenarios.	A 5xx error was received from the peer NRF. Review problem details and application logs of both NRFs to identify the reported error further. Contact My Oracle Support if required.
ONRF-SUB-SUBROAM-E0302	This error code indicates that 4xx error response is received for roaming scenarios.	A 4xx error was received from the peer NRF. Review problem details and application logs of both NRFs to identify the reported error further. Contact My Oracle Support if required.
ONRF-SUB-SUBROAM-E0303	This error code indicates that 3xx error response is received for roaming scenarios.	A 3xx error was received from the peer NRF. Review problem details and application logs of both NRFs to identify the reported error further. Contact My Oracle Support if required.
ONRF-SUB-SUBROAM-E0304	This error code indicates that 5xx error response is received from egress gateway for roaming scenarios.	Egress Gateway failed to process or route the request to the peer entity. Verify NRF roaming configuration and peer reachability. If the issue persists, share application logs with My Oracle Support .
ONRF-SUB-SUBROAM-E0305	This error code indicates that 4xx error response is received from egress gateway for roaming scenarios.	Egress Gateway failed to process or route the request to the peer entity. Verify NRF roaming configuration and peer reachability. If the issue persists, share application logs with My Oracle Support .
ONRF-SUB-SUBROAM-E0306	This error code indicates that 3xx error response is received from egress gateway for roaming scenarios.	Egress Gateway failed to process or route the request to the peer entity. Verify NRF roaming configuration and peer reachability. If the issue persists, share application logs with My Oracle Support .
ONRF-SUB-SUBROAM-E0308	This error code indicates that loop is detected during roaming scenario for roaming scenarios.	NRF detected a forwarding loop. Review NRF roaming configuration and routing rules at subsequent NFs or nodes to ensure the message is not routed back to NRF. If the issue persists, share application logs with My Oracle Support .
ONRF-SUB-SUBROAM-E0309	This error code indicates that target PLMN not matches with NRF PLMN for roaming scenarios.	The target plmn attribute doesn't matches with the NRF PLMN in home NRF. Verify the routing and configuration on intermediate nodes (visited NRF, SCP, SEPP). Review problem details and logs to identify the reported error further. Contact My Oracle Support if required.

Table E-17 (Cont.) SUBROAM - NFStatusSubscribe Service Operation During Roaming

Error Code	Details	Action
ONRF-SUB-SUBROAM-E0399	This error code indicates that generic internal error occurred for roaming scenarios.	An internal error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-SUB-SUBROAM-E2008	This error code indicates that not able to determine that NFStatusSubscribe service operation message is intended for HomeNRF or Visited NRF.	Provide reqPlmnList attribute in NFSubscription data or set the nfStatusNotificationURI attribute as per Inter PLMN format. If issue persists, share application logs with My Oracle Support .
ONRF-SUB-SUBROAM-E2009	This error code indicates that nfStatusNotificationURI is not present in inter-plmn format for roaming scenarios.	nfStatusNotificationURI attribute in NFSubscription data is not in Inter PLMN format. Correct the attribute value with Inter PLMN format. If issue persists, share application logs with My Oracle Support .
ONRF-SUB-SUBROAM-E0205	This error code indicates that egress gateway is not reachable for roaming scenarios.	Verify reachability between NRF backend microservices and the Egress gateway microservice, confirm the gateway service is in-service, and review CNE logs to resolve the issue. If it persists, share application logs with My Oracle Support .
ONRF-SUB-SUBROAM-E0206	This error code indicates that some unexpected error occurred for roaming scenarios.	An internal error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.

E.2.4 NFStatusUnsubscribe Service Operation During Roaming

The following table lists the error codes and its problem details for the NF Subscription microservices for the NFStatusUnsubscribe service operation during roaming.

Table E-18 UNSROAM - NFStatusUnSubscribe Service Operation During Roaming

Error Code	Details	Action
ONRF-SUB-UNSROAM-E0301	This error code indicates that 5xx error response is received for roaming scenarios.	A 5xx error was received from the peer NRF. Review problem details and application logs of both NRFs to identify the reported error further. Contact My Oracle Support if required.

Table E-18 (Cont.) UNSROAM - NFStatusUnSubscribe Service Operation During Roaming

Error Code	Details	Action
ONRF-SUB-UNSROAM-E0302	This error code indicates that 4xx error response is received for roaming scenarios.	A 4xx error was received from the peer NRF. Review problem details and application logs of both NRFs to identify the reported error further. Contact My Oracle Support if required.
ONRF-SUB-UNSROAM-E0303	This error code indicates that 3xx error response is received for roaming scenarios.	A 3xx error was received from the peer NRF. Review problem details and application logs of both NRFs to identify the reported error further. Contact My Oracle Support if required.
ONRF-SUB-UNSROAM-E0304	This error code indicates that 5xx error response is received from egress gateway for roaming scenarios.	Egress Gateway failed to process or route the request to the peer entity. Verify NRF roaming configuration and peer reachability. If the issue persists, share application logs with My Oracle Support .
ONRF-SUB-UNSROAM-E0305	This error code indicates that 4xx error response is received from egress gateway for roaming scenarios.	Egress Gateway failed to process or route the request to the peer entity. Verify NRF roaming configuration and peer reachability. If the issue persists, share application logs with My Oracle Support .
ONRF-SUB-UNSROAM-E0306	This error code indicates that 3xx error response is received from egress gateway for roaming scenarios.	Egress Gateway failed to process or route the request to the peer entity. Verify NRF roaming configuration and peer reachability. If the issue persists, share application logs with My Oracle Support .
ONRF-SUB-UNSROAM-E0308	This error code indicates that loop is detected during roaming scenario for roaming scenarios.	NRF detected a forwarding loop. Review NRF roaming configuration and routing rules at subsequent NFs or nodes to ensure the message is not routed back to NRF. If the issue persists, share application logs with My Oracle Support .
ONRF-SUB-UNSROAM-E0399	This error code indicates that generic internal error occurred for roaming scenarios.	An internal error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-SUB-UNSROAM-E0205	This error code indicates that egress gateway is not reachable for roaming scenarios.	Verify reachability between NRF backend microservices and the Egress gateway microservice, confirm the gateway service is in-service, and review CNE logs to resolve the issue. If it persists, share application logs with My Oracle Support .

Table E-18 (Cont.) UNSROAM - NFStatusUnSubscribe Service Operation During Roaming

Error Code	Details	Action
ONRF-SUB-UNSROAM-E0206	This error code indicates that some unexpected error occurred for roaming scenarios.	An internal error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.

E.2.5 NFStatusNotify Service Operation

The following table lists the error codes and its problem details for the NF Subscription microservices for the NFStatusNotify service operation.

Table E-19 SNOTIF - NFStatus Notify Service Operation

Error Code	Details	Action
ONRF-SUB-SNOTIF-E0009	This error code indicates that mandatory attribute is missing while processing the NFStatusNotify service operation message trigger coming from NFRegistration microservice.	This error occurred when notification trigger is checked for any attribute is missing. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-SUB-SNOTIF-E0012	This error code indicates that subscription not found while processing the NFStatusNotify service operation message trigger coming from NFRegistration microservice.	Verify that the Subscriptions exists in NRF STATE data which can match Notification trigger. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-SUB-SNOTIF-E0100	This error code indicates that generic bad request received while processing the NFStatusNotify service operation message trigger coming from NFRegistration microservice.	Validate the message structure and formats of mandatory and optional attributes as per specifications. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-SUB-SNOTIF-E0803	This error code indicates that database resource failure exception occurred while processing the NFStatusNotify service operation message trigger coming from NFRegistration microservice.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-SUB-SNOTIF-E0999	This error code indicates that generic exception occurred while processing the NFStatusNotify service operation message trigger coming from NFRegistration microservice.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error further. Contact My Oracle Support if required.

Table E-19 (Cont.) SNOTIF - NFStatus Notify Service Operation

Error Code	Details	Action
ONRF-SUB-SNOTIF-E2007	This error code indicates that targetNFtype is null while processing the NFStatusNotify service operation message trigger coming from NFRegistration microservice.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error further. Contact My Oracle Support if required.

E.2.6 NFStatus UnSupported HTTP Method for Service Operation

The following table lists the error codes and its problem details for the NF Subscription microservices for the NFStatus UnSupported HTTP Method for service operation.

Table E-20 INVSROP - UnSupported HTTP Method for Service Operation

Error Code	Details	Action
ONRF-SUB-INVSROP-E0910	This error code indicates that an invalid service operation is received.	Verify that the HTTP operation is defined in the specifications. Review application logs to identify the reported error further. Contact My Oracle Support if required.

E.2.7 NFStatus UnSupported Media Type

The following table lists the error codes and its problem details for the NF Subscription microservices for the NFStatus UnSupported media type.

Table E-21 UNKSROP - UnSupported Media Type

Error Code	Details	Action
ONRF-SUB-UNKSROP-E0905	This error code indicates that an unknown service operation decoding error occurred.	Verify that the HTTP operation is defined in the specifications. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-SUB-UNKSROP-E0999	This error code indicates that generic error occurred for service operation.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error further. Contact My Oracle Support if required.

E.3 NF Discovery Microservice

The following table lists the error codes and its problem details for the NF Discovery microservices.

E.3.1 NFDDiscover Service Operation

The following table lists the error codes and its problem details for the NF Discovery microservices for the NFDDiscover service operation.

Table E-22 DISC - NFDDiscover Service Operation

Error Code	Details	Action
ONRF-DIS-DISC-E0003	This error code indicates that the discovery query contains an invalid query parameter.	Validate that search query parameters have been provided as per the specifications. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISC-E0004	This error code indicates that the discovery query contains an incorrect mandatory query parameter.	Validate that search query parameters have been provided as per the specifications. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISC-E0005	This error code indicates that the discovery query contains an incorrect optional query parameter.	Validate that search query parameters have been provided as per the specifications. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISC-E0006	This error code indicates that a mandatory query parameter is missing in the discovery query.	Validate that search query parameters have been provided as per the specifications. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISC-E0007	This error code indicates that a part of the query parameter value is incorrect.	Validate that search query parameters have been provided as per the specifications. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISC-E0010	The error code indicates that an unspecified message failure occurred during the processing of the discovery query.	Validate that search query parameters have been provided as per the specifications. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISC-E0021	This error code indicates that multiple attributes are incorrect in the discovery query.	Validate that search query parameters have been provided as per the specifications. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-22 (Cont.) DISC - NFDDiscover Service Operation

Error Code	Details	Action
ONRF-DIS-DISC-E0100	This error code indicates that message failure occurred which is generic in nature while processing the discovery query.	An internal error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISC-E0108	This error code indicates that NRF PLMN is not configured and there is need to match NRF PLMN to incoming PLMN in discovery query.	Configure nrfPlmnList with the PLMN IDs served by the NRF. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISC-E0902	This error code indicates that JSON processing exception occurred while processing the NFDDiscover service operation message.	Validate that the JSON payload is in the right format and compliant with the specified JSON schema. Fix any JSON errors. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISC-E0903	This error code indicates that an interrupted exception occurred while processing the NFDDiscover service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISC-E0999	This error code indicates that any generic error is occurred while processing the NFDDiscover service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISC-E3003	This error code indicates that requester NF is not allowed to discover the specific NF producers while processing the NFDDiscover service operation message.	Producer NFs have not authorized the consumer NF to access their NF profiles via the allowedXXX attributes. Review these attributes for the correctness as per specification. If they are not restrictive but access is still denied, collect and share logs with My Oracle Support .

E.3.2 NFDDiscover Service Operation During Authorization

The following table lists the error codes and its problem details for the NF Discovery microservices for the NFDDiscover service operation during authorization.

Table E-23 DISAUTH - NFDISCOVER Service Operation During Authorization

Error Code	Details	Action
ONRF-DIS-DISAUTH-E0104	This error code indicates that NF FQDN authentication failure occurred while processing the NFDISCOVER service operation message.	XFCC-based FQDN authentication is enabled on the NRF. Verify whether this is intended in this deployment. If not, disable the feature. If yes, correct the XFCC header value in the request to resolve the FQDN authentication error. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISAUTH-E0899	This error code indicates that general error occurred for authentication while processing the NFDISCOVER service operation message.	XFCC-based FQDN authentication is enabled on the NRF. Verify whether this is intended in this deployment. If not, disable the feature. If yes, correct the XFCC header value in the request to resolve the FQDN authentication error. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.3.3 NFDISCOVER Service Operation During Forwarding

The following table lists the error codes and its problem details for the NF Discovery microservices for the NFDISCOVER service operation during forwarding.

Table E-24 DISCFWD - NFDISCOVER Service Operation During Forwarding

Error Code	Details	Action
ONRF-DIS-DISCFWD-E0002	This error code indicates that message format is invalid while forwarding the NFDISCOVER service operation message to another NRF.	Validate that search query parameters have been provided as per the specifications. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISCFWD-E0005	This error code indicates that an optional query parameter is incorrect while forwarding the NFDISCOVER service operation message to another NRF.	Validate that search query parameters have been provided as per the specifications. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISCFWD-E0103	This error code indicates that egress gateway error occurred while forwarding the NFDISCOVER service operation message to another NRF.	Review Egress gateway configuration and logs to identify and fix any misconfiguration. If the configuration is correct and the issue persists, share application logs with My Oracle Support .

Table E-24 (Cont.) DISCFWD - NFDDiscover Service Operation During Forwarding

Error Code	Details	Action
ONRF-DIS-DISCFWD-E0201	This error code indicates that NRF forwarding configuration is missing while forwarding the NFDDiscover service operation message to another NRF.	Check and configure the NRF forwarding configurations as per NRF documentation. In case, NRF forwarding configuration exists already and properly configured, share application logs with My Oracle Support .
ONRF-DIS-DISCFWD-E0202	This error code indicates that NRF is not reachable while forwarding the NFDDiscover service operation message to another NRF.	Verify and restore reachability to the peer NRF. If reachability is confirmed and the issue persists, share application logs with My Oracle Support .
ONRF-DIS-DISCFWD-E0203	This error code indicates that NRF forwarding loop is detected while forwarding the NFDDiscover service operation message to another NRF.	NRF detected a loop during the message processing. Review NRF forwarding configuration and routing rules at subsequent NFs or nodes to ensure the message is not routed back to NRF. If the issue persists, share application logs with My Oracle Support .
ONRF-DIS-DISCFWD-E0204	This error code indicates that parsing of problem details failed for the response received back from another NRF for forwarding scenarios.	Problem details returned from peer NRF is incorrect. Check logs for NRF and peer NRF and validate that the message structure and attribute formats are as per the specification. If the issue persists, share application logs with My Oracle Support .
ONRF-DIS-DISCFWD-E0205	This error code indicates that egress gateway is not reachable while trying to forward the NFDDiscover Service Operation message to another NRF.	Verify reachability between NRF backend microservices and the Egress gateway microservice. Check if the Egress gateway is in-service, and review CNE and application logs to resolve the issue. If the issue persists, share logs with My Oracle Support .
ONRF-DIS-DISCFWD-E0206	This error code indicates that some unexpected error occurred while forwarding the NFDDiscover Service Operation message.	Review NRF forwarding configuration as per NRF documentation. Verify the reachability between backend microservices and the egress gateway microservice. Check if the egress gateway is in-service, and review CNE and application logs to resolve the issue. If the issue persists, share logs with My Oracle Support .
ONRF-DIS-DISCFWD-E0299	This error code indicates that NRF forwarding internal error is occurred while forwarding the NFDDiscover service operation message to another NRF.	An internal error occurred at the NRF while processing and forwarding the request to peer NRF. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-24 (Cont.) DISCFWD - NFDDiscover Service Operation During Forwarding

Error Code	Details	Action
ONRF-DIS-DISCFWD-E0902	This error code indicates that JSON processing exception occurred while forwarding the NFDDiscover service operation message to another NRF.	Validate that the JSON payload is in the right format and compliant with the specified JSON schema. Fix any JSON errors. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.3.4 SLF for NFDDiscover

The following table lists the error codes and its problem details for the NF Discovery microservices for SLF for NFDDiscover.

Table E-25 DISCSLF - SLF for NFDDiscover

Error Code	Details	Action
ONRF-DIS-DISCSLF-E0103	This error code indicates that egress gateway error occurred for SLF query.	Review egress gateway configuration and logs to identify and fix any misconfiguration. If the configuration is correct and the issue persists, share application logs with My Oracle Support.
ONRF-DIS-DISCSLF-E0401	This error code indicates that mandatory attributes are missing for SLF query.	Validate that search query parameters have been provided as per the specifications need for SLF lookup as mentioned in NRF documentation. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-DIS-DISCSLF-E0402	This error code indicates that SLF configuration is missing for SLF query.	Verify the SLF configuration is done as per NRF documentation. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-DIS-DISCSLF-E0403	This error code indicates that SLF/UDR is not reachable for SLF query.	Verify and restore reachability to the peer SLF or UDR. If reachability is confirmed and the issue persists, share application logs with My Oracle Support.
ONRF-DIS-DISCSLF-E0404	This error code indicates that subscriber is not configured at UDR for specific subscriber details in SLF query.	UDR or SLF is not provisioned for the given Subscriber ID or NF Type. Verify provisioning and Group ID mapping. If the issue persists, check whether the Group ID is returned in the SLF response and review UDR or SLF logs. If UDR or SLF is returning the correct Group ID, share NRF application logs with My Oracle Support.

Table E-25 (Cont.) DISCSLF - SLF for NFDDiscover

Error Code	Details	Action
ONRF-DIS-DISCSLF-E0406	This error code indicates that 4xx error response is received for SLF query.	A 4xx error was received from the peer SLF or UDR. Review problem details and application logs of NRF and SLF to identify the reported error further. Contact My Oracle Support if required.
ONRF-DIS-DISCSLF-E0407	This error code indicates that 5xx error response is received for SLF query.	A 5xx error was received from the peer SLF or UDR. Review problem details and application logs of NRF and SLF to identify the reported error further. Contact My Oracle Support if required.
ONRF-DIS-DISCSLF-E0408	This error code indicates that SLF OAuth token error occurred for SLF query.	Error occurred when NRF was taking token for accessing SLF. Verify OAuth token parameters in the SLF request. Validate the NRF deployment and connectivity is as expected. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-DIS-DISCSLF-E0499	This error code indicates that any internal error occurred for SLF query.	An internal error occurred at the NRF for SLF query. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-DIS-DISCSLF-E3004	This error code indicates that SLF discovered candidate list is empty for DISCOVERED_SLF_CONFIG_MODE.	Verify SLF configuration at NRF. If SLF selection is set to Discoverable (NFDDiscover API), ensure SLF or UDR instances are registered with NRF. If registered instances exist and the issue persists, share application logs with My Oracle Support . If this configuration is not expected, switch SLF selection to Static and configure static SLF or UDR profiles in NRF.
ONRF-DIS-DISCSLF-E0205	This error code indicates that egress gateway is not reachable for SLF query.	Verify reachability between NRF backend microservices and the Egress gateway microservice, confirm the gateway service is in-service, and review CNE logs to resolve the issue. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-DIS-DISCSLF-E0206	This error code indicates that some unexpected error occurred for SLF query.	Unexpected Internal error occurred. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.

E.3.5 NFDDiscover Service Operation During Roaming

The following table lists the error codes and its problem details for the NF Discovery microservices for the NFDDiscover service operation during roaming.

Table E-26 DISROAM - NFDDiscover Service Operation During Roaming

Error Code	Details	Action
ONRF-DIS-DISROAM-E0002	This error code indicates that the message format is invalid for roaming scenarios.	Validate that search query parameters have been provided as per the specifications. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISROAM-E0005	This error code indicates that an optional query parameter is incorrect for roaming scenarios.	Validate that search query parameters have been provided as per the specifications. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISROAM-E0101	This error code indicates that a mandatory attribute missing for roaming scenarios.	Validate that search query parameters have been provided as per the specifications. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISROAM-E0103	This error code indicates that egress gateway error occurred for roaming scenarios.	Review Egress gateway configuration and logs to identify and fix any misconfiguration. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISROAM-E0205	This error code indicates that egress gateway is not reachable for roaming scenarios.	Verify reachability between NRF backend microservices and the Egress gateway microservice, confirm the gateway service is in-service, and review CNE logs to resolve the issue. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISROAM-E0206	This error code indicates that some unexpected error occurred for roaming scenarios.	An internal error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISROAM-E0301	This error code indicates that 5xx error response is received for roaming scenarios.	A 5xx error was received from the peer NRF. Review problem details and application logs of both NRFs to identify the reported error further. Contact My Oracle Support if required.

Table E-26 (Cont.) DISROAM - NFDISCOVER Service Operation During Roaming

Error Code	Details	Action
ONRF-DIS-DISROAM-E0302	This error code indicates that 4xx error response is received for roaming scenarios.	A 4xx error was received from the peer NRF. Review problem details and application logs of both NRFs to identify the reported error further. Contact My Oracle Support if required.
ONRF-DIS-DISROAM-E0303	This error code indicates that 3xx error response is received for roaming scenarios.	A 3xx error was received from the peer NRF. Review problem details and application logs of both NRFs to identify the reported error further. Contact My Oracle Support if required.
ONRF-DIS-DISROAM-E0304	This error code indicates that 5xx error response is received from egress gateway for roaming scenarios.	Egress Gateway failed to process or route the request to the peer entity. Verify NRF roaming configuration and peer reachability. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISROAM-E0305	This error code indicates that 4xx error response is received from egress gateway for roaming scenarios.	Egress Gateway failed to process or route the request to the peer entity. Verify NRF roaming configuration and peer reachability. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISROAM-E0306	This error code indicates that 3xx error response is received from egress gateway for roaming scenarios.	Egress Gateway failed to process or route the request to the peer entity. Verify NRF roaming configuration and peer reachability. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-DIS-DISROAM-E0308	This error code indicates that loop is detected for roaming scenarios.	NRF detected a loop during the message processing. Review Roaming, Egress gateway configuration, and routing rules at subsequent NFs or nodes to ensure the message is not routed back to NRF. If the issue persists, share application logs with My Oracle Support .
ONRF-DIS-DISROAM-E0309	This error code indicates that target not matches the NRF PLMN for roaming scenarios.	target plmn attribute doesn't matches with NRF PLMN in home NRF. Verify routing and configuration on intermediate nodes (visited NRF, SCP, SEPP). Review problem details and logs to identify the reported error further. Contact My Oracle Support if required.

Table E-26 (Cont.) DISROAM - NFDDiscover Service Operation During Roaming

Error Code	Details	Action
ONRF-DIS-DISROAM-E0399	This error code indicates that internal error occurred for roaming scenarios.	An internal error occurred at the NRF while processing the request. Review problem details and logs to identify the reported error further. Contact My Oracle Support if required.

E.3.6 Unsupported HTTP Method for NFDDiscover Service Operation

The following table lists the error codes and its problem details for the unsupported HTTP method for NFDDiscover service operation.

Table E-27 INVSROP - UnSupported HTTP Method for Service Operation

Error Code	Details	Action
ONRF-DIS-INVSROP-E0910	This error code indicates that an invalid service operation is received.	Verify that the HTTP operation is defined in the specifications. If not, correct it accordingly. If it is valid, collect and share logs with My Oracle Support .

E.3.7 Unsupported Media Type for NFDDiscover Service Operation

The following table lists the error codes and its problem details for the unsupported media type for NFDDiscover service operation.

Table E-28 UNKSROP - UnSupported Media Type

Error Code	Details	Action
ONRF-DIS-UNKSROP-E0999	This error code indicates that generic error occurred for the NFDDiscover service operation.	An internal error occurred at the NRF while processing the request. Review problem details and logs to identify the reported error further. Contact My Oracle Support if required.

E.4 NF Access Token Microservice

The following table lists the error codes and its problem details for the NF Access Token microservices.

E.4.1 NF Access Token Microservice

The following table lists the error codes and its problem details for the NF Access Token microservices for the NFAccessToken service operation category.

Table E-29 ACTOK - Access Token Service Operation

Error Code	Details	Action
ONRF-ACC-ACTOK-E0002	This error code indicates that an invalid message format is received for Access Token service operation message.	Validate the message body and attributes are as per the specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-ACC-ACTOK-E0105	This error code indicates that requester NF is unauthorized for Access Token service operation message.	NF Instance registered its NF Profile at NRF with restrictive allowedXXX attributes that do not authorize the requester NF. Update the allowedXXX attributes to permit the requester NF with its service request. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACTOK-E0106	This error code indicates that invalid key details are configured during Access Token service operation message.	NRF is configured with an invalid private key or public key certificate pair for OAuth token generation. Verify and correct the private key or public key certificate pair mapped to currentKeyID in OAuthKeyDetails. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACTOK-E0107	This error code indicates that current key id is not configured during Access Token service operation message.	NRF requires currentKeyID to reference a valid private key–public key certificate pair for OAuth token generation. Verify and correct the currentKeyID configuration as per NRF documentation. If the issue persists despite a valid key pair, share application logs with My Oracle Support .
ONRF-ACC-ACTOK-E0802	This error code indicates that pessimistic locking exception occurred during Access Token service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACTOK-E0803	This error code indicates that data access resource failure exception occurred during Access Token service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACTOK-E0899	This error code indicates that generic DB exception occurred during Access Token service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.

Table E-29 (Cont.) ACTOK - Access Token Service Operation

Error Code	Details	Action
ONRF-ACC-ACTOK-E0902	This error code indicates that JSON processing exception occurred during Access Token service operation message.	Validate that the JSON payload is in the right format and compliant with the specified JSON schema. Fix any JSON errors. Review logs to identify the NRF-reported error further. If the issue persists, share application logs with My Oracle Support .
ONRF-ACC-ACTOK-E0903	This error code indicates that an interrupted exception occurred during Access Token service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACTOK-E0999	This error code indicates that general exception occurred during Access Token service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACTOK-E4001	This error code indicates that unable to deduce the targetNfType during Access Token service operation message.	Access Token requested for NFType based but valid targetNfType value need to be present in the request payload. Correct the request payload. If the issue persists, share application logs with My Oracle Support .
ONRF-ACC-ACTOK-E4002	This error code indicates that OAuthTokenIssuerId in TokenSigningDetails is not configured during Access Token service operation message.	oAuthTokenIssuerId is not configured in tokenSigningDetails for AccessToken Configuration. Configure the oAuthTokenIssuerId value. If the issue persists, share application logs with My Oracle Support .
ONRF-ACC-ACTOK-E4004	This error code indicates that attribute values are different from the registered NFProfile during Access Token service operation message.	Authorization of registered requester NF is enabled. But attributes like NFType, requesterPLMN is different with respect to the incoming request and registered NF Profile. If the issue persists, share application logs with My Oracle Support .
ONRF-ACC-ACTOK-E4011	This error code indicates that attributes shall only be present for targetNfType during Access Token service operation message.	AccessToken not requested for NFType but attributes like targetNfSetId, targetNsiList, targetSnsaiList are present in the request. If the issue persists, share application logs with My Oracle Support .
ONRF-ACC-ACTOK-E4015	This error code indicates that oAuth2 client is not registered with OCNRF during Access Token service operation message.	Authorization of registered requester NF is enabled. But requester nfInstanceId is registered with NRF. If the issue persists, share application logs with My Oracle Support .

Table E-29 (Cont.) ACTOK - Access Token Service Operation

Error Code	Details	Action
ONRF-ACC-ACTOK-E4101	This error code indicates that an invalid grant is received during Access Token service operation message.	The grant_type attribute in Access Token Request is not as per 3GPP specification. If the issue persists, share application logs with My Oracle Support .
ONRF-ACC-ACTOK-E4102	This error code indicates that an invalid scope is received during Access Token service operation message.	The scope attribute in Access Token Request is not as per 3GPP specification. If the issue persists, share application logs with My Oracle Support .
ONRF-ACC-ACTOK-E4103	This error code indicates that invalid request is received during Access Token service operation message.	Access Token Request body is not as per 3GPP specification. If the issue persists, share application logs with My Oracle Support .

E.4.2 Access Token Service Operation During Forwarding

The following table lists the error codes and its problem details for the NF Access Token microservices for the Access Token service operation during forwarding.

Table E-30 ACFWD - Access Token Service Operation During Forwarding

Error Code	Details	Action
ONRF-ACC-ACFWD-E0002	This error code indicates that an invalid message format received while forwarding the Access Token service operation message.	Validate the message body and attributes are as per the specification. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACFWD-E0103	This error code indicates that egress gateway error occurred while forwarding the Access Token service operation message.	Review Egress gateway configuration and logs to identify and fix any misconfiguration. If the configuration is correct and the issue persists, share application logs with My Oracle Support .
ONRF-ACC-ACFWD-E0201	This error code indicates that NRF forwarding configuration missing while forwarding the Access Token service operation message.	Check and configure the NRF forwarding configurations as per NRF documentation. In case, NRF forwarding configuration exists already and properly configured, share application logs with My Oracle Support .
ONRF-ACC-ACFWD-E0202	This error code indicates that NRF is not reachable error occurred while forwarding the Access Token service operation message.	Verify and restore reachability to the peer NRF. If reachability is confirmed and the issue persists, share application logs with My Oracle Support .

Table E-30 (Cont.) ACFWD - Access Token Service Operation During Forwarding

Error Code	Details	Action
ONRF-ACC-ACFWD-E0203	This error code indicates that NRF loop is detected while forwarding the Access Token service operation message.	NRF detected a loop during the message processing. Review NRF forwarding configuration and routing rules at subsequent NFs or nodes to ensure the message is not routed back to NRF. If the issue persists, share application logs with My Oracle Support .
ONRF-ACC-ACFWD-E0204	This error code indicates that parsing of problem details is failed which is received in the response from another NRF while forwarding the Access Token service operation message.	Problem details parsing received from peer is failed. Review problem details received from peer and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACFWD-E0299	This error code indicates that forwarding internal error occurred while forwarding the Access Token service operation message.	An internal error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACFWD-E4016	This error code indicates that NRF failed to forward the Access Token service operation message.	Check NRF configuration for Forwarding is correct. NRF hosts are reachable. If the issue persists, share application logs and configuration with My Oracle Support .

E.4.3 Access Token Service Operation During Roaming

The following table lists the error codes and its problem details for the NF Access Token microservices for the Access Token service operation during roaming.

Table E-31 ACROAM - Access Token Service Operation During Roaming

Error Codes	Details	Action
ONRF-ACC-ACROAM-E0002	This error code indicates that invalid message format received during roaming scenario of Access Token service operation message.	Validate the message structure and attribute formats per specification. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACROAM-E0108	This error code indicates that NRF plmn is not configured during roaming scenario of Access Token service operation message.	Validate and configure the NRF with the PLMN IDs it serves to ensure access-token requests with plmnId (that is, PLMN ID of target network) are correctly classified as local or roaming and processed accordingly. Review application logs to identify the reported error further. Contact My Oracle Support if required.

Table E-31 (Cont.) ACROAM - Access Token Service Operation During Roaming

Error Codes	Details	Action
ONRF-ACC-ACROAM-E0301	This error code indicates that NRF peer 5xx response received during roaming scenario of Access Token service operation message.	A 5xx error was received from the peer roaming entity. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACROAM-E0302	This error code indicates that NRF peer 4xx response received during roaming scenario of Access Token service operation message.	A 4xx error was received from the peer roaming entity. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACROAM-E0303	This error code indicates that NRF peer 3xx response received during roaming scenario of Access Token service operation message.	A 3xx error was received from the peer roaming entity. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACROAM-E0304	This error code indicates that Egress gateway 5xx response received during roaming scenario of Access Token service operation message.	Egress Gateway failed to process or route the request to the peer entity. Verify NRF roaming configuration and peer reachability. If the issue persists, share application logs with My Oracle Support .
ONRF-ACC-ACROAM-E0305	This error code indicates that Egress gateway 4xx response received during roaming scenario of Access Token service operation message.	Egress Gateway failed to process or route the request to the peer entity. Verify NRF roaming configuration and peer reachability. If the issue persists, share application logs with My Oracle Support .
ONRF-ACC-ACROAM-E0306	This error code indicates that Egress gateway 3xx response received during roaming scenario of Access Token service operation message.	Egress Gateway failed to process or route the request to the peer entity. Verify NRF roaming configuration and peer reachability. If the issue persists, share application logs with My Oracle Support .
ONRF-ACC-ACROAM-E0308	This error code indicates that loop is detected during roaming scenario of Access Token service operation message.	NRF detected a loop. Review NRF roaming configuration and routing rules at subsequent NFs or nodes to ensure the message is not routed back to NRF. If the issue persists, share application logs with My Oracle Support .
ONRF-ACC-ACROAM-E0309	This error code indicates that target PLMN not matches NRF PLMN during roaming scenario of Access Token service operation message.	target plmn attribute does not matches with NRF PLMN in home NRF. Verify routing and configuration on intermediate nodes (visited NRF, SCP, SEPP). Review problem details and logs to identify the reported error further. Contact My Oracle Support if required.

Table E-31 (Cont.) ACROAM - Access Token Service Operation During Roaming

Error Codes	Details	Action
ONRF-ACC-ACROAM-E0399	This error code indicates that internal error occurred for roaming scenarios of Access Token service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACROAM-E0807	This error code indicates that database read error occurred during roaming scenario of Access Token service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACROAM-E0902	This error code indicates that JSON processing error occurred during roaming scenario of Access Token service operation message.	Validate that the JSON payload is in the right format and compliant with the specified JSON schema. Fix any JSON errors. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACROAM-E4004	This error code indicates that attribute values are different from the registered NF profile during roaming scenario of Access Token service operation message.	Authorization of registered requester NF is enabled. But attributes like NFType, requesterPLMN is different with respect to the incoming request and registered NF Profile. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACROAM-E4015	This error code indicates that OAuth2 client is not registered with OCNRF during roaming scenario of Access Token service operation message.	Authorization of registered requester NF is enabled. But requester nfinstanceId is registered with NRF. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACROAM-E4017	This error code indicates that NRF failed to send the roaming scenario of Access Token service operation message.	Verify NRF roaming configuration for the target PLMN ID, including the prioritized SEPP list, and ensure SEPP reachability. If all checks pass and the issue persists, share application logs with My Oracle Support .

E.4.4 Authentication During Access Token Service Operation

The following table lists the error codes and its problem details for the NF Access Token microservices for the Authentication during Access Token service operation.

Table E-32 ACAUTHN - Authentication During Access Token Service Operation

Error Codes	Details	Action
ONRF-ACC-ACAUTHN-E0018	This error code indicates that some system failure occurred during authentication scenario of Access Token service operation message.	Generic failure occurred during authentication scenario of Access Token service operation message. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACAUTHN-E0104	This error code indicates that NF FQDN authentication failure occurred during authentication scenario of Access Token service operation message.	XFCC-based FQDN authentication is enabled on the NRF. Verify whether this is intended in this deployment. If not, disable the feature. If yes, correct the XFCC header value in the request to resolve the FQDN authentication error. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACAUTHN-E0110	This error code indicates that OC-XFCC-DNS header is missing during authentication scenario of Access Token service operation message.	XFCC-based FQDN authentication is enabled on the NRF. Verify whether this is intended in this deployment. If not, disable the feature. If yes, make sure XFCC header value is included in the request to resolve the FQDN authentication error. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACAUTHN-E4003	This error code indicates that requester NF is not authorized to access targetNF services during authentication scenario of Access Token service operation message.	NF Instance registered its NF Profile at NRF with restrictive allowedXXX attributes that do not authorize the requester NF. Update the allowedXXX attributes to permit the requester NF with its service request. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACAUTHN-E4004	This error code indicates that attribute values are different from the registered NF profile during authentication scenario of Access Token service operation message.	Attributes like NFType, targetPlmn is different with respect to the incoming request and registered target NF Profile. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACAUTHN-E4006	This error code indicates that targetNFInstanceid does not match the configured NRF instance id during authentication scenario of Access Token service operation message.	When AccessToken is requested for NRF and targetNFInstanceid does not match the configured NRF instance id. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.

Table E-32 (Cont.) ACAUTHN - Authentication During Access Token Service Operation

Error Codes	Details	Action
ONRF-ACC-ACAUTHN-E4007	This error code indicates that target NF Type is not NRF during authentication scenario of Access Token service operation message.	When AccessToken is requested for NRF and targetNFType does not match with NRF as NF type. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACAUTHN-E4008	This error code indicates that no NFs found for the specific information during authentication scenario of Access Token service operation message.	No NF Profiles found based upon attributes of Access Token Request like targetPlmn, targetNsiList, targetSnassaiList. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACAUTHN-E4009	This error code indicates that no NFs found for the requested scope during authentication scenario of Access Token service operation message.	No NF Profiles found based upon scope attribute of Access Token Request. Correct the value of scope attribute in the Access Token Request. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACAUTHN-E4010	This error code indicates that NFs with specific attribute values are not allowed to access the requested NFProfile during authentication scenario of Access Token service operation message.	No NF Profiles found which are allowed to be accessed using attributes of Access Token Request like requesterPlmn/requesterPlmnList, nfType, requesterSnassaiList. Correct the values of the requester attributes in the Access Token Request. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACAUTHN-E4012	This error code indicates that NF services in scope doesn't belong to scope of same NF type during authentication scenario of Access Token service operation message.	NF services doesn't belong to same NF type in scope attribute of Access Token Request. Correct the Access Token Request scope attribute. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACAUTHN-E4013	This error code indicates that Either targetNfType or targetNfInstanceId needs to be present if token is requested for only custom service(s) during authentication scenario of Access Token service operation message.	Add targetNfType or targetNfInstanceId if token is requested for custom NFServices in scope attribute of Access Token Request. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.

Table E-32 (Cont.) ACAUTHN - Authentication During Access Token Service Operation

Error Codes	Details	Action
ONRF-ACC-ACAUTHN-E4014	This error code indicates that no NfInstance is found with the requested targetNfInstanceId during authentication scenario of Access Token service operation message.	Configure Rules in forwardingRulesConfig configuration to enable forwarding in case NFInstances are not registered for targetNfInstanceId. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACAUTHN-E4015	This error code indicates that oAuth2 client is not registered with OCNRF during authentication scenario of Access Token service operation message.	authFeatureConfig feature is enabled and NF Consumer NF instance is not Registered with NRF. Register the consumer NF instance with NRF. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.

E.4.5 Authorization During Access Token Service Operation

The following table lists the error codes and its problem details for the NF Access Token microservices for the Authorization during Access Token service operation.

Table E-33 ACAUTHZ - Authorization During Access Token Service Operation

Error Codes	Details	Action
ONRF-ACC-ACAUTHZ-E0899	This error code indicates that general database exception occurred during authorization scenario of Access Token service operation message.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACAUTHZ-E0902	This error code indicates that JSON processing exception occurred during authorization scenario of Access Token service operation message.	Validate that the JSON payload is in the right format and compliant with the specified JSON schema. Fix any JSON errors. Review problem details and application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-ACC-ACAUTHZ-E4015	This error code indicates that oAuth2 client is not registered with OCNRF during authorization scenario of Access Token service operation message.	NRF has Authorize Requester NF enabled, which validates requester NF registration. If this feature is required, ensure the requester NF is registered; if the issue persists, share logs with My Oracle Support . If not required, disable the feature. If the issue persists, share logs with My Oracle Support .

E.5 NRF Cache Data Microservice

This section lists the error codes and its problem details for the NRF Cache Data microservice.

E.5.1 GET Subscription

The following table lists the error codes and its problem details for the NRF Cache Data microservice for the GET Subscription service operation.

Table E-34 GTSUB - Get Subscription

Error Code	Details	Action
ONRF-CDS-GTSUB-E5001	This error code indicates that cache fallback failed for getting subscriptions.	Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-CDS-GTSUB-E0999	This error code indicates that any other exception occurred while getting subscriptions from cache data.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error further. Contact My Oracle Support if required.

E.5.2 GET Remote Discovery Instance and Remote Instance Data

This section lists the error codes and its problem details for the NRF Cache Data microservice for GET remote discovery instance and remote instance data.

Table E-35 NFINSTS - GET Remote Discovery Instance and Remote Instance Data

Error Code	Details	Action
ONRF-CDS-NFINSTS-E5001	This error code indicates that cache fallback failed for remote instance discovery.	Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-CDS-NFINSTS-E0999	This error code indicates that any other exception occurred while remote instance discovery.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error further. Contact My Oracle Support if required.

E.5.3 NFListRetrieval Service Operation

This section lists the error codes and its problem details for the NRF Cache Data microservice for NFListRetrieval service operation.

Table E-36 NFLR - NFListRetrieval Service Operation

Error Code	Details
ONRF-CDS-NFLR-E5001	This error code indicates that cache fallback failed for NF list retrieval.

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Table E-36 (Cont.) NFLR - NFListRetrieval Service Operation

Error Code	Details

E.5.4 NFProfileRetrieval Service Operation

This section lists the error codes and its problem details for the NRF Cache Data microservice for NFProfileRetrieval service operation.

Table E-37 NFPR - NFProfileRetrieval Service Operation

Error Code	Details	Action
ONRF-CDS-NFLR-E5001	This error code indicates that cache fallback failed for NF list retrieval.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error further. Contact My Oracle Support if required.

E.6 NRF Auditor Microservice

This section lists the error codes and its problem details for the NRF Auditor microservice.

E.6.1 Heart Beat for NRF Auditor Service Operation

The following table lists the error codes and its problem details for the Heart Beat for NRF Auditor service operation.

Table E-38 HBAUD - Heart Beat for NRF Auditor Service Operation

Error Codes	Details	Action
ONRF-AUD-HBAUD-E0899	This error code indicates that general database exception occurred while auditing heartbeat.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-AUD-HBAUD-E0901	This error code indicates that an IO exception occurred while auditing heartbeat.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-AUD-HBAUD-E0902	This error code indicates that JSON processing exception occurred while auditing heartbeat.	Validate that the JSON payload is in the right format and compliant with the specified JSON schema. Fix any JSON errors. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-AUD-HBAUD-E0999	This error code indicates that any other exception occurred auditing heartbeat.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error. Contact My Oracle Support if required.

E.6.2 Remote Heart Beat for NRF Auditor

The following table lists the error codes and its problem details for the Remote Heart Beat for NRF Auditor service operation.

Table E-39 HBRMAUD - Remote Heart Beat for NRF Auditor

Error	Details	Action
ONRF-AUD-HBRMAUD-E0899	This error code indicates that general database exception occurred while remote auditing heartbeat.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-AUD-HBRMAUD-E0901	This error code indicates that an IO exception occurred while remote auditing heartbeat.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-AUD-HBRMAUD-E0902	This error code indicates that JSON processing exception occurred while remote auditing heartbeat.	Validate that the JSON payload is in the right format and compliant with the specified JSON schema. Fix any JSON errors. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-AUD-HBRMAUD-E0999	This error code indicates that any other exception occurred while remote auditing heartbeat.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error. Contact My Oracle Support if required.

E.6.3 NRF Auditor Service Operation for NF Profiles

The following table lists the error codes and its problem details for the NRF Auditor microservice for the NRF Auditor service operation for NF Profiles.

Table E-40 NFPRAUD - NRF Auditor Service Operation for NF Profiles

Error Codes	Details	Action
ONRF-AUD-NFPRAUD-E0899	This error code indicates that general database exception occurred while auditing NF profile.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-AUD-NFPRAUD-E0901	This error code indicates that IO exception occurred while auditing NF profile.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-AUD-NFPRAUD-E0902	This error code indicates that JSON processing exception occurred while auditing NF profile.	Validate that the JSON payload is in the right format and compliant with the specified JSON schema. Fix any JSON errors. Review application logs to identify the reported error. Contact My Oracle Support if required.

E.6.4 Fetching NRF Configuration

The following table lists the error codes and its problem details for the NRF Auditor microservice for Fetching NRF Configuration.

Table E-41 NRFCFG - Fetching NRF Configuration

Error Codes	Details	Action
ONRF-AUD-NRFCFG-E0802	This error code indicates that pessimistic locking exception occurred while fetching NRF configurations.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-AUD-NRFCFG-E0803	This error code indicates that data access resource failure exception occurred while fetching NRF configurations.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-AUD-NRFCFG-E0899	This error code indicates that general database exception occurred while fetching NRF configurations.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error. Contact My Oracle Support if required.

E.6.5 NRF Auditor Service Operation for Reloading Site and Network Version Info

The following table lists the error codes and its problem details for the NRF Auditor microservice for NRF Auditor service operation for reloading site and network version information.

Table E-42 RELDVER - NRF Auditor Service Operation for Reloading Site and Network Version Info

Error Codes	Details	Action
ONRF-AUD-RELDVER-E0901	This error code indicates that an IO exception occurred while reloading site and network version info.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error. Contact My Oracle Support if required.

E.6.6 NRF Auditor Service Operation for Remote Subscription

The following table lists the error codes and its problem details for the NRF Auditor microservice for NRF Auditor service operation for remote subscription.

Table E-43 SUBAUD - NRF Auditor Service Operation for Remote Subscription

Error Codes	Details	Action
ONRF-AUD-SUBAUD-E0899	This error code indicates that general database exception occurred while remote auditing subscription.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error. Contact My Oracle Support if required.

E.6.7 NRF Auditor Service Operation for Subscription

The following table lists the error codes and its problem details for the NRF Auditor microservice for NRF Auditor service operation for subscription.

Table E-44 SUBAUD - NRF Auditor Service Operation for Subscription

Error Codes	Details	Action
ONRF-AUD-SUBAUD-E0899	This error code indicates that general database exception occurred while auditing subscriptions.	An internal application error occurred at the NRF while processing the request. Review application logs to identify the reported error. Contact My Oracle Support if required.

E.7 NRF Artisan Microservice

This section lists the error codes and its problem details for the NRF Artisan microservice.

E.7.1 NRF Artisan for NAPTR Registration

The following table lists the error codes and its problem details for the NRF Artisan microservice for NRF Artisan for NAPTR registration.

Table E-45 NPTRREG - NRF Artisan for NAPTR Registration

Error Codes	Details	Action
ONRF-ART-NPTRREG-E0001	This error code indicates that an invalid API was used when sending NAPTR registration.	An error occurred at the NRF while processing the request when DNS NAPTR feature is enabled as per NRF documentation. This is an internal microservice communication. Review application logs to identify the reported error. Contact My Oracle Support if required.

Table E-45 (Cont.) NPTRREG - NRF Artisan for NAPTR Registration

Error Codes	Details	Action
ONRF-ART-NPTRREG-E0009	This error code indicates that a mandatory attribute is missing when sending NAPTR registration.	An error occurred at the NRF while processing the request when DNS NAPTR feature is enabled as per NRF documentation. This is an internal microservice communication. Review application logs to identify the reported error. Contact My Oracle Support if required.

E.7.2 Status API for DNS NAPTR Record

The following table lists the error codes and its problem details for the NRF Artisan microservice for Status API for DNS NAPTR Record.

Table E-46 NPTRREC - Status API for DNS NAPTR Record

Error Details	Details	Action
ONRF-ART-NPTRREC-E0001	This error code indicates that an invalid API was used when returning AMF DNS NAPTR records from cache.	An error occurred at the NRF while processing the request when DNS NAPTR feature is enabled as per NRF documentation. This is an internal microservice communication. Review application logs to identify the reported error. Contact My Oracle Support if required.

E.7.3 NRF Artisan for Notification Event to DNS NAPTR on Deleting AMF Profile

The following table lists the error codes and its problem details for the NRF Artisan microservice for Notification Event to DNS NAPTR on deleting AMF Profile.

Table E-47 NPTRDRG - NRF Artisan for Notification Event to DNS NAPTR on Deleting AMF Profile

Error Codes	Details	Action
ONRF-ART-NPTRDRG-E0001	This error code indicates that an invalid API was used when notification event to DNS NAPTR on delete AMF profile.	An error occurred at the NRF while processing the request when DNS NAPTR feature is enabled as per NRF documentation. This is an internal microservice communication. Review application logs to identify the reported error. Contact My Oracle Support if required.

Table E-47 (Cont.) NPTRDRG - NRF Artisan for Notification Event to DNS NAPTR on Deleting AMF Profile

Error Codes	Details	Action
ONRF-ART-NPTRDRG-E0009	This error code indicates that a mandatory attribute is missing when notification event to DNS NAPTR on delete AMF profile.	An error occurred at the NRF while processing the request when DNS NAPTR feature is enabled as per NRF documentation. This is an internal microservice communication. Review application logs to identify the reported error. Contact My Oracle Support if required.

E.7.4 NRF Artisan for DNS NAPTR Update

This section lists the error codes and its problem details for the NRF Artisan microservice for NRF Artisan for DNS NAPTR update.

Table E-48 NPTRUPD - NRF Artisan for DNS NAPTR Update

Error Code	Details	Action
ONRF-ART-NPTRUPD-E0001	This error code indicates that an invalid API was used when notification event to DNS NAPTR on changed AMF profile.	An error occurred at the NRF while processing the request when DNS NAPTR feature is enabled as per NRF documentation. This is an internal microservice communication. Review application logs to identify the reported error. Contact My Oracle Support if required.

E.7.5 Manual Cache Update of DNS NAPTR Records

The following table lists the error codes and its problem details for the NRF Artisan microservice for manual cache update of DNS NAPTR records.

Table E-49 RTNPTR - Manual Cache Update of DNS NAPTR Records

Error Code	Details	Action
ONRF-ART-RTNPTR-E0001	This error code indicates that an invalid API was used when retriggering DNS NAPTR record update.	An error occurred at the NRF while processing the request when DNS NAPTR feature is enabled as per NRF documentation. This is an internal microservice communication. Review application logs to identify the reported error. Contact My Oracle Support if required.

Table E-49 (Cont.) RTNPTR - Manual Cache Update of DNS NAPTR Records

Error Code	Details	Action
ONRF-ART-RTNPTR-E0002	This error code indicates that an invalid message format received when retriggering DNS NAPTR record update.	An error occurred at the NRF while processing the request when DNS NAPTR feature is enabled as per NRF documentation. This is an internal microservice communication. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-ART-RTNPTR-E0100	This error code indicates that request is invalid when retriggering DNS NAPTR record update.	An error occurred at the NRF while processing the request when DNS NAPTR feature is enabled as per NRF documentation. This is an internal microservice communication. Review application logs to identify the reported error. Contact My Oracle Support if required.

E.7.6 UnSupported Media Type

The following table lists the error codes and its problem details for the NRF Artisan microservice for UnSupported Media Type.

Table E-50 UNKSROP - UnSupported Media Type

Error Details	Details	Action
ONRF-ART-UNKSROP-E0902	This error code indicates that JSON processing exception occurred during an unknown service operation.	An error occurred at the NRF while processing the request when DNS NAPTR feature is enabled as per NRF documentation. This is an internal microservice communication. Review application logs to identify the reported error. Contact My Oracle Support if required.

E.8 NRF Configuration Microservice

This section lists the error codes and its problem details for the NRF Configuration microservice.

E.8.1 NRF Configuration for General Options

The following table lists the error codes and its problem details for the NRF Configuration service operation for General Options category.

Table E-51 GENOPT - NRF Configuration General Options

Error Code	Details	Action
ONRF-CFG-GENOPT-E0007	This error code indicates that request had mandatory IE incorrect during updates of General Options.	Verify that all mandatory IEs are present and valid per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GENOPT-E0008	This error code indicates that request had optional IE incorrect during updates of General Options.	Verify that all optional IEs are valid and per configuration API definition if provided. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GENOPT-E0009	This error code indicates that request had mandatory IE missing during updates of General Options.	Verify that all mandatory IEs are present and valid per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GENOPT-E0010	The error code indicates that an unspecified message failure occurred while updating the General Options.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GENOPT-E0021	This error code indicates that request had multiple attributes missing or incorrect during updates of General Options.	Validate the message for both missing mandatory attributes and invalid format of multiple attributes as per specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GENOPT-E0100	This error code indicates that request is invalid for updating the configuration of General Options.	Validate message structure to comply with API definition. Also, verify that the attributes meet their specified constraints. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GENOPT-E0802	This error code indicates that database exception occurred during updates of General Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GENOPT-E0803	This error code indicates that data access resource failure exception occurred during updates of General Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-51 (Cont.) GENOPT - NRF Configuration General Options

Error Code	Details	Action
ONRF-CFG-GENOPT-E0805	This error code indicates that NRF is unable to update the required data to database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GENOPT-E0807	This error code indicates that NRF unable to fetch the required data from database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GENOPT-E0899	This error code indicates that a general database exception occurred during updates of General Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GENOPT-E0903	This error code indicates that an interrupted exception occurred during updates of General Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GENOPT-E0904	This error code indicates that class cast exception occurred during updates of General Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GENOPT-E0999	This error code indicates that a general exception occurred during updates of General Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.2 Screening Options Configuration

The following table lists the error codes and its problem details for the NRF Configuration service operation for Screening Options Configuration.

Table E-52 SCRNOPT - Screening Options Configuration

Error Code	Details	Action
ONRF-CFG-SCRNOPT-E0008	This error code indicates that request had optional IE incorrect during updates of Screening Options.	Verify that all optional IEs are valid and as per configuration API definition if provided. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-52 (Cont.) SCRNOPT - Screening Options Configuration

Error Code	Details	Action
ONRF-CFG-SCRNOPT-E0009	This error code indicates that request had mandatory IE missing during updates of Screening Options.	Verify that all mandatory IEs are present and valid as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SCRNOPT-E0010	The error code indicates that an unspecified message failure occurred while updating the Screening Options.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SCRNOPT-E0021	This error code indicates that request had multiple attributes missing or incorrect during updates of Screening Options.	Verify that all mandatory attributes are present and valid as per configuration API definition. Also, verify that all optional attributes have valid values per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SCRNOPT-E0802	This error code indicates that a database exception occurred during updates of Screening Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SCRNOPT-E0803	This error code indicates that data access resource failure exception occurred during updates of Screening Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SCRNOPT-E0805	This error code indicates that NRF is unable to update the required data regarding Screening Options to database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SCRNOPT-E0807	This error code indicates that NRF is unable to fetch the required data regarding Screening Options from database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SCRNOPT-E0899	This error code indicates that a general database exception occurred during updates of Screening Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SCRNOPT-E0903	This error code indicates that an interrupted exception occurred during updates of Screening Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-52 (Cont.) SCRNOPT - Screening Options Configuration

Error Code	Details	Action
ONRF-CFG-SCRNOPT-E0904	This error code indicates that class cast Exception occurred during updates of Screening Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SCRNOPT-E0999	This error code indicates that general exception occurred during updates of Screening Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.3 Management Options Configuration

The following table lists the error codes and its problem details for the NRF Configuration service operation for Management Options Configuration.

Table E-53 MGMTOPT - Management Options Configuration

Error Codes	Details	Action
ONRF-CFG-MGMTOPT-E0007	This error code indicates that request had mandatory IE incorrect during updates of Management Options.	Verify that all mandatory IEs are present and valid as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-MGMTOPT-E0008	This error code indicates that request had optional IE incorrect during updates of Management Options.	Verify that all optional IEs are valid and as per configuration API definition if provided. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-MGMTOPT-E0009	This error code indicates that request had mandatory IE missing during updates of Management Options.	Verify that all mandatory IEs are present and valid as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-MGMTOPT-E0010	The error code indicates that an unspecified message failure occurred while updating the Management Options.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-MGMTOPT-E0021	This error code indicates that request had multiple attributes missing or incorrect during updates of Management Options	Validate the message for both missing mandatory attributes and invalid format of multiple attributes as per specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-53 (Cont.) MGMTOPT - Management Options Configuration

Error Codes	Details	Action
ONRF - CFG - MGMTOPT - E0100	This error code indicates that request is invalid during updates of Management Options.	Validate message structure to comply with API definition. Also, verify that the attributes meet their specified constraints. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF - CFG - MGMTOPT - E0802	This error code indicates that database exception occurred during updates of Management Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF - CFG - MGMTOPT - E0803	This error code indicates that data access resource failure exception occurred during updates of Management Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF - CFG - MGMTOPT - E0805	This error code indicates that NRF is unable to update the required data regarding Management Options to database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF - CFG - MGMTOPT - E0807	This error code indicates that NRF is unable to fetch the required data regarding Management Options from database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF - CFG - MGMTOPT - E0899	This error code indicates that general database exception occurred during updates of Management Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF - CFG - MGMTOPT - E0903	This error code indicates that an interrupted exception occurred during updates of Management Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF - CFG - MGMTOPT - E0904	This error code indicates that class cast exception occurred during updates of Management Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF - CFG - MGMTOPT - E0999	This error code indicates that a general exception occurred during updates of Management Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.4 Discovery Options Configuration

The following table lists the error codes and its problem details for the NRF Configuration service operation for Discovery Options Configuration.

Table E-54 DISCOPT-Discovery Options Configuration

Error Code	Details	Action
ONRF-CFG-DISCOPT-E0007	This error code indicates that request had mandatory IE incorrect during updates of Discovery Options.	Verify that all mandatory IEs are present and valid as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-DISCOPT-E0008	This error code indicates that request had optional IE incorrect during updates of Discovery Options.	Verify that all optional IEs are valid and as per configuration API definition if provided. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-DISCOPT-E0009	This error code indicates that request had mandatory IE missing during updates of Discovery Options.	Verify that all mandatory IEs are present and valid as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-DISCOPT-E0010	The error code indicates that an unspecified message failure occurred while updating the Discovery Options.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-DISCOPT-E0021	This error code indicates that request had multiple attributes missing or incorrect during updates of Discovery Options.	Validate the message for both missing mandatory attributes and invalid format of multiple attributes as per specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-DISCOPT-E0100	This error code indicates that request is invalid for updating the configuration of Discovery Options.	Validate message structure to comply with API definition. Also, verify that the attributes meet their specified constraints. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-DISCOPT-E0802	This error code indicates that database exception occurred during updates of Discovery Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-54 (Cont.) DISCOPT-Discovery Options Configuration

Error Code	Details	Action
ONRF-CFG-DISCOPT-E0803	This error code indicates that data access resource failure exception occurred during updates of Discovery Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-DISCOPT-E0805	This error code indicates that NRF is unable to update the required data regarding Discovery Options to database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-DISCOPT-E0807	This error code indicates that NRF is unable to fetch the required data regarding Discovery Options from database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-DISCOPT-E0899	This error code indicates that a general database exception occurred during updates of Discovery Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-DISCOPT-E0903	This error code indicates that an interrupted exception occurred during updates of Discovery Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-DISCOPT-E0904	This error code indicates that class cast exception occurred during updates of Discovery Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-DISCOPT-E0999	This error code indicates that general exception occurred during updates of Discovery Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.5 Access Token Configuration

The following table lists the error codes and its problem details for the NRF Configuration service operation for Access Token Configuration.

Table E-55 ACCOPT- Access Token Configuration

Error Code	Details	Action
ONRF-CFG-ACCOPT-E0007	This error code indicates that request had mandatory IE incorrect during updates of AccessToken Options.	Verify that all mandatory IEs are present and valid as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ACCOPT-E0008	This error code indicates that request had optional IE incorrect during updates of AccessToken Options.	Verify that all optional IEs are valid and as per configuration API definition if provided. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ACCOPT-E0009	This error code indicates that request had mandatory IE missing during updates of AccessToken Options.	Verify that all mandatory IEs are present and valid as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ACCOPT-E0010	The error code indicates that an unspecified message failure occurred while updating the AccessToken Options.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ACCOPT-E0021	This error code indicates that request had multiple attributes missing or incorrect during updates of AccessToken Options.	Validate the message for both missing mandatory attributes and invalid format of multiple attributes as per specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ACCOPT-E0100	This error code indicates that request is invalid for updating the configuration of AccessToken Options.	Validate message structure to comply with API definition. Also, verify that the attributes meet their specified constraints. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ACCOPT-E0802	This error code indicates that database exception occurred during updates of AccessToken Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ACCOPT-E0803	This error code indicates that data access resource failure exception occurred during updates of AccessToken Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-55 (Cont.) ACCOPT- Access Token Configuration

Error Code	Details	Action
ONRF-CFG-ACCOPT-E0807	This error code indicates that NRF is unable to fetch the required data regarding AccessToken Options to database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ACCOPT-E0899	This error code indicates that general database exception occurred during updates of AccessToken Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ACCOPT-E0903	This error code indicates that interrupted exception occurred during updates of AccessToken Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ACCOPT-E0904	This error code indicates that class cast exception occurred during updates of AccessToken Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ACCOPT-E0999	This error code indicates that general exception occurred during updates of AccessToken Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.6 Forwarding Options Configuration

The following table lists the error codes and its problem details for the NRF Configuration service operation for Forwarding Options Configuration.

Table E-56 FWD OPT - Forwarding Options Configuration

Error Code	Details	Action
ONRF-CFG-FWDOPT-E0007	This error code indicates that request had mandatory IE incorrect during updates of Forwarding Options.	Verify that all mandatory IEs are present and valid as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-FWDOPT-E0008	This error code indicates that request had optional IE incorrect during updates of Forwarding Options.	Verify that all optional IEs are valid and as per configuration API definition if provided. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-56 (Cont.) FWD OPT - Forwarding Options Configuration

Error Code	Details	Action
ONRF-CFG-FWD OPT - E0009	This error code indicates that request had mandatory IE missing during updates of Forwarding Options.	Verify that all mandatory IEs are present and valid as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-FWD OPT - E0010	The error code indicates that an unspecified message failure occurred while processing the Forwarding Options.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-FWD OPT - E0021	This error code indicates that request had multiple attributes missing or incorrect during updates of Forwarding Options.	Validate the message for both missing mandatory attributes and invalid format of multiple attributes as per specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-FWD OPT - E0100	This error code indicates that request is invalid for updating the configuration of Forwarding Options.	Validate message structure to comply with API definition. Also, verify that the attributes meet their specified constraints. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-FWD OPT - E0802	This error code indicates that database exception occurred during updates of Forwarding Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-FWD OPT - E0803	This error code indicates that data access resource failure exception occurred during updates of Forwarding Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-FWD OPT - E0805	This error code indicates that NRF is unable to update the required data regarding Forwarding Options to database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-FWD OPT - E0807	This error code indicates that NRF is unable to fetch the required data regarding Forwarding Options from database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-FWD OPT - E0899	This error code indicates that a general database exception occurred during updates of Forwarding Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-56 (Cont.) FWD OPT - Forwarding Options Configuration

Error Code	Details	Action
ONRF-CFG-FWD OPT-E0903	This error code indicates that an interrupted exception occurred during updates of Forwarding Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-FWD OPT-E0904	This error code indicates that class cast exception occurred during updates of Forwarding Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-FWD OPT-E0999	This error code indicates that a general exception occurred during updates of Forwarding Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.7 SLF Options Configuration

The following table lists the error codes and its problem details for the NRF Configuration service operation for SLF Options Configuration.

Table E-57 SLFOPT - SLF Options Configuration

Error Code	Details	Action
ONRF-CFG-SLFOPT-E0007	This error code indicates that request had mandatory IE incorrect during updates of SLF Options.	Verify that all mandatory IEs are present and valid per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SLFOPT-E0008	This error code indicates that request had optional IE incorrect during updates of SLF Options.	Verify that all optional IEs are valid and per configuration API definition if provided. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SLFOPT-E0009	This error code indicates that request had mandatory IE missing during updates of SLF Options.	Verify that all mandatory IEs are present and valid per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SLFOPT-E0010	The error code indicates that an unspecified message failure occurred while processing the SLF Options.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-57 (Cont.) SLFOPT - SLF Options Configuration

Error Code	Details	Action
ONRF-CFG-SLFOPT-E0021	This error code indicates that request had multiple attributes missing or incorrect during updates of SLF Options.	Validate the message for both missing mandatory attributes and invalid format of multiple attributes as per specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SLFOPT-E0100	This error code indicates that request is invalid for updating the configuration of SLF Options.	Validate message structure to comply with API definition. Also, verify that the attributes meet their specified constraints. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SLFOPT-E0802	This error code indicates that database exception occurred during updates of SLF Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SLFOPT-E0803	This error code indicates that data access resource failure exception occurred during updates of SLF Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SLFOPT-E0805	This error code indicates that NRF is unable to update the required data regarding SLF Options to database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SLFOPT-E0807	This error code indicates that NRF is unable to fetch the required data regarding SLF Options from database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SLFOPT-E0899	This error code indicates that a general database exception occurred during updates of SLF Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SLFOPT-E0903	This error code indicates that an interrupted exception occurred during updates of SLF Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SLFOPT-E0904	This error code indicates that class cast exception occurred during updates of SLF Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-57 (Cont.) SLFOPT - SLF Options Configuration

Error Code	Details	Action
ONRF-CFG-SLFOPT-E0999	This error code indicates that a general exception occurred during updates of SLF Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.8 GeoRedundancy Options Configuration

The following table lists the error codes and its problem details for the NRF Configuration service operation for GeoRedundancy options configuration.

Table E-58 GROPT-GeoRedundancy Options Configuration

Error code	Details	Action
ONRF-CFG-GROPT-E0007	This error code indicates that request had mandatory IE incorrect during updates of GeoRedundancy Options.	Verify that all mandatory IEs are present and valid per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GROPT-E0008	This error code indicates that request had optional IE incorrect during updates of GeoRedundancy Options.	Verify that all optional IEs are valid and per configuration API definition if provided. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GROPT-E0009	This error code indicates that request had mandatory IE missing during updates of GeoRedundancy Options.	Verify that all mandatory IEs are present and valid per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GROPT-E0010	The error code indicates that an unspecified message failure occurred while updating the GeoRedundancy Options.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GROPT-E0021	This error code indicates that request had multiple attributes missing or incorrect during updates of GeoRedundancy Options	Validate the message for both missing mandatory attributes and invalid format of multiple attributes as per specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-58 (Cont.) GROPT-GeoRedundancy Options Configuration

Error code	Details	Action
ONRF-CFG-GROPT-E0100	This error code indicates that request is invalid for updating the configuration of GeoRedundancy Options.	Validate message structure to comply with API definition. Also, verify that the attributes meet their specified constraints. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GROPT-E0802	This error code indicates that database exception occurred during updates of GeoRedundancy Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GROPT-E0803	This error code indicates that data access resource failure Exception occurred during updates of GeoRedundancy Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GROPT-E0805	This error code indicates that NRF is unable to update the required data regarding GeoRedundancy Options to database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GROPT-E0807	This error code indicates that NRF is unable to fetch the required data regarding GeoRedundancy Options from database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GROPT-E0899	This error code indicates that general database exception occurred during updates of GeoRedundancy Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GROPT-E0903	This error code indicates that an interrupted exception occurred during updates of GeoRedundancy Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GROPT-E0904	This error code indicates that class cast exception occurred during updates of GeoRedundancy Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GROPT-E0999	This error code indicates that a general exception occurred during updates of GeoRedundancy Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.9 NAPTR Options Configuration

The following table lists the error codes and its problem details for the NRF Configuration service operation for NAPTR Options configuration.

Table E-59 NPTR0PT - NAPTR Options Configuration

Error Code	Details	Action
ONRF-CFG-NPTR0PT-E0007	This error code indicates that request had mandatory IE incorrect during updates of NAPTR Options.	Verify that all mandatory IEs are present and valid as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-NPTR0PT-E0008	This error code indicates that request had optional IE incorrect during updates of NAPTR Options.	Verify that all optional IEs are valid and as per configuration API definition if provided. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-NPTR0PT-E0009	This error code indicates that request had mandatory IE missing during updates of NAPTR Options.	Verify that all mandatory IEs are present and valid as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-NPTR0PT-E0010	The error code indicates that an unspecified message failure occurred while updating the NAPTR Options.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-NPTR0PT-E0021	This error code indicates that request had multiple attributes missing or incorrect during updates of NAPTR Options.	Validate the message for both missing mandatory attributes and invalid format of multiple attributes as per specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-NPTR0PT-E0100	This error code indicates that request is invalid for updating the configuration of NAPTR Options.	Validate message structure to comply with API definition. Also, verify that the attributes meet their specified constraints. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-NPTR0PT-E0802	This error code indicates that a database exception occurred during updates of NAPTR Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-59 (Cont.) NPTR OPT - NAPTR Options Configuration

Error Code	Details	Action
ONRF-CFG-NPTR OPT -E0803	This error code indicates that data access resource failure exception occurred during updates of NAPTR Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-NPTR OPT -E0805	This error code indicates that NRF is unable to update the required data regarding NAPTR Options to the database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-NPTR OPT -E0807	This error code indicates that NRF unable to fetch the required data regarding NAPTR Options from the database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-NPTR OPT -E0899	This error code indicates that a general database exception occurred during updates of NAPTR Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-NPTR OPT -E0903	This error code indicates that an interrupted exception occurred during updates of NAPTR Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-NPTR OPT -E0904	This error code indicates that class cast exception occurred during updates of NAPTR Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-NPTR OPT -E0999	This error code indicates that a general exception occurred during updates of NAPTR Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.10 Pod Protection Options Configuration

The following table lists the error codes and its problem details for the NRF Configuration service operation for Pod Protection Options Configuration.

Table E-60 POPROPT - Pod Protection Options Configuration

Error Code	Details	Action
ONRF-CFG-POPROPT-E0007	This error code indicates that request had mandatory IE incorrect during updates of pod protection.	Verify that all mandatory IEs are present and valid as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-POPROPT-E0008	This error code indicates that request had optional IE incorrect during updates of pod protection.	Verify that all optional IEs are valid and as per configuration API definition if provided. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-POPROPT-E0009	This error code indicates that request had mandatory IE missing during updates of pod protection.	Verify that all mandatory IEs are present and valid as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-POPROPT-E0010	The error code indicates that an unspecified message failure occurred while updating the pod protection options.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-POPROPT-E0021	This error code indicates that request had multiple attributes missing or incorrect during updates of pod protection options.	Validate the message for both missing mandatory attributes and invalid format of multiple attributes as per specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-POPROPT-E0100	This error code indicates that request is invalid for updating the configuration of pod protection options.	Validate message structure to comply with API definition. Also, verify that the attributes meet their specified constraints. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-POPROPT-E0802	This error code indicates that database exception occurred during updates of pod protection options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-POPROPT-E0803	This error code indicates that data access resource failure exception occurred during updates of pod protection options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-60 (Cont.) POPROPT - Pod Protection Options Configuration

Error Code	Details	Action
ONRF-CFG-POPROPT-E0805	This error code indicates that NRF is unable to update the required data regarding pod protection options to database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-POPROPT-E0807	This error code indicates that NRF is unable to fetch the required data regarding pod protection options from database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-POPROPT-E0899	This error code indicates that a general database exception occurred during updates of pod protection options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-POPROPT-E0903	This error code indicates that an interrupted exception occurred during updates of pod protection options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-POPROPT-E0904	This error code indicates that class cast exception occurred during updates of pod protection options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-POPROPT-E0999	This error code indicates that a general exception occurred during updates of pod protection options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.11 Authentication Options Configuration

The following table lists the error codes and its problem details for the NRF Configuration service operation for Authentication Options Configuration.

Table E-61 AUTHOPT - Authentication Options Configuration

Error Code	Details	Action
ONRF-CFG-AUTHOPT-E0007	This error code indicates that request had mandatory IE incorrect during updates of Authentication Options.	Verify that all mandatory IEs are present and valid as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-61 (Cont.) AUTHOPT - Authentication Options Configuration

Error Code	Details	Action
ONRF-CFG-AUTHOPT-E0008	This error code indicates that request had optional IE incorrect during updates of Authentication Options.	Verify that all optional IEs are valid and as per configuration API definition if provided. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-AUTHOPT-E0009	This error code indicates that request had mandatory IE missing during updates of Authentication Options.	Verify that all mandatory IEs are present and valid as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-AUTHOPT-E0010	The error code indicates that an unspecified message failure occurred while updating the Authentication Options.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-AUTHOPT-E0021	This error code indicates that request had multiple attributes missing or incorrect during updates of Authentication Options	Validate the message for both missing mandatory attributes and invalid format of multiple attributes as per specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-AUTHOPT-E0100	This error code indicates that request is invalid for updating the configuration of Authentication Options.	Validate message structure to comply with API definition. Also, verify that the attributes meet their specified constraints. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-AUTHOPT-E0802	This error code indicates that database exception occurred during updates of Authentication Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-AUTHOPT-E0803	This error code indicates that data access resource failure Exception occurred during updates of Authentication Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-AUTHOPT-E0805	This error code indicates that NRF is unable to update the required data regarding Authentication Options to database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-61 (Cont.) AUTHOPT - Authentication Options Configuration

Error Code	Details	Action
ONRF-CFG-AUTHOPT-E0807	This error code indicates that NRF unable to fetch the required data regarding Authentication Options from database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-AUTHOPT-E0899	This error code indicates that general database exception occurred during updates of Authentication Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-AUTHOPT-E0903	This error code indicates that Interrupted exception occurred during updates of Authentication Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-AUTHOPT-E0904	This error code indicates that class cast exception occurred during updates of Authentication Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-AUTHOPT-E0999	This error code indicates that general exception occurred during updates of Authentication Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.12 Logging Options Configuration

The following table lists the error codes and its problem details for the NRF Configuration service operation for Logging Options Configuration.

Table E-62 LOGOPT - Logging Options Configuration

Error Codes	Details	Action
ONRF-CFG-LOGOPT-E0007	This error code indicates that request had mandatory IE incorrect during updates of Logging Options.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-LOGOPT-E0008	This error code indicates that request had optional IE incorrect during updates of Logging Options.	Validate the message for both missing mandatory attributes and invalid format of multiple attributes as per specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-62 (Cont.) LOGOPT - Logging Options Configuration

Error Codes	Details	Action
ONRF-CFG-LOGOPT-E0009	This error code indicates that request had mandatory IE missing during updates of Logging Options.	Validate message structure to comply with API definition. Also, verify that the attributes meet their specified constraints. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-LOGOPT-E0010	The error code indicates that an unspecified message failure occurred while updating Logging Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-LOGOPT-E0021	This error code indicates that request had multiple attributes missing or incorrect during updates of Logging Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-LOGOPT-E0100	This error code indicates that request is invalid for updating the configuration of Logging Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-LOGOPT-E0802	This error code indicates that database exception occurred during updates of Logging Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-LOGOPT-E0803	This error code indicates that data access resource failure Exception occurred during updates of Logging Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-LOGOPT-E0805	This error code indicates that NRF is unable to update the required data regarding Logging Options to database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-LOGOPT-E0807	This error code indicates that NRF is unable to fetch the required data regarding Logging Options from database.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-LOGOPT-E0899	This error code indicates that general database exception occurred during updates of Logging Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-62 (Cont.) LOGOPT - Logging Options Configuration

Error Codes	Details	Action
ONRF-CFG-LOGOPT-E0902	This error code indicates that JSON processing exception occurred during updates of Logging Options.	Validate that the JSON payload is in the right format and compliant with the specified JSON schema. Fix any JSON errors. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-LOGOPT-E0903	This error code indicates that an interrupted exception occurred during updates of Logging Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-LOGOPT-E0904	This error code indicates that class cast exception occurred during updates of Logging Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-LOGOPT-E0999	This error code indicates that general exception occurred during updates of Logging Options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.13 Control Shutdown Options Configuration

The following table lists the error codes and its problem details for the NRF Configuration service operation for Control Shutdown Options Configuration.

Table E-63 CSHTOPT - Control Shutdown Options Configuration

Error Code	Details	Action
ONRF-CFG-CSHTOPT-E0007	This error code indicates that mandatory attribute is incorrect in request for configuring the controlled shutdown options.	Validate the format of mandatory attributes as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-CSHTOPT-E0008	This error code indicates that optional attribute is incorrect in request for configuring the controlled shutdown options.	Validate the format of optional attributes as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-CSHTOPT-E0009	This error code indicates that mandatory attribute is missing in request for configuring the controlled shutdown options.	Verify that all mandatory attributes are present as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-63 (Cont.) CSHTOPT - Control Shutdown Options Configuration

Error Code	Details	Action
ONRF-CFG-CSHTOPT-E0010	The error code indicates that an unspecified message failure occurred while updating the controlled shutdown options.	Validate message structure to comply as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-CSHTOPT-E0020	This error code indicates that request timed out while configuring the controlled shutdown options.	Validate message structure to comply as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-CSHTOPT-E0021	This error code indicates that request had multiple attributes missing or incorrect for configuring the controlled shutdown options.	Validate the message for both missing mandatory attributes and invalid format of multiple attributes as per specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-CSHTOPT-E0100	This error code indicates that request is invalid for configuring the controlled shutdown options.	Validate message structure to comply with API definition. Also, verify that the attributes meet their specified constraints. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-CSHTOPT-E0802	This error code indicates that pessimistic locking exception occurred while configuring the controlled shutdown options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-CSHTOPT-E0803	This error code indicates that data access resource failure exception occurred while configuring the controlled shutdown options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-CSHTOPT-E0805	This error code indicates that NRF is unable to update the required data for updating configuring the controlled shutdown options.	Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-CSHTOPT-E0807	This error code indicates that NRF unable to fetch the required data while fetching the controlled shutdown options.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-CSHTOPT-E0899	This error code indicates that general database exception occurred while accessing the controlled shutdown options.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-63 (Cont.) CSHTOPT - Control Shutdown Options Configuration

Error Code	Details	Action
ONRF-CFG-CSHTOPT-E0903	This error code indicates that an interrupted exception occurred while accessing the controlled shutdown options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-CSHTOPT-E0904	This error code indicates that class cast exception occurred while accessing the controlled shutdown options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-CSHTOPT-E0999	This error code indicates that a general exception occurred while accessing the controlled shutdown options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.14 Roaming Options Configuration

The following table lists the error codes and its problem details for the NRF Configuration service operation for Roaming Options Configuration.

Table E-64 ROAMOPT - Roaming Options Configuration

Error Code	Details	Action
ONRF-CFG-ROAMOPT-E0007	This error code indicates that mandatory IE is incorrect in request for configuring the roaming options.	Verify that all mandatory IEs are present and valid as per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ROAMOPT-E0008	This error code indicates that an optional IE is incorrect in request for configuring the roaming options.	Verify that all optional IEs are valid and per configuration API definition if provided. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ROAMOPT-E0009	This error code indicates that mandatory IE is missing in request for configuring the roaming options.	Verify that all mandatory IEs are present and valid per configuration API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ROAMOPT-E0010	The error code indicates that an unspecified message failure occurred while configuring the roaming options.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-64 (Cont.) ROAMOPT - Roaming Options Configuration

Error Code	Details	Action
ONRF-CFG-ROAMOPT-E0020	This error code indicates that request timed out while configuring the roaming options.	Check service or database latency; improve performance or increase timeout settings. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ROAMOPT-E0021	This error code indicates that request had multiple attributes missing or incorrect for configuring the roaming options.	Validate the message for both missing mandatory attributes and invalid format of multiple attributes as per NRF documentation. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ROAMOPT-E0100	This error code indicates that request is invalid for configuring the roaming options.	Validate message structure to comply with API definition. Also, verify that the attributes meet their specified constraints. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ROAMOPT-E0802	This error code indicates that pessimistic locking exception occurred while configuring the roaming options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ROAMOPT-E0803	This error code indicates that data access resource failure exception occurred while configuring the roaming options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ROAMOPT-E0805	This error code indicates that NRF is unable to update the required data for updating the roaming options.	Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ROAMOPT-E0807	This error code indicates that NRF unable to fetch the required data while fetching the roaming options.	Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ROAMOPT-E0899	This error code indicates that while general database exception occurred while accessing the roaming options.	Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ROAMOPT-E0903	This error code indicates that an interrupted exception occurred while accessing the roaming options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-64 (Cont.) ROAMOPT - Roaming Options Configuration

Error Code	Details	Action
ONRF-CFG-ROAMOPT-E0904	This error code indicates that class cast exception occurred while accessing the roaming options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-ROAMOPT-E0999	This error code indicates that General Exception occurred while accessing the roaming options.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.15 Screening Rules Configuration

The following table lists the error codes and its problem details for the NRF Configuration service operation for Screening Rules Configuration.

Table E-65 SCRNRUL - Screening Rules Configuration

Error Code	Details	Action
ONRF-CFG-SCRNRUL-E0007	This error code indicates that request has mandatory IE Incorrect.	Verify that all mandatory IEs are present and valid per configuration API definition. Review logs to identify the NRF-reported error further. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SCRNRUL-E0008	This error code indicates that request has optional IE Incorrect.	Verify that all optional IEs are valid and per configuration API definition if provided. Review logs to identify the NRF-reported error further. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SCRNRUL-E0009	This error code indicates that request has mandatory IE missing.	Verify that all mandatory IEs are present and valid per configuration API definition. Review logs to identify the NRF-reported error further. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SCRNRUL-E0100	This error code indicates that request is invalid for updating the screening rules.	Validate message structure to comply with API definition. Also, verify that the attributes meet their specified constraints. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-65 (Cont.) SCRNRUL - Screening Rules Configuration

Error Code	Details	Action
ONRF-CFG-SCRNRUL-E0802	This error code indicates that pessimistic locking exception occurred while updating the screening rules.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SCRNRUL-E0803	This error code indicates that data access resource failure exception occurred for fetching the screening rules.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SCRNRUL-E0805	This error code indicates that NRF is unable to update the required data for updating the screening rules.	Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SCRNRUL-E0807	This error code indicates that NRF unable to fetch the required data fetching the screening rules.	Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SCRNRUL-E0899	This error code indicates that general database exception occurred during accessing the screening rules.	Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SCRNRUL-E0902	This error code indicates that an interrupted exception occurred while accessing the screening rules.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SCRNRUL-E0903	This error code indicates that an interrupted exception occurred while accessing the screening rules.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SCRNRUL-E0904	This error code indicates that class cast exception occurred during accessing the screening rules.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SCRNRUL-E0999	This error code indicates that general exception occurred during accessing the screening rules.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.16 Growth Options Configuration

The following table lists the error codes and its problem details for the NRF Configuration service operation for Growth Options Configuration.

Table E-66 GWTHOPT - Growth Options Configuration

Error Code	Details	Action
ONRF-CFG-GWTHOPT-E0007	This error code indicates that a mandatory attribute is incorrect for updating the Growth Options.	Validate the format of mandatory attributes as per NRF documentation. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GWTHOPT-E0008	This error code indicates that an optional attribute is incorrect for updating the Growth Options.	Validate the format of optional attributes as per NRF documentation. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GWTHOPT-E0009	This error code indicates that a mandatory attribute is missing for updating the Growth Options.	Verify that all mandatory attributes are present as per NRF documentation. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GWTHOPT-E0010	The error code indicates that an unspecified message failure occurred while updating the Growth Options.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GWTHOPT-E0021	This error code indicates that request had multiple attributes missing or incorrect for updating the Growth Options.	Validate the message for both missing mandatory attributes and invalid format of multiple attributes as per NRF documentation. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GWTHOPT-E0100	This error code indicates that request is invalid for updating the Growth Options.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.17 Growth Configuration for Forwarding

The following table lists the error codes and its problem details for the NRF Configuration service operation for Growth configuration for Forwarding.

Table E-67 GWTHFOR - Growth Configuration for Forwarding

Error Code	Details	Action
ONRF-CFG-GWTHFOR-E0007	This error code indicates that a mandatory attribute is incorrect for updating the Growth forwarding.	Validate the format of mandatory attributes as per NRF documentation. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-67 (Cont.) GWTHFOR - Growth Configuration for Forwarding

Error Code	Details	Action
ONRF-CFG-GWTHFOR-E0008	This error code indicates that an optional attribute is incorrect for updating the Growth forwarding.	Validate the format of optional attributes as per NRF documentation. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GWTHFOR-E0009	This error code indicates that a mandatory attribute is missing for updating the Growth forwarding.	Verify that all mandatory attributes are present as per NRF documentation. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GWTHFOR-E0010	The error code indicates that an unspecified message failure occurred while updating the Growth forwarding.	Validate message structure to comply with API definition as per NRF documentation. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GWTHFOR-E0021	This error code indicates that request had multiple attributes missing or incorrect for updating the Growth forwarding.	Validate the message for both missing mandatory attributes and invalid format of multiple attributes as per specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-GWTHFOR-E0100	This error code indicates that request is invalid for updating the Growth forwarding.	Validate message structure to comply with API definition. Also, verify that the attributes meet their specified constraints. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.18 Fetching NRF Configuration

The following table lists the error codes and its problem details for fetching NRF Configuration.

Table E-68 NRFCFG - Fetching NRF Configuration

Error Code	Details	Action
ONRF-CFG-NRFCFG-E0802	This error code indicates that pessimistic locking exception occurred while fetching the NRF Configurations.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-NRFCFG-E0803	This error code indicates that data access resource failure exception occurred while fetching the NRF Configurations.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-68 (Cont.) NRFCFG - Fetching NRF Configuration

Error Code	Details	Action
ONRF-CFG-NRFCFG-E0807	This error code indicates that NRF is unable to fetch the required data while fetching the NRF Configurations.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-NRFCFG-E0899	This error code indicates that general database exception occurred while fetching the NRF Configurations.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-NRFCFG-E0903	This error code indicates that an interrupted exception occurred while fetching the NRF Configurations.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-NRFCFG-E0904	This error code indicates that class cast exception occurred while fetching the NRF Configurations.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-NRFCFG-E0999	This error code indicates that general exception occurred while fetching the NRF Configurations.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.19 Fetching NF State Data

The following table lists the error codes and its problem details for the NRF Configuration service operation for Fetching NF State Data.

Table E-69 NFDTLS - Fetching NF State Data

Error Code	Details	Action
ONRF-CFG-NFDTLS-E0021	This error code indicates that request had multiple attributes missing or incorrect for fetching the NF details.	Validate the message for both missing mandatory attributes and invalid format of multiple attributes as per specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-NFDTLS-E0100	This error code indicates that request is invalid for fetching the NF details.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

Table E-69 (Cont.) NFDTLS - Fetching NF State Data

Error Code	Details	Action
ONRF-CFG-NFDTLS-E0807	This error code indicates that NRF is unable to fetch the required data for the fetching NF details.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-NFDTLS-E0999	This error code indicates that general exception occurred while fetching the NF details.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.20 Retrieve Subscription Details Based on Query Attributes for Configuring the Non-Signaling API

The following table lists the error codes and its problem details for retrieving subscription details based on query attributes for configuring the non-signaling API.

Table E-70 SUBDTLS - Retrieve Subscription Details Based on Query Attributes for Configuring the Non-Signaling API

Error Code	Details	Action
ONRF-CFG-SUBDTLS-E0021	This error code indicates that request had multiple attributes missing or incorrect for fetching subscription details.	Validate the message for both missing mandatory attributes and invalid format of multiple attributes as per specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SUBDTLS-E0807	This error code indicates that NRF is unable to fetch the required data for fetching subscription details.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-SUBDTLS-E0999	This error code indicates that general exception occurred during fetching subscription details.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.21 Status API for DNS NAPTR Record

The following table lists the error codes and its problem details for the Status API for DNS NAPTR record.

Table E-71 NPTRREC- Status API for DNS NAPTR Record

Error Code	Details	Action
ONRF-CFG-NPTRREC-E0807	This error code indicates that NRF is unable to fetch the required data from cache.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.22 Manual Cache Update of DNS NAPTR Records

The following table lists the error codes and its problem details for the NRF Configuration Manual cache update of DNS NAPTR records.

Table E-72 RTNPTR - Manual Cache Update of DNS NAPTR Records

Error Details	Details	Action
ONRF-CFG-RTNPTR-E7000	This error code indicates that there was failure to trigger DNS NAPTR Update records.	Validate message structure to comply with API definition. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-RTNPTR-E0902	This error code indicates that JSON processing exception occurred while triggering DNS NAPTR Update records.	Validate that the JSON payload is in the right format and compliant with the specified JSON schema. Fix any JSON errors. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-RTNPTR-E0100	This error code indicates that request is invalid for triggering DNS NAPTR Update records.	Validate the message structure to ensure compliance with the API definition. Also, verify that the size of reTriggerNaptrUpdateRecords in the request body is less than or equal to 10. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-CFG-RTNPTR-E0021	This error code indicates that request had multiple attributes missing or incorrect for triggering DNS NAPTR Update records.	Validate the message for both missing mandatory attributes and invalid format of multiple attributes as per specification. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.23 NRF Operation State Configuration

The following table lists the error codes and its problem details for the NRF Operation State Configuration.

Table E-73 NRFOPER - NRF Operation State Configuration

Error Code	Details	Action
ONRF - CFG - NRFOPER - E0020	This error code indicates that the request timed out when fetching NRF Configuration NRF operation state.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF - CFG - NRFOPER - E0802	This error code indicates that pessimistic locking exception occurred when fetching NRF Configuration NRF operation state.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF - CFG - NRFOPER - E0803	This error code indicates that data access resource failure exception occurred while fetching NRF Configuration NRF operation state.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF - CFG - NRFOPER - E0805	This error code indicates that NRF is unable to update the required data for NRF Configuration NRF operation state.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF - CFG - NRFOPER - E0807	This error code indicates that NRF is unable to fetch the required data while fetching NRF Configuration NRF operation state.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF - CFG - NRFOPER - E0899	This error code indicates that general database exception occurred while fetching NRF Configuration NRF operation state.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF - CFG - NRFOPER - E0903	This error code indicates that interrupted exception occurred while fetching NRF Configuration NRF operation state.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF - CFG - NRFOPER - E0904	This error code indicates that class cast exception occurred while fetching NRF Configuration NRF operation state.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF - CFG - NRFOPER - E0999	This error code indicates that general exception occurred while fetching NRF Configuration NRF operation state.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.24 CNCC Controller Configuration

The following table lists the error codes and its problem details for the NRF Configuration service operation for CNCC Controller Configuration

Table E-74 CNCCDTN - CNCC Controller Configuration

Error Code	Details	Action
ONRF-CFG-CNCCDTN-E7001	This error code indicates that there is an error in CNCC controller.	An internal application error occurred at the NRF while processing the request. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.8.25 UnSupported Media Type

The following table lists the error codes and its problem details for the NRF Configuration microservice for UnSupported Media Type.

Table E-75 UNKSROP - UnSupported Media Type

Error Details	Details	Action
ONRF-CFG-UNKSROP-E0902	This error code indicates that JSON processing exception occurred during an unknown service operation.	Verify that the HTTP operation is defined in the specifications. If not, correct it accordingly. If it is valid, collect and share logs with Oracle Support. Validate that the JSON payload is in the right format and compliant with the specified JSON schema. Fix any JSON errors. Review problem details and application logs to identify the reported error. Contact My Oracle Support if required.

E.9 Ingress Gateway Service

The following table lists the error codes and its problem details for the Ingress Gateway service.

Table E-76 Ingress Gateway Service Error Codes

Error Code	Description	Action
ONRF-IGW-E001	This error code indicates that Ingress Gateway is unable to establish the connection with the backend service in the configured connectionTimeout period.	Verify reachability between the Ingress Gateway and NRF backend microservices, ensure services are in-service, and check for network delay, packet loss, or pod resource overload (CPU/memory) causing timeouts. Review CNE logs, address environmental issues, or adjust connection timeouts if needed. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E002	This error code indicates that request processing time is more than the configured request timeout at Ingress Gateway.	Verify reachability between the Ingress Gateway and NRF backend microservices, ensure services are in-service, and check for network delay, packet loss, or pod resource overload (CPU/memory) causing the timeout. Review CNE logs and address environmental issues or adjust request processing time accordingly. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E003	This error code indicates that Ingress Gateway is unable to resolve the configured backend service host name.	Verify that the backend service hostname is resolvable via DNS. If not, ensure DNS entries are correctly configured and retrievable. If DNS resolution is successful and the issue persists, review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E004	This error code indicates that Ingress Gateway is unable to establish the connection with the backend service.	Verify reachability between the Ingress Gateway and NRF backend microservices, ensure services are in-service, and check for network delay or packet loss. Review CNE logs and correct any issues. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E005	This error code indicates that Blocklist IP exception has occurred while establishing a new connection with the blocklisted IP at Ingress Gateway. IP is blocklisted if the TCP connection to this IP has failed more than 10 times.	Investigate why the IP is blocklisted; check backend service health; review firewall and network routes. Review application logs to identify the reported error further. Contact My Oracle Support if required.

Table E-76 (Cont.) Ingress Gateway Service Error Codes

Error Code	Description	Action
ONRF-IGW-E006	This error code indicates that closed channel exception has occurred because the incoming TCP connection was abruptly terminated before Ingress Gateway sent back the response.	Check client-side connection-handling, load balancer keep-alives; look for network interruptions. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E051	This error code indicates that RejectedExecutionException has occurred at Ingress Gateway as the number of incoming requests is more than the queueCapacity configured in applicationThreadPoolConfig.	Values already been tuned for the system. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E052	This error code indicates that Ingress Gateway received the request path with no endpoint implemented in the backend service.	Required Endpoints will be already configured in the system. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E053	This error indicates that SocketException has occurred as Ingress Gateway was unable to create a TCP connection.	Check network connectivity, firewall rules, and backend service status. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E054	This error code indicates some unknown internal error occurred at Ingress Gateway while processing the request.	Verify reachability between backend microservices and the egress gateway microservice, confirm services are in-service, and check CNE logs to resolve the issue. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E102	This error code indicates that late arrival exception occurred at Ingress Gateway as the request has already expired as part of the SbiTimer feature.	Values already been tuned for the system. If needed, review problem details and application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-IGW-E112	This error code indicates validation of the user-agent header failed at Ingress Gateway.	User-Agent validation for allowed consumer NF types is enabled. If enforcement is required, ensure allowed consumer NF types configuration includes the requester. Review application logs to identify the reported error further. Contact My Oracle Support if required.

Table E-76 (Cont.) Ingress Gateway Service Error Codes

Error Code	Description	Action
ONRF-IGW-E122	This error code indicates requests received at Ingress Gateway were rejected gracefully during the Ingress Gateway shutdown.	Control Shutdown is enabled and processed. Nothing much can be done, however if needed review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E132	This error code indicates requests are being rejected after exceeding the burstCapacity when the global ratelimit feature is enabled.	Values already been tuned for the system. Reduce request rate or implement client-side rate limiting. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E152	This error code indicates that requests are being rejected after exceeding the burstCapacity when the rss ratelimit feature is enabled.	Adjust route-level ratelimit entries in the Ingress Gateway configuration. So, that limits match observed traffic for that route. Reduce peak request rates at the source, so bursts remain within the configured burstCapacity; or increase globalIngressRateLimiting.burstCapacity only if justified. Validate via Ingress Gateway or gateway metrics and traffic captures; confirm that rejections cease for the affected route(s). Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E162	This error code indicates that validation of the XFCC header failed at Ingress Gateway.	Check that XFCC header is present and correctly formatted as feature is enabled. Disable the XFCC feature if not needed. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E163	This error code indicates that a request received at Ingress Gateway has no XFCC header or an empty XFCC header.	Ensure XFCC header is set in request as feature is enabled. Disable the XFCC feature if not needed. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E164	This error code indicates that the XFCC header validation failed due to XFCC certificate count mismatch in Ingress Gateway.	Verify and correct the certificate chain length as feature is enabled. Disable the XFCC feature if not needed. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E165	This error code indicates that an invalid XFCC header is received at Ingress Gateway.	Correct XFCC header structure and contents as feature is enabled. Disable the XFCC feature if not needed. Review application logs to identify the reported error further. Contact My Oracle Support if required.

Table E-76 (Cont.) Ingress Gateway Service Error Codes

Error Code	Description	Action
ONRF-IGW-E171	This error code indicates that validation of the OAuth token failed at Ingress Gateway.	Validate token's claims, expiration, and digital signature. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E172	This error code indicates that the OAuth cert that has expired is received at Ingress Gateway.	Renew OAuth certificate. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E173	This error code indicates that OAuth mismatch occurred in KID at Ingress Gateway.	Ensure correct key identifier (KID); sync token and configuration. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E174	This error code indicates that producer scope is absent in the OAuth token received at Ingress Gateway.	Add required producer scope to OAuth token. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E175	This error code indicates that the producer scope present in the OAuth token mismatches with the producer scope configured at Ingress Gateway.	Align producer scope in token as per the configuration. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E176	This error code indicates that the NRF instance ID present in the OAuth token mismatches with the NRF instance ID configured at Ingress Gateway.	Sync incoming request with OAuth token value configured. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E177	This error code indicates that the received OAuth token mismatches with the producer PLMN configured at Ingress Gateway.	Align producer PLMN in token and gateway configuration. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E178	This error code indicates that the received OAuth token does not contain an audience or an invalid audience at Ingress Gateway.	Add valid audience claim to OAuth token. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E179	This error code indicates that an invalid OAuth token is received at Ingress Gateway.	Issue and use a valid OAuth token. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E180	This error code indicates that a request was received at Ingress Gateway with no OAuth token or an empty OAuth token.	Include a valid OAuth token in the request. Review application logs to identify the reported error further. Contact My Oracle Support if required.

Table E-76 (Cont.) Ingress Gateway Service Error Codes

Error Code	Description	Action
ONRF-IGW-E182	This error code indicates that overload control exception occurred at Ingress Gateway.	Reduce load and review overload policies. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E183	This error code indicates that ResponseStatusException was created by Spring boot as Ingress Gateway exception handler was unable to handle an exception.	Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E184	This error code indicates that no route is configured for the requested URI.	The invalid request URI or missing route configuration for the required route. Update the request URI or routesConfiguration. Contact My Oracle Support if required.
ONRF-IGW-E191	This error code indicates that validation of the CCA header failed at Ingress Gateway.	Correct or provide the appropriate CCA header. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E192	This error code indicates that requests are being discarded partially at Ingress Gateway when the control shutdown feature is enabled.	Control Shutdown is enabled and processed. Nothing much can be done, however if needed, review application logs to identify the reported error further. Contact My Oracle Support .
ONRF-IGW-E193	This error code indicates that requests are being discarded completely at Ingress Gateway when the control shutdown feature is enabled.	Control Shutdown is enabled and processed. Nothing much can be done, however if needed, review application logs to identify the reported error further. Contact My Oracle Support .
ONRF-IGW-E200	This error code indicates all requests will be rejected at Ingress Gateway when the traffic reject feature is enabled.	Disable traffic reject or change policy as appropriate. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E201	This error code indicates that requests are being rejected when the load level matches the configured percentage in the discard policy mapping of the overload control feature.	Tune discard policy mappings or reduce incoming request rate as overload feature is enabled. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E202	This error code indicates that requests with sbi-priority header with value greater than the configured value of discarded load level matches discard policy mapping of the overload control feature.	Assign correct sbi-priority or change policy mapping. Review application logs to identify the reported error further. Contact My Oracle Support if required.

Table E-76 (Cont.) Ingress Gateway Service Error Codes

Error Code	Description	Action
ONRF-IGW-E211	This error code indicates that requests are being rejected when the priority level matches the configured priority in the discard policy mapping of the overload control feature.	Change discard policy mapping or manage request priority. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E220	This error code indicates that requests are being rejected after exceeding the burstCapacity when the PLMN Egress Rate Limit feature is enabled.	Adjust rate limit settings. Increase per-PLMN egress rate limits to justified levels or reduce per-PLMN traffic rate as feature is enabled. Disable feature if not needed. Review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E221	This error code indicates that an invalid route exception has occurred as invalidRouteFilter was configured in the routesConfiguration.	Routes are already configured in the system as needed. If this error persists, review application logs to identify the reported error further. Contact My Oracle Support if required.
ONRF-IGW-E223	This error code indicates that requests are being rejected after exceeding the fillRate when the Ingress pod protection by rate limiting feature is enabled.	Review the pod protection by Rate limiting configurations. Verify the limits are configured as per the recommendation. Identify the NF that sends the additional traffic (the source of it and the traffic type). Reduce the additional traffic. Contact My Oracle Support if required.

E.10 Egress Gateway Service

The following table lists the error codes and its problem details for the Egress Gateway service.

Table E-77 Egress Gateway Service Error Codes

Error Code	Description	Action
ONRF-EGW-E001	This error code indicates that Egress Gateway is unable to establish the connection with peer NF in the configured connectionTimeout period.	Values are already been tuned for the system. Confirm peer NF network status and increase timeout if needed. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E002	This error code indicates that request processing time is more than the configured request timeout at Egress Gateway.	Values are already been tuned for the system. Review application logs to identify the reported error. Contact My Oracle Support if required.

Table E-77 (Cont.) Egress Gateway Service Error Codes

Error Code	Description	Action
ONRF-EGW-E003	This error code indicates that Egress Gateway is unable to resolve the peer NF service host name.	Check DNS setup and FQDN correctness. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E004	This error code indicates that Egress Gateway is unable to establish the connection with peer NF service.	Verify peer NF service status and network connectivity. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E005	This error code indicates an exception occurred because HTTP1.1 is disabled, but the oc-http-version header has a value http1.	This is internal error occurred at Egress Gateway. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E006	This error code indicates that a closed channel exception has occurred as the incoming TCP connection was abruptly terminated before Egress Gateway sent the response.	Review network reliability and client connection handling. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E007	This error code indicates the SSL handshake exception occurred in Egress Gateway.	Check SSL certificates, protocol versions, and network trust settings. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E051	This error code indicates that RejectedExecutionException has occurred at Egress Gateway as the number of incoming requests is more than the queueCapacity configured in applicationThreadPoolConfig.	This is internal error occurred at Egress Gateway. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E052	This error code indicates that Egress Gateway received a request path with an endpoint that is not implemented in the peer NF service.	Check that the requested endpoint exists in peer NF; adjust request path or peer configuration. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E054	This error code indicates that some unknown internal error occurred in Egress Gateway while processing the request.	Review NRF forwarding configuration, verify reachability between backend microservices and the egress gateway microservice, confirm services are in-service, and check CNE logs to resolve the issue. Review application logs to identify the reported error. Contact My Oracle Support if required.

Table E-77 (Cont.) Egress Gateway Service Error Codes

Error Code	Description	Action
ONRF-EGW-E102	This error code indicates that late arrival exception has occurred at Egress Gateway as the request has already expired as part of the SbiTimer feature.	This is internal error occurred at Egress Gateway. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E112	This error code indicates that requests are being rejected after exceeding the bucketCapacity when the notificationRateLimit feature is enabled.	Values already been tuned for the system. Increase notificationRateLimit or reduce notification frequency as notificationRateLimit feature is enabled. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E122	This error code indicates that the retry-after feature is enabled and producer FQDN is blocklisted, therefore the request cannot be fulfilled.	This is internal error occurred at Egress Gateway. Validate the network connectivity and deployment. Need to find reason for blocking the producer FQDN. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E127	This error code indicates that the service shutdown is in progress.	Control Shutdown is already in progress. Nothing much can be done. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E132	This error code indicates that the DNS resolution of virtual FQDN failed.	Check DNS configurations; verify FQDN correctness; ensure DNS server availability. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E152	This error code indicates the exception occurred because of a bad AccessToken request received.	This is internal error occurred at Egress Gateway. Validate the network connectivity and deployment. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E153	This error code indicates that Egress Gateway is unable to send an AccessToken request to NRF.	This is internal error occurred at Egress Gateway. Validate the network connectivity and deployment. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E154	This error code indicates an error in retrieving a token from NRF.	This is internal error occurred at Egress Gateway. Validate the network connectivity and deployment. Review application logs to identify the reported error. Contact My Oracle Support if required.

Table E-77 (Cont.) Egress Gateway Service Error Codes

Error Code	Description	Action
ONRF-EGW-E155	This error code indicates response failure from NRF(invalid/bad response) while trying to fetch oauth token.	This is internal error occurred at Egress Gateway. Validate the network connectivity and deployment. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E172	This error code indicates that requests are being rejected after exceeding the bucketCapacity when the egressRateLimiting feature is enabled.	This is an internal error occurred at Egress Gateway. System values are already tuned. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E182	This error code indicates that custom exception occurred in some feature at Egress Gateway because some conditions failed to fulfill at runtime, such as SbiRouting, SeppProxyFilter, PeerBlackListHelper, EgressGatewayFilter, and so on.	This is an internal error occurred at Egress Gateway. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E183	This error code indicates that ResponseStatusException was created by Spring boot as Egress Gateway exception handler was unable to handle an exception.	This is an internal error occurred at Egress Gateway. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E192	This error code indicates that requests are being discarded partially at Egress Gateway when the control shutdown feature is enabled.	Control Shutdown is already in progress. Nothing much can be done. If needed, review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E193	This error code indicates that requests are being discarded completely at Egress Gateway when the control shutdown feature is enabled.	Control Shutdown is already in progress. Nothing much can be done. If needed, review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E202	This error code indicates that an invalid route exception has occurred as invalidRouteFilter was configured in routesConfiguration.	Review and correct the routing filter configuration. Review application logs to identify the reported error. Contact My Oracle Support if required.
ONRF-EGW-E223	This error code indicates that requests are being rejected after exceeding the fillRate when the Egress pod protection by rate limiting feature is enabled.	Review the pod protection by Rate limiting configurations. Verify the limits are configured as per the recommendation. Identify the NF that sends the additional traffic (the traffic type). Reduce the additional traffic. Contact My Oracle Support if required.

E.11 Alternate Route Service

The following table lists the error codes and its problem details for the Alternate Route Service.

Table E-78 Alternate Route Service Error Codes

Error Code	Description	Action
ARS-E101	This error code indicates that Alternate Route Service experienced an exception while trying to connect/send request to upstream DNS for the DNS NAPTR feature.	Check upstream DNS connectivity and troubleshoot Alternate Route Service. Review application logs to identify the reported error. Contact My Oracle Support if required.
ARS-E102	This error code indicates FQDN or scheme parsing exception has occurred at Alternate Route Service.	Review FQDN and URI schemes; correct invalid values. Review application logs to identify the reported error. Contact My Oracle Support if required.
ARS-E103	This error code indicates a custom exception has occurred at Alternate Route Service.	Review application logs to identify the reported error. Contact My Oracle Support if required.

E.12 Common Configuration

The following table lists the error codes and its problem details for the Common Configuration.

Table E-79 Common Configuration Error Codes

Error Code	Description	Action
CFG-E101	This error code indicates that an invalid method argument exception has occurred at Common Configuration Service.	Check API client or request; correct the method arguments as documented in the API specification. Review application logs to identify the reported error. Contact My Oracle Support if required.
CFG-E102	This error code indicates that the missing request parameter exception has occurred at Common Configuration Service.	Add the required request parameters as documented in the API specification. Review application logs to identify the reported error. Contact My Oracle Support if required.
CFG-E103	This error code indicates that no suitable converter was found for Common Configuration Service.	Check the request or response content types and converters configuration; update or add missing converters as documented in the API specification. Review application logs to identify the reported error. Contact My Oracle Support if required.

Table E-79 (Cont.) Common Configuration Error Codes

Error Code	Description	Action
CFG-E105	This error code indicates that the triggered HTTP method is not supported for the URI/API end point.	Use supported HTTP method as documented in the API specification. Review application logs to identify the reported error. Contact My Oracle Support if required.
CFG-E106	This error code indicates that exception has occurred as the payload was not in the proper format to read.	Validate and correct the request or response payload format as documented in the API specification. Review application logs to identify the reported error. Contact My Oracle Support if required.
CFG-E107	This error code indicates that configuration related exception has occurred at Common Configuration Service.	Review configuration files and environment variables for errors or omissions. Review application logs to identify the reported error. Contact My Oracle Support if required.
CFG-E108	This error code indicates that HTTP error has occurred at Common Configuration Service.	Check server network and endpoint status; retry when service is available. Review application logs to identify the reported error. Contact My Oracle Support if required.
CFG-E109	This error code indicates that custom exception has occurred at Common Configuration Service.	Review application logs to identify the reported error. Contact My Oracle Support if required.

F

Server Header Propagation

F.1 Adding Filters for Server Header Propagation

For service-mesh based deployment the below filter needs to be applied for the server header to be propagated so that the sidecar container will propagate the server header sent by the application container. Otherwise, it sends the server header as envoy.

The filter should be applied in each namespace for the server header propagation. Use the following command to apply this filter in each namespace:

```
kubectl apply -f server-header-envoy-filter.yaml --namespace $NAMESPACE
```

Where,

<namespace> is the namespace.

The content of the `server-header-envoy-filter.yaml` file is given below:

```
apiVersion: networking.istio.io/v1alpha3
kind: EnvoyFilter
metadata:
  name: serverheaderfilter
spec:
  configPatches:
    - applyTo: NETWORK_FILTER
      match:
        listener:
          filterChain:
            filter:
              name: envoy.filters.network.http_connection_manager
      patch:
        operation: MERGE
        value:
          typed_config:
            '@type': type.googleapis.com/
envoy.extensions.filters.network.http_connection_manager.v3.HttpConnectionMana
ger
          server_header_transformation: PASS_THROUGH
```

G

Error Handling and Expected Outcomes for NRF Growth Feature

This section outlines the behavior of NRF with failure scenarios if the NRF growth feature is enabled. Each use case describes the scenario, expected system behavior, customer impact, and observability.

Unavailability of the Cache Data Microservice (CDS) of an NRF Instance

The CDS pods of an NRF instance can go down and become unavailable due to unexpected traffic surges, or an increase in the number of NFs beyond the supported capacity, and so on. This can cause the request towards the CDS to timeout or receive a non-2xx error response.

Expected behavior:

- NRF will continue to support all service operations, with a limited segment view.
- The affected NRF instance falls back to its database to continue providing services.

The following table describes the impact of different service operations in the affected NRF:

Table G-1 The CDS microservice of an NRF instance is down or overloaded

Service Operation	Impact
NFRegister, NFUpdate, NfHeartbeat, and NFDeregister	There is no impact on NF Consumer, and it remains unaffected.
NFProfileRetrieval/NFListRetrieval	Uses the local set nfInstances data only.
NFStatusSubscribe/NFStatusUnsubscribe	Uses the local set nfsubscription and nfInstances data only.
NFStatusNotify	Notification is generated for the subscription taken in the local NRF set only.
Nnrf_AccessToken_Get	Uses the local set nfInstances data only.
NFDiscover	Uses the local set nfInstances data and the last known remote set nfInstances data (if available in the in-memory cache of the discovery microservice).

Customer Impact: Customers may experience degraded service and higher service latencies. Some operations may not return the latest nfProfile content, and it returns the content from a local set data only depending on the NRF operation. The impact varies by NRF service operation—for example, discovery may still return some data that is not the latest data of the remote set, but for other service operations, the response will contain data of the same set (current NRF) only.

Observability:

Alerts: The following alerts can be monitored to identify CDS microservice issues, including unavailability and overload conditions:

- [OcnrfCacheDataServiceDown](#) – Triggered when the CDS microservice becomes unavailable due to pod restarts, database connectivity failure, and so on.

- [OcnrfDatabaseFallbackUsed](#) – Triggered when the CDS microservice is overloaded or when the system switches to database fallback due to CDS unavailability.

The following metrics can be monitored for higher latency indication:

- `oc_ingressgateway_request_latency_seconds_[suffix]`
- `oc_ingressgateway_backend_invocation_latency_seconds_[suffix]`

Communication Between the Local and the Remote NRFs is Down

- **Communication Between the Local NRF and Any One of the Remote NRF Set is Down**

CDS pods communicate with the remote set NRFs to synchronize the state data between the set. During this synchronization, communication may become unavailable or down between the local NRF and the remote primary NRF, or between the local NRF and the remote NRFs (primary or alternate NRFs).

This can occur due to various scenarios. Some of them are as follows:

- network issues
- remote set CDS pods are unavailable or overloaded. In this case, the request may timeout, and an error response may be received
- remote NRF set is completely down

Expected behavior:

- For periodic state data synchronization requests, the NRF will receive a 4xx/5xx error response from the remote NRF of the remote NRF set when its CDS is down or unavailable.
- In case when the synchronization requests fail with an remote NRF, an attempt will be made to the alternate NRFs of the remote NRF set to synchronize the data. (On failure, NRF attempts the remote set NRFs sequentially.)

Note

All the NRFs of the remote set include the same state data in their synchronization response.

The following table describes the impact of different service operations in the current NRF:

Table G-2 Communication between the local NRF and any one of the remote NRF set is down

Service Operation	Impact
NFRegister, NFUpdate, NfHeartbeat, and NFDeregister	There is no impact on NF Consumer, and it remains unaffected.
NFProfileRetrieval/NFListRetrieval	There is no impact on NF Consumer, and it remains unaffected. Uses the local set nInstances data and the remote nInstances sync from a non-primary NRF.
NFStatusSubscribe/NFStatusUnsubscribe	There is no impact on NF Consumer, and it remains unaffected. Uses the local set nSubscription and nInstances data, and the remote nInstances and nSubscription sync from a non-primary NRF.

Table G-2 (Cont.) Communication between the local NRF and any one of the remote NRF set is down

Service Operation	Impact
NFStatusNotify	There is no impact on NF Consumer, and it remains unaffected. Notification is generated for the subscription taken in the local NRF set and the remote NRF set sync from a non-primary NRF.
Nnrf_AccessToken_Get	There is no impact on NF Consumer, and it remains unaffected. Uses the local set nInstances data and the remote nInstances sync from a non-primary NRF.
NFDiscover	There is no impact on NF Consumer, and it remains unaffected. Uses the local nInstances and the remote nInstances sync from a non-primary NRF.

Customer Impact: As long as the NRF can synchronize the state data from any one of the NRFs of the remote NRF set, NF Consumers have no impact on any service operations.

Observability:

Alerts: [OcnrfRemoteSetNrfSyncFailed](#) -Monitors if any failure occurs while synchronizing the remote NRF set data.

Metrics:

The following metrics can be monitored for higher latency indication:

- oc_ingressgateway_request_latency_seconds_[suffix]
- oc_ingressgateway_backend_invocation_latency_seconds_[suffix]
- **Communication Between Local NRF and All Remote NRF Sets is Down**
The communication between a local NRF and all remote NRFs is unavailable or down. This affects the ability of the NRF to synchronize the state data with the NRFs of the remote set.

This can occur due to various scenarios. Some of them are as follows:

- network issues
- all the remote set CDS pods are unavailable or overloaded
- all the NRFs in the remote NRF set is completely down

Expected behavior:

- The CDS of the local NRF uses the last known data of the remote sets (available in the in-memory cache) for all service operations, along with the latest data of the local NRF set, till the communication between any of the NRFs of the remote set is restored.
- If the remote NRF set is completely down, then the consumer NF registered to the set may have a service outage, as there is no other NRF with a GR site to fallback.
- NRF continue to attempt to sync the data from the remote set until it is successful.

The following table describes the impact of different service operations in the current NRF:

Table G-3 Communication Between Local NRF and All Remote NRF Sets is Down

Service Operation	Impact
NFRegister, NFUpdate, NfHeartbeat, and NFDeregister	There is no impact on Consumer NFs, and it remains unaffected.

Table G-3 (Cont.) Communication Between Local NRF and All Remote NRF Sets is Down

Service Operation	Impact
NFProfileRetrieval/NFListRetrieval	Uses the latest nfInstances from the current (local) NRF set and the last synchronized nfInstances from the remote set.
NFStatusSubscribe/NFStatusUnsubscribe	Uses the latest nfsubscription and nfInstances from the current (local) NRF set and the last synchronized nfInstances and nfsubscription from the remote set.
NFStatusNotify	Notification is generated for the latest subscription taken in the current (local) set NRF and the last synchronized remote set NRF.
Nnrf_AccessToken_Get	Uses the latest nfInstances from the current (local) NRF set and the last synchronized nfInstances from the remote set.
NFDiscover	Uses the local set nfInstances data and the last known remote set nfInstances data (if available in the in-memory cache of the CDS).

Customer Impact: NF Consumers may experience degraded service till the communication with the remote set is restored, as the remote set's data will not be the latest.

It is considered that the NRF is working with limited capacity. In this state, the operator should explore diverting the traffic to an alternate NRF within the same NRF set, provided the alternate NRFs are not having similar fault and having necessary capacity to handle the additional traffic.

Observability:

Alerts: The following alerts can be monitored to check if the communication between the local NRF and all the remote NRF sets is down.

- [OcnrfRemoteSetNrfSyncFailed](#) (for each local NRF instance) is used to check the sync request to the NRF in the remote set has failed.
- [OcnrfSyncFailureFromAllNrfOfAnyRemoteSet](#) is used to check if the sync requests to all the NRFs of a remote set has failed.
- [OcnrfSyncFailureFromAllNrfOfAllRemoteSets](#) is used to check if the sync request to all the NRFs in all the remote sets have failed.

Metrics:

The following metrics can be monitored for higher latency indication:

- `oc_ingressgateway_request_latency_seconds_[suffix]`
- `oc_ingressgateway_backend_invocation_latency_seconds_[suffix]`

Unavailability of the Database for the Remote NRF Sets

- **The Database Service for One or More Remote NRF Site is Unavailable or Down**
The database service for one or more remote NRF site is unavailable or down. This affects the ability of the NRF to synchronize the data.

Expected behavior:

- The NRF site, whose DB service is down, marks itself as unavailable. When the database service of an NRF site is unavailable, the microservices like discovery, access token, registration, subscription, auditor, and CDS mark themselves as unavailable by moving their pod to "Not Ready" state.

- The current NRF receives the 5xx response for a synchronization request that is sent to the NRF whose database services is down.
- NRF sends the request to an alternate NRF of that set to synchronize the state data.

The following table describes the impact of different service operations in the current NRF:

Table G-4 The database service for one or more remote NRF site is unavailable or down

Service Operation	Impact
NFRegister, NFUpdate, NfHeartbeat, and NFDeregister	There is no impact on NF Consumer, and it remains unaffected.
NFProfileRetrieval/NFListRetrieval	There is no impact on NF Consumer, and it remains unaffected. Uses the local set nInstances data and the remote nInstances sync from a non-primary NRF.
NFStatusSubscribe/NFStatusUnsubscribe	There is no impact on NF Consumer, and it remains unaffected. Uses the local set nSubscription and nInstances data, and the remote nInstances and nSubscription sync from a non-primary NRF.
NFStatusNotify	There is no impact on NF Consumer, and it remains unaffected. Notification is generated for the subscription taken in the local set NRF and the remote set NRF sync from a non-primary NRF.
Nnrf_AccessToken_Get	There is no impact on NF Consumer, and it remains unaffected. Uses the local set nInstances data and the remote nInstances sync from a non-primary NRF.
NFDiscover	There is no impact on NF Consumer, and it remains unaffected. Uses the local nInstances and the remote nInstances sync from a non-primary NRF.

Customer Impact: As long as the NRF is able to get the state data from any of the NRFs of the remote set, NF Consumers have no impact on any service operation.

In case, all the NRFs of the remote set are unavailable, NF Consumers may experience degraded service till the communication with the remote set is restored, as the remote set's data will not be the latest.

Observability:

Alerts: [-OcnrfRemoteSetNrfSyncFailed](#) is used to monitor whether the remote sync has failed or whether the database service for a remote NRF is unavailable or down.

- **Database Services of All the Remote NRF Sets are Down**

When the database services of all the remote NRF sets are down, NRF marks the service as unavailable.

Expected behavior:

- The NRF site, whose database service is down, marks itself as unavailable. When the database service of an NRF site is unavailable, the microservices like discovery, access token, registration, subscription, auditor, and CDS mark themselves as unavailable by moving their pod to "Not Ready" state.
- All NRFs in the remote set declare themselves as service-unavailable.
- NRF will try to attempt all the NRFs of that set to synchronize the data, and will fail.
- The CDS of the local NRF will use the last known data of the remote set.
- NRF continue to attempt to sync the data from the remote set until it is successful.

The following table describes the impact of different service operations in the current NRF:

Table G-5 Database services of all the remote NRF sets are down

Service Operation	Impact
NFRegister, NFUpdate, NfHeartbeat, and NFDeregister	There is no impact on Consumer NFs, and it remains unaffected.
NFProfileRetrieval/NFListRetrieval	Uses the latest nfInstances from the current (local) NRF set and the last synchronized nfInstances from the remote set.
NFStatusSubscribe/NFStatusUnsubscribe	Uses the latest nfsubscription and nfInstances from the current (local) NRF set and the last synchronized nfInstances from the remote set.
NFStatusNotify	Notification is generated for the subscription taken in the local NRF set and the last synchronized data from the remote NRF set.
Nnrf_AccessToken_Get	Uses the latest nfInstances from the current (local) NRF set and the last synchronized nfInstances from the remote set.
NFDiscover	Uses the local set nfInstances data and the last known remote set nfInstances data (if available in the in-memory cache of the CDS).

Customer Impact: NF Consumers may experience degraded service till the communication with the remote set is restored, as the remote set's data will not be the latest.

Observability:

The following alerts can be monitored when the database services of all the remote NRF sets are down.

- [OcnrfRemoteSetNrfSyncFailed](#): Indicates that synchronization with a specific local NRF instance in a remote set has failed.
- [OcnrfSyncFailureFromAllNrfsOfAnyRemoteSet](#): Triggers when synchronization fails from all NRFs within any one remote set.
- [OcnrfSyncFailureFromAllNrfsOfAllRemoteSets](#): Triggers when synchronization fails from all NRFs in all configured remote sets.

Remote NRF Instance's Replication Channel

- **When the Primary NRF of the Remote Set has the Replication Down with One of its Mated Sites**

The replication channel is down between one or more NRFs of the remote NRF sets.

Expected behavior:

- The current NRF continues to use the remote NRF site/set for synchronizing even if the replication is down even if the replication of the remote set is down with one or more of its peer NRF.
- The remote NRF will have the latest nf state data for the peer NRF with whom the replication is up and for NRF whose replication is down will have the last replicated data.
- This results in the unavailability of the latest remote NRF set data being used for service operations.

The following table describes the impact of different service operations in the current NRF:

Table G-6 When the Primary NRF of the Remote set has the Replication down with one of its Mated Sites

Service Operation	Impact
NFRegister, NFUpdate, NfHeartbeat, and NFDeregister	There is no impact on NF Consumer, and it remains unaffected.
NFProfileRetrieval/NFListRetrieval	Uses the local set nInstances data and the remote nInstances sync from a primary NRF which may not have the latest state data.
NFStatusSubscribe/NFStatusUnsubscribe	Uses the local set nfsubscription and nInstances data, and the remote nInstances sync from a primary NRF which may not have the latest state data.
NFStatusNotify	Notification is generated for the subscription taken in the local NRF set and the remote NRF set which may not have the latest state data.
Nnrf_AccessToken_Get	Uses the local set nInstances data and the remote nInstances sync from a primary NRF which may not have the latest state data.
NFDiscover	Uses the local nInstances and the remote nInstances sync from a primary NRF which may not have the latest state data.

Customer Impact: NF Consumers may experience service impacts due to the unavailability of the latest remote NRF set data.

Observability:

There is no alert to monitor the current NRF behavior.

[OcnrfDbReplicationStatusInactive](#) alert is used to monitor the target NRF behavior.

- **When the Primary NRF of the Remote Set has the Replication Down with All of its Mated Sites**

The replication channel is down between the Primary NRF and all of its georedundant NRFs.

Expected behavior:

- The current NRF continues to use the remote NRF site or set for synchronizing even if the replication is down even if the replication of the remote set is down with one or more of its peer NRF.
- The remote NRF will have the have the last replicated data of the georedundant NRFs.
- This results in the unavailability of the latest remote NRF set data being used for service operations.

The following table describes the impact of different service operations in the current NRF:

Table G-7 When the Primary NRF of the Remote set has the Replication down with all of its Mated sites

Service Operation	Impact
NFRegister, NFUpdate, NfHeartbeat, and NFDeregister	There is no impact on Consumer NFs, and it remains unaffected.
NFProfileRetrieval/NFListRetrieval	There is no impact on Consumer NFs, and it remains unaffected. Uses the last synchronized nInstances from the remote set and the latest nInstances from the current NRF set.

Table G-7 (Cont.) When the Primary NRF of the Remote set has the Replication down with all of its Mated sites

Service Operation	Impact
NFStatusSubscribe/NFStatusUnsubscribe	Uses the local set nInstances data, the remote nInstances data, and the nfSubscription data only.
NFStatusNotify	Notification is generated for the subscription taken in the local NRF set and the remote NRF set.
Nnrf_AccessToken_Get	There is no impact on Consumer NFs, and it remains unaffected. Uses the last synchronized nInstances from the remote set and the latest nInstances from the current NRF set.
NFDiscover	There is no impact on Consumer NFs, and it remains unaffected. Uses the local set nInstances data and the last known remote set nInstances data (if available in the in-memory cache of the discovery microservice).

Customer Impact: NF Consumers may experience service impact because the remote set's data will not be the latest.

Observability: There are no alerts for this scenario.

Local Database Failure

- **Local Database Tier is Down**

The database of the local NRF is unavailable or down.

Expected behavior:

- NRF considers the database tier as a mandatory component and checks for the health of the Database periodically.
- When the database is unavailable, all services, including CDS, mark their pods as "Not Ready". Any requests for these services will fail, and Egress Gateway will send an error response (5xx).

Customer Impact: On receiving the 5xx error, the NF Consumers are expected to move to an alternate NRF of the set. As long as NF Consumers can communicate with NRF, the NF Consumers will not have any service impact.

Observability:

Alerts:

- [OcnrfNfStatusUnavailable](#) is used to check if the database service for a remote NRF is unavailable or down.
- The database-related alerts should be monitored. For more details, see *Oracle Communications Cloud Native Core, cnDBTier User Guide*.

- **Local NRF's Replication Failure**

- **Total Replication Failure (to all remote NRF peers):**

The replication from the local NRF to all configured remote NRFs (primary and alternates) is down.

Expected behavior:

Remote NRFs retain only the last successfully replicated NF state and become increasingly outdated data until replication is restored and re-synchronization completes.

Customer Impact: NF Consumers may experience service impact because the remote set's data will not be the latest.

Observability: There are no alerts for this scenario.

- **Partial Replication Failure (to one or more remote NRF peers):**

Replication from the local NRF to some remote NRFs is down while replication to other peers continues.

Expected behavior:

Remote NRFs with replication up have the latest NF state; remote NRFs with replication down retain the last successfully replicated NF state until recovery.

Customer Impact: NF Consumers may experience service impact because the affected remote NRF set(s) will not have the latest NF state data while other remote sets may still be up to date.

Observability: There are no alerts for this scenario.

Periodic Refresh of Discovery and CDS PODs

- **Discovery in-memory cache**

Each discovery pod maintains independent cache.

During initialization or pod restart scenario, each discovery pod gets the local NRF and remote NRF data and retains in-memory cache.

- In every 2 seconds, it queries CDS to get the delta data.
- In every X seconds, it reloads the complete NF profile from CDS.
- Additionally, in every 60 seconds it reloads the local set data by directly going to the database.

Note

During initialization, if CDS communication fails, discovery goes to the database and loads the local set data so that at least it can provide service with local set data. It continues to reach out to CDS in every 2 seconds to get the remote set data until it is successful.

Customer Impact: There is a possibility that NF Consumers may receive a different view of the topology if the underlying data is updated during the synchronization period.

Observability: There are no alerts for this scenario.

- **CDS in-memory cache**

Each CDS pod maintains independent cache.

During pod initialization or pod restart, each CDS pod gets the local NRF data from the database and remote NRF data by querying the remote sets and retains it in the in-memory cache.

After Pod initialization, CDS performs periodic sync requests to the remote sets every 2 seconds to get the delta data (Data that has not been synced within the last two seconds).

Additionally, CDS also performs complete resync of remote set data every 60 seconds.

Note

If CDS is unable to perform sync with the remote sets, due to network issues, other set is down etc, CDS will retain its last known data of the remote set in its cache till its able to re-establish sync with the remote set.

Customer Impact: There is a possibility that NF Consumers may receive a different view of the topology if the underlying data is updated during the synchronization period.

Observability: [OcnrfRemoteSetNrfSyncFailed](#)- Indicates that synchronization with a specific local NRF instance in a remote set has failed.

H

NF Distribution Guidelines between NRF Instances for Single-set and Multi-set based Deployments

NF Consumers generate discovery traffic toward the NRF. Both NF Consumers and NF Producers generate NRF management and NF Access token traffic. As the networks scale by adding NFs, supporting more traffic, or transitioning from single-set to multi-set georedundancy deployments, NF distribution can become uneven. Due to this, certain NRF sites or sets may reach an overload condition, leading to performance variations.

This section provides the guidelines to define a structured approach for assigning Network Functions (NFs) to NRF instances and NRF sets for achieving balanced traffic distribution, efficient resource utilization, and resilience in both single-set and multi-set deployments (using the Growth feature).

In a **single-set deployment**, all NRF instances operate as one logical entity, and all NFs register and perform service discovery within that same set. When deployed across multiple geographic sites, geo-redundancy ensures service availability during site failures, while georeplication synchronizes NF registration data between sites. This model maintains a unified logical architecture while providing high availability and consistent discovery behavior.

In a **multi-set deployment**, all NRF instances operate as one logical entity which are organized into multiple logical sets, and all NFs register to a specific set and perform service discovery across the sets. When deployed across geographic sites, geo-redundancy ensures availability of each individual set. If georeplication is enabled it maintains data consistency within that set. For more details about multi-set deployment, see [Enhanced NRF Set Based Deployment \(NRF Growth\)](#).

The following NF distribution guidelines are defined to ensure balanced and resilient deployments.

- **Distribution based on NF**
 - **Single-set:** Distributing NF Consumers and NF Producers between the NRF instances in the set so that Ingress traffic (management, discovery, and access token) towards each NRF instance remains balanced.
For example, NF-1, NF-2, and NF-3, which belong to same nfSet should be configured with distinct NRFs of an NRF set (NRF-A, NRF-B and NRF-C) as their primary NRF so that the traffic generated towards the NRFs by the NFs remains balanced. That is, NF-1's primary NRF is NRF-A, NF-2's primary NRF is NRF-B and NF-3's primary NRF is NRF-C.
 - **Multi-set:** Distributing NF Consumers and NF Producers between the NRF instances across multiple NRF sets so that the Ingress traffic (management, discovery, and access token) towards each NRF set remains balanced.
For example:
 - * 4 NFs in a single set - 2 in first set and 2 in second set.
 - * 3 NF in a single set, 2 in first set and 1 in second set.

Note

This does not provide an even distribution but a better distribution with respect to resiliency.

- * Multiple NF sets, and each set having 3 or 4 NFs, distribute the NFs in such a way that all the NF counts remain balanced across each NRF instance.
- **Distribution based on Traffic**
If NFs in a set have different capacities and NFs are not generating the same quantum of traffic, then while distributing them in different NRF instances, the quantum of traffic has to be considered so that the traffic distribution between the NRF instances remains balanced.
 - **Single-set:** Distributing NF Consumers and NF Producers between the NRF instances in the set based on the traffic quantum generated by each NF, so that the ingress traffic towards each NRF instance remains balanced even when NFs produce unequal traffic.
For example: NF-1, NF-2, and NF-3 which belongs to the same nfSet generate different ingress traffic towards NRF (that is, NF-1 generates high traffic, NF-2 generates medium traffic, and NF-3 generates low traffic). They should be configured with Primary NRFs in a way that balances the overall traffic per NRF instance rather than distributing NFs evenly by count.
For example, configure:
 - * NF-1's Primary NRF as NRF-A
 - * NF-2's Primary NRF as NRF-B
 - * NF-3's Primary NRF as NRF-B (or NRF-C, depending on NRF capacity or target balance)
 so that the combined traffic directed towards each NRF instance remains balanced (for example, Do not place the high-traffic NFs on the same NRF instance).
 - **Multi-set:** Distributing NF Consumers and NF Producers between the NRF instances across multiple NRF sets based on the traffic quantum generated by each NF, so that the ingress traffic towards each NRF set (and NRF instances within the sets) remains balanced, even when NFs have different capacities and generate different traffic volumes.
For example, consider two NRF sets (different failure domains), each with three NRF instances:
 - * NRF Set-1: NRF-A, NRF-B, NRF-C
 - * NRF Set-2: NRF-D, NRF-E, NRF-F
 Assume there are six NFs in the same nfSet, each generating different ingress traffic like (management, discovery, access-token):
 - * NF-1: high traffic
 - * NF-2: high traffic
 - * NF-3: medium traffic
 - * NF-4: medium traffic
 - * NF-5: low traffic
 - * NF-6: low traffic

They should be configured with Primary NRFs based on traffic quantum so that the total ingress traffic per NRF set (and per instance within the set) stays balanced and should not be split by NF count.

For example, configure Primary NRFs as:

- * NF-1 → NRF-A (Set-1)
- * NF-2 → NRF-D (Set-2)
- * NF-3 → NRF-E (Set-2)
- * NF-4 → NRF-B (Set-1)
- * NF-5 → NRF-C (Set-1)
- * NF-6 → NRF-F (Set-2)

This spreads the high traffic NFs across different NRF sets, and places the medium or low traffic NFs to keep the overall ingress load balanced across both NRF sets and their instances.

- **Multi-Set Awareness**

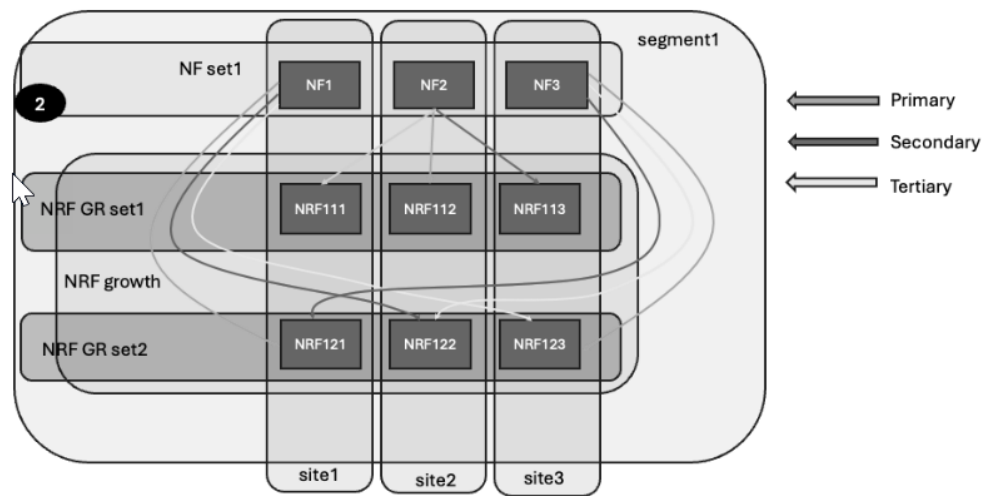
This focuses on deploying and configuring NRF to avoid distributing all NF registrations and discovery traffic within a single NRF set or failure domain. It improves resiliency and continuity by spreading NF Consumers and NF Producers across multiple NRF sets (and their instances). With this approach, an NRF instance or full set failure impacts only a subset of NFs, while the remaining NFs continue operating via other NRF sets.

- **Single-set:** Multi-set awareness requires spreading NFs across multiple NRF sets and failure domains, which is not possible in a single-set deployment.
- **Multi-set:** NF Consumers and NF Producers are distributed across NRF sets (and instances) so that NFs are split across multiple failure domains. Configure Primary (and Secondary or alternate) NRF associations such that NFs are not concentrated in one set, and ensure failover paths exist to another NRF set if an instance or an entire set becomes unavailable.

For example: Consider a scenario where instances within an NF set (such as, NF1, NF2, and NF3 from NF set 1) are distributed across two NRF GR sets:

Note

- * As part of this distribution, ensure Primary, Secondary and Tertiary NRFs for an NF are configured with NRFs of a single set and does not spread across multiple NRF Sets.
- * In case, Virtual FQDN is configured for NRF, ensure the resolved Primary, Secondary and Tertiary NRFs belongs to a single NRF Set.

Figure H-1 Multi Set Awareness

- * NF1 is primarily mapped to NRF121 (part of NRF GR set 2), with secondary and tertiary fallback options pointing to NRF122 and NRF123 in the second set.
- * NF2 is mapped primarily to NRF112 (in NRF GR set 1), with fallback options to NRF113 and NRF111 in the first set.
- * NF3 follows a similar mapping, with primary and backup associations distributed across both NRF GR sets.

This distribution ensures that if an entire NRF GR set fails, only part of the NF set is affected, while the remaining instances connected to other NRF GR sets continue operating.

Loop Detection and Loop Prevention in NRF Forwarding Scenarios

NRF forwarding may involve multiple NRFs. Since `nrfHostConfig` defines the NRF peers used for forwarding, NRF also uses it together with the `Via` header (forwarding history) to ensure that forwarded requests do not circulate between NRFs.

The following sections describes the behavior of loop detection and loop prevention for NRF forwarding in the following modes:

- NRF forwarding : URI- `{apiRoot}/nrf-configuration/v1/forwardingOptions`
- NRF Growth forwarding: URI- `{apiRoot}/nrf-configuration/v1/nrfGrowth/nrfForwardingOptions`

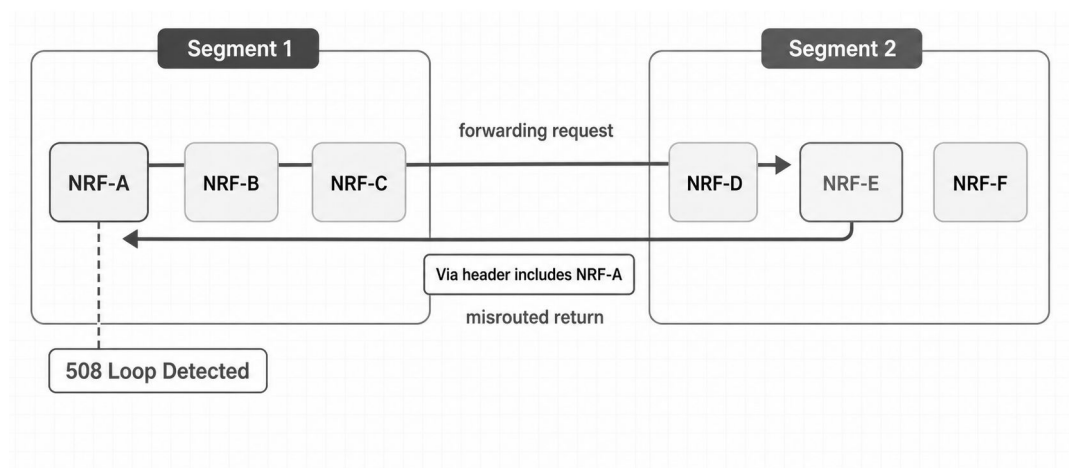
Loop detection

Loop detection helps to detect if a request has been forwarded to the same NRF causing an infinite loop. To detect, NRF evaluates the `Via` header in the incoming requests. If it contains its own host and port, NRF declares a loop has been detected and returns an error response as configured under `errorResponses` for `errorCondition=NRF_Forwarding_Loop_Detection`.

Example:

- NRF forwarding:
The following image describes the high-level view of NRF forwarding across Segment 1 and Segment 2, where the request is forwarded from one NRF to another and then incorrectly returned to the originating NRF, resulting in loop detection.

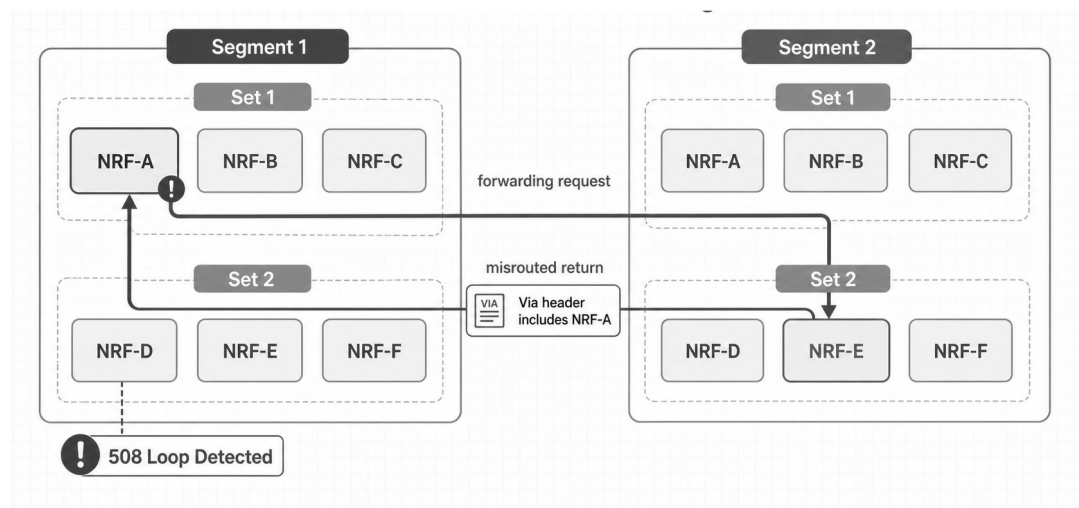
Figure I-1 Loop Detection -NRF Forwarding



NRF-A of Segment 1 forwards a request to NRF-E of Segment 2. Due to an incorrect routing or forwarding configuration, the request is routed back to NRF-A. Upon receiving the request, NRF-A detects that the Via header already contains its own configured host:port (ocnrHost:ocnrPort in {apiRoot}/nrf-configuration/v1/generalOptions URI) entry. NRF identifies this as a forwarding loop and returns the configured error response (for example, HTTP 508 "Loop Detected").

- **NRF Growth forwarding:**
The following image describes the high-level view of NRF Growth forwarding across Segment 1 and Segment 2, where each segment contains Set 1 and Set 2, and a returned request reaches the originating NRF again, resulting in loop detection.

Figure I-2 Loop Detection_NRF Growth Forwarding



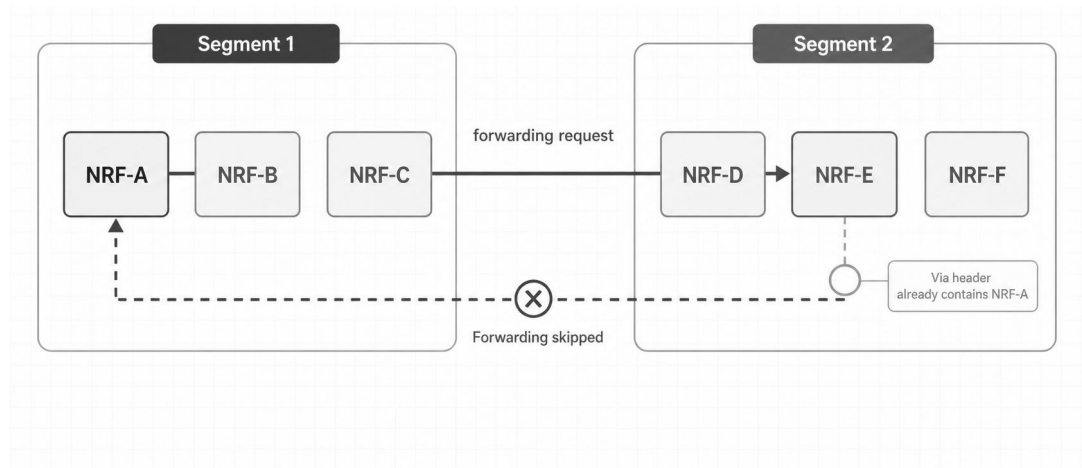
NRF-A in NRF Set-1 of Segment 1 forwards a request to NRF-E in NRF Set-2 of Segment 2 based on the NRF Growth forwarding configuration. Due to an incorrect routing or forwarding configuration, the request is forwarded back to NRF-A in NRF Set-1 of Segment 1. Upon receiving the request, NRF-A in NRF Set-1 of Segment 1 detects that the Via header already contains its own configured ocnrfHost:ocnrPort entry. NRF identifies this as a forwarding loop and returns the configured error response (for example, HTTP 508 Loop Detected).

Loop Prevention

Loop prevention prevents creation of loops by checking the forwarding history before forwarding a request. Before forwarding a request, NRF compares the entries in the Via header with the configured NRF identities in nrfHostConfig. If the selected destination NRF already appears in the Via header, NRF determines that the destination NRF has already processed the request and skips forwarding to that NRF to prevent a forwarding loop.

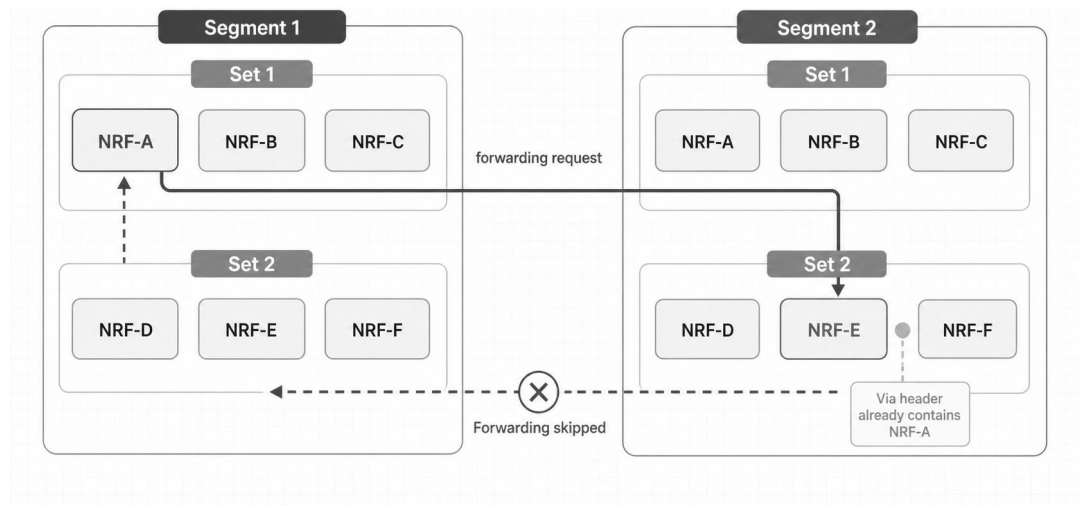
Example

- **NRF forwarding:**
The following image describes the high-level view of NRF forwarding across Segment 1 and Segment 2, where the destination NRF checks the Via header before forwarding and skips sending the request back to an NRF that already processed it.

Figure I-3 Loop Prevention_NRF Forwarding

NRF-A in Segment 1 forwards a request to NRF-E in Segment 2. NRF-E in Segment 2 determines that the next forwarding destination is NRF-A in Segment 1. Before forwarding the request, NRF-E in Segment 2 compares the Via header with the configured NRF identities in `nrfHostConfig` and finds that NRF-A in Segment 1's host:port already exists in the Via header. Since the destination NRF has already processed the request, NRF-E in Segment 2 does not forward the request to NRF-A in Segment 1, thereby preventing a forwarding loop.

- **NRF Growth forwarding:**
The following image describes the high-level view of NRF Growth forwarding across Segment 1 and Segment 2, where each segment contains Set 1 and Set 2, and the destination NRF prevents a loop by skipping forwarding to an NRF already present in the Via header.

Figure I-4 Loop Prevention_NRF Growth Forwarding

NRF-A in Segment 1 of NRF Set1 forwards a request to NRF-E in Segment 2 of NRF Set 2. NRF-E in Segment 2 of NRF Set 2 determines that the next forwarding destination is NRF-A in Segment 1 of NRF Set1. Before forwarding the request, NRF-E in Segment 2 of NRF Set 2 compares the Via header with the configured NRF identities under `nrfHostConfig.staticNrfConfigList[].nrfHostConfigList[]` and finds that NRF-A in Segment 1 of NRF Set 1's host:port already exists in the Via header. Since the destination NRF has already processed the request, NRF-E in Segment 2 of NRF Set 2 does not forward the request to NRF-A in Segment 1 of NRF Set1, thereby preventing a forwarding loop.

J

Managing Ingress Gateway Routes Configuration Using REST APIs

With this enhancement, NRF introduces support for configuring Ingress Gateway Routes settings through REST APIs, replacing the earlier Helm-based configuration approach. This enhancement provides a centralized and unified REST interface for managing route configurations, improving usability, consistency, and operational efficiency.

Caution

Use the suggested configurations for {apiRoot}/nrf/nf-common-component/v1/igw/routesconfiguration API as mentioned in the *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*. This API should be used with utmost caution to ensure no routes are accidentally removed which will cause severe service outage.

Example:

Suggested configuration

```
[
  {
    "id": "registration_mapping",
    "uri": "http://ocnrf-nfregistration:8080",
    "order": 1,
    "filters": [
      {
        "args": {
          "applicableShutdownStates": [
            "COMPLETE_SHUTDOWN"
          ]
        },
        "name": "ControlledShutdownFilter"
      }
    ],
    "predicates": [
      {
        "args": {
          "pattern": "/nnrf-nfm/v1/nf-instances/**"
        },
        "name": "Path"
      }
    ]
  },
  {
    "id": "subscription_mapping",
    "uri": "http://ocnrf-nfsubscription:8080",
    "order": 2,
```

```

        "filters": [
            {
                "args": {
                    "applicableShutdownStates": [
                        "COMPLETE_SHUTDOWN"
                    ]
                },
                "name": "ControlledShutdownFilter"
            }
        ],
        "predicates": [
            {
                "args": {
                    "pattern": "/nnrf-nfm/v1/subscriptions/**"
                },
                "name": "Path"
            }
        ]
    },
    {
        "id": "disc_mapping",
        "uri": "http://ocnrf-nfdiscovery:8080",
        "order": 3,
        "filters": [
            {
                "args": {
                    "applicableShutdownStates": [
                        "COMPLETE_SHUTDOWN"
                    ]
                },
                "name": "ControlledShutdownFilter"
            }
        ],
        "predicates": [
            {
                "args": {
                    "pattern": "/nnrf-disc/v1/nf-instances/**"
                },
                "name": "Path"
            }
        ]
    },
    {
        "id": "cachedata_mapping",
        "uri": "http://ocnrf-nrfcachedata:8080",
        "order": 5,
        "filters": [
            {
                "args": {
                    "applicableShutdownStates": [
                        "COMPLETE_SHUTDOWN"
                    ]
                },
                "name": "ControlledShutdownFilter"
            }
        ]
    }
],

```

```

        "predicates": [
            {
                "args": {
                    "pattern": "/nrfset-data/v1/**"
                },
                "name": "Path"
            }
        ]
    },
    {
        "id": "accesstoken_mapping",
        "uri": "http://ocnrf-nfaccesstoken:8080",
        "order": 4,
        "filters": [
            {
                "args": {
                    "applicableShutdownStates": [
                        "COMPLETE_SHUTDOWN"
                    ]
                },
                "name": "ControlledShutdownFilter"
            }
        ],
        "metadata": [
            {
                "ccaHeaderValidation": {
                    "enabled": false
                }
            }
        ],
        "predicates": [
            {
                "args": {
                    "pattern": "/oauth2/token"
                },
                "name": "Path"
            }
        ]
    }
]

```

For example, if you want to enable the CCA Header Validation feature, set the value of enabled attribute from false to true in the "accesstoken_mapping" id. Do not remove any of the existing routes in the above configuration and provide the complete JSON.

```

[
    {
        "id": "registration_mapping",
        "uri": "http://ocnrf-nfregistration:8080",
        "order": 1,
        "filters": [
            {
                "args": {
                    "applicableShutdownStates": [
                        "COMPLETE_SHUTDOWN"
                    ]
                }
            }
        ]
    }
]

```

```

        ],
        },
        "name": "ControlledShutdownFilter"
    }
],
"predicates": [
    {
        "args": {
            "pattern": "/nnrf-nfm/v1/nf-instances/**"
        },
        "name": "Path"
    }
]
},
{
    "id": "subscription_mapping",
    "uri": "http://ocnrf-nfsubscription:8080",
    "order": 2,
    "filters": [
        {
            "args": {
                "applicableShutdownStates": [
                    "COMPLETE_SHUTDOWN"
                ]
            },
            "name": "ControlledShutdownFilter"
        }
    ],
    "predicates": [
        {
            "args": {
                "pattern": "/nnrf-nfm/v1/subscriptions/**"
            },
            "name": "Path"
        }
    ]
},
{
    "id": "disc_mapping",
    "uri": "http://ocnrf-nfdiscovery:8080",
    "order": 3,
    "filters": [
        {
            "args": {
                "applicableShutdownStates": [
                    "COMPLETE_SHUTDOWN"
                ]
            },
            "name": "ControlledShutdownFilter"
        }
    ],
    "predicates": [
        {
            "args": {
                "pattern": "/nnrf-disc/v1/nf-instances/**"
            },

```

```

        "name": "Path"
      }
    ]
  },
  {
    "id": "cachedata_mapping",
    "uri": "http://ocnrf-nrfcachedata:8080",
    "order": 5,
    "filters": [
      {
        "args": {
          "applicableShutdownStates": [
            "COMPLETE_SHUTDOWN"
          ]
        },
        "name": "ControlledShutdownFilter"
      }
    ],
    "predicates": [
      {
        "args": {
          "pattern": "/nrfset-data/v1/**"
        },
        "name": "Path"
      }
    ]
  },
  {
    "id": "accesstoken_mapping",
    "uri": "http://ocnrf-nfaccesstoken:8080",
    "order": 4,
    "filters": [
      {
        "args": {
          "applicableShutdownStates": [
            "COMPLETE_SHUTDOWN"
          ]
        },
        "name": "ControlledShutdownFilter"
      }
    ],
    "metadata": [
      {
        "ccaHeaderValidation": {
          "enabled": true
        }
      }
    ],
    "predicates": [
      {
        "args": {
          "pattern": "/oauth2/token"
        },
        "name": "Path"
      }
    ]
  }
]

```



```
    }
  ]
}
```

⚠ Caution

Enabling CCA Header Validation using only the below "accesstoken_mapping" configuration is **not supported** and will lead to a **service outage**. Ensure that all required configurations are applied as per the documented procedure.

```
{
  "id": "accesstoken_mapping",
  "uri": "http://ocnrf-nfaccessstoken:8080",
  "order": 4,
  "filters": [
    {
      "args": {
        "applicableShutdownStates": [
          "COMPLETE_SHUTDOWN"
        ]
      },
      "name": "ControlledShutdownFilter"
    }
  ],
  "metadata": [
    {
      "ccaHeaderValidation": {
        "enabled": true
      }
    }
  ],
  "predicates": [
    {
      "args": {
        "pattern": "/oauth2/token"
      },
      "name": "Path"
    }
  ]
}
```

K

Use Cases for Allow Duplicate Subscriptions

This section describes the behavior of `allowDuplicateSubscriptions` parameter for different use cases. For more information, about configuring `allowDuplicateSubscriptions` parameter, see "NF Management Options" section in *Oracle Communications Cloud Native Core, Network Repository Function REST Specification Guide*.

Use Case 1: If the value of `allowDuplicateSubscriptions` is set as false and same subscription request than existing ones

NRF checks for duplicate subscription by matching the current subscription request with every subscription present in NRF except the `validityTime` attribute.

Existing subscription with NRF:

Subscription-1

```
{
  "nfStatusNotificationUri":http://notification-url.oracle.com/subscribe/
  notification,
  "subscriptionId":"54d05ee9d3c042b0bf1499463cf53fe0",
  "reqNotifEvents":["NF_REGISTERED","NF_PROFILE_CHANGED"],
  "subscrCond":{"nfType" : "UDM"},
  "validityTime":"2025-01-18T08:56:23.382Z"
}
```

New NFStatusSubscribe Request:

Subscription-2

```
{
  "nfStatusNotificationUri":http://notification-url.oracle.com/subscribe/
  notification,
  "reqNotifEvents":["NF_REGISTERED","NF_PROFILE_CHANGED"],
  "subscrCond":{"nfType":"UDM"},
  "validityTime":"2025-06-12T08:56:23.382Z"
}
```

As per the above example, Subscription-2 matches exactly with Subscription-1 except with the `validityTime`, the subscription response contains the same `subscriptionId` and `validityTime` of Subscription-1.

Use Case 2: If the value of `allowDuplicateSubscriptions` value is set to false and different subscription request than existing ones.

NRF checks for duplicate subscription by matching the current subscription request with every subscription present in NRF except the `validityTime` attribute.

Existing Subscription with NRF:

Subscription-1

```
{
  "nfStatusNotificationUri":http://notification-url.oracle.com/subscribe/
  notification,
  "subscriptionId":"54d05ee9d3c042b0bf1499463cf53fe0",
  "reqNotifEvents":["NF_REGISTERED","NF_PROFILE_CHANGED"],
  "subscrCond":{"nfType" : "UDM"},
  "validityTime":"2025-01-18T08:56:23.382Z"
}
```

New NFStatusSubscribe Request:

Subscription-3

```
{
  "nfStatusNotificationUri":http://notification-url.oracle.com/subscribe/
  notification-new,
  "reqNotifEvents":["NF_REGISTERED","NF_PROFILE_CHANGED"],
  "subscrCond":{"nfType" : "UDM"},
  "validityTime":"2025-06-12T08:56:23.382Z"
}
```

As per the above example, Subscription-3 does not match with Subscription-1 as nfStatusNotificationUri is different. In this case, NRF creates a new subscription. Hence, subscription response returns the new subscriptionId.

Use Case 3:- If the value of allowDuplicateSubscriptions is set to false and different subscription request than existing ones

NRF checks for duplicate subscription by matching the current subscription request with every subscription present in NRF except the validityTime attribute.

Existing Subscription with NRF:

Subscription-1

```
{
  "nfStatusNotificationUri":http://notification-url.oracle.com/subscribe/
  notification,
  "subscriptionId":"54d05ee9d3c042b0bf1499463cf53fe0",
  "reqNotifEvents":["NF_REGISTERED","NF_PROFILE_CHANGED"],
  "subscrCond":{"nfType" : "UDM"},
  "validityTime":"2025-01-18T08:56:23.382Z"
}
```

New NFStatusSubscribe Request:

Subscription-3

```
{
  "nfStatusNotificationUri":http://notification-url.oracle.com/subscribe/
```

```
notification,
"reqNotifEvents":["NF_REGISTERED", "NF_PROFILE_CHANGED"],
"subscrCond":{"nfType" : "AMF"},
"validityTime":"2025-06-12T08:56:23.382Z"
}
```

Subscription-3 does not match with Subscription-1 as the value of subscrCond is different. NRF creates a new subscription. Hence, subscription response returns the new subscriptionId.

Use Case-4:- When the value of allowDuplicateSubscriptions value is set to true and same subscription request than existing ones

NRF does not check for duplicate subscription and creates a new subscription.

Existing Subscription with NRF:

Subscription-1

```
{
"nfStatusNotificationUri":http://notification-url.oracle.com/subscribe/
notification,
"subscriptionId":"54d05ee9d3c042b0bf1499463cf53fe0",
"reqNotifEvents":["NF_REGISTERED", "NF_PROFILE_CHANGED"],
"subscrCond":{"nfType" : "UDM"},
"validityTime":"2025-01-18T08:56:23.382Z"
}
```

New NFStatusSubscribe Request:-

Subscription-2

```
{
"nfStatusNotificationUri":http://notification-url.oracle.com/subscribe/
notification,
"subscriptionId":"54d05ee9d3c042b0bf1499463cf53fe0",
"reqNotifEvents":["NF_REGISTERED", "NF_PROFILE_CHANGED"],
"subscrCond":{"nfType" : "UDM"},
"validityTime":"2025-06-12T08:56:23.382Z"
}
```

Subscription-2 matches exactly with Subscription-1 except validityTime, NRF creates a new subscription. Hence, subscription response returns the new subscriptionId.

Use Cases for Setting SBI Message Priority

This section describes the use cases supported by the Setting SBI Message Priority feature. The use cases illustrate how the 3gpp-Sbi-Message-Priority header is determined and applied based on configuration and incoming request characteristics.

Use Case Types: The Setting SBI Message Priority feature supports the following use case types:

- [Standalone Server Role](#)
- [Standalone Client Role](#)
- [Back-to-Back Agent Client Role](#)
- [Back-to-Back Agent Server Role](#)

Notes

The common points for use cases are defined to capture the baseline behavior and rules that apply consistently across all use case scenarios:

- The discovery response corresponding to the SLF response will follow the rules defined for NRF acting as a server for the NFDDiscover service operation.
- For certain use cases, such as forwarding and roaming, NRF sends requests to a peer NF. If an error occurs within NRF while it is acting as an NF and sending the message to the peer, the response generated toward the client NF will follow NRF standalone server rules. In such scenarios, the Back-to-Back server rules defined for forwarding and roaming cases will not be applied.
- Header names in incoming requests are matched in a case-insensitive manner with the configuration.
- Headers in both generated requests and responses from NRF will always be in lowercase.
- When rule values are incremented or decremented, the final value is restricted to the range of 0–31. Values below 0 are set to 0, and values above 31 are capped at 31.
- Whenever NRF functions as either a server or a client, a rule must be defined for the configured default value; otherwise, the header will not be included in outgoing requests or generated responses for the default case.
- If the feature is disabled, NRF will not add the header to either requests or responses, even if the header is present in the incoming request or response.
- Rule matching follows this order: exact match, range-based match, and finally the default match (*).
- For received requests, `ocnrf_smp_parsing_error_total` metric is pegged using the service operation handled in server mode. For received responses, the metric is pegged using the service operation handled in client mode.
- The 3gpp-Sbi-Message-Priority header applies only to API and method combinations defined for NRF. If an invalid combination is used, the header will not be added to generated requests or responses.
- When NRF sends a request to a peer NRF (for example, in forwarding or roaming scenarios), the 3gpp-Sbi-Message-Priority header received in the response is

considered for response mapping only if the corresponding header was included in the outbound request through a valid initiatedRequestPriorityRule mapping. If the header is not included in the outbound request due to a missing or unmatched request mapping, any 3gpp-Sbi-Message-Priority returned in the response is not recognized as an SMP-specific header and is therefore ignored for propagated response mapping. In such cases, NRF uses the defaultPriority configured in the applicable response rules for the corresponding scenario and applies the configured responsePriorityRule to determine the response priority.

L.1 Standalone Server Role

NRF is receiving a request from Consumer NFs and returning a response towards consumer NFs (without sending messages to any peer NFs).

In standalone server role, the priority value is derived from the incoming request and applied to the response using the configured responsePriorityRule.

Service Operations and Corresponding Configuration for Standalone Server

The following table lists the service operations and corresponding sbiServiceOperation configurations used for standalone server role.

Table L-1 Service Operations and Corresponding Configuration for Standalone Server Role

Service Operations	API	HTTP Method	sbiServiceOperation Configuration
NF Register NF Update Complete Replacement	/nnrf-nfm/v1/nf-instances/ <nfnInstanceID>	PUT	Nnrf_NFManagement_NFRegister_Full Update
NF Update Partial NF Heartbeat	/nnrf-nfm/v1/nf-instances/ <nfnInstanceID>	PATCH	Nnrf_NFManagement_NFHeartBeat_NF PartialUpdate
NF Deregister	/nnrf-nfm/v1/nf-instances/ <nfnInstanceID>	DELETE	Nnrf_NFManagement_NFDeregister
NF OPTIONS	/nnrf-nfm/v1/nf-instances/	OPTIONS	Nnrf_NFManagement_Options
NF LIST RETRIEVAL	/nnrf-nfm/v1/nf-instances/	GET	Nnrf_NFManagement_NFListRetrieval
NF INSTANCE RETRIEVAL	/nnrf-nfm/v1/nf-instances/ <nfnInstanceID>	GET	Nnrf_NFManagement_NFProfileRetrieval
NF Status Subscribe	/nnrf-nfm/v1/subscriptions	POST	Nnrf_NFManagement_NFStatusSubscribe
NF Status Subscribe Update	/nnrf-nfm/v1/subscriptions/ <subscriptionID>	PATCH	Nnrf_NFManagement_NFStatusSubscribeUpdate
NF Status Unsubscribe	/nnrf-nfm/v1/subscriptions/ <subscriptionID>	DELETE	Nnrf_NFManagement_NFStatusUnSubscribe
NF Discover	/nnrf-disc/v1/nf-instances	GET	Nnrf_NFDiscovery_Request
NF Access Token	/oauth2/token	POST	Nnrf_AccessToken_Get

Table L-1 (Cont.) Service Operations and Corresponding Configuration for Standalone Server Role

Service Operations	API	HTTP Method	sbiServiceOperation Configuration
CDS Response	/nrftcache-data/v1/nf-instances/nrfset-data/v1/nf-subscriptions	GET	Nnrf_CacheData_Response

Use Case Scenarios for Standalone Server

The following table describes the use case scenarios for standalone server role, including the applicable conditions and the corresponding behavior of the Setting SBI Message Priority feature.

Table L-2 Use Case Scenarios For Standalone Server Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming service operation - VALID Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured with range and default match (that is, . *) and range is not matching	Header is present in the Request and configured in requestsmphheaders configuration	"3gpp-Sbi-Message-Priority"="12"	<pre> /nf-common-component/v1/global-configuration/sbiserviceoperations " [{ "sbiServiceOperation": "Nnrf_NFManagement_NFRegister_FullUpdate", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Rule" }]" and /nf-common-component/v1/global-configuration/prioritymappingrules " [{ "name": "NRF_As_Server_Rule", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "13-15", "used": "14" }, { "received": "*", "used": "11" }]]" and /nf-common-component/v1/global-configuration/requestsmphheaders " ["3gpp-Sbi-Message-Priority"]" </pre>	NRF_As_Server_Rule corresponding to responsePriorityRule rule is selected. If a range-based value match rule is configured but not matching, then the rule is applied. The mapped value is sent for the SBI message priority header in the response. "3gpp-Sbi-Message-Priority"="11" Observability: None

Table L-2 (Cont.) Use Case Scenarios For Standalone Server Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation - VALID Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured range value match only.	Header is present in Request and configured in requestsmphheaders Configuration	"3gpp-Sbi-Message-Priority"="12"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFManagement_NFRegister_FullUpdate", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Rule" }] "</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Server_Rule", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "12-16", "used": "11" }] }]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	NRF_As_Server_Rule corresponding to responsePriorityRule rule is selected, range based value match rule is selected and the mapped value is sent for Sbi Message Priority Header in the response. "3gpp-Sbi-Message-Priority"="17" Observability: None

Table L-2 (Cont.) Use Case Scenarios For Standalone Server Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation - VALID Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured Matching rule for incoming header value - Not Configured	Header Present in Request and configured in requestsmphheaders Configuration	"3gpp-Sbi-Message-Priority"="12"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFManagement_NFRegister_FullUpdate", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Rule" }] "</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Server_Rule", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "13-16", "used": "11" }] }]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	NRF_As_Server_Rule corresponding to responsePriorityRule rule is selected, No Rule Found for Value 12. No SMP header will go in the response Observability: None

Table L-2 (Cont.) Use Case Scenarios For Standalone Server Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Response and Observability
SBI message priority feature - DISABLED SBI Message Priority header in incoming Service operation - VALID Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured with exact value match, range and default match (that is, .*)	Header Present in Request and configured in requestSmpheaders Configuration	"3gpp-Sbi-Message-Priority"="12"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFManagement_NFRegister_FullUpdate", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Rule" }] "</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Server_Rule", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "12", "used": "10" }, "received": "12-15", "used": "14" }, "received": "12-15", "used": "16"] }]"</pre> and /nf-common-component/v1/global-configuration/requestSmpheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	Feature is disabled. No header will go in the response even they are present in request. Observability: None

Table L-2 (Cont.) Use Case Scenarios For Standalone Server Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation - INVALID Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured with range and default match (that is, .*)	Header Present in Request and configured in requestsmphheaders Configuration	"3gpp-Sbi-Message-Priority"="35"	/nf-common-component/v1/global-configuration/sbiserviceoperations "[{ "sbiServiceOperation": "Nnrf_NFManagement_NFRegister_FullUpdate", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Rule" }]" and /nf-common-component/v1/global-configuration/prioritymappingrules "[{ "name": "NRF_As_Server_Rule", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "15-20", "used": "14" }, { "received": "*", "used": "16" }]]]" and /nf-common-component/v1/global-configuration/requestsmphheaders "["3gpp-Sbi-Message-Priority"]"	Default Priority from SBI service operation is used and header from NRF_As_Server_Rule corresponding to responsePriorityRule rule is selected, range based value match rule is selected and mapped value is sent for Sbi Message Priority Header in the response. "3gpp-Sbi-Message-Priority"="14" Observability: None

Table L-2 (Cont.) Use Case Scenarios For Standalone Server Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation - INVALID Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured with default match (that is, .*) only	Header Present in Request and configured in requestsmphheaders Configuration	"3gpp-Sbi-Message-Priority"="35"	/nf-common-component/v1/global-configuration/sbiserviceoperations "[{ "sbiServiceOperation": "Nnrf_NFManagement_NFRegister_FullUpdate", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Rule" }]" and /nf-common-component/v1/global-configuration/prioritymappingrules "[{ "name": "NRF_As_Server_Rule", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": ".*", "used": "16" }]" and /nf-common-component/v1/global-configuration/requestsmphheaders "["3gpp-Sbi-Message-Priority"]"	Default Priority from SBI service operation is used and header from NRF_As_Server_Rule corresponding to responsePriorityRule rule is selected, default value match rule is selected and mapped value is sent for SBI Message Priority Header in the response. "3gpp-Sbi-Message-Priority"="16" Observability: None

Table L-2 (Cont.) Use Case Scenarios For Standalone Server Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation - INVALID Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured with range match only	Header Present in Request and configured in requestsmphheaders Configuration	"3gpp-Sbi-Message-Priority"="35"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFManagement_NFRegister_FullUpdate", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Rule" }] "</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Server_Rule", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "16-20", "used": "18" }] }]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	Default Priority from SBI service operation is used and header from NRF_As_Server_Rule corresponding to responsePriorityRule rule is selected, range based value match rule is selected and mapped value is sent for Sbi Message Priority Header in the response. "3gpp-Sbi-Message-Priority"="18" Observability: None

Table L-2 (Cont.) Use Case Scenarios For Standalone Server Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation - INVALID Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured Matching rule for default configured value - NA	Header Present in Request and configured in requestsmphheaders Configuration	"3gpp-Sbi-Message-Priority"="-1"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFManagement_NFRegister_FullUpdate", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Rule" }] "</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Server_Rule", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "13-16", "used": "17" }] }]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	Rule is not configured for defaultPriority. No SMP header will go in the response. Observability: Metric will be pegged with reason.

Table L-2 (Cont.) Use Case Scenarios For Standalone Server Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation - INVALID Corresponding sbiServiceOperation - Not Configured responsePriorityRule - NA Matching rule for incoming header value - NA	Header Present in Request and configured in requestSmpheaders Configuration	"3gpp-Sbi-Message-Priority"="-1"	/nf-common-component/v1/global-configuration/sbiserviceoperations "[{ "sbiServiceOperation": "Nnrf_NFDDiscovery_Request", "defaultPriority": 18, "preferReceivedPriority": true }]" and /nf-common-component/v1/global-configuration/prioritymappingrules "[{ "name": "NRF_As_Server_Rule", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "13-16", "used": "17" }] }]" and /nf-common-component/v1/global-configuration/requestSmpheaders "["3gpp-Sbi-Message-Priority"]"	SBI Service operation is not configured for the incoming request. No SMP header will go in the response. Observability: Metric will be pegged with reason.

Table L-2 (Cont.) Use Case Scenarios For Standalone Server Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Response and Observability
SBI message priority feature - DISABLED SBI Message Priority header in incoming Service operation - INVALID Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured with exact value match, range and default match (that is, .*)	Header Present in Request and configured in requestSmpheaders Configuration	"3gpp-Sbi-Message-Priority"="-2"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFManagement_NFRegister_FullUpdate", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Rule" }] "</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Server_Rule", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "12", "used": "10" }, "received": "12-15", "used": "14" }, "received": "*", "used": "16"] }]"</pre> and /nf-common-component/v1/global-configuration/requestSmpheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	Feature is disabled. No header will go in the response even they are present in request. Observability: None

Table L-2 (Cont.) Use Case Scenarios For Standalone Server Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation -NOT PRESENT/ CANNOT BE USED Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured with range and default match (that is, . *)	Header Present in Request and not configured in requestsmphheaders configuration Header Not Present in Request but configured in requestsmphheaders configuration Header Not Present in Request and not configured in requestsmphheaders configuration	-	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFManagement_NFRegister_FullUpdate", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Rule", "initiatedRequestPriorityRule": "" }]"</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Server_Rule", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "15-20", "used": "14" }, "received": "", "used": "16" }] }]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority", "Custom-SMP-Header"]"</pre>	Default Priority from SBI service operation is used and header from NRF_As_Server_Rule corresponding to responsePriorityRule rule is selected, range based value match rule is selected and mapped value is sent for Sbi Message Priority Header in the response. "3gpp-Sbi-Message-Priority"="14" Observability: None

Table L-2 (Cont.) Use Case Scenarios For Standalone Server Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation -NOT PRESENT/ CANNOT BE USED Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured with default match (that is, .*) only	Header Present in Request and not configured in requestsmphheaders configuration Header Not Present in Request but configured in requestsmphheaders configuration Header Not Present in Request and not configured in requestsmphheaders configuration	-	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFManagement_NFRegister_FullUpdate", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Rule" }] "</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Server_Rule", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "*", "used": "16" }] }]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	Default Priority from SBI service operation is used and header from NRF_As_Server_Rule corresponding to responsePriorityRule rule is selected, default value match rule is selected and mapped value is sent for Sbi Message Priority Header in the response. "3gpp-Sbi-Message-Priority"="16" Observability: None.

Table L-2 (Cont.) Use Case Scenarios For Standalone Server Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation -NOT PRESENT/ CANNOT BE USED Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured with range match only	Header Present in Request and not configured in requestsmphheaders configuration Header Not Present in Request but configured in requestsmphheaders configuration Header Not Present in Request and not configured in requestsmphheaders configuration	-	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFManagement_NFRegister_FullUpdate", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Rule" }] "</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Server_Rule", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "16-20", "used": "18" }] }]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	Default Priority from SBI service operation is used and header from NRF_As_Server_Rule corresponding to responsePriorityRule rule is selected, range based value match rule is selected and mapped value is sent for Sbi Message Priority Header in the response. "3gpp-Sbi-Message-Priority"="18" Observability: None

Table L-2 (Cont.) Use Case Scenarios For Standalone Server Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation -NOT PRESENT/ CANNOT BE USED Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured Matching rule for default configured value - NA	Header Present in Request and not configured in requestsmphheaders configuration. Header Not Present in Request but configured in requestsmphheaders configuration. Header Not Present in Request and not configured in requestsmphheaders configuration,	-	<pre> /nf-common-component/v1/global-configuration/sbiserviceoperations "[{ "sbiServiceOperation": "Nnrf_NFManagement_NFRegister_FullUpdate", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Rule" }] " and /nf-common-component/v1/global-configuration/prioritymappingrules "[{ "name": "NRF_As_Server_Rule", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "13-16", "used": "17" }] }] " and /nf-common-component/v1/global-configuration/requestsmphheaders "[3gpp-Sbi-Message-Priority]" </pre>	Rule is not configured for defaultPriority. The SMP header will not go in the response. Observability: Metric will be pegged with reason.

Table L-2 (Cont.) Use Case Scenarios For Standalone Server Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Response and Observability
- SBI message priority feature - DISABLED - SBI Message Priority header in incoming Service operation - NOT PRESENT or CANNOT BE USED - Corresponding sbiServiceOperations - Configured - responsePriorityRule - Configured - rule corresponding to SBI Message Priority header value is configured with exact value match, range and default match (that is, *)	Header Present in Request and not configured in requestsmphheaders configuration Header Not Present in Request but configured in requestsmphheaders configuration Header Not Present in Request and not configured in requestsmphheaders configuration	-	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFManagement_NFRegister_FullUpdate", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Rule" }] "</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Server_Rule", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "12", "used": "10" }, "received": "12-15", "used": "14" }, "received": "", "used": "16" }] }]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	Feature is disabled. The SMP header will not go in the response even they are present in the request. Observability: None.

L.2 Standalone Client Role

In this role, NRF is generating a request of its own without getting any request from Consumer NF.

In this role, NRF initiates requests and determines the 3gpp-Sbi-Message-Priority header value based on the configured service operation behavior and priority mapping rules.

Service Operations and Corresponding Configuration for Standalone Client

The following table lists the service operations and corresponding sbiServiceOperation configurations used for standalone client role.

Table L-3 Service Operations and Corresponding sbiServiceOperation Configuration for Standalone Client Role

Service Operation	API	HTTP Method	sbiServiceOperation
NF Status Notify	Will be generated internally by NRF	POST	Nnrf_NFManagement_NFStatusNotify
CDS Request Generated	/nrfcache-data/v1/nf-instances /nrfset-data/v1/nf-subscriptions	GET	Nnrf_CacheData_Request
CDS Periodic Request	/nrfset-data/v1/nf-instances?	GET	Nnrf_CacheData_PeriodicRequest
CDS Request Generated by NRF Configuration	/nrfcache-data/v1/nf-instances /nrfset-data/v1/nf-subscriptions	GET	Nnrf_Configuration_CacheData_Request

Use Case Scenarios for Standalone Client Role

The following table describes the use case scenarios for standalone client role, including the applicable conditions and the corresponding behavior of the Setting SBI Message Priority feature.

Table L-4 Use Case Scenarios for Standalone Client Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Response and Observability
SBI message priority feature - ENABLED Corresponding sbiServiceOperation - Configured initiatedRequestPriorityRule - Configured rules - Configured as range matching for default value	NA	NA	<pre> /nf-common-component/v1/global-configuration/sbiserviceoperations "[[{ "sbiServiceOperation": "Nnrf_NFManagement_NFStatusNotify", "defaultPriority": 18, "preferReceivedPriority": true, "initiatedRequestPriorityRule": ": "NRF_As_Client_Notification" }]]" and /nf-common-component/v1/global-configuration/prioritymappingrules "[[{ "name": "NRF_As_Client_Notification", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "15-20", "used": "14" }, "received": "*", "used": "16" }]]]" and /nf-common-component/v1/global-configuration/requestsmphheaders ["3gpp-Sbi-Message-Priority"]" </pre>	NRF_As_Client_Notification corresponding to initiatedRequestPriorityRule rule is selected, Header Name comes from defaultSmpHeaderName And value comes from defaultPriority. Range based rule is matched and hence corresponding value will go in the request "3gpp-Sbi-Message-Priority"="14" Observability: None.

Table L-4 (Cont.) Use Case Scenarios for Standalone Client Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Response and Observability
SBI message priority feature - ENABLED Corresponding sbiServiceOperation - Configured initiatedRequestPriorityRule - Not Configured	NA	NA	<pre> /nf-common-component/v1/global-configuration/sbiserviceoperations "[[{ "sbiServiceOperation": "Nnrf_NFManagement_NFStatusNoti fy", "defaultPriority": 18, "preferReceivedPriority": true }]]" and /nf-common-component/v1/global-configuration/prioritymappingrules "[[{ "name": "NRF_As_Client_Notification", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "12", "used": "10" }, "received": "12-15", "used": "14" }, "received": "16" "used": "16" }}]]" and /nf-common-component/v1/global-configuration/requestsmphheaders ["3gpp-Sbi-Message-Priority"]" </pre>	initiatedRequestPriorityRule is not configured. The header name comes from defaultSmpHeaderName, and the header and rules are not configured. So, the header will not go. Observability: Metric will peg with reason.

Table L-4 (Cont.) Use Case Scenarios for Standalone Client Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Response and Observability
SBI message priority feature - ENABLED Corresponding sbiServiceOperation - Not Configured initiatedRequestPriorityRule - Not Configured	NA	NA	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre> "[[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Request", "defaultPriority": 18, "preferReceivedPriority": true }]]"</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre> "[[{ "name": "NRF_As_Client_Notification", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "12", "used": "10" }, { "received": "12-15", "used": "14" }, { "received": "*", "used": "16" }] }]]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders "["3gpp-Sbi-Message-Priority"]"	initiatedRequestPriorityRule rule is not configured, SBI operation is not configured The header name comes from defaultSmpHeaderName, and rules are not configured. So, the header will not go. Observability: Metric will peg with reason.

Table L-4 (Cont.) Use Case Scenarios for Standalone Client Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Response and Observability
SBI message priority feature - DISABLED Corresponding sbiServiceOperation - Configured initiatedRequestPriorityRule - Configured rules configured - Does not matter as client	NA	NA	/nf-common-component/v1/global-configuration/sbiserviceoperations "[[{ "sbiServiceOperation": "Nnrf_NFManagement_NFStatusNotify", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "", "initiatedRequestPriorityRule": "NRF_As_Client_Notification" }]]" and /nf-common-component/v1/global-configuration/prioritymappingrules "[[{ "name": "NRF_As_Client_Notification", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "12", "used": "10" }, "received": "12-15", "used": "14" }, "received": " "used": "16" }}]]" and /nf-common-component/v1/global-configuration/requestsmphheaders ["3gpp-Sbi-Message-Priority"]"	Feature is disabled. No header will go in request. Observability: None.

L.3 Back-to-Back Agent Client Role

In this role, NRF receives a request from Consumer NF and sends the request to peer NF.

In this role, NRF forwards requests to target network functions (for example, AMF, SMF, PCF) and determines the 3gpp-Sbi-Message-Priority header value based on the configured service operation behavior and priority mapping rules.

Service Operations and Corresponding Configuration for Back-to-Back Agent Client Role

This table is used to determine the applicable configuration for deriving and applying the priority value when forwarding requests.

The following table lists the service operations and corresponding sbiServiceOperation configurations used for back-to-back agent client role.

Table L-5 Service Operations and Corresponding sbiServiceOperation Configuration

Service Operation	API	HTTP Method	sbiServiceOperation
NF Profile Retrieval Forwarding Request	/nnrf-nfm/v1/nf-instances/<nfnInstanceID>	GET	Nnrf_NFManagement_NFProfileRetrieval_Forward_Request
NF Status Subscribe Create Forwarding Request	/nnrf-nfm/v1/subscriptions	POST	Nnrf_NFManagement_NFStatusSubscribe_Forward_Request
NF Status Subscribe Create Roaming Request	/nnrf-nfm/v1/subscriptions	POST	Nnrf_NFManagement_NFStatusSubscribe_Roaming_Request
NF Status Subscribe Update Forwarding Request	/nnrf-nfm/v1/subscriptions	PATCH	Nnrf_NFManagement_NFStatusSubscribeUpdate_Forward_Request
NF Status Subscribe Update Roaming Request	/nnrf-nfm/v1/subscriptions	PATCH	Nnrf_NFManagement_NFStatusSubscribeUpdate_Roaming_Request
NF Status UnSubscribe Forwarding Request	/nnrf-nfm/v1/subscriptions	DELETE	Nnrf_NFManagement_NFStatusUnSubscribe_Forward_Request
NF Status UnSubscribe Roaming Request	/nnrf-nfm/v1/subscriptions	DELETE	Nnrf_NFManagement_NFStatusUnSubscribe_Roaming_Request
NF Discover Forwarding Request	/nnrf-disc/v1/nf-instances	GET	Nnrf_NFDiscovery_Forward_Request
NF Discover Roaming Request	/nnrf-disc/v1/nf-instances	GET	Nnrf_NFDiscovery_Roaming_Request
SLF Request	/nudr-group-id-map/v1/nf-group-ids	GET	Nnrf_NFDiscovery_SLF
NF Access Token Forwarding Request	/oauth2/token	POST	Nnrf_AccessToken_Forward_Request
NF Access Token Roaming Request	/oauth2/token	POST	Nnrf_AccessToken_Roaming_Request

Use Case Scenarios for Back-to-Back Agent – Client Role

The following table describes the use case scenarios for back-to-back agent – client role, including the applicable conditions and the corresponding behavior of the Setting SBI Message Priority feature.

Table L-6 Use Case Scenarios for Back-to-Back Agent – Client Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Request behavior and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation - VALID Corresponding sbiServiceOperation - Configured initiatedRequestPriorityRule- Configured rule corresponding to SBI Message Priority header value is configured with range and default match (that is, *)	Header Present in Request and configured in requestsmphheaders configuration	"3gpp-Sbi-Message-Priority"="12"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Request", "defaultPriority": 18, "preferReceivedPriority": true, "initiatedRequestPriorityRule": "NRF_As_Client_Forwarding_Request" }]]"</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>[{ "name": "NRF_As_Client_Forwarding_Request", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "12-15", "used": "14" }, { "received": "*", "used": "16" }] }]]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>[{"3gpp-Sbi-Message-Priority"}]"</pre>	NRF_As_Client_Forwarding_Request corresponding to initiated Request PriorityRule rule is selected, range value match rule is selected, and the mapped value is sent for Sbi Message Priority Header in the request. "3gpp-Sbi-Message-Priority"="14" Observability: None

Table L-6 (Cont.) Use Case Scenarios for Back-to-Back Agent – Client Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Request behavior and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation - VALID Corresponding sbiServiceOperation - Configured initiatedRequestPriorityRule- Configured rule corresponding to SBI Message Priority header value is configured with default match (that is, *)	Header Present in Request and configured in requestsmphheaders configuration	"3gpp-Sbi-Message-Priority"="12"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Request", "defaultPriority": 18, "preferReceivedPriority": true, "initiatedRequestPriorityRule": "NRF_As_Client_Forwarding_Request" }]</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>[{ "name": "NRF_As_Client_Forwarding_Request", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "*", "used": "16" }] }]</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>["3gpp-Sbi-Message-Priority"]</pre>	NRF_As_Client_Forwarding_Request corresponding to initiated Request PriorityRule rule is selected, * match rule is selected and mapped value is sent for Sbi Message Priority Header in the request. "3gpp-Sbi-Message-Priority"="16" Observability: None

Table L-6 (Cont.) Use Case Scenarios for Back-to-Back Agent – Client Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Request behavior and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation - VALID Corresponding sbiServiceOperation - Configured initiatedRequestPriorityRule- Configured rule corresponding to SBI Message Priority header value is configured with range match only	Header Present in Request and configured in requestsmphheaders configuration	"3gpp-Sbi-Message-Priority"="12"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Req est", "defaultPriority": 18, "preferReceivedPriority": true, "initiatedRequestPriorityRule": "NRF_As_Client_Forwarding_Req est" }]"</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Client_Forwarding_Req uest", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "12-15", "used": "14" } }]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	NRF_As_Client_Forwarding_Request corresponding to initiated Request PriorityRule rule is selected, range based value match rule is selected and mapped value is sent for Sbi Message Priority Header in the request. "3gpp-Sbi-Message-Priority"="14" Observability: None

Table L-6 (Cont.) Use Case Scenarios for Back-to-Back Agent – Client Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Request behavior and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation - VALID Corresponding sbiServiceOperation - Configured initiatedRequestPriorityRule- Configured rule corresponding to SBI Message Priority header value - Not configured	Header Present in Request and configured in requestsmphheaders configuration	"3gpp-Sbi-Message-Priority"="10"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Request", "defaultPriority": 18, "preferReceivedPriority": true, "initiatedRequestPriorityRule": "NRF_As_Client_Forwarding_Request" }]"</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Client_Forwarding_Request", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "11-15", "used": "14" } }]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	NRF_As_Client_Forwarding_Request corresponding to initiated Request PriorityRule rule is selected, But no rules for matching value as incoming request. No header will be sent out in the request. Observability: Metri c pegged with Reason

Table L-6 (Cont.) Use Case Scenarios for Back-to-Back Agent – Client Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Request behavior and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation - VALID Corresponding sbiServiceOperation - Configured initiatedRequestPriorityRule- Not Configured rule corresponding to SBI Message Priority header value - Not configured	Header Present in Request and configured in requestsmphheaders configuration	"3gpp-Sbi-Message-Priority"="12"	/nf-common-component/v1/global-configuration/sbiserviceoperations "[{ "sbiServiceOperation": "Nnrf_NFDDiscovery_Forward_Request", "defaultPriority": 18, "preferReceivedPriority": true }]" and /nf-common-component/v1/global-configuration/prioritymappingrules "[{ "name": "NRF_As_Client_Forwarding_Request", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "11-15", "used": "14"}]]" and /nf-common-component/v1/global-configuration/requestsmphheaders "["3gpp-Sbi-Message-Priority"]"	NRF_As_Client_Forwarding_Request corresponding to initiated Request PriorityRule not configured. No header will be sent out in request. Observability: Metric pegged with Reason

Table L-6 (Cont.) Use Case Scenarios for Back-to-Back Agent – Client Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Request behavior and Observability
SBI message priority feature - Disabled SBI Message Priority header in incoming Service operation - VALID Corresponding sbiServiceOperation - Configured initiatedRequestPriorityRule- Configured rule corresponding to SBI Message Priority header value is configured with exact value match, range and default match (that is, *)	Header Present in request and configured in requestsmphheaders configuration	"3gpp-Sbi-Message-Priority"="12"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Req est", "defaultPriority": 18, "preferReceivedPriority": true "initiatedRequestPriorityRule": "NRF_As_Client_Forwarding_Req est" }]"</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Client_Forwarding_Req uest", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules":</pre> <pre>[{ "received": "12", "used": "10" }, "received": "12-15", "used": "14" }, "received": "16" "used": "16" }]]]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	The feature is disabled. The header will not go in the generated request even if it is present in the request. Observability: None

Table L-6 (Cont.) Use Case Scenarios for Back-to-Back Agent – Client Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Request behavior and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation - INVALID Corresponding sbiServiceOperation - Configured initiatedRequestPriorityRule - Configured rules - Configured	Header is present in request and configured in requestsmphheaders configuration	"3gpp-Sbi-Message-Priority"="36"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFDDiscovery_Forward_Request", "defaultPriority": 18, "preferReceivedPriority": true, "initiatedRequestPriorityRule": "NRF_As_Client_Forwarding_Request" }]]"</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Client_Forwarding_Request", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "15-20", "used": "14" }, "received": "*", "used": "16" }]]]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	NRF_As_Client_Forwarding_Request corresponding to initiated Request PriorityRule rule is selected, the Header Name comes from defaultSmpHeaderName and value comes from defaultPriority and then rule is applied for default value. "3gpp-Sbi-Message-Priority"="14" Observability:

Table L-6 (Cont.) Use Case Scenarios for Back-to-Back Agent – Client Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Request behavior and Observability
				None
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation - INVALID Corresponding sbiServiceOperation - Not Configured initiatedRequestPriorityRule - Not present rules configured - Doesn't matter as client	Header is present in request and configured in requestsmphheaders configuration	"3gpp-Sbi-Message-Priority"="36"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_AccessToken_Forward_Request", "defaultPriority": 18, "preferReceivedPriority": true }]" and /nf-common-component/v1/global-configuration/prioritymappingrules "[{ "name": "NRF_As_Client_Forwarding_Request", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "12", "used": "10" }, "received": "12-15", "used": "14" }, "received": "*", "used": "16" }] }]" and /nf-common-component/v1/global-configuration/requestsmphheaders "[3gpp-Sbi-Message-Priority]"</pre>	Service operation is not configured. The default header name CANNOT be determined. The header will not go. Observability: Metric pegged with Reason

Table L-6 (Cont.) Use Case Scenarios for Back-to-Back Agent – Client Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Request behavior and Observability
SBI message priority feature - DISABLED SBI Message Priority header in incoming Service operation - INVALID Corresponding sbiServiceOperation - Configured initiatedRequestPriorityRule - Configured rules configured - Doesn't matter as client	Header is present in request and configured in requestsmphheaders configuration	"3gpp-Sbi-Message-Priority"="36"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFDDiscovery_Forward_Request", "defaultPriority": 18, "preferReceivedPriority": true, "initiatedRequestPriorityRule": "NRF_As_Client_Forwarding_Request" }]"</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Client_Forwarding_Request", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "12", "used": "10" }, "received": "12-15", "used": "14" }, "received": "16", "used": "16" }] }]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	The feature is disabled. The header will not go in the request generated by NRF.

Table L-6 (Cont.) Use Case Scenarios for Back-to-Back Agent – Client Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Request behavior and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation - Not Present/Valid header CANNOT be used Corresponding sbiServiceOperation - Configured initiatedRequestPriorityRule - Configured rules configured - Configured	Header is present in request and not configured in requestsmphheaders configuration. Header is not present in request but configured in requestsmphheaders configuration Header is not present in request and not configured in requestsmphheaders configuration	NA	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFDDiscovery_Forward_Request", "defaultPriority": 18, "preferReceivedPriority": true, "initiatedRequestPriorityRule": "NRF_As_Client_Forwarding_Request" }]"</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Client_Forwarding_Request", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "15-20", "used": "14" }, "received": "*", "used": "16" }] }]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	NRF_As_Client_Forwarding_Request corresponding to initiated Request PriorityRule rule is selected, Header Name comes from defaultSmpHeaderName and value comes from defaultPriority Rules configured as range-based and *, but range matched and corresponding value will go in header. "3gpp-Sbi-Message-Priority"="14"

Table L-6 (Cont.) Use Case Scenarios for Back-to-Back Agent – Client Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Request behavior and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation - Not Present/Valid header CANNOT be used Corresponding sbiServiceOperation - Configured initiatedRequestPriorityRule - Not Present rules configured - Doesn't matter as client	Header is present in request and not configured in requestsmphheaders configuration Header is not present in request but configured in requestsmphheaders configuration Header is not present in request and not configured in requestsmphheaders configuration	NA	/nf-common-component/v1/global-configuration/sbiserviceoperations "[{ "sbiServiceOperation": "Nnrf_NFDDiscovery_Forward_Request", "defaultPriority": 18, "preferReceivedPriority": true }]" and /nf-common-component/v1/global-configuration/prioritymappingrules "[{ "name": "NRF_As_Client_Forwarding_Request", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "12", "used": "10" }, "received": "12-15", "used": "14" }, "received": "*", "used": "16"]]]]" and /nf-common-component/v1/global-configuration/requestsmphheaders "["3gpp-Sbi-Message-Priority"]"	NRF_As_Client_Forwarding_Request corresponding to initiated Request PriorityRule rule is not configured, header will not go in the request. Observability: Metric pegged with Reason

Table L-6 (Cont.) Use Case Scenarios for Back-to-Back Agent – Client Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Request behavior and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming Service operation - Not Present/Valid header CANNOT be used Corresponding sbiServiceOperation - Not Configured initiatedRequestPriorityRule - Not Present rules configured - Doesn't matter as client	Header is present in request and not configured in requestsmphheaders configuration Header is not present in request but configured in requestsmphheaders configuration Header is not present in request and not configured in requestsmphheaders configuration	NA	/nf-common-component/v1/global-configuration/sbiserviceoperations "[]" and /nf-common-component/v1/global-configuration/prioritymappingrules "[{ "name": "NRF_As_Client_Forwarding_Request", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "12", "used": "10" }, "received": "12-15", "used": "14" }, "received": "16" }]]]" and /nf-common-component/v1/global-configuration/requestsmphheaders "["3gpp-Sbi-Message-Priority"]"	SBI Service operation not configured. The header will not go in the request. Observability: Metric pegged with Reason

Table L-6 (Cont.) Use Case Scenarios for Back-to-Back Agent – Client Role

Use Case Description	Use Case Type	Incoming Header Request	SMP Feature Configuration	Request behavior and Observability
SBI message priority feature - Disabled SBI Message Priority header in incoming Service operation - Configured Corresponding sbiServiceOperation - Configured initiatedRequestPriorityRule - Present rules configured	Header is present in request and not configured in requestsmphheaders configuration Header is not present in request but configured in requestsmphheaders configuration Header is not present in request and not configured in requestsmphheaders configuration	NA	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_AccessToken_Forward_Req est", "defaultPriority": 18, "preferReceivedPriority": true, "initiatedRequestPriorityRule": "NRF_As_Client_Forwarding_Req est"}]"</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Client_Forwarding_Req uest", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "12", "used": "10" }, "received": "12-15", "used": "14" }, "received": "*", "used": "16" }] }]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	Feature is disabled. The header will not go in the request.

L.4 Back-to-Back Agent Server Role

In this role, NRF receives response from peer NF and sends back response to Consumer NF.

In this role, NRF processes responses received from target network functions and determines the 3gpp-Sbi-Message-Priority header value based on the configured service operation behavior and priority mapping rules.

Service Operations and Corresponding Configuration for Back-to-Back Agent Server Role

The following table lists the service operations and corresponding sbiServiceOperation configurations used for back-to-back agent server role. This is used to determine the applicable configuration for evaluating and updating the priority value in responses before sending them to the originating network function.

Table L-7 Service Operations and Corresponding sbiServiceOperation Configuration

Service Operation	API	HTTP Method	sbiServiceOperation
NF Profile Retrieval Forwarding Response	/nnrf-nfm/v1/nf-instances/<nfnInstanceId>	GET	Nnrf_NFManagement_NFProfileRetrieval_Forward_Response
NF Status Subscribe Creation Forwarding Response	/nnrf-nfm/v1/subscriptions	POST	Nnrf_NFManagement_NFStatusSubscribe_Forward_Response
NF Status Subscribe Creation Roaming Response	/nnrf-nfm/v1/subscriptions	POST	Nnrf_NFManagement_NFStatusSubscribe_Roaming_Response
NF Status Subscribe Update Forwarding Response	/nnrf-nfm/v1/subscriptions	PATCH	Nnrf_NFManagement_NFStatusSubscribeUpdate_Forward_Response
NF Status Subscribe Update Roaming Response	/nnrf-nfm/v1/subscriptions	PATCH	Nnrf_NFManagement_NFStatusSubscribeUpdate_Roaming_Response
NF Status UnSubscribe Creation Forwarding Response	/nnrf-nfm/v1/subscriptions	DELETE	Nnrf_NFManagement_NFStatusUnSubscribe_Forward_Response
NF Status UnSubscribe Creation Roaming Response	/nnrf-nfm/v1/subscriptions	DELETE	Nnrf_NFManagement_NFStatusUnSubscribe_Roaming_Response
NF Discover Forwarding Response	/nnrf-disc/v1/nf-instances?	GET	Nnrf_NFDiscovery_Forward_Response
NF Discover Roaming Response	/nnrf-disc/v1/nf-instances?	GET	Nnrf_NFDiscovery_Roaming_Response
NF Access Token Forwarding Response	/oauth2/token	POST	Nnrf_AccessToken_Forward_Response
NF Access Token Roaming Response	/oauth2/token	POST	Nnrf_AccessToken_Roaming_Response

Use Case Scenarios for Back-to-Back Agent – Server Role

The following table describes the use case scenarios for Back-to-Back Agent – Server Role, including the applicable conditions and the corresponding behavior of the Setting SBI Message Priority feature.

Table L-8 Use Case Scenarios for Back-to-Back Agent – Server Role

Use Case Description	Use Case Type	Incoming Header Request	Response and Observability	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming response - VALID Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured with range and default match (that is, *)	The header is present in the response which was sent in the request.	"3gpp-Sbi-Message-Priority"="12"	/nf-common-component/v1/global-configuration/sbiserviceoperations "[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Response", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Forwarding_Response" }]" and /nf-common-component/v1/global-configuration/prioritymappingrules "[{ "name": "NRF_As_Server_Forwarding_Response", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "12-15", "used": "14" }, "received": "*", "used": "16" }]]" and /nf-common-component/v1/global-configuration/requestsmphheaders "["3gpp-Sbi-Message-Priority"]"	NRF_As_Server_Forwarding_Response corresponding to the responsePriorityRule rule is selected, The range-based value match rule is selected and mapped value is sent for Sbi Message Priority Header in the response. "3gpp-Sbi-Message-Priority"="14" Observability: None

Table L-8 (Cont.) Use Case Scenarios for Back-to-Back Agent – Server Role

Use Case Description	Use Case Type	Incoming Header Request	Response and Observability	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming response - VALID Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured with default match (that is, *) only	The header is present in the response which was sent in the request.	"3gpp-Sbi-Message-Priority"="12"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre> "[[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Response", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Forwarding_Response" }]]" and /nf-common-component/v1/global-configuration/prioritymappingrules "[[{ "name": "NRF_As_Server_Forwarding_Response", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "*", "used": "16" }] }]]" and /nf-common-component/v1/global-configuration/requestsmphheaders "["3gpp-Sbi-Message-Priority"]" </pre>	NRF_As_Server_Forwarding_Response corresponding to responsePriorityRule rule is selected, default value match rule is selected and mapped value is sent for Sbi Message Priority Header in the response. "3gpp-Sbi-Message-Priority"="16" Observability: None

Table L-8 (Cont.) Use Case Scenarios for Back-to-Back Agent – Server Role

Use Case Description	Use Case Type	Incoming Header Request	Response and Observability	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming response - VALID Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured range value match only.	The header is present in the response which was sent in the request.	"3gpp-Sbi-Message-Priority"="12"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Response", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Forwarding_Response" }]"</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Server_Forwarding_Response", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "12-16", "used": "17" }] }]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	NRF_As_Server_Forwarding_Response corresponding to responsePriorityRule rule is selected, range based value match rule is selected and mapped value is sent for Sbi Message Priority Header in the response. "3gpp-Sbi-Message-Priority"="17" Observability: None

Table L-8 (Cont.) Use Case Scenarios for Back-to-Back Agent – Server Role

Use Case Description	Use Case Type	Incoming Header Request	Response and Observability	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming response - VALID Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured Matching rule for incoming header value - Not Configured	The header is present in the response which was sent in the request.	"3gpp-Sbi-Message-Priority"="12"	/nf-common-component/v1/global-configuration/sbiserviceoperations "[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Response", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Forwarding_Response" }]" and /nf-common-component/v1/global-configuration/prioritymappingrules "[{ "name": "NRF_As_Server_Forwarding_Response", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "13-16", "used": "17" }] }]" and /nf-common-component/v1/global-configuration/requestsmphheaders "["3gpp-Sbi-Message-Priority"]"	NRF_As_Server_Forwarding_Response corresponding to responsePriorityRule rule is selected, No Rule Found for Value 12. No SMP header will go in the response. Observability: Metric will be pegged with reason.

Table L-8 (Cont.) Use Case Scenarios for Back-to-Back Agent – Server Role

Use Case Description	Use Case Type	Incoming Header Request	Response and Observability	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming response- VALID Corresponding sbiServiceOperation - Not Configured responsePriorityRule - NA Matching rule for incoming header value - NA	The header is present in the response which was sent in the request.	"3gpp-Sbi-Message-Priority"="12"	/nf-common-component/v1/global-configuration/sbiserviceoperations "[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Request", "defaultPriority": 18, "preferReceivedPriority": true }]" and /nf-common-component/v1/global-configuration/prioritymappingrules "[{ "name": "NRF_As_Server_Rule", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "13-16", "used": "17" }]]]" and /nf-common-component/v1/global-configuration/requestsmphheaders "["3gpp-Sbi-Message-Priority"]"	sbiServiceOperation is not present in the configuration for the incoming response. No SMP header will go in the response. Observability: Metric will be pegged with reason.

Table L-8 (Cont.) Use Case Scenarios for Back-to-Back Agent – Server Role

Use Case Description	Use Case Type	Incoming Header Request	Response and Observability	Response and Observability
SBI message priority feature - DISABLED SBI Message Priority header in incoming response- VALID Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured with exact value match, range and default match (that is, *)	The header is present in the response which was sent in the request.	"3gpp-Sbi-Message-Priority"="12"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre> "[[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Response", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Forwarding_Response" }]]" and /nf-common-component/v1/global-configuration/prioritymappingrules "[[{ "name": "NRF_As_Server_Forwarding_Response", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "12", "used": "10" }, "received": "12-15", "used": "14" }, "received": "*", "used": "16"]]]]" and /nf-common-component/v1/global-configuration/requestsmphheaders ["3gpp-Sbi-Message-Priority"]" </pre>	Feature is disabled. No header will go in the response even they are present in request. Observability: None.

Table L-8 (Cont.) Use Case Scenarios for Back-to-Back Agent – Server Role

Use Case Description	Use Case Type	Incoming Header Request	Response and Observability	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming response- INVALID Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured with range and default match (that is, *)	The header is present in the response which was sent in the request.	"3gpp-Sbi-Message-Priority"="35"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Response", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Forwarding_Response" }]"</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Server_Forwarding_Response", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "15-20", "used": "14" }, "received": "", "used": "16" }]]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	Default Priority from SBI service operation is used and header from NRF_As_Server_Rule corresponding to responsePriorityRule rule is selected, range based value match rule is selected and mapped value is sent for Sbi Message Priority Header in the response. "3gpp-Sbi-Message-Priority"="14" Observability: None.

Table L-8 (Cont.) Use Case Scenarios for Back-to-Back Agent – Server Role

Use Case Description	Use Case Type	Incoming Header Request	Response and Observability	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming response - INVALID Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured with default match (that is, *) only	The header is present in the response which was sent in the request.	"3gpp-Sbi-Message-Priority"="35"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre> "[[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Response", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Forwarding_Response" }]]" and /nf-common-component/v1/global-configuration/prioritymappingrules "[[{ "name": "NRF_As_Server_Forwarding_Response", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "*", "used": "16" }] }]]" and /nf-common-component/v1/global-configuration/requestsmphheaders "["3gpp-Sbi-Message-Priority"]" </pre>	Default Priority from SBI service operation is used and header from NRF_As_Server_Rule corresponding to responsePriorityRule is selected, default value match rule is selected and mapped value is sent for Sbi Message Priority Header in the response. "3gpp-Sbi-Message-Priority"="16" Observability: None .

Table L-8 (Cont.) Use Case Scenarios for Back-to-Back Agent – Server Role

Use Case Description	Use Case Type	Incoming Header Request	Response and Observability	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming response - INVALID Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured with range match only	The header is present in the response which was sent in the request.	"3gpp-Sbi-Message-Priority"="35"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Response", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Forwarding_Response" }]"</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Server_Forwarding_Response", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "16-20", "used": "18" }] }]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	Default Priority from SBI service operation is used and header from NRF_As_Server_Rule corresponding to responsePriorityRule is selected, range based value match rule is selected and mapped value is sent for Sbi Message Priority Header in the response. "3gpp-Sbi-Message-Priority"="18" Observability: None.

Table L-8 (Cont.) Use Case Scenarios for Back-to-Back Agent – Server Role

Use Case Description	Use Case Type	Incoming Header Request	Response and Observability	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming response - INVALID Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured Matching rule for default configured value - No	The header is present in the response which was sent in the request.	"3gpp-Sbi-Message-Priority"="-1"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre> "[[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Response", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Forwarding_Response" }]]"</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre> "[[{ "name": "NRF_As_Server_Forwarding_Response", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "13-16", "used": "17" }]]]]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre> "["3gpp-Sbi-Message-Priority"]"</pre>	Rule is not configured for defaultPriority No SMP header will go in the response. Observability: Metric will be pegged with reason.

Table L-8 (Cont.) Use Case Scenarios for Back-to-Back Agent – Server Role

Use Case Description	Use Case Type	Incoming Header Request	Response and Observability	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming response- INVALID Corresponding sbiServiceOperation - Configured responsePriorityRule - Not Configured Matching rule for incoming header value - NA	The header is present in the response which was sent in the request.	"3gpp-Sbi-Message-Priority"="40"	/nf-common-component/v1/global-configuration/sbiserviceoperations "[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Response", "defaultPriority": 18, "preferReceivedPriority": true }]" and /nf-common-component/v1/global-configuration/prioritymappingrules "[{ "name": "NRF_As_Server_Forwarding_Response", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "13-16", "used": "17" }]]]" and /nf-common-component/v1/global-configuration/requestsmphheaders "["3gpp-Sbi-Message-Priority"]"	responsePriorityRule is not configured. No SMP header will go in the response. Observability: Metric will be pegged with reason.

Table L-8 (Cont.) Use Case Scenarios for Back-to-Back Agent – Server Role

Use Case Description	Use Case Type	Incoming Header Request	Response and Observability	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming response - INVALID Corresponding sbiServiceOperation - Not Configured responsePriorityRule - NA Matching rule for incoming header value - NA	The header is present in the response which was sent in the request.	"3gpp-Sbi-Message-Priority"="-1"	/nf-common-component/v1/global-configuration/sbiserviceoperations "[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Request", "defaultPriority": 18, "preferReceivedPriority": true }]" and /nf-common-component/v1/global-configuration/prioritymappingrules "[{ "name": "NRF_As_Server_Rule", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "13-16", "used": "17" }]]" and /nf-common-component/v1/global-configuration/requestsmphheaders "["3gpp-Sbi-Message-Priority"]"	SBI Service operation is not configured for the incoming response. No SMP header will go in the response. Observability: Metric will be pegged with reason.

Table L-8 (Cont.) Use Case Scenarios for Back-to-Back Agent – Server Role

Use Case Description	Use Case Type	Incoming Header Request	Response and Observability	Response and Observability
SBI message priority feature - DISABLED SBI Message Priority header in incoming response- INVALID Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured with exact value match, range and default match (that is, *)	The header is present in the response which was sent in the request.	"3gpp-Sbi-Message-Priority"="-2"	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre> "[[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Respo nse", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Forwarding_Respo nse" }]]" and /nf-common-component/v1/global- configuration/prioritymappingrules "[[{ "name": "NRF_As_Server_Forwarding_Res ponse", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "12", "used": "10" }, "received": "12-15", "used": "14" }, "received": "*", "used": "16"]]]]" and /nf-common-component/v1/global- configuration/requestsmphheaders "["3gpp-Sbi-Message-Priority"]" </pre>	Feature is disabled. No header will go in the response even they are present in request. Observability: None.

Table L-8 (Cont.) Use Case Scenarios for Back-to-Back Agent – Server Role

Use Case Description	Use Case Type	Incoming Header Request	Response and Observability	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming response - Not present/ Cannot be used Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured with range and default match (that is, *)	The header is not present in the response which was sent in the request.	—	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre> "[[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Response", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Forwarding_Response" }]]" and /nf-common-component/v1/global-configuration/prioritymappingrules "[[{ "name": "NRF_As_Server_Forwarding_Response", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "15-20", "used": "14" }, "received": "", "used": "16" }]]]" and /nf-common-component/v1/global-configuration/requestsmphheaders ["3gpp-Sbi-Message-Priority"]" </pre>	Default Priority from SBI service operation is used and header from NRF_As_Server_Rule corresponding to responsePriorityRule is selected, range based value match rule is selected, and mapped value is sent for Sbi Message Priority Header in the response. "3gpp-Sbi-Message-Priority"="14" Observability: None.

Table L-8 (Cont.) Use Case Scenarios for Back-to-Back Agent – Server Role

Use Case Description	Use Case Type	Incoming Header Request	Response and Observability	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming response - Not present/ Cannot be used Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured with default match (that is, *) only	The header is not present in the response which was sent in the request.	-	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Response", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Forwarding_Response" }]"</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Server_Forwarding_Response", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules":</pre> <pre>[{ "received": "*", "used": "16" }] }]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	Default Priority from SBI service operation is used and header from NRF_As_Server_Rule corresponding to responsePriorityRule is selected, default value match rule is selected and mapped value is sent for Sbi Message Priority Header in the response. "3gpp-Sbi-Message-Priority"="16" Observability: None.

Table L-8 (Cont.) Use Case Scenarios for Back-to-Back Agent – Server Role

Use Case Description	Use Case Type	Incoming Header Request	Response and Observability	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming response-Not present/ Cannot be used Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured with range match only	The header is not present in the response which was sent in the request.	-	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Response", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Forwarding_Response" }]"</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Server_Forwarding_Response", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules":</pre> <pre>[{ "received": "16-20", "used": "18" }] }]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	Default Priority from SBI service operation is used and header from NRF_As_Server_Rule corresponding to responsePriorityRule is selected, range based value match rule is selected and mapped value is sent for Sbi Message Priority Header in the response. "3gpp-Sbi-Message-Priority"="18" Observability: None .

Table L-8 (Cont.) Use Case Scenarios for Back-to-Back Agent – Server Role

Use Case Description	Use Case Type	Incoming Header Request	Response and Observability	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming response - Not present/ Cannot be used Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured Matching rule for default configured value - NA	The header is not present in the response which was sent in the request.	-	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre> "[[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Response", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Forwarding_Response" }]]"</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre> "[[{ "name": "NRF_As_Server_Forwarding_Response", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules":</pre> <pre> [{ "received": "13-16", "used": "17" }]]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre> ["3gpp-Sbi-Message-Priority"]"</pre>	Rule is not configured for defaultPriority. No SMP header will go in the response. Observability: Metric will be pegged with reason.

Table L-8 (Cont.) Use Case Scenarios for Back-to-Back Agent – Server Role

Use Case Description	Use Case Type	Incoming Header Request	Response and Observability	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming response - Not present/ Cannot be used Corresponding sbiServiceOperation - Configured responsePriorityRule - Not Configured Matching rule for incoming header value - NA	The header is not present in the response which was sent in the request.	—	/nf-common-component/v1/global-configuration/sbiserviceoperations "[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Response", "defaultPriority": 18, "preferReceivedPriority": true}]" and /nf-common-component/v1/global-configuration/prioritymappingrules "[{ "name": "NRF_As_Server_Forwarding_Response", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "13-16", "used": "17" }]]]" and /nf-common-component/v1/global-configuration/requestsmphheaders "["3gpp-Sbi-Message-Priority"]"	responsePriorityRule is not configured. No SMP header will go in the response. Observability: Metric will be pegged with reason.

Table L-8 (Cont.) Use Case Scenarios for Back-to-Back Agent – Server Role

Use Case Description	Use Case Type	Incoming Header Request	Response and Observability	Response and Observability
SBI message priority feature - ENABLED SBI Message Priority header in incoming response-Not present/ Cannot be used Corresponding sbiServiceOperation - Not Configured responsePriorityRule - NA Matching rule for incoming header value - NA	The header is not present in the response which was sent in the request.	—	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre>"[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Request", "defaultPriority": 18, "preferReceivedPriority": true }]"</pre> and /nf-common-component/v1/global-configuration/prioritymappingrules <pre>"[{ "name": "NRF_As_Server_Rule", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "13-16", "used": "17" }] }]"</pre> and /nf-common-component/v1/global-configuration/requestsmphheaders <pre>"["3gpp-Sbi-Message-Priority"]"</pre>	SBI Service operation is not configured for the incoming response. No SMP header will go in the response. Observability: Metric will be pegged with reason.

Table L-8 (Cont.) Use Case Scenarios for Back-to-Back Agent – Server Role

Use Case Description	Use Case Type	Incoming Header Request	Response and Observability	Response and Observability
SBI message priority feature - DISABLED SBI Message Priority header in incoming response - Not present/ Cannot be used Corresponding sbiServiceOperation - Configured responsePriorityRule - Configured rule corresponding to SBI Message Priority header value is configured with exact value match, range and default match (that is, *)	The header is not present in the response which was sent in the request.	—	/nf-common-component/v1/global-configuration/sbiserviceoperations <pre> "[[{ "sbiServiceOperation": "Nnrf_NFDiscovery_Forward_Respo nse", "defaultPriority": 18, "preferReceivedPriority": true, "responsePriorityRule": "NRF_As_Server_Forwarding_Respo nse" }]]" and /nf-common-component/v1/global- configuration/prioritymappingrules "[[{ "name": "NRF_As_Server_Forwarding_Res ponse", "defaultSmpHeaderName": "3gpp-Sbi-Message-Priority", "rules": [{ "received": "12", "used": "10" }, "received": "12-15", "used": "14" }, "received": "", "used": "16"]]]]" and /nf-common-component/v1/global- configuration/requestsmphheaders "["3gpp-Sbi-Message-Priority"]" </pre>	Feature is disabled. No header will go in the response even they are present in request. Observability: None.