NOKIA

NSP
Network Services Platform

Release 18.9

Applications Guide

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Legal notice

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1 Network Services Platform

1.1 Overview

1.1.1

The NSP allows operators to automate, optimize, and assure network services across multiple network layers and both physical and virtual infrastructure, including equipment from multiple vendors.

1.1.2 To navigate the NSP Help

The NSP Help system includes information about all applications in the NSP product group (including applications that may not be licensed in your NSP deployment). The Help pages for individual applications are grouped according to application category, as laid out on the NSP Launchpad. The NSP Applications Guide provides the contents of the NSP Help system in PDF format, available on OLCS.

1

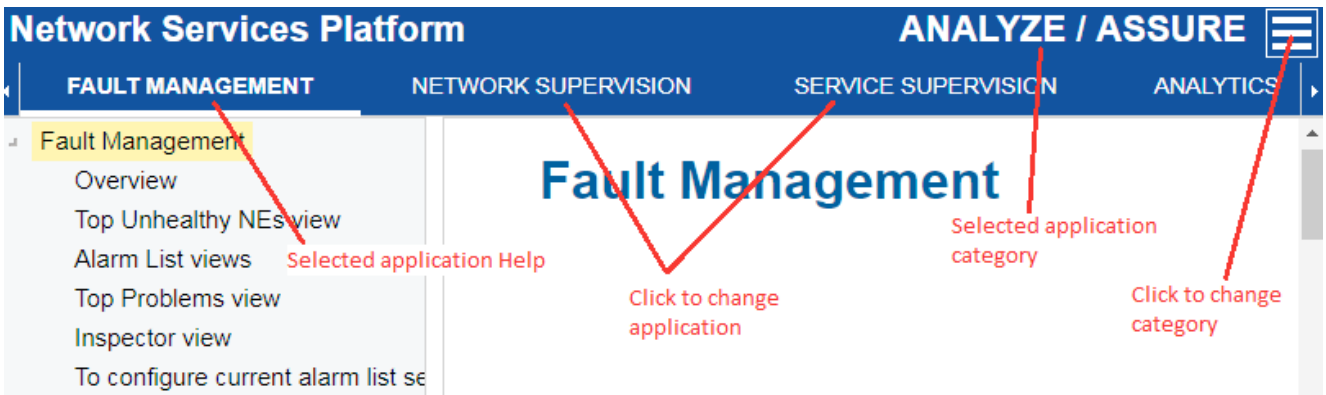
In the NSP Help page, click the menu button in the upper right-hand corner and choose an application category from the drop-down list.

For example, the figure below shows the ANALYZE / ASSURE category, with the Fault Management Help displayed.

2

Click on an application name (displayed horizontally across the banner) to display the Help for another application in the same category.

END OF STEPS



1.1.3 Applications

The NSP includes the following applications:

Category	Application name	Description
Analyze / Assure	Fault Management	Provides alarm monitoring, correlation, and troubleshooting for the most unhealthy NEs in the network, allowing you to filter, identify root causes, and determine the impact of alarms
	Network Supervision	Monitors the health of physical NEs and virtual NFs using pre-defined KPIs and alarms to provide a launchpad for monitoring the overall health of NEs in the network
	Service Supervision	Provides alarm and KPI monitoring on user-defined service views and groups
	Analytics	Provides graphical and tabular reports of network conditions and trends, based on the analysis of raw statistics data and big-data aggregation using business intelligence software In NSP 18.6, the Analytics application requires an NFM-P license and NFM-P analytics server for data collection.
	Link Utilization	Provides IP, MPLS, and aggregated utilization statistics for interfaces within a specific domain
	Subscriber Management	Provides NE and subscriber KPI information, alarm monitoring and correlation, and troubleshooting functions for subscriber hosts
	Telemetry	Provides a graphical dashboard of NE KPIs based on real-time telemetry statistics

Category	Application name	Description
Manage IP	Network Functions Manager - Packet	End-to-end network and service management across all domains of the converged IP network. Operational efficiency through fast provisioning and troubleshooting, service assurance, and enhanced network operations tools.

Category	Application name	Description
Control / Fulfill / Optimize	Policy Management	Allows for the creation of customized global or domain rules, as well as highly abstract service definitions
	Service Fulfillment	Allows for multi-vendor service provisioning and activiation across all network accessible to the NSD
	Task Scheduler	Enables users to do CRUD operations with respect to scheduling bandwidth modification requests/tasks on an existing E-Line service
	Autonomous System Optimizer	Allows traffic on monitored routers that is destined for autonomous systems to be steered to alternate next hops
	Latency Optimizer	Allows for traffic flows from an entry point router to a specific destination to be routed onto a path with the least possible latency.
	Traffic Steering Controller	Allows all existing flows within a network to be viewed, and also allows additional flows to be created
	IP/MPLS Optimization	Provides a view of the IGP topology and PCE LSPs, displays the status of the network, and provides functionality to optimize the network resources
	Ingress Peer Optimization	Optimizes connection utilization by moving traffic between peer routers to less used connections.
	Cross Domain Coordinator	Enables automatic discovery of cross domain links between IP and optical networks.
	Modeled Device Configurator	Allows for viewing the state and configuration of model-based devices, and for editing the device configuration.

Category	Application name	Description
Manage Data Centers / SD WAN	Inventory Management	Provides a dashboard inventory view of virtual network components and virtualized services in the network, allowing you to filter, search, and map data center network
	Service Navigator	Provides a dashboard of the operational health of the service objects in a specified administrative domain
Manage Wireless	Wireless NE View	Provides a visual representation of eNodeB hardware, links, states and fault status for a single NE
	Wireless Supervision	Provides alarm monitoring based on user-defined views and groups for an LTE RAN network
Administer NSP	Supervision Manager	Configure NE supervision groups and summary views of supervision groups for use with NSP applications.
	VNF Manager	Provides VNF lifecycle management functionality for an NFV network.
	Device Administrator	Allows for discovering model-based devices using mediation policies and network rules.

1.1.4 MDM-aware applications

MDM-aware applications include framework to allow them to work with modeled devices, that is, devices that are managed using MDM.

In the current release, the following applications are MDM-aware:

- Service Fulfillment
- Network Supervision
- Modeled Device Configurator
- Device Administrator
- Fault Management

- Telemetry

Restrictions may apply; see the *NSP Release Notice*.

1.2 To configure NSP user settings

1.2.1

Use this procedure to specify your personal GUI preferences for NSP applications.

1

Sign in to NSP.

2

Choose More→Settings from the NSP launchpad.

3

Click User Preferences.

4

Set the application polling time.

5

Choose a Language from the drop-down menu.

Nokia recommends that the NSP user preference for language matches the NSP system setting for language.

6

Enable the Color row with severity in IP and Wireless applications checkbox, if required.

7

Click Save.

END OF STEPS

Note: If you click Restore to System Settings, the language is restored to the NSP system language.

1.3 To configure NSP system settings

1.3.1

Use this procedure to specify global settings for NSP applications.

1

Sign in to NSP as an administrator.

2

From the NSP Launchpad, click More→Settings.

3

Click System Settings.

4

Set the application polling time.

5

Choose a Language from the drop-down menu.

6

Type a security statement in the text field and enable the checkbox to enable the security statement.

7

Enable the Color row with severity in IP and Wireless applications checkbox, if required.

8

Click Save.

End of steps

1.4 To configure NSP system colors

1.4.1

Use this procedure to associate custom colors with alarm severities.

1

Sign in to NSP as an administrator.

2

Choose More→Settings from the NSP launchpad.

3

Click System Colors.

4

Under Alarms, click on an alarm severity category and then click on the color you want to associate with the alarm severity category.

Repeat this step to set custom colors for other alarm severity categories.

5

Select a text color.

6

Click Save.

END OF STEPS

1.5 To configure NSP linked URLs

1.5.1

Use this procedure to link up to 20 external URLs that application users can launch to a new browser tab from the More menu on the NSP Launchpad.

1

Sign in to NSP as an administrator.

2

Choose More→Settings from the NSP launchpad.

3

Click Linked URLs.

4

Configure the Display Name and URL parameters.

5

Click Add.

6

To remove a linked URL, hover over the URL item in the list and click the Delete button at the end of the row.

END OF STEPS

1.6 To configure NSP application access control

1.6.1

Use this procedure to specify which NSP applications are loaded on the NSP server, and available to users on the NSP Launchpad.

Note: Disabling unused NSP applications improves NSP start-up time.

1

Sign in to NSP as an administrator.

2

Choose More→Settings from the NSP launchpad.

3

Click App Access Control.

4

Expand an application category and then enable or disable the check boxes to grant or restrict access to those applications.

5

Enable the check box to indicate that you understand the implications your changes.

6

Click Save.

If you are re-enabling access to an application, there may be a brief delay before the application icon appears on the Launchpad.

END OF STEPS

1.7 Licensing

1.7.1

Two types of licenses exist for NSP: Standard and Premium. When a Premium NSP license is in use, all NSP applications can be accessed from the Launchpad. When a Standard NSP license is in use, applications that require a Premium NSP license are identified by a badge.

NOTE: To acquire an NSP license, please contact your local Nokia representative.

1.8 REST API

1.8.1

Applications that use REST APIs publish a set of URLs that point to resources, or web services, managed by them. Each domain application documents the URLs that are available to users. These URLs can be accessed through a browser by any authorized user, including OSSs that can use them to cross-launch from their own application.

See the NSP Developer portal (https://nsp.developer.nokia.com/) for more information.

1.9 Accessibility

1.9.1

You can use the keyboard to navigate and interact with most of the applications. Keyboard navigation allows you to highlight and select interactive components in the application using keystrokes instead of a mouse.

The following table lists the accessibility options:

Keystroke	Action
Tab	Move to next element
Shift + Tab	Go back to previous element
Alt + down arrow Option/ALT + down arrow in Apple/OSX	Open pop-up menus, such as drop-down menus
Shift + F10 Shift + Fn + F10 in Apple/OSX	Open contextual menus
Ctrl + c Command + c in Apple/OSX	Copy
Ctrl + v Command + v in Apple/OSX	Paste
Enter	Open a folder or expandable object, such as a tile Invoke an action on a button or menu item
F8 Fn + F8 in Apple/OSX	Move over larger components or to the next page of a perspective
F5 Shift + Fn + F5 in Apple/OSX	Refresh
Shift + F1 Shift + Fn + F1 in Apple/OSX	Open tooltip
Esc	Close tooltip or menu

Keystroke	Action
Arrow	When you select a tile using the Tab key, navigate across tiles in a matrix, such as the Fault Management Top Unhealthy NEs view, or matrix view in Service Supervision, using the arrow keys. Up and down arrows for navigation across menu items in an open contextual menu or pop-up menu Up and down arrows for navigation across table rows Left and right arrows for navigation across table column headers
Shift + right or left arrow	Re-order columns of a data table when applied to a selected header button

1.10 Troubleshooting

1.10.1

This section describes various issues that application users may encounter, and provides recommendations to assist in the resolution of these issues, where possible.

1.10.2 Browser connections

All NSP applications are supported on the latest version of Google Chrome. For information about additional supported browsers for NSP applications, see the NSP NFM-P Planning Guide.

NOTE: For the Safari web browser to open the Analytics application, you must ensure that the following Safari privacy settings are configured, if they appear in your browser version:

- Cookies And Website Data setting on the Safari Preferences page is set to **Always Allow**
- Prevent cross-site tracking is disabled

NOTE: If you are using Chrome or Firefox on Windows 8.1 or Windows Server 2012, it is recommended that you enable ClearType Text for optimal viewing of fonts. In the Windows Control Panel, open the Display settings, and enable the Turn on ClearType parameter under the Adjust ClearType text settings.

NOTE: You cannot switch browsers between clients or applications. You must always use the browser configured as the default. See the *NSP NFM-P System Administrator Guide* for more information.

NOTE: The NSP Launchpad should should always be used to access NSP applications, as user-created links to individual applications can be broken by activity switches and/or software upgrades.

1.10.3 Remove unused applications to improve performance

To improve NSP start-up time, an NSP administrator can prevent any unused NSP applications from appearing on the NSP Launchpad. See 1.6 “To configure NSP application access control” (p. 19).

1.10.4 Browser- and session-related errors

Some HTTP errors and/or stalled user sessions can be avoided by adhering to the following suggested best practices for working with NSP:

- Although other browser types are supported, Chrome is the preferred browser.
- Sign in to the NSP Launchpad before opening additional NSP applications in other tabs.
- Before signing in as a different user, close all other NSP tabs and sign out of the last tab.
- If multiple NSP applications are open in one browser, close all other NSP tabs before signing out of the last NSP tab. Do not just close the browser.
- Avoid pausing a polling application for more than ten minutes.
- In the event of NSP server activity switch or shutdown, close all browser tabs. Following server recovery, sign in again.
- Enable cookies in your browser.

1.10.5 Application GUI behavior during server connection timeout

NSP application sessions that are terminated by loss of connection to an NSP server may require up to two minutes to reset after the server connection is restored. In the interim, the application GUI may appear to function but executing commands within the GUI will result in Server Not Found browser errors. This condition persists until an automated system function clears the old application session.

1.11 Documentation

1.11.1

This section provides information about accessing NSP product documentation.

1.11.2 NSP product-level documentation

Information about NSP in general is conveyed in product-level documentation.

The following documents apply to the entire NSP product and are available to registered users on the OLCS documentation center (https://infoproducts.alcatel-lucent.com/aces/cgi-bin/dbaccessproddoc.cgi.edit?entryId=1-0000000004100):

- NSP Deployment and Installation Guide
- NSP Lab Installer Reference
- NSP Release Notice
- NSP Analytics Report Catalog

In addition, the NSP has a channel on YouTube (https://www.youtube.com/channel/UCjnWSQv4u90rfrhoO3DSkeQ).

1.11.3 Application help

The NSP applications have documentation available from the product user interfaces.

2 Fault Management

2.1 Overview

2.1.1

Fault Management provides alarm monitoring, correlation, and troubleshooting for the most unhealthy NEs in the network. Filter alarm lists, identify root causes, and determine alarm impacts.

Fault Management components are also available in other applications in the NSP suite, such as Network Supervision and Service Supervision. Quickly investigate network problems and assess service impact with Fault Management and on-application alarm lists. Target specific alarms by filtering on set criteria.

2.2 Top Unhealthy NEs view

2.2.1 Overview

The Top Unhealthy NEs view displays the NEs in your network with the highest number of alarms in a matrix format. NEs are represented as tiles, with alarm count information and links to alarm lists for the selected NE.

Manage the order and content of your Top Unhealthy NEs view using the following tasks:

- **Control what's visible in the matrix:** Click on the Filter button and select one of these options:
  - Product - Select a product type from the list and you'll only see that NE product type in the matrix.
  - Topology Group - Select a topology group from the list and you'll only see NEs in that topology group in the matrix.
  - Unlocked Only - Select this option to see only unlocked NEs in the matrix.

  Add as many of these filters as you need. They appear as filter chips Product: 7750 SR at the top of the matrix. Click the Close button on a filter chip to remove it from the matrix.
- **Sort the matrix NE tiles:** Click the sort menu in the top right-hand corner of the matrix and select one of these options:
  - Total Active - NE tiles are sorted by the number of alarms against them.
  - Total Unacknowledged Active - NE tiles are sorted by the number of unacknowledged alarms against them.
  - Impact Counts - NE tiles are sorted by the number of network objects impacted by alarms on each NE.
- **View current alarms on an NE:** Hover over the More icon and click the Current Alarms button .
- **View historical alarms on an NE:** Hover over the More icon and click the Historical Alarms button .

- **View current and historical alarms on an NE:** Hover over the More icon and click the Merged Alarms button .
- **Export a list of unhealthy NEs to a local CSV file:** Click More > Export.

2.3 Alarm List views

2.3.1 Overview

The alarm list views present all alarms against NEs in your network. The lists can be filtered and sorted in a variety of ways to reduce the number of visible alarm messages to a manageable number. Open an alarm list from a specific NE to view alarms only for that NE. Open the general Alarm List view to see alarms for your entire network. Alarm messages are listed under three categories:

- The **current alarm list** displays all active alarms in the network, or for specific NEs.
- The **historical alarm list** displays all previously-active alarms in the network (or for specific NEs) over a specified time period.
- The **merged alarm list** displays all active and previously-active alarms in the network (or for specific NEs) over a specified time period.

2.3.2 To manage an alarm list

Manage the order and content of your alarm list using the following tasks:

- **Filter the Alarm List view by severity:** Click on an alarm severity level icon in the Severity filter selector to display only alarms of that particular severity level.
- **Filter the Alarm List view to show root cause alarms only:** Click on the Filter button and select Show Root Causes Only.
- **Clear Alarm List filters:** Click on the Clear Filter button.
- **Filter the alarm list under a specific column:** Type a text string in the text field at the top of a column and press Enter, or use the date picker or drop-down menu (where available) and press Enter. Click on the Clear Filter button to clear column filters.
- **Sort the alarm list under a specific column:** Click on a column header to sort the list under that column. Click the column header a second time to toggle the sort order (ascending/ descending), as indicated by the Up/Down arrow.
- **Refresh the alarm list manually:** Click the Refresh button.
- **Configure columns:** Right-click on a column header and choose Columns. A list of column names appears.
  Click on the names of the columns that you want to display. Click above the column headers on the list to close the column selector and refresh the view.
- **Configure column sorting:** Right-click on a column header and choose Configure Sort.
  In the Configure Sort form, click Add Level and choose the first column on which to sort, in ascending or descending order. You can continue to choose columns by which to sort the list.
  In the Configure Sort form, you can also copy, delete, and re-order selected entries.
- **Export alarms to a local CSV file:** Click More > Export Visible Rows | All | Selected.

2.3.3 To manage alarm messages

Perform the following operations on selected alarm messages in the alarm list:

- **Acknowledge or unacknowledge an alarm:** On the right-hand side of an alarm item in the list, click More > Acknowledge Alarm(s) | Unacknowledge Alarms.

  You can acknowledge or unacknowledge multiple alarms by pressing the Ctrl key and selecting the alarms, and clicking More > Acknowledge Alarm(s) | Unacknowledge Alarms in the top right-hand corner of the application window.

  If you select multiple NFM-P alarms, you can configure the Assigned Severity, and Acknowledgement Note. If you select multiple NFM-T alarms, you can configure the Acknowledgement Note. If you select both NFM-P and NFM-T alarms, you can configure the Acknowledgement Note.
- **Delete or clear an alarm:** Click More on the right side of a row and choose Delete Alarm(s) | Clear Alarm(s).

  You can delete or clear multiple alarms by pressing the Ctrl key and selecting the alarms, and clicking More > Delete Alarm(s) | Clear Alarms in the top right-hand corner of the application window.
- **Assign alarm severity:** On the right-hand side of an alarm item in the list, click More > Assign Severity.

  You can assign the same severity to multiple alarms by pressing the Ctrl key and selecting the alarms, and clicking More > Assign Severity in the top right-hand corner of the application window.
- **Assign alarm admin state:** On the right-hand side of an alarm item in the list, click More > Assign Admin State.

  You can assign the same admin state to multiple alarms by pressing the Ctrl key and selecting the alarms, and clicking More > Assign Admin State in the top right-hand corner of the application window.
- **Edit alarm custom text:** On the right-hand side of an alarm item in the list, click More > Edit Custom Text.

  You can add the same custom text to multiple alarms by pressing the Ctrl key and selecting the alarms, and clicking More > Edit Custom Text in the top right-hand corner of the application window.

2.3.4 To investigate alarms

Perform the following operations to further investigate selected alarm messages in the alarm list:

- **Show alarm impacts:** Click Show Impacts on the right-hand side of an alarm item in the list to open the Impacts diagram for the selected alarm.

  Note: When NFM-T is deployed and an optical object is selected, viewing object impacts is not available
- **Show the root cause of an alarm:** Click Show Root Causes on the right-hand side of an alarm item in the list to open the Root Cause diagram for the selected alarm.

  Note: This function is not available for NFM-T.
- **Show the object impacted by an alarm:** Click Show Object Impacts on the right-hand side of an alarm item in the list to view the non-alarmed objects that are impacted by the alarm.

Note: This function is not available for NFM-T.

- **Show alarms from the point of view of an affected object:** On the right-hand side of an alarm item in the list, click More > Show Object Point Of View to open the Object Point of View diagram for the selected alarm.

  Note: This function is not available for NFM-T.

2.3.5 Alarm statistics

The Alarm Statistics chart displays network alarm counts by alarm severity. Click the Alarm Statistics button to see the chart.

Click More > Export Data to CSV to export the chart to a CSV file.

2.3.6 Alarm distributiion

The Alarm Distribution diagram shows all the root cause trees for the most impacting alarms for the network. Click the Alarm Distribution button to see the diagram. The inner circle is each root cause alarm. The outer circles are objects impacted by the alarm, with the width of the blocks representing the impact magnitude. Click on an alarm to see its information in the panel on the right.

On the Info panel:

- Click Show Impacts to open the Impacts diagram.
- Click Alarm List to open the alarm list for the selected alarm, filtered by the alarm object full name.

Manage the order and content of your alarm distribution diagram using the following tasks:

- **Control what's visible in the alarm distribution diagram:** Click on the Filter button and select one of the options (date range, name, system ID, product, topology group, or saved filter). Depending on what you select, additional filters options appear.

  Add as many of these filters as you need. They appear as filter chips Product: 7750 SR at the top of the diagram. Click the Close button on a filter chip to remove it from the diagram.
- **Hide specific alarm types:** Click More and select the appropriate menu option to hide root alarms with no impact, acknowledged alarms, or maintenance (admin state) alarms.
- **Hide alarms of specific severity:** Click More and de-select the appropriate severity options.

2.3.7 Alarm hierarchy

The Alarm Hierarchy diagram shows the most impactful problems in the network, allowing you to locate the biggest problems first, from the root cause alarm to the symptomatic alarms. Click the Alarm Hierarchy button to see the diagram. Click on a ring or dot to zoom in, and click again to zoom out. Click on an alarm to see its information in the panel on the right.

On the Info panel:

- Click Show Impacts to open the Impacts diagram.

- Click Alarm List to open the alarm list for the selected alarm, filtered by the alarm object full name.

Manage the order and content of your Alarm Hierarchy diagram using the following tasks:

- **Control what's visible in the Alarm Hierarchy diagram:** Click on the Filter button and select one of the options (date range, name, system ID, product, topology group, or saved filter). Depending on what you select, additional filters options appear.
  Add as many of these filters as you need. They appear as filter chips Product: 7750 SR at the top of the diagram. Click the Close button on a filter chip to remove it from the diagram.
- **Hide specific alarm types:** Click More and select the appropriate menu option to hide root alarms with no impact, acknowledged alarms, or maintenance (admin state) alarms.
- **Hide alarms of specific severity:** Click More and de-select the appropriate severity options.

2.4 Top Problems view

2.4.1

The Top Problems view displays the alarm types with the most occurrences in the network in the form of a bar chart. Each bar represents a specific alarm type, and its size represents the number of occurrences. The top 50 alarm types with the most occurrences are listed by default, from the highest to lowest number of occurrences. The top problems are polled according to the time interval your administrator set in the system preferences or that you set in your user preferences, from the Settings menu on the NSP Launchpad.

When you hover over a bar in the chart, the corresponding alarm type in the list is highlighted.

Sort alarms: Click the sort menu in the top right-hand corner of the chart and select a sort option (by total number of occurrences, total alarm count, or number of NEs on which the alarm is raised).

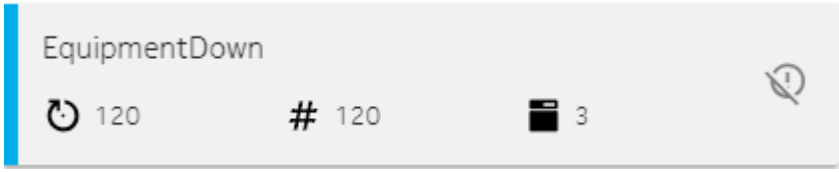
Display preferences: click More and select a display preference for the chart. You can display the alarms by name, probable cause, or specific problem.

Filter alarms by severity: Click on the Filter button (appears only when the alarms are displayed by alarm name) and select a severity level from the drop-down menu. Only alarms of the selected severity are displayed in the chart. Click the Close button on the filter chip to remove it from the chart.

Export list of top problems to a CSV file: Click More > Export. Your display and sorting selections are preserved in the CSV file.

2.4.2 Alarm Type list

The Alarm Type list displays name and alarm count information for the top 50 alarm types displayed in the chart. The first icon in an alarm type list item shows the number of occurrences of the alarm type, the second icon shows the total alarm count, and the third icon shows the number of NEs affected by the alarm type. When you hover over an alarm type in the list, the corresponding bar in the chart is highlighted.



Hide Alarm Types: Hide an alarm type from the list and the chart by clicking the Hide button that appears when you hover on the right-hand side of an alarm type item. If any alarms are hidden, the Hidden Alarm Type button is enabled on the main toolbar. Click this button to remove the alarm type from the list of hidden alarms (the alarm type is re-displayed).

2.4.3 Top Problems Matrix

The Top Problems Matrix view displays up to 50 NEs on which the selected alarm type occurs. Click on a bar in the Top Problems view to opens it in the Matrix view. Each affected NE is represented as a tile. The first icon in a tile shows the number of occurrences of the alarm type and the second shows the total alarm count.

- **View current alarms on an NE:** Hover over the More icon on a tile and click the Current Alarms button .
- **View historical alarms on an NE:** Hover over the More icon on a tile and click the Historical Alarms button .
- **View current and historical alarms on an NE:** Hover over the More icon on a tile and click the Merged Alarms button .
- **Export a list of unhealthy NEs to a local CSV file:** Click More > Export.

2.5 Inspector view

2.5.1

In the Inspector, search for specific NEs to be displayed in a matrix.

Adding NEs - Click on Add New NE and use the search menu to select your search criterion. You can enter text in the search field to limit the results or scroll through the list. Up to 256 results are listed. Click on an NE to add it to the beginning of the matrix, or drag an NE to the desired location in the matrix. You can add up to 50 NEs.

Details Click on an NE to view more information about the NE in the Details panel.

Merged Alarms Hover over the right side of the NE and click Merged Alarms to view the merged list of current and historical alarms.

Removing NEs Hover over the right side of the NE and click Remove to remove the NE from the Inspector. Click Remove All to remove all of the NEs from the Inspector.

2.6 To configure current alarm list settings

2.6.1

Configure aging and overflow settings for the current alarm list. These settings apply to NFM-T alarms and MDM alarms. NFM-P alarm settings are configured in the NFM-P GUI; see the *NFM-P System Administrator Guide*.

You must have administrator privileges to configure alarm settings.

1

Click More→Settings. The Alarm Settings form opens.

2

Click Current Alarms on the left-hand panel.

3

Enable the Aging Settings option and specify the number of days after which alarms are deleted.

4

Under Overflow Settings, specify the percentage of the maximum alarm count at which an alarm overflow warning is issued. (The maximum alarm count is hard coded at 150000 alarms if NFM-T and NFM-P are deployed in shared mode, or 300000 alarms if NFM-T is deployed alone.)

5

Specify an overflow action. If you choose Halt, all new alarms are dropped. If you choose Wrap, alarms are purged from the database, based on the following settings:

- Purge Amount - the percentage of the current alarm count to be deleted.
- Purge Policy - either the lowest severity alarms are deleted first or the oldest alarms are deleted first.

6

Save your changes.

END OF STEPS

2.7 To configure historical alarm list settings

2.7.1

Configure logging and overflow settings for the historical alarm list. These settings apply to NFM-T alarms and MDM alarms. NFM-P alarm settings are configured in the NFM-P GUI; see the *NFM-P System Administrator Guide*.

You must have administrator privileges to configure alarm settings.

1

Click More→Settings. The Alarm Settings form opens.

2

Click Historical Alarms on the left-hand panel.

3

Enable the Archive Settings option and enable either or both of the Log on Change and Log on Deletion options.

4

Under Overflow Settings, specify the maximum alarm count at which an alarm overflow warning is issued.

5

Specify a warning threshold as a percentage of the maximum alarm count, and specify the percentage of the alarm count to be purged at the time of the warning message.

6

Specify a critical threshold as a percentage of the maximum alarm count, and specify the percentage of the alarm count to be purged at the time of the critical message.

7

Save your changes.

END OF STEPS

2.8 To configure system alarm settings

2.8.1

Use this procedure to configure alarm handling options for alarm messages originating from the NSP system for the Fault Management application.

You must have administrator privileges to configure alarm settings.

1

Click More→Settings. The Alarm Settings form opens.

2

Click System Alarms on the left-hand panel to configure system-wide alarm settings.

3

Enable the Alarm Severity Settings option and then configure manual and automatic options, as required.

4

Enable the Alarm Deletion Settings option, as required, and then enable and configure any of the following options:

- Manual Alarm Deletion Settings
- Correlated Alarm Settings for Manually Deleted Alarms
- Automatic Alarm Deletion Settings

5

Enable the alarm acknowledgement policy, as required.

6

Save your changes.

END OF STEPS

2.9 To create an alarm e-mail policy

2.9.1

Note: This function is supported for NFM-P alarms on NFM-P servers only.

A user with admin privileges can create up to five policies for E-mail notifications with alarm notification rules and a list of recipients. When a filter is matched, an e-mail is sent to the list of recipients. The e-mail is a text version of a set of alarm fields, and includes a URL to the Impact Analysis tool in Fault Management in the context of the alarm.

Your administrator must ensure that the outgoing SMTP e-mail server is configured. See the *NFM-P System Administrator Guide*.

LI alarms are not sent in the e-mails.

E-mails are not sent for alarm attribute change events, only for alarm creation. For example, if an alarm is created with a severity of major, and the severity is subsequently changed to critical, alarm e-mail policy filters for critical alarms will not include this alarm.

When you modify the e-mail policy properties form, the e-mail counts for the e-mail policy are reset. If you select a different filter for the e-mail policy, the e-mail counts are reset. If you modify the contents of the saved filter from the alarm table, the e-mail counts for the e-mail policy are not reset.

1

Choose Administration→Alarm Settings from the NFM-P main menu. The Alarm Settings form opens.

2

Click on the E-mail tab and click Create. The Alarm Email Filter (Create) form opens.

3

Configure the Name and Max Emails Per Hour parameters.

4

Select an alarm filter. To configure and apply an advanced search filter using the filter configuration form, see the *NFM-P User Guide*.

5

Click on the Users tab, then on Add to create a list of e-mail recipients. The e-mail is sent to the e-mail address configured for the selected users. See To create an NFM-P user account in the *NFM-P System Administrator Guide*.

You can add up to 20 users as recipients of an e-mail for each policy.

6

Save the changes and close the forms.

END OF STEPS

2.10 Alarm reload behavior

2.10.1

When alarm messages from MDM and NFM-T sources are modified or deleted in the Fault Management application, the change is recorded in the NSP database, but not at the alarm source. If alarms are bulk-reloaded from an MDM or NFM-T source to the Fault Management application, previously modified or deleted alarms from that source are handled in the following manner:

- For alarms with modified fields, any data already in the NSP database is not overwritten by the reloaded alarm.
- Alarms in the NSP database that are tagged as Transient (i.e., not standing alarms) are not deleted by the reload, even if they are no longer present on the source system.

3 Network Supervision

3.1 Overview

3.1.1

Network Supervision allows users to monitor the health of objects, such as NEs, cards, ports, or links, using KPIs, and monitor the fault status of a network. Network Supervision uses supervision groups, which can belong to one or more views.

A supervision group is a logical set of monitored objects, in this case NEs and VNFs, that is specified by user-defined filters.

NEs are both physical network functions and virtual network functions. Physical network functions are referred to as PNFs and virtual network functions are referred to as VNFs in the online help.

Supervision groups can be used to partition objects into distinct categories and are associated with views. There is no limit to the number of supervision groups to which an object can belong.

The criteria for monitored objects in a supervision group are based on inclusion filters. The inclusion filter is the rule on whether to include an object in a supervision group.

A view is a collection of one or more supervision groups that provides a summarized, high-level view of a group of network objects. There is no limit to the number of views to which a supervision group can belong, but each view can contain only up to 200 supervision groups.

3.2 To create a view

3.2.1

Note: You must be logged into NSP as an administrative user to complete this procedure.

1

In the Network Supervision application, click More→Supervision Manager. The Supervision Manager application opens on a new browser tab.

2

On the Views list on the left-hand side of the GUI, click the Add View (+) button. The Add a New View form appears.

3

Specify a name for the view.

4

Enable the Automatically Creates Supervision Groups option.

If this option is disabled, the resulting view will contain no supervision groups. You can add groups later.

5

Choose an option to create supervision groups based on Product Type or VNF Type.

6

Click Ok. The Supervision Manager grid is populated with supervision groups, represented as tile objects.

7

Return to the Network Supervision application browser tab.

8

Click More→View and select the new view from the menu.

END OF STEPS

3.3 To create a supervision group

3.3.1

Note: You must be logged into NSP as an administrative user to complete this procedure.

1

In the Network Supervision application, click More→Supervision Manager. The Supervision Manager application opens on a new browser tab.

2

On the Views list on the left-hand side of the GUI, click on the view to which you want to add a group.

3

On the right-hand side of the GUI, click on the Add Supervision Group (+) button. The Add Supervision Group form appears.

4

Specify a name for the supervision group and follow the instructions in the form, clicking Continue to navigate through the pages.

In order to add NEs to the supervision group, you will need to specify inclusion filters to list the NEs. You can filter the NEs based on NE attributes, or you can create advanced filter expressions. Alternatively, you can manually add NEs to the group by specifying individual NE management IP addresses, or by importing a comma-separated list of NE management IP addresses.

5

When you have reviewed the list of NEs to include in the supervision group, click Finish to save the group.

6

Return to the Network Supervision application browser tab.

END OF STEPS

3.4 To configure KPI threshold settings

3.4.1

Use the KPI Threshold Settings form to specify the affected NE/component counts at which Network Supervision GUI objects change color to indicate status change.

1

In the Network Supervision application, click More→KPI Threshold Settings.

2

In the KPI Threshold Settings form, drag the cursors on the threshold line to the levels at which you want object color changes to occur.

3

Save your changes.

END OF STEPS

3.5 To configure Event Timeline settings

3.5.1

Note: You must be logged into NSP as an administrative user to complete this procedure.

Use the Event Timeline settings form to enable/disable event logging and specify the object types that appear in the Event Timeline view.

1

In the Network Supervision application, click More→Timeline Settings.

2

In the Timeline Settings form, enable or disable event recording in the Network Supervision application.

3

Enable the checkbox for each network object type that you want to appear in the Event Timeline.

4

Save your changes.

END OF STEPS

3.6 To configure application preferences

3.6.1

You can specify whether an object's administrative state is used to calculate its KPI level in Network Supervision.

1

Login to NSP as an administrator and launch Network Supervision.

2

In the Network Supervision application, click More→Application Preferences.

3

Enable or disable the checkbox to use object administrative state for KPI calculations.

4

Save your changes.

END OF STEPS

3.7 To configure user preferences

3.7.1

You can specify a variety of custom view settings in Network Supervision to suit your needs.

1

In the Network Supervision application, click More→User Preferences.

2

In the User Preferences form, configure view capacity, sorting, and refresh settings, as required.

3

Save your changes.

End of steps

3.8 To configure utilization map preferences

3.8.1

1

In the Network Supervision application, click More → Utilization Map Preferences.

2

In the Utilization Map Preferences form, configure the Refresh Rate, Port Speed, and KPI color threshold parameters as required.

3

Save your changes.

End of steps

3.9 Routine NE maintenance with Network Supervision

3.9.1 Purpose

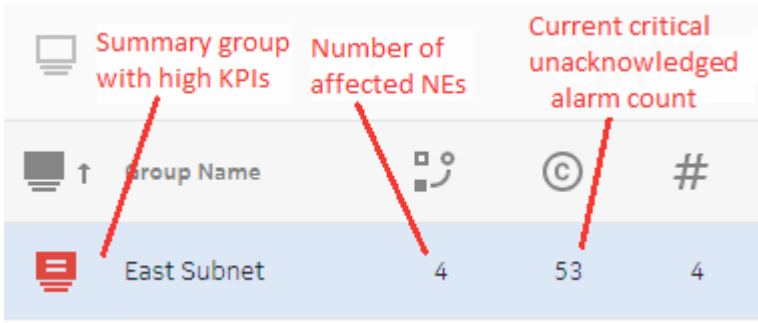
This topic is provides you with a task flow to use the Network Supervision application to monitor the status of your network hardware (NEs and their installed equipment) and to locate and troubleshoot the root cause of problems.

3.9.2 Starting points for troubleshooting monitored NEs

Any of the following events could indicate that you need to troubleshoot your network:

- One or many KPI icons turn red or show upward trending arrows on NEs in the Watch view. To add NEs to the Watch view, hover over an NE tile in the NE Matrix and click More > Add To Watch View.

- A summary group turns red or shows upward trending arrows in the Summary view.



- NE tiles change color or show upward trending arrows in the NE Matrix.

3.9.3 Triaging steps for a summary group

1

Select an affected summary group in the Summary view.

2

Determine the number of affected NEs and critical alarms for the group.

3

Click on the summary group to display its NEs in the NE Matrix.

From the Matrix, you can open the Alarms list to view alarms for the entire summary group.

4

Proceed to 3.9.4 “Triaging steps for an NE” (p. 39).

END OF STEPS

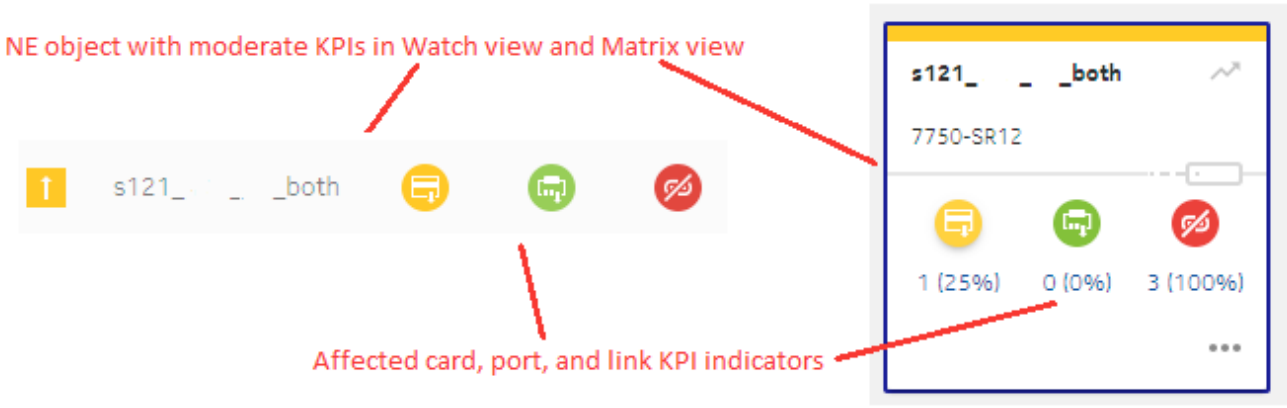
3.9.4 Triaging steps for an NE

1

Select an affected NE in the Watch view or NE Matrix.

2

Determine which KPIs on the NE are affected (yellow or red color): the number of cards, ports, or links that are down.



Also look for upward trending arrows on NEs in the Watch view or NE Matrix. These indicate affected NEs that developed problems recently.

3

Select one or more of the following methods to troubleshoot the problem.

Troubleshooting with the Alarms List and Event Timeline

4

Open the Alarms List to view all standing alarms for the selected NE; on the NE tile, click More > Current Alarms.

5

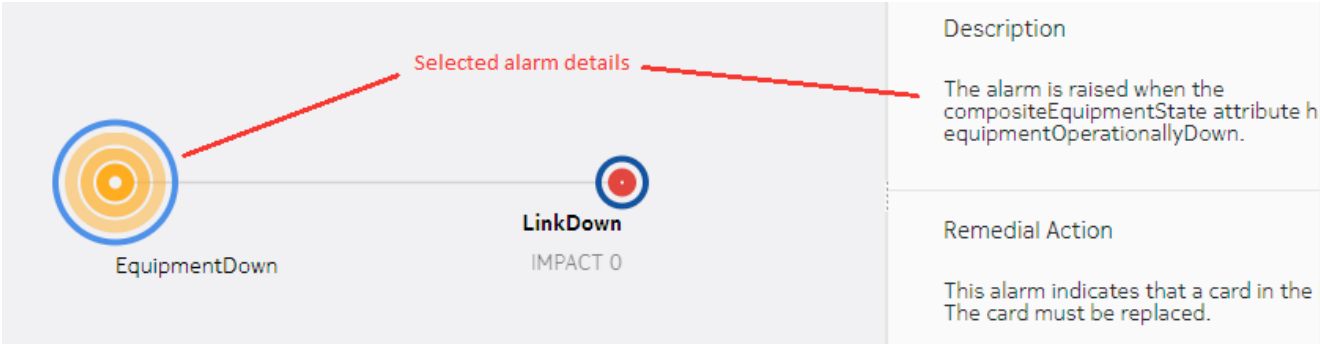
Click on an alarm message in the list to display complete details of the alarm, including descriptive and remedial information.

If you suspect that the affected object for the selected alarm is a cause of the current problem, you can open the affected object in its management application directly from the Alarms list. On the selected alarm item, click More > Show Affected Object. Make configuration changes to the affected object while monitoring the object in Network Supervision to determine if KPIs improve as a result of the change.

6

To further investigate a selected alarm, open its Impact Analysis diagram to view objects impacted by the alarm. On the selected alarm item, click Show Impacts .

The selected alarm object is circled in dark blue. Click on an alarm object to view details and remedial information.

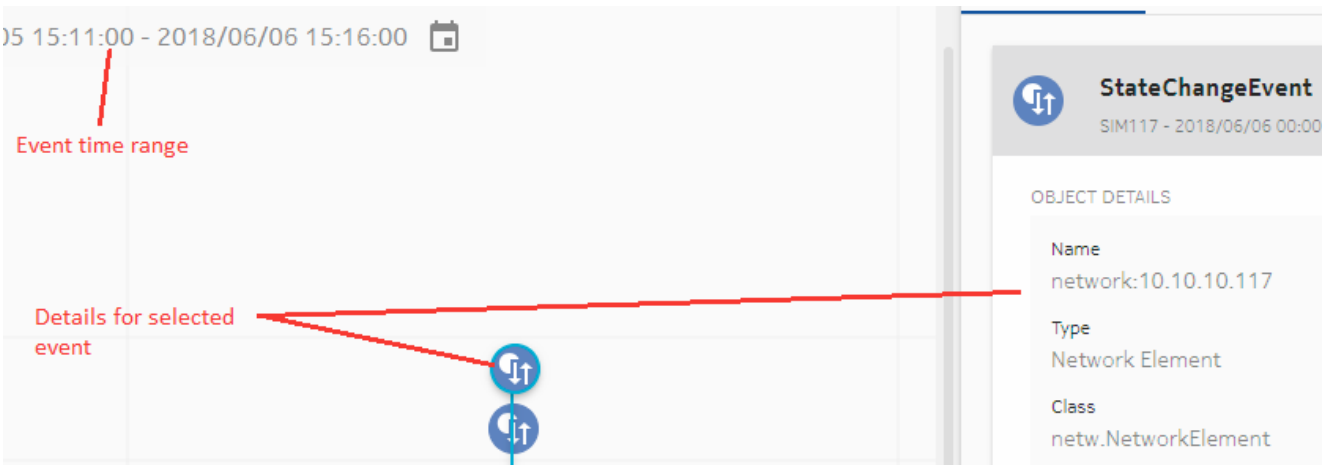


If you suspect that the affected object for the selected alarm is a cause of the current problem, you can open the affected object in its management application from the Impact Analysis view. At the bottom of the Details panel, click Show Affected Object . Make configuration changes to the affected object while monitoring the object in Network Supervision to determine if KPIs improve as a result of the change.

7

Open the Event Timeline for the alarm to view events that occurred just prior to the alarm being raised, and determine the possible cause (for example, an object configuration change).

Adjust the date range around the alarm event as required.

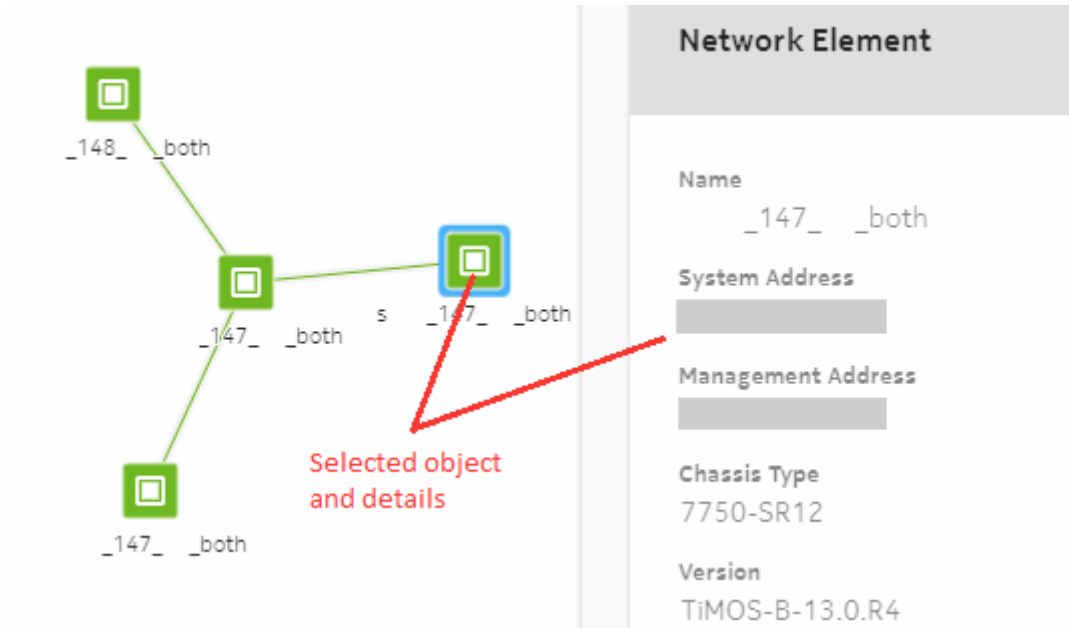


Select an event icon in the timeline to view information related to the event.

Troubleshooting with the Troubleshooting Map

8

Return to the NE Matrix or Watch view and open the Troubleshooting Map for the selected NE. Click on a red NE or link object and then click on the Info button to view details about the object.



To correct a problem on an affected object, you can open the object in its management application to change its configuration, or to undo a previous configuration change that caused the problem. On the Details panel, click More > Show Object. Make configuration changes to the affected object while monitoring the object in Network Supervision to determine if KPIs improve as a result of the change.

9

When troubleshooting is complete, verify that all alarms have cleared and KPI indicators are green.

End of steps

3.10 Operational maintenance in Network Supervision

3.10.1

This section describes various issues that users may encounter and provides recommendations to assist in the resolution of these issues, where possible.

3.10.2 Mediation software capabilities

Actions performed on objects in the Network Supervision application depend on the capabilities of the object's source mediation software. In particular, certain application functions described in on-product tours may not be available when the NSP is deployed with the NFM-T, but in the absence of the NFM-P:

- The Event Timeline function is disabled for NFM-T objects in the Watch view, NE Matrix, and NE List.
- Event Timeline settings cannot be configured in an NFM-T-only deployment. Default settings are used.
- The Policy Agent function is not available in an NFM-T-only only deployment.
- The CBAM Access Point function is not available in an NFM-T-only deployment.

3.10.3 Map view performance

Users should consider the performance information in this section when working in Network Supervision map views.

Nokia recommends a maximum of 2000 NEs per supervision group. Multi-layer maps support a recommended maximum of 4000 objects.

Users should expect the following Multi-layer map loading times with different numbers of NEs:

- for 250 NEs (125 physical links); approximately six seconds for the initial page loading and four seconds to reload
- for 500 NEs (250 physical links); approximately nine seconds for the initial page loading and six seconds to reloads
- for 2000 NEs (1000 physical links); approximately 50 seconds for the initial page loading and 28 seconds to reload

3.10.4 To purge assurance event records

The event timeline in applications is a log of events that is mapped over a specified period of time. You can filter the event types presented on the timeline, such as alarm events, OAM test failures, and configuration and state change events. You can use the event timeline to search for patterns in events over a period of time.

Perform this procedure to purge assurance event records when the AssuranceEventLoggingTurnedOff alarm is raised. This alarm is raised when the database disk space used to log assurance events grows above the predefined threshold.

Assurance Event logging is disabled to protect the database disk space.

Note: You must be logged into the NFM-P as an administrator to perform this procedure.

1

From the NFM-P main menu, choose Tools→Events→Event Policies. The Manage Event Policies form opens.

2

Choose the assurance.AssuranceEvent event type and click Properties. The Event Policy - assurance.AssuranceEvent (Edit) form opens.

3

Click the More Actions button and choose Purge Event Records. The Event Policy - assurance.AssuranceEvent (Edit) Filter form opens.

4

Click OK to purge all event records.

5

If necessary, configure the Event Retention Time (hours) to a value lower than the default value.

6

Save the changes and close the forms.

End of steps

4 Service Supervision

4.1 Overview

4.1.1

Service Supervision allows you to monitor the health of services using KPIs, and monitor the fault status of a network. Service Supervision uses supervision groups, which can belong to one or more summary views.

A supervision group is a logical set of monitored services that is specified by user-defined filters. Supervision groups can be used to partition services into distinct categories and are associated with summary views. There is no limit to the number of supervision groups to which a service can belong.

Up to 50 000 services can be included in a supervision group. VLL, VPLS, MVPLS, IES, and VPRN services can be included.

The criteria for monitored objects in a supervision group are based on inclusion filters. The inclusion filter is the rule on whether to include an object in a supervision group. For example, for the Wireless Supervision application, the inclusion filters used to specify the eNodeBs in a supervision group must exclude pre-provisioned NEs and all other non-eNodeB NE types to avoid misleading alarms and KPI numbers.

A summary view is a collection of one or more supervision groups that provides a summarized, high-level view of a group of services. There is no limit to the number of summary views to which a supervision group can belong, but each summary view can contain only up to 200 supervision groups.

4.2 To create a supervision group

4.2.1

Note: The Service Supervision application GUI includes a Create Automatically option for supervision group creation. In network deployments with a large number of services (more than 100, 000), use of the Create Automatically option could take a long time to complete. Nokia recommends that automated supervision group creation operations are done during network maintenance periods, or immediately after an NSP upgrade.

Nokia also recommends not to start a second automated supervision group creation operation until the current operation has completed.

1

Choose Administration→Supervision Settings from the NMF-P main menu. The Supervision Settings (Edit) form opens.

2

Configure the KPI History Interval (minutes) and KPI History Duration (hours) parameters.

3

Click on the Supervision Groups tab and click Create. The Supervision Group (Create) form opens.

4

Configure the parameters.

The Category parameter distinguishes which monitored objects the Supervision Group manages, and to which application it applies in the Summary View.

For instance, when you set the Category parameter to service, you can create inclusion filters that apply only to service properties. You can add the supervision group to a Summary View that has the Application parameter set to Service Supervision.

5

Configure the KPI History Interval (minutes) and KPI History Duration (hours) parameters.

6

To apply an inclusion filter to the supervision group, click on the Inclusion Filters tab and click Add to select a filter.

7

To create an inclusion filter, click on the Inclusion Filters tab and click Create, then Add. Configure the filter properties.

8

To create an exclusion filter, click on the Exclusion Filters tab and click Create, then Add. Configure the filter properties.

9

Search for the filter you created and add it to the supervision group.

10

Save the changes and close the forms.

END OF STEPS

4.3 To create a summary view

4.3.1

1

Choose Administration→Supervision Settings from the NMF-P main menu. The Supervision Settings (Edit) form opens.

2

Configure the KPI History Interval (minutes) and KPI History Duration (hours) parameters, if required.

3

Click the Summary View tab and click Create or choose a summary view and click Properties. The Summary View (Create|Edit) form opens.

4

Configure the required general parameters.

Configure the Application parameter to select the application to which to associate the view.

5

Click on the Supervision Groups tab.

6

Click Add to select the supervision group you created.

7

You can add user groups to restrict access to the summary view to only the users that belong to the selected user group or groups. Users with administrative privileges have access to all summary views. If no user group is assigned to a summary view, all users have access to the summary view. Click on the User Groups tab, and click Add to select one or more user groups.

8

Save the changes and close the forms.

END OF STEPS

4.4 Routine service maintenance with Service Supervision

4.4.1 Purpose

This topic provides you with task flows to use the Service Supervision application to monitor the status of the services running in your network and to locate and troubleshoot problems.

4.4.2 Starting points for troubleshooting monitored services

Changes to services manifest themselves through trending arrows on summary tiles and KPI icon color change on service objects.

Any of the following events could indicate that you need to troubleshoot your services:

- One or more KPI icons turn red on services in the Watch view.
  To add services to the Watch view, hover over a service item in the Service List and click More > Add To Watch Drawer.
- A trending arrow appears on a summary tile or the tile changes color as services are impacted by new issues.
- A service item in the Service List shows problems with service objects: service site down, SAP down, SDP binding down, and/or OAM test validation failure.

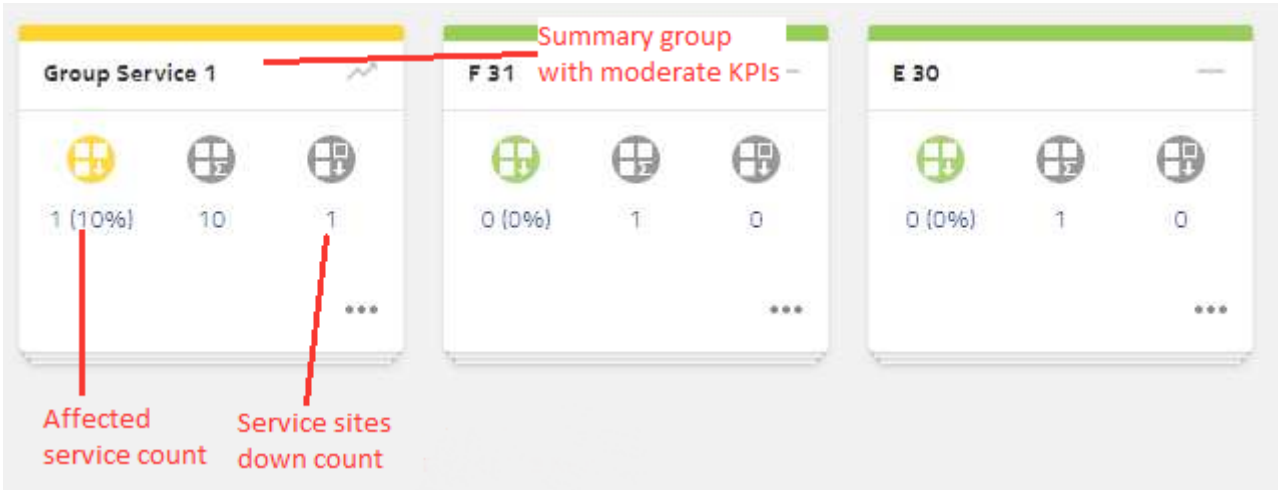
4.4.3 Triaging steps for a summary group

1

Select an affected summary group tile in the Summary view.

2

Determine the number of affected services and services with sites down for the group.



Click on the More Details button to expand a summary group tile and view additional KPIs: services with SAPs down, SDP bindings down, or OAM test failures.

3

Double-click on the summary group to display its affected services in the Service List.

From the Service List, you can open the Alarms list to view alarms for the entire summary group.

4

Proceed to 4.4.4 “Triaging steps for services” (p. 50).

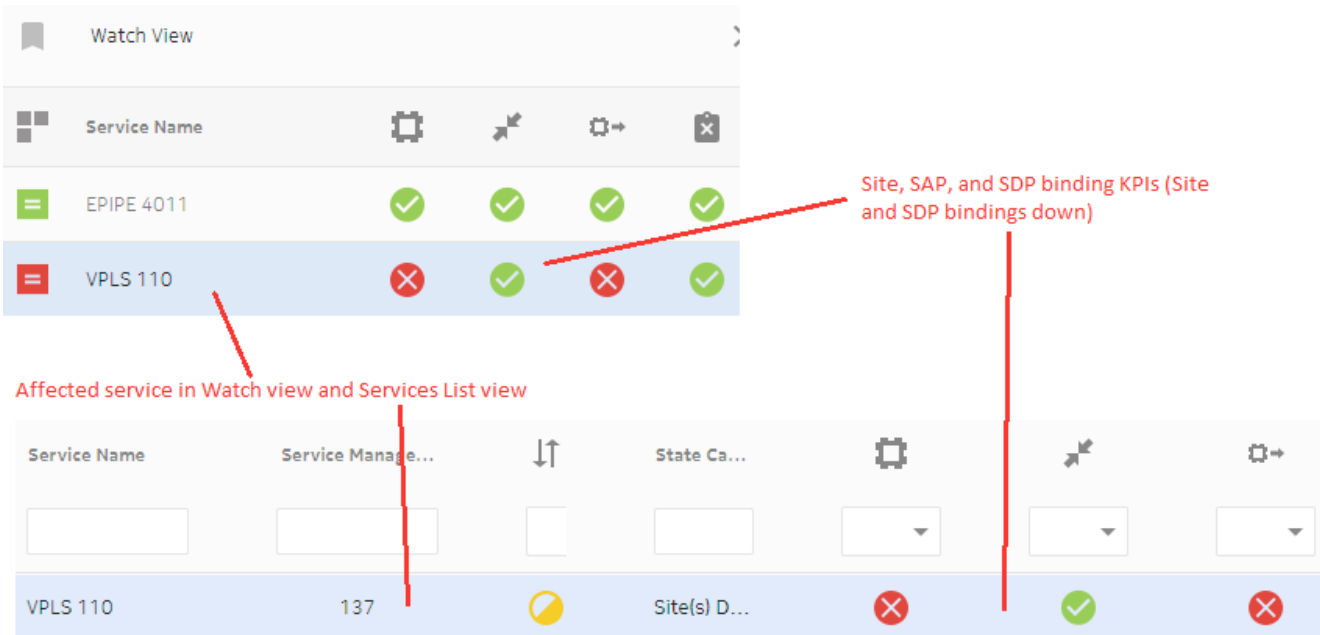
END OF STEPS

4.4.4 Triaging steps for services

One or more KPI icons turn red on services in the Watch or the Service List.

1

Click on an affected service in the Watch view or double-click an affected service in the Service List.



The affected service opens in the Service List as a list of service sites.

2

Determine which KPIs are affected (i.e. down ⊗): service site down, SAP down, SDP binding down, and/or OAM test validation failure.

3

Open the Alarms list for the affected service; on the service item click More > Alarms. Use the Alarms List, Impacts diagram, and Event Timeline as described in 4.4.8 “Troubleshoot problems in the Alarms list” (p. 54) and 4.4.9 “Troubleshoot problems in the Event Timeline” (p. 54) to view events that might point to the problem.

4

On the service item, click on the IGP Map icon . On the IGP map, check the status of SDP bindings as described in 4.4.11 “Troubleshoot problems in the IGP Map” (p. 56).

5

To change the configuration of the service item in its management application, hover over a service item and click More > View Properties. Monitor the object in Service Supervision to determine if KPIs improve as a result of the change.

6

After troubleshooting, verify that all alarms and KPIs have cleared and run OAM tests to prove that traffic can flow.

End of steps

4.4.5 Triaging steps for a service site

For a selected service item in the Service List, the Service Site KPI is Down.

1

Double-click on the service item to drill down to a list of all sites for the service.

2

Open the Alarms list for the affected service site; on the site item, click More > Alarms.

3

Use the Alarms List and Impacts diagram as described in 4.4.8 “Troubleshoot problems in the Alarms list” (p. 54) to view events that might point to the problem.

4

On the service item, click on the Event Timeline icon . Use the Event Timeline as described in 4.4.9 “Troubleshoot problems in the Event Timeline” (p. 54) to view events that might point to the problem.

5

Select multiple affected service site item(s) and click on the OAM Test icon . Perform OAM tests as described in 4.4.10 “Troubleshoot problems with OAM tests” (p. 55) .

End of steps

4.4.6 Triaging steps for a SAP

For a selected service item in the Service List, the SAP KPI is Down.

1

On the service item, click on the SAP icon to drill down to a list of SAPs on the service.

2

On an affected SAP item, click on the Alarms icon . Use the Alarms List and Impacts diagram as described in 4.4.8 “Troubleshoot problems in the Alarms list” (p. 54) to view events that might point to the problem.

3

On an affected SAP item, click on the Event Timeline icon . Use the Event Timeline as described in 4.4.9 “Troubleshoot problems in the Event Timeline” (p. 54) to view events that might point to the problem.

4

Select multiple affected SAP item(s) and click on the OAM Test icon . Perform OAM tests as described in 4.4.10 “Troubleshoot problems with OAM tests” (p. 55) .

END OF STEPS

4.4.7 Triaging steps for an SDP binding

For a selected service item in the Service List, the SDP Binding KPI is Down.

1

On the service item, click on the SDP Binding icon to drill down to a list of SDP bindings on the service.

2

On an affected SDP binding item, click on the Alarms icon . Use the Alarms List and Impacts diagram as described in 4.4.8 “Troubleshoot problems in the Alarms list” (p. 54) to view events that might point to the problem.

3

On an affected SDP binding item, click on the Event Timeline icon . Use the Event Timeline as described in 4.4.9 “Troubleshoot problems in the Event Timeline” (p. 54) to view events that might point to the problem.

4

Select one or more affected SDP binding item(s) and click on the OAM Test icon . Perform OAM tests as described in 4.4.10 “Troubleshoot problems with OAM tests” (p. 55) .

END OF STEPS

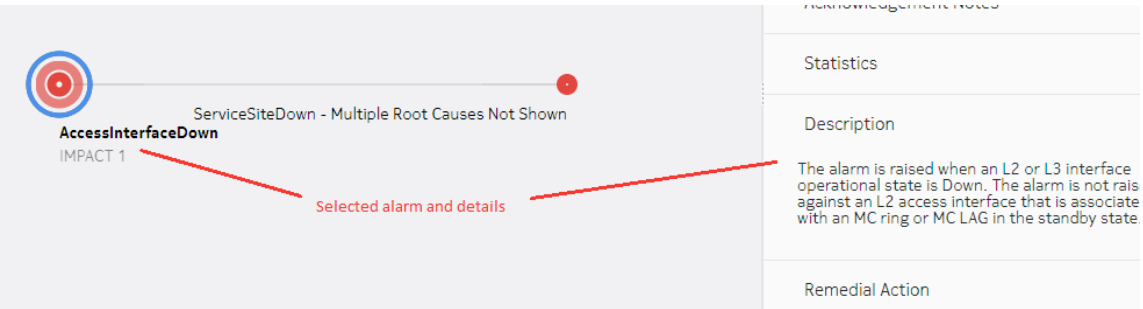
4.4.8 Troubleshoot problems in the Alarms list

Click on an alarm message in the list to display complete details of the alarm, including descriptive and remedial information.

If you suspect that the affected object for the selected alarm is a cause of the current problem, you can open the affected object in its management application directly from the Alarms list. On the selected alarm item, click More > Show Affected Object. Make configuration changes to the affected object while monitoring the object in Service Supervision to determine if KPIs improve as a result of the change.

From the Alarms list (in the context of the selected service) you can take the following actions:

- For an alarm item in the list, click Show Impacts to determine the root cause of the alarm.
- The selected alarm object is circled in dark blue. Click on an alarm object to view details and remedial information.



If you suspect that the affected object for the selected alarm is a cause of the current problem, you can open the affected object in its management application from the Impact Analysis view. At the bottom of the Details panel, click Show Affected Object . Make configuration changes to the affected object while monitoring the object in Service Supervision to determine if KPIs improve as a result of the change.

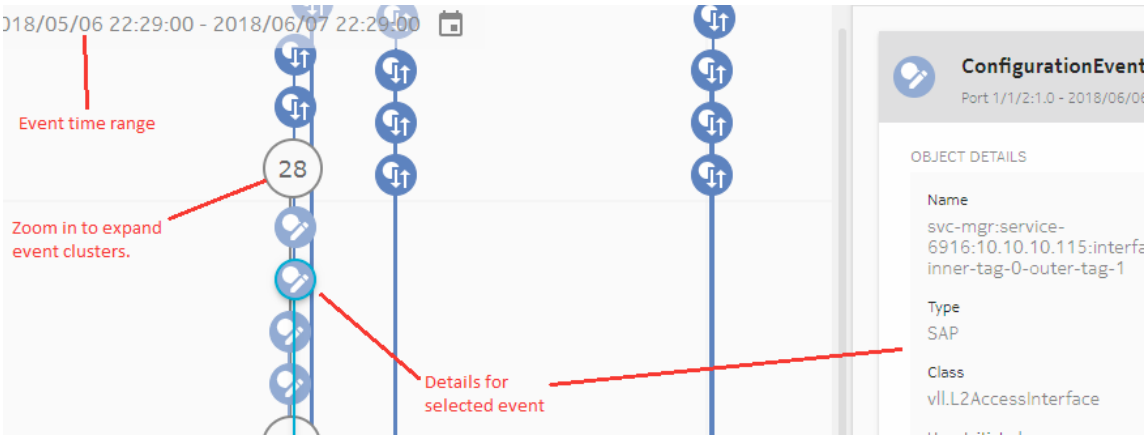
- Open the Event Timeline for the alarm.
  Set a date range around the alarm event and view events that occurred prior to alarm being raised to determine a possible cause (for example, an object configuration change).

4.4.9 Troubleshoot problems in the Event Timeline

You can open the Event Timeline directly from a service object, or from individual alarm objects to view events that occurred prior to a hardware problem or an alarm being raised to determine a possible cause (for example, an object configuration change).

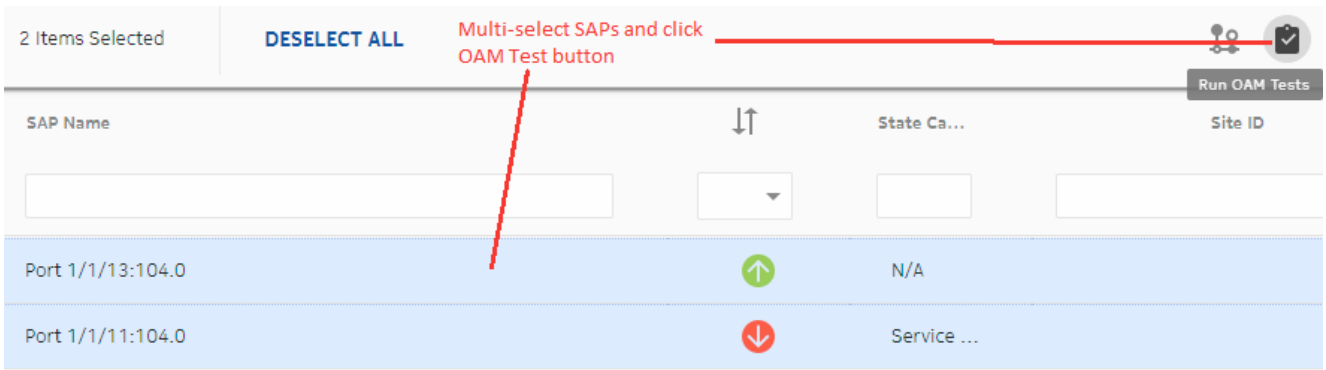
- Set an appropriate date range around the hardware problem or alarm event.
- Select an event icon in the timeline and click Event Details to view information related to the event. Use the Zoom function to expand clusters of events and search for causal events for a

failure.



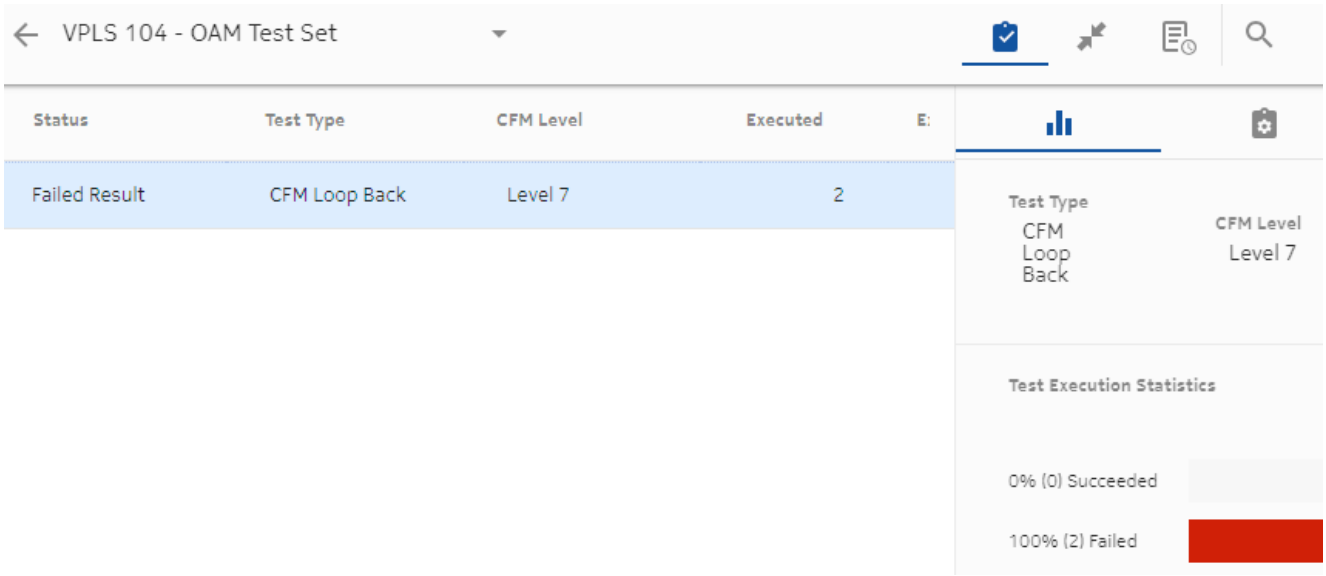
4.4.10 Troubleshoot problems with OAM tests

OAM diagnostic tests allow on-demand service performance monitoring and SLA verification to ensure that a service meets its performance settings in a controlled test time.



OAM tests can be run on a service by multi-selecting service sites, SAPs, or SDP bindings. A failed OAM test result generally indicates that the service or part of the service is not operational. Not all OAM test types apply to all service types.

Select a test type and click Run Test. The results are displayed in the Test Results Summary.

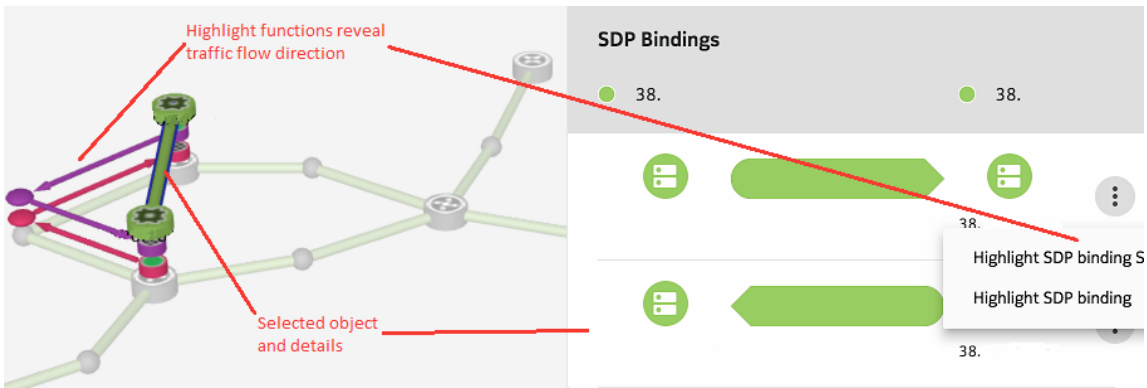


4.4.11 Troubleshoot problems in the IGP Map

Note: CPAM configuration is required in the service management application in order for the IGP Map to display.

From the Service List, you can open a selected service in the IGP Map view. The IGP Map can be useful in identifying the service segment that is experiencing a failure.

- In the IGP Map, click on an SDP binding, IGP link, or Service site object and then click on the Info button to view details about the object.



- Set the Map Type parameter to Troubled SDPs to display only SDP bindings that are not working on the service.

4.5 Operational maintenance in Service Supervision

4.5.1

This section contains procedures related to general operations and maintenance with the Service Supervision application:

- 4.5.2 “To enable the SAP Down state cause KPI ” (p. 56)
- 4.5.3 “To purge assurance event records” (p. 57)

4.5.2 To enable the SAP Down state cause KPI

Because the monitoring of the operational state of all SAPs in NFM-P can affect performance, you must choose only the SAPs you want to monitor by performing this procedure in NFM-P.

1

Choose Manage→Service→Services from the NFM-P main menu. The Manage Services form opens.

2

Choose a service and click Properties. The *Service* (Edit) form opens.

3

Click on the Sites tab.

4

Choose the site on which you want to monitor the operational state of access interfaces and click Properties. The Site (Edit) form opens.

5

Enable the Monitor Access Interface Operational State parameter.

6

Save the changes and close the forms.

END OF STEPS

4.5.3 To purge assurance event records

Perform this procedure in NFM-P to purge assurance event records when the AssuranceEventLoggingTurnedOff alarm is raised. This alarm is raised when the database disk space used to log assurance events grows above the predefined threshold. Assurance Event logging is disabled to protect the database disk space.

1

Choose Tools→Event Policies from the NFM-P main menu. The Manage Event Policies form opens.

2

Choose the assurance.AssuranceEvent event type and click Properties. The Event Policy - assurance.AssuranceEvent (Edit) form opens.

3

Click the More Actions button and choose Purge Event Records. The Event Policy - assurance.AssuranceEvent (Edit) Filter form opens.

4

Click OK to purge all event records.

5

If necessary, configure the Event Retention Time (hours) to a value lower than the default value.

6

Save the changes and close the forms.

END OF STEPS

5 Analytics

5.1 Overview

5.1.1 Introduction

The Analytics application provides insight into network infrastructure conditions, service utilization, subscriber traffic analysis, and quality of user experience using a variety of reports. Data is analyzed using business intelligence software and is presented in graphical or tabular reports.

5.1.2 Analytics reports

Analytics reports enable a network operator to quickly determine the overall status of network functions and monitor trends. For example, you can identify the top subscribers in terms of overall network traffic, or based on application usage. The Analytics browser-based application allows a user to specify the reporting period, the objects on which to report, and the desired view. A report can be displayed in different formats such as a pie chart, trend diagram, or histogram. You can also export reports to files using the following formats:

- Excel (Paginated)
- Excel
- CSV
- DOCX
- RTF
- ODT
- ODS
- XLSX (Paginated)
- XLSX
- PPTX

5.1.3 Server requirements

To accommodate the significant NFM-P Analytics data throughput, storage, and analysis requirements, an NFM-P system requires the following components:

- one or more NFM-P auxiliary servers
- an NFM-P auxiliary database
- one or more NFM-P analytics servers that each host the business intelligence software and a web server

See the *NFM-P Planning Guide* for specific information about the NFM-P system requirements for Analytics, based on the managed network size, functional requirements, and deployment scope.

5.1.4 Browser requirements

If an adBlocker extension is in use, it may block some files in the Analytics application. To use the Analytics application with an adBlocker extension, add the NSP server and analytics server IP addresses to the whitelist.

5.1.5 Analytics configuration

An operator uses a GUI or OSS client to:

- enable or disable the collection of data
- specify the statistics classes for data aggregation
- specify how long to retain the raw and aggregated data

5.2 Workflow to configure NFM-P analytics

5.2.1

This workflow outlines the sequence of actions required to configure and manage NFM-P analytics.

1

Configure and enable the collection of the required statistics from NEs; see the *NFM-P Statistics Management Guide*.

2

Configure one or more analytics rules to specify the statistics to collect; see 5.3 “To configure an NFM-P analytics rule” (p. 61).

3

Configure one or more aggregation rules; see 5.4 “To configure analytics aggregation” (p. 61).

4

Configure the time zone for the analytics session in the User Preferences menu. See 5.5 “To configure the Analytics application session time zone” (p. 62).

5

Configure analytics server load balancing. See 5.6 “To configure analytics server load balancing” (p. 63).

6

Configure report purging in the Application Preferences menu. See 5.7 “To configure application preferences” (p. 64).

7

Configure scheduled reports as needed; see 5.8 “To schedule a report” (p. 64).

END OF STEPS

5.3 To configure an NFM-P analytics rule

5.3.1

Perform this procedure to enable or disable raw data collection, and to specify data retention, for a statistics class to be processed using NFM-P analytics. Raw data collection is enabled by default for each statistics class.

1

Choose Tools→Analytics→AA Collection Manager from the NFM-P main menu. The AA Collection Manager form opens with a list of analytics rules displayed.

2

Select the required analytics rule and click Properties. The Analytics Rule (Edit) form opens.

3

Select the Collection Enabled parameter.

4

Configure the Raw Data Retention Time (days) parameter.

5

Close the AA Collection Manager form.

END OF STEPS

5.4 To configure analytics aggregation

5.4.1

Perform this procedure to configure the following for a statistics class to be processed using the Analytics application:

- level of data aggregation
- retention of the aggregation data

Note: You can also configure the aggregation rule for a statistics class from the properties form of the analytics rule associated with the statistics class.

1

Choose Tools→Analytics→Aggregation Manager from the NFM-P main menu. The Aggregation Manager form opens.

2

Select an aggregation time zone if needed. The aggregation time zone is the time zone used to define daily, weekly, or monthly aggregations, that is, the definition of midnight.

3

On the Aggregation Rule tab, select the required aggregation rule and click Properties. The Aggregation Rule (Edit) form opens.

4

Select the Enable Aggregation parameter.

5

Configure the Aggregation Sync Time parameter.

6

Configure the Aggregation Levels parameter. As you select or deselect an option, other options may be automatically selected or deselected, as the aggregation logic requires.

7

Configure the parameters in the Aggregation Retention Configuration panel to specify how long the aggregation data is stored.

8

Click OK to save your changes and close the form.

9

Close the Aggregation Manager form.

END OF STEPS

5.5 To configure the Analytics application session time zone

5.5.1

Perform this procedure to configure the time zone for the analytics session. If no time zone is selected, the browser time zone will be used for report generation.

The session time zone defines the current time displayed in the Analytics application. The time zone used for aggregation, that is, the definition of when a day ends, is the aggregation time zone. The session time zone and the aggregation time zone should be the same. See 5.4 “To configure analytics aggregation” (p. 61).

1

Open the help menu at the top right of the Analytics application main page.

2

Choose User Preferences. The default browser time zone is displayed.

3

Choose a time zone from the Select Time Zone of Current Analytics Browser Session menu.

4

Click Apply to save your changes and close the form.

END OF STEPS

5.6 To configure analytics server load balancing

5.6.1

Perform this procedure to manage load balancing if more than one analytics server is in use.

If load balancing is disabled, analytics server sessions are managed according to the order the analytics servers connected to the NSP server. Every user session in the Analytics application will connect to the first analytics server to connect to the NSP server. If the first server is down, application sessions will connect to the next server.

Load balancing can be configured with the following policies:

- round-robin: every user session request to the Analytics application is sent to the next analytics server in the list
- round-robin-with-stickiness: the round-robin system is used the first time a browser connects to the Analytics application. Browser cookies are used to bind the browser to the same analytics server for future sessions.

1

Open the help menu at the top right of the Analytics application main page.

2

Choose Analytics Server Load Balancing. The Analytics Server Load Balancing form opens.

3

Configure the Enable Load Balancing check box.

4

Select a load balancing policy.

5

Click Apply to save your changes and close the form.

END OF STEPS

5.7 To configure application preferences

5.7.1

Perform this procedure to configure analytics report purging. When the number of reports in the Results folder exceeds the configured number of reports to keep, the oldest reports exceeding the maximum number are permanently deleted. If you need to keep more than 5000 reports, Nokia recommends configuring your scheduled jobs to output to an FTP server; see 5.8 "To schedule a report" (p. 64).

The purge is performed automatically every 24 hours or manually from the Application Preferences menu.

1

Open the help menu at the top right of the Analytics application main page.

2

Choose Application Preferences. The default number of reports to keep is displayed.

3

Enter the number of reports to keep.

4

To purge reports manually if needed, click Purge Results Now and click OK in the confirmation message.

5

Click Apply to save your changes and close the form.

END OF STEPS

5.8 To schedule a report

5.8.1

Perform this procedure to configure a schedule. You can schedule reports to run once or to repeat.

1

Right-click on a report and choose Schedule. The Scheduled Jobs page opens.

2

In the Scheduled Jobs page, click Create Schedule. The New Schedule page opens.

3

In the Schedule panel, configure the parameters for the scheduled start of the job, and the recurrence.

4

Click Parameters to set the input parameters for the scheduled report.

5

Click Output Options to set the report format, for example, PDF, and where it will be saved.

6

Click Notifications to configure notification of job status, success, or failure, or for email copies of the report to be sent.

7

Click Save to add your scheduled job to the Schedules page.

END OF STEPS

5.9 To manage scheduled reports

5.9.1

You can edit or delete scheduled report jobs that you created, that is, jobs for which your username appears in the owner column on the Schedules page.

To edit or delete tasks for which you are not the owner, you must log in to the Launchpad as the admin user.

If a scheduled job is deleted, it is immediately removed from the list and no further reports will be run according to the schedule. If you want a scheduled job to stop running but remain in the list for future use, you can disable it.

Deleting the scheduled job does not delete results of previously run reports from the Results folder.

Scheduled jobs that were upgraded from a release prior to 18.6 are owned by samuser. These tasks can only be managed by the admin user.

1

Select Schedules from the Analytics application main page. The scheduled jobs are displayed, with the Edit and Delete icons at the right of the page.

2

To disable a scheduled job, remove the check mark from the Enabled check box. The job will stop running but remain in the list.

3

To delete a scheduled job, click the Delete icon. The scheduled job is removed from the list.

4

To edit the scheduled job:

1. Click the Edit icon. The Scheduled Jobs page opens.
2. Configure the parameters you need to change.
3. Click Save.

END OF STEPS

5.10 To upload images for report branding

5.10.1

You can add logos to certain reports. Images can be saved to the analytics server or uploaded from the Analytics application. For the server procedure, see the NFM-P System Administrator guide.

Image files can be in any of the following formats:

- JPEG
- JPG
- GIF
- PNG
- SVG
- BMP

The images will be scaled to fit an 80 pixel square when they are shown in the report.

1

Log in to the Launchpad as the admin user.

2

From the Analytics application main page, right-click on the Images folder.

3

Select Add Resource→File→Image. The Add File page opens.

4

Click Choose File and navigate to the image file.

5

Configure the Name and Resource ID parameters.

Note: The user will be asked to specify the Resource ID when adding the image to a report.

6

Click Submit. The file is saved to the Images folder.

End of steps

6 Link Utilization

6.1 Introduction to the Link Utilization application

6.1.1 In this section:

6.1.2 Overview

The Link Utilization application provides graphical views of utilization for IP and MPLS interfaces within a specific administrative domain. The views allow you to assess how efficiently your network is managing traffic, and to identify interfaces (links) that are over- or under-utilized.

You can toggle between a Statistics view and a Weather Map view. The Statistics view shows utilization data in comparison charts and in a list of interfaces. The Weather Map view mimics CPAM L3 IGP topology to show utilization on IP and MPLS interfaces. You can click on items in the map to show detailed information.

In the Statistics view and the Weather Map view, you can switch among different administrative domains and configure the data retrieval time. For IP utilization in the Statistics view, you can also select a reference speed.

Statistics and other data are provided for the application using functions in the NFM-P. You must enable collection of the required performance statistics for the NEs or objects that participate in the application.

The NFM-P uses the performance statistics to derive a traffic rate for a given time period. That rate is then shown as a percentage of the capacity on the corresponding interface. The result is shown graphically and in the list of interfaces table.

6.1.3 Current and historical utilization

The Link Utilization application allows you to view current or historical utilization. Current utilization is displayed by default, and shows the latest statistics for which a calculated percentage is available. The time period is based on the polling interval configured in the MIB Entry policy used for statistics collection.

Historical utilization is available when you select a date and time that is in the past, in the Set Data Retrieval Time dialog. The utilization shown in the application is an average for the hour that ends at the selected time.

The NFM-P delays historical utilization calculations by half an hour, to ensure that all statistics have been flushed to the database.

Note: For historical utilization, Nokia recommends that you select a time that is at least one hour in the past. If the selected time is too recent, statistics collection and calculations may not be complete. In such cases, NFM-P systems that deploy an auxiliary database may show no results, and systems with no auxiliary database may show current rather than historical utilization.

6.1.4 Statistics view

The Statistics view shows utilization data in charts and in a list of interfaces.

The upper part of the display contains pie charts that show IP, MPLS, and Aggregated utilization statistics. Each colored segment of a pie chart corresponds to a utilization percentage range. A legend of Utilization Ranges identifies the percentage range associated with each color; for instance, red is for links operating at 81 to100% of capacity. The relative sizes of the pie chart segments indicate the proportion of interfaces operating in each percentage range. That is, if a red segment makes up half of a chart, half of the interfaces in that admin domain are operating at 81 to 100% of their capacity.

The charts allow you to quickly assess how many interfaces in the admin domain are lightly utilized, moderately utilized, or heavily utilized. You can click on a utilization range within any chart to view a list of interfaces operating at that range. You can also click on the icon on the top-right corner of each pie chart to visualize the utilization data in the Weather map view.

The lower part of the display shows the list of interfaces that are participating in the utilization calculations, and is populated or refreshed when you click on a segment in a pie chart. You can expand an MPLS interface to view any LSPs that are contributing to the utilization. You can manage the display of information in the list by sorting and filtering, to view fine-grained results. You can also export interface information to a CSV file.

See 6.3.4 “To view and manage data in the Statistics view” (p. 75).

6.1.5 Weather Map view

The Weather Map view mimics CPAM L3 IGP topology to show utilization on IP or MPLS interfaces. Links are displayed between objects on the map. Colored arrows show the utilization in each direction, pointing toward a midline in the link that indicates full utilization. The color of the arrows, and how closely they approach the midline, indicate the level of utilization.

Panning and view controls allow you to move the map, change your viewing angle, or zoom in and out. You can click on an interface with utilization to view data for that interface, or click on a router icon to view data for that router.

See 6.3.5 “To view and manage data in the Weather Map view” (p. 76).

6.1.6 Reference Speed

Utilization is shown (in percent) as the statistical traffic rate over the reference speed. The reference speed is either the port speed or the interface speed. The reference speed is correlated with the capacity on the link.

For MPLS and Aggregated utilization, the reference speed is always Port Speed. Port Speed is the actual operational port speed.

For IP utilization in the Statistics view, you can choose either Port Speed or Interface Speed in the Reference Speed drop down. The interface speed may vary from the actual port speed, depending on configuration.

When Interface Speed is selected, the Statistics view shows only IP utilization. When Port Speed is selected, the Statistics view shows IP, MPLS, and Aggregated utilization.

Depending on the Reference Speed selected, either the Port Speed or the Interface Speed is displayed in the list of interfaces.

Interface Speed is not supported in the Weather Map view. The Weather Map uses only Port Speed.

6.1.7 Sign out and links to other NSP applications

You can sign out of the Link Utilization application, or quickly navigate to other NSP applications or the launchpad, by clicking on the navigation icon next to the User field in the top right of the display.

6.2 Preparing for Link Utilization (initial setup)

6.2.1 In this section:

6.2.2 Workflow to configure Link Utilization

For the Link Utilization application to function, preliminary steps are required to ensure that data is collected, stored, processed, and made available to the application. The following workflow describes these preliminary configurations.

1

If required, change the default partitioning in the NFM-P database. See 6.2.3 “To overwrite the default database partitioning size” (p. 72).

2

Enable performance statistics collection for IP interfaces, MPLS interfaces, and LSPs by setting the Administrative State parameter of the MIB Entry policy to Up and setting the Polling Interval parameter to less than one hour:

- IP interfaces - for a MIB statistics policy, or for the IP Interface Stats (Routing Management: General) monitored statistics class on the Statistics tab of the Network Interface properties form, configure the policy for the MIB entry vRtrIfStatsEntry.
- MPLS interfaces - for a MIB statistics policy, or for the MPLS Interface Stats (Path/Routing Management: MPLS) monitored statistics class on the Statistics tab of the MPLS Interface properties form, configure the policy for the MIB entry vRtrMplsIfStatEntry.
- LSPs - for a MIB statistics policy, or for the MPLS LSP Egress Stats (Path/Routing

Management: MPLS) monitored statistics class on the Statistics tab of the Dynamic LSP properties form, configure the policy for the MIB entry vRtrMplsLspStatisticsEntry.

See “Performance statistics collection” in the *NFM-P Statistics Management Guide* for more information about how to configure performance statistics collection.

If your network contains links that use only LDP interfaces, not MPLS interfaces, see 6.2.4 “To enable statistics collection for LDP-only links” (p. 73).

3

For LSP utilization, on the Accounting tab of the Dynamic LSP properties form for each LSP, assign an accounting policy and set the Administrative State to Up.

See “To configure a Dynamic LSP” in the *NFM-P User Guide* for more information.

4

For LSP utilization, create an LSP path monitor for each dynamic LSP.

See “To monitor a dynamic LSP” in the *CPAM User Guide* for more information.

5

Configure retention times for historical LSP utilization statistics.

A statistics event occurs each time an object is polled and statistics are collected. For LSP utilization statistics, an event policy defines the retention times for statistics in the NFM-P database. For longer retention times, ensure that the system has sufficient physical disk space.

See “To monitor a dynamic LSP” in the *CPAM User Guide* for more information.

END OF STEPS

6.2.3 To overwrite the default database partitioning size

The Link Utilization application provides database partitioning with the following default values:

CPAM_STATS_DEFAULT_DB_SIZE_IN_MBYTE = 20480

CPAM_STATS_MIN_DB_SIZE_IN_MBYTE = 500

CPAM_STATS_MAX_DB_SIZE_IN_MBYTE = 61440

Perform the following to overwrite the database partitioning size:

1

Log in to the main server station as the nsp user.

2

Navigate to the /opt/nsp/nfmp/server/nms/config directory.

3

Create a backup copy of the nms-server.xml file.

4

NOTICE

Service-disruption hazard

Contact your Nokia technical support representative before you attempt to modify the nms-server.xml file. Modifying the nms-server.xml file can have serious consequences that can include service disruption.

Open the nms-server.xml file using a plain-text editor.

5

To overwrite the default size, add the following lines to the nms-sever.xml file.

<cpamUtilizationStats

cpamStatisticDbSizeInMBytes = "<size_in_bytes>"/>

For example:

<cpamUtilizationStats

cpamStatisticDbSizeInMBytes = "1024"/>

6

Save and close the nms-server.xml file.

7

Open a console window.

8

Navigate to the /opt/nsp/nfmp/server/nms/bin directory.

9

Enter the following at the prompt:

```
bash$ ./nmsserver.bash read_config
```

The main server reads the nms-server.xml file.

10

Log out of the main server and close the open console windows.

END OF STEPS

6.2.4 To enable statistics collection for LDP-only links

In Nokia MPLS networks, you can create LDP interfaces or MPLS interfaces on routing instances. LDP interfaces use only LDP signaling. MPLS interfaces use RSVP signaling.

Statistics for MPLS link utilization are collected only from MPLS interfaces. LDP interfaces do not provide statistics for link utilization. To collect statistics for links that use only LDP interfaces, you must create a corresponding MPLS interface for each LDP interface, using the same interface ID.

If you do not want to enable RSVP signaling on the corresponding MPLS interfaces, leave them administratively down. The MPLS statistics will still be collected and used in link utilization calculations for the LDP-only links.

6.3 Viewing and managing utilization information

6.3.1 In this section:

6.3.2 Before you begin

For the Link Utilization application to provide information, preliminary configurations and settings must be completed. See 6.2 “Preparing for Link Utilization (initial setup)” (p. 71).

If the display shows no utilization, see 6.3.6 “Troubleshooting to confirm statistics collection” (p. 77).

6.3.3 To configure the Admin Domain, Data Retrieval Time, and Reference Speed

For the Statistics view and the Weather Map view, you can specify the admin domain and the data retrieval time for utilization statistics. For IP utilization in the Statistics view, you can also choose the reference speed.

Perform the following procedure to select the admin domain, data retrieval time, and reference speed parameters for the utilization display.

1

To select the administrative domain, click on the Admin Domain drop-down in the menu bar. The available options correspond to the IGP administrative domains configured in the network.

2

To select the data retrieval time, perform the following:

1. Click on the Data Retrieval Time in the menu bar. The Set Data Retrieval Time dialog opens.
2. Click on the calendar icon to show the date chooser, then select a date. Click Today to display data for the current day.
3. Enter a time, or use the arrows to scroll and select a time.
4. To display the current utilization, select Latest.

5. Click Update.

See 6.1.3 “Current and historical utilization” (p. 69) for more information.

3

To select the reference speed, click on the Reference Speed drop-down in the menu bar, and select a reference speed.

See 6.1.6 “Reference Speed” (p. 70) for more information.

END OF STEPS

6.3.4 To view and manage data in the Statistics view

The Statistics view shows utilization data in charts and in a list of interfaces. For an overview of the Statistics view functionality, see 6.1.4 “Statistics view” (p. 70).

1

Click on Statistics in the view selector bar. The Statistics view is displayed, showing utilization pie charts for IP, MPLS, and Aggregated utilization.

The charts allow you to quickly assess how many interfaces of each type are lightly utilized, moderately utilized, or heavily utilized. The Utilization Ranges legend identifies the percentage of utilization associated with each color.

2

Click on a colored segment within any chart to view a list of interfaces operating at the utilization percentage range for that color. A list of interfaces with utilization rates in the selected range is displayed in the list of interfaces.

Alternatively, you can display the data in the Weather Map view by clicking on the icon in the top-right corner of the chart.

3

To maximize the size of the list of interfaces, click on the maximize icon in the upper right of the list.

4

For MPLS utilization, you can expand an interface to view the LSPs that are contributing to the utilization.

5

To remove or restore columns, right-click on a column header and choose Columns.

6

To filter the list, perform the following:

1. To filter any column, enter text into the field below the column header. The filter shows results that contain the entered text.

2. To filter by timestamp, click on the calendar icon in the Time of Computation column, then configure a range for the date and time. The filter shows results from within the configured range.
3. Click on the filter icon to clear any filters that have been applied.

7

To sort columns, perform the following:

1. To rearrange the order of columns, click and drag on the column headers.
2. To configure the sorting priority for columns, right-click on a column header and choose Configure Sort. The Sort dialog opens.

   In the Sort dialog, you can create a list of priority levels for sorting columns, or edit the priority levels at any time. When multiple levels are configured, the priority levels are displayed numerically in the column headers. For columns assigned with a priority level, you can configure ascending or descending order.
3. To quickly sort by ascending or descending order for any column, click on the column header. Alternatively, you can right-click on a column header and choose Sort Ascending or Sort Descending.

   Note: Changing the ascending or descending order in a column using these methods establishes the column as the first-level priority for sorting, and removes any priority levels configured in the Sort dialog.

8

To adjust the width of columns, click and drag the lines between columns.

Alternatively, right-click on a column header and choose Auto Fit to make the column wide enough to display all text in the longest entry in that column. Choose Auto Fit All Columns to make all columns wide enough to display all text.

9

To export interface information in the list to a CSV file, click on the Export icon.

You can choose to export visible rows, selected rows, or all rows. Click on the drop-down arrow beside the Export icon and select an option.

10

To change the type of statistics shown in the list of interfaces, click on the drop-down at the top-left of the list, then select a Utilization Range from the colored buttons.

Alternatively, you can click on another segment in the pie charts.

END OF STEPS

6.3.5 To view and manage data in the Weather Map view

The Weather Map view mimics CPAM L3 IGP topology to show utilization on IP and MPLS interfaces. For an overview of the Weather Map view functionality, see 6.1.5 “Weather Map view” (p. 70).

1

Click on Weather Map in the view selector bar. The Weather Map view is displayed.

The NE icons and the colored links between them allow you to quickly assess NEs and interfaces that are lightly utilized, moderately utilized, or heavily utilized. Colors correspond to the percent utilization ranges shown in the Statistics view.

2

Choose the type of Weather Map to display. On the left side of the menu bar, click on the drop-down arrow for the Weather Map type and choose a statistics type from the menu.

3

Use the zoom, view, and panning controls in the upper left to move the map, change your viewing angle, or zoom in and out.

Click on the View Options drop-down to show or hide the panning controls.

You can click and drag icons to change the shape of the map, or click and drag empty space to pan on the map.

4

Click on a colored arrow to view detailed information about that interface. Use CTRL-click to view details for multiple interfaces at one time.

5

Click on a router icon to view detailed information about that router. Use CTRL-click to view details for multiple routers at one time.

6

Double-click on a group to view its components. Double-click on a blank area of the map to back out.

END OF STEPS

6.3.6 Troubleshooting to confirm statistics collection

For IP and MPLS utilization, a very low utilization rate may show as 0%. In such a case, to confirm that the application is functioning properly, you can view the list of interfaces table in the lower part of the Statistics view. If the table contains results and shows a Time of Computation, interfaces are appropriately managed for statistics collection.

To confirm values for very low utilization rates, open the properties form for the IP or MPLS interface in the NFM-P GUI, and view the Statistics tab.

7 Subscriber Management

7.1 Overview

7.1.1

The Subscriber Management KPI Monitor view displays the NEs within a specified supervision group or site. Each NE object in the view displays abbreviated KPI information, and the view can be expanded to display detailed KPI and alarm information for individual NEs. The Troubleshoot view displays session-related information for subscriber hosts and user equipment (UE) devices connected to an access point (AP). In order for the Subscriber Management application to display information, statistics collection must be configured in the NFM-P. For the Subscriber Management application released with the former 5620 SAM Release 14.0 R5 or later, statistics collection is configured automatically the first time the Subscriber Management application is launched.

Automatic statistics configuration is supported on the following NE versions:

- 7750 SR - Release 10.0 and later
- 7750MG - Release 5.0 and later

7.2 Statistics polling

7.2.1

Statistics polling is only enabled for MIB entry policies applicable to NE types and versions, managed for default and non-default NE MIB statistics policies. The Subscriber Management application scans for newly-managed NEs, and enables applicable MIB entry policies every 30 seconds. Statistics polling is not disabled when an NE is un-managed.

NFM-P users may change the administrative state and polling interval of MIB entry policies through the Java GUI or OSSI. This means that polling may be disabled for a policy, or its polling interval changed after it is enabled by the Subscriber Management application. If an NE is un-managed and re-managed, polling is enabled on all applicable policies and the polling interval set to 15 minutes.

If you are working with NE versions that are older than the versions listed above, you must configure statistics collection manually in the NFM-P, as described in "Statistics collection configuration" in the NFM-P Statistics Management Guide.

Enable collection for the following MIB entries:

KPI Monitor perspective	Troubleshoot perspective
sgiCpuUsage	SLAProfInstStatsEntry
sgiMemoryUsed	SLAProfInstEgrPStatsEntry
tmnxSubMgmtMdaStatsEntry	SLAProfInstEgrQStatsEntry
tmnxSubMgmtSystStatsEntry	SLAProfInstIngPStatsEntry

tmnxWlanGwIsaMemberEntry	SLAProfInstIngQStatsEntry
wlanGwStatsGroup	SubIngPStatsEntry
tmnxDhcpServerStatsEntry	SubscriberIngQStatsEntry
tmnxDhcpSvrPoolStatsEntry	SubscriberEgrQStatsEntry
tmnxDhcpServerStats6Entry	SubEgrOverrideCounterEntry
tmnxDhcpsPoolStats6Entry	

8 Telemetry

8.1 About

8.1.1 Description

The NSP Telemetry application uses gRPC telemetry data from NEs to provide a near-real-time graphical dashboard of NE KPIs.

The application supports the monitoring of NEs discovered using the following:

- SNMP
- MDM

Note: Telemetry reporting is sensitive to NE and NSP clock synchronization. To ensure that the Telemetry data from multiple NEs is assigned to the correct reporting period, it is strongly recommended that you engage NTP or a similar mechanism to maintain synchrony between the NE and NSP system clocks.

8.1.2 Getting started

To enable Telemetry reporting for one or more NEs, you must do the following:

- Enable TLS between each NE and the NSP.
- Enable gRPC access on a designated NE user account.
- Add each NE to the NSP configuration.

See 8.2 “To enable telemetry reporting for a managed NE” (p. 81) for configuration information.

Troubleshooting

In the event that an NE fails to forward Telemetry data to the NSP, see 8.3 “Telemetry troubleshooting” (p. 86) for information about determining the cause.

8.2 To enable telemetry reporting for a managed NE

8.2.1 Description

The following steps describe how to enable the collection of gRPC telemetry data from one or more NEs by the NSP. The data is used as statistical input for reporting by the NSP Telemetry application.

The telemetry data from an NE is forwarded over a channel secured using TLS. Establishing the channel requires the distribution of security artifacts to the NE, as described in the procedure steps. For information about configuring and managing TLS on an NE, see the NE *System Management Guide*.

Prepare security artifacts

1

Obtain the required TLS artifacts. You can use a publicly available utility such as OpenSSL to generate and manage the artifacts, which are the following:

- public certificate
- private server certificate

Note: As a certificate renewal reminder, it is important to record the expiry date of each certificate.

1. Generate an RSA encryption key for the public certificate.
2. Create a Certificate Signing Request, or CSR, for the public certificate.
3. Have the CSR signed by a CA.
4. Generate an RSA encryption key for the private server certificate.
5. Create a Certificate Signing Request, or CSR, for the private server certificate.
6. Have the CSR signed by a CA.

Note: The Subject Alternative Name, or SAN, of the private server certificate, must include the system IP address of each NE that is to establish a gRPC session using the certificate.

Add certificate to each NSP truststore

2

Log in to the appropriate station as the nsp user.

- if the NSP system includes the NSD and NRC—standalone or primary NSP server
- if the NSP system includes only the NFM-P—standalone or primary NFM-P main server

Note: In subsequent steps, the station is called the NSP server station.

3

Open a console window.

4

Make a backup copy of the /opt/nsp/os/ssl/nsp.truststore file and store it in a secure location.

5

Enter the following:

```
bash$ keytool -import -alias alias -keystore /opt/nsp/os/ssl/nsp.
truststore -file certificate_file ↵
```

where *certificate_file* is the absolute path of the file that contains the certificate to import

Note: The certificate must be used to sign the server certificates.

You are prompted to trust the certificate that you are importing.

6

Enter yes ↲.

The certificate is imported to the truststore.

7

If you are configuring an NFM-P main server, enter the following:

```
bash$ cp /opt/nsp/os/ssl/nsp.truststore /opt/nsp/os/tls ↲
```

8

Close the console window.

9

If the NSP system is redundant, perform Step 2 to Step 8 on the standby NSP server station..

Enable security on NE

10

Log in to the NE as the admin user.

11

Transfer the certificate files from the NSP server station to a compact flash drive on the NE, for example, cf3:.

12

Enter the following to import the public certificate to a file:

/admin certificate import type cert input *drive/CA_cert_file* output *public_cert_file* format pem ↲

where

drive is a compact flash drive, for example, cf3:

CA_cert_file is the name of the transferred public certificate file

public_cert_file is the public certificate file to create on the NE

13

Enter the following to import the private server certificate to a file:

/admin certificate import type key input *drive/server_cert_file* output *private_cert_file* format pem ↲

where

drive is a compact flash drive, for example, cf3:

server_cert_file is the name of the transferred private server certificate file

private_cert_file is the private server certificate file to create on the NE

14

Create a TLS cipher list.

1. Enter the following:

   /configure system security tls server-cipher-list *gRPC_cipher_list* create ↵

   where *gRPC_cipher_list* is a name to assign to the TLS cipher list for gRPC

2. Enter the following for each cipher:

   cipher *n* name *cipher_name* ↵

   where

   n is the cipher priority

   cipher_name is the name of a cipher; see the latest device documentation for the currently available ciphers

   For example:

```
cipher 1 name tls-rsa-with-null-md5
cipher 2 name tls-rsa-with-null-sha
cipher 3 name tls-rsa-with-null-sha256
cipher 4 name tls-rsa-with3des-ede-cbc-sha
cipher 5 name tls-rsa-with-aes128-cbc-sha
cipher 6 name tls-rsa-with-aes256-cbc-sha
cipher 7 name tls-rsa-with-aes128-cbc-sha256
cipher 8 name tls-rsa-with-aes256-cbc-sha256
```

15

Create a TLS certificate profile.

1. Enter the following:

   /configure system security tls cert-profile *gRPC_cert_profile* create ↵

   where *gRPC_cert_profile* is a name to assign to the TLS certificate profile for gRPC

2. Enter the following, in sequence:

   entry 1 create ↵

   cert "*public_cert_file*" ↵

   key "*private_cert_file*" ↵

   exit ↵

   no shutdown ↵

   where

public_cert_file is the file created in Step 12

private_cert_file is the file created in Step 13

16

Create a TLS server profile.

1. Enter the following:

   /configure system security tls server-tls-profile *gRPC_server_profile* create ↵

   where *gRPC_server_profile* is a name to assign to the TLS server profile for gRPC

2. Enter the following, in sequence:

   cert-profile *grpc_cert_profile* ↵

   cipher-list *grpc_cipher_list* ↵

   no shutdown ↵

Configure and enable gRPC on NE

17

1. Enter the following:

   /configure system grpc tls-server-profile *gRPC_server_profile* ↵

   where *gRPC_server_profile* is the name of the server profile created in Step 16

2. Enter the following:

   /configure system security user *username* access console grpc ↵

   where *username* is the name of the user to be granted gRPC access

3. Enter the following:

   /configure system security user admin console member administrative

4. Enter the following:

   /configure system grpc no shutdown ↵

18

Log out of the NE.

Add NE to NSP telemetry collector configuration

19

Perform one of the following.

a. Enable telemetry collection for an NE discovered by the NFM-P using SNMP.

   1. Open an NFM-P GUI client.
   2. Choose Administration→Mediation from the NFM-P main menu. The Mediation (Edit) form opens.

3. Select the mediation policy associated with the NE and click Properties. The Mediation Policy (Edit) form opens.
4. In the gRPC panel, configure the Password and Confirm Password parameters using the gRPC NE user password.
5. Select the Use Secure Transport parameter in the gRPC panel.
6. Save your changes and close the form.

b. Enable telemetry collection for an NE discovered by the NSP using MDM; see “Workflow for using the Device Administrator application” in the Device Administrator Help for information about using the application to configure device mediation and discovery.

20

Open the NSP Telemetry application.

21

Specify the system IP address of each NE to monitor.

22

View the Telemetry dashboard to monitor NE performance, as required.

END OF STEPS

8.3 Telemetry troubleshooting

8.3.1 Description

Telemetry reporting by an NE occurs only when the TLS, gRPC, and NE user configurations are correct.

Note: Telemetry reporting is sensitive to NE and NSP clock synchronization. To ensure that the Telemetry data from multiple NEs is assigned to the correct reporting period, it is strongly recommended that you engage NTP or a similar mechanism to maintain synchrony between the NE and NSP system clocks.

8.3.2 To troubleshoot NSP Telemetry reporting

The following steps describe a series of basic checks that can help you identify a Telemetry reporting issue.

See the NE documentation for specific information about using CLI commands and interpreting NE log messages.

Contact technical support for further assistance.

1

View the Telemetry application logs on the NSP server.

1. Log in as the root user on the primary or standalone NSP server or NFM-P main server, as required.
2. Open a console window.
3. View real-time log updates to the following Telemetry application logs using the “tail -f” command, or scan the log files to identify error messages:
   - /opt/nsp/os/tomcat/logs/telemetry.log
   - /opt/nsp/os/tomcat/logs/telemetry-collector.log
   - /opt/nsp/os/tomcat/logs/telemetry-collector-Notif.log

   For example, in /opt/nsp/os/tomcat/logs/telemetry-collector.log:
   - The following error message indicates that the NE is not recognized by the NSP, perhaps because the NE is not discovered:

     ```
     No connection found for system id [n.n.n.n] for subscription.
      Please verify your connection configuration.
     ```
   - The following error message typically indicates a TLS certificate issue; for example, the certificate is not imported to the NSP truststore, the NE certificate import has failed, or the Secure Transport parameter in the gRPC mediation policy is incorrectly set:

     ```
     Network element [n.n.n.n] unavailable: UNAVAILABLE: Channel closed
     while performing protocol negotiation
     ```

2

To see whether gRPC is active on an NE, enter the following at the NE CLI:

`show system grpc` ↵

Ensure that the Adminstrative State is Enabled, and the Operational State is Up.

show system security user # admin certificate display type cert cf3:/cert.pem format pem # show log log-id 98 subject TLS # show log log-id 98 subject Cert

3

To view the status of the gRPC TLS server profile on an NE, enter the following at the NE CLI:

`show system security tls server-tls-profile` ↵

Ensure that the AdminState and OperState indicators of the gRPC server profile each read Up.

4

To view the status of the gRPC TLS certificate profile on an NE, enter the following at the NE CLI:

`show system security tls cert-profile` ↵

Ensure that the AdminState and OperState indicators of the gRPC certificate profile each read Up, and that OperFlags does not indicate a problem, such as an invalid or expired certificate.

5

To view statistics about the gRPC NE user login and logout operations, including failed login attempts, enter the following at the NE CLI:

`show log event-control "security" | match grpc` ↵

6

To display the SNMP security log for the purpose of identifying the NE user login and logout operations, perform the following steps at the NE CLI.

1. Enter the following:

   `configure log log-id 98` ↵
2. Enter the following:

   `from security` ↵
3. Enter the following:

   `to memory` ↵
4. Enter the following:

   `no shutdown` ↵
5. Enter the following:

   `show log log-id 98` ↵

   The security log entries are displayed in chronologically descending order.
6. View the log entries to identify failed login and logout operations by the gRPC NE user.

7

If you require assistance from technical support, provide the following:

- the Telemetry application logs listed in Step 1
- the output of the NE status and log display commands in this procedure
- the /opt/nsp/os/tomcat/logs/telemetry-collector-Metrics.log file

END OF STEPS

9 Network Functions Manager - Packet

9.1 About

9.1.1

The Network Functions Manager - Packet (NFM-P) application provides end-to-end network and service management across all domains of the converged IP network. Operational efficiency through fast provisioning and troubleshooting, service assurance, and enhanced network operations tools.

To access the NFM-P customer documentation, go to the NFM-P GUI and click Help→User Documentation.

10 Inventory Management

10.1 Overview

10.1.1

The Inventory Management application provides a dashboard inventory view of virtual network components and virtualized services in the network. It lists the total count of an object type, along with the number of operational and not operational objects. The dashboard view panel provides an at-a-glance summary of the virtual network components and virtualized services associated with the specified data center. It lists the total count of an object type, along with the number of operational and not operational objects.

Integrated help

The Inventory Management application has integrated help to guide you through the features and explain use case workflows. This integrated help includes product tours and use case videos. Click on the Help (?) button for a list of tours available in the application.

10.1.2 Inventory Search panel

The inventory search panel provides a list of VMs in the specified data center. The panel allows you to quickly find the status of a specific VM and view its associated underlay components. It includes a persisted administrative state for the last known status of VMs.

You can click on the Services tab to view the service-to-underlay mapping. You can select a virtualized service and see associated network components in a hierarchical view. The inventory represents of drill-down view of the component hierarchy. When you select a virtualized service from the Services tab, the Associated Components tab updates with a list of the associated V-Switches, V-Switch controllers, and upstream routers. When you select a Virtual Switch Controller, the Upstream Routers list updates to show routers for the selected controller. When you select a V-Switch, the panel shows a list of V-Ports for that service.

10.1.3 Inventory Topology panel

The inventory topology panel displays a conceptual map of the specified data center. It shows the association of virtual services controllers, virtual switch groups, virtual switches, virtual machines, and virtual ports. The topology also displays software gateways as both VRS-G and VSG virtual switches.

10.1.4 Profiles panel

The Profiles view allows you to configure local and global DC policies. The following profiles can be configured from the Profile View:

- BGP profiles
- aging profiles
- historical event profile

- historical event partition profile

BGP Profiles

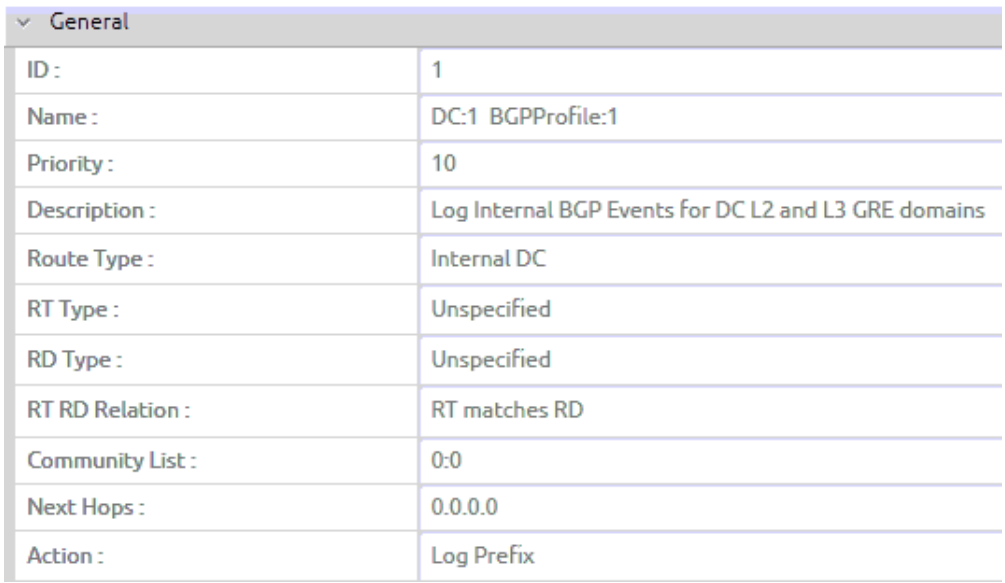
BGP Profiles are local profiles that monitor BGP prefix updates according to user-defined rules. The profiles then either log or reject the prefix—whichever action is specified.

There is one default BGP profiles that is created automatically when the data center is created. The default profile logs prefixes for internal BGP events for L2 and L3 GRE domains and for L3 domains with VXLAN tunnels.

You can create up to eight additional BGP profiles. You can specify a priority order to determine which profiles should attempt to match a prefix first. When a profile matches a prefix, the specific action is performed and no other profile matches are attempted.

See the *Configure BGP profiles* tour on the Profile View for more information about the parameters that can be configured for a BGP profile. The tour describes the required input format for each parameter.

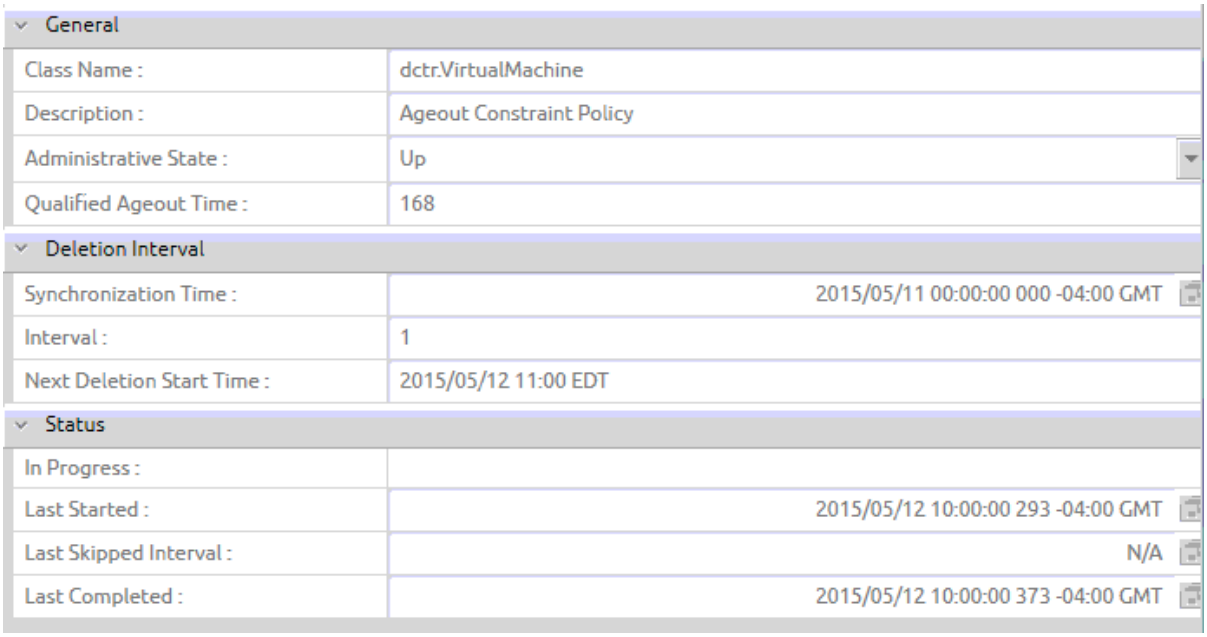
Figure 10-1 BGP profile



Ageout constraint profiles

Ageout constraint policies (or aging profiles) define the period of time that a persisted object is retained in the VSAP database. When the age of an object reaches the ageout value, VSAP deletes the object from the database.

Figure 10-2 Aging profile



Historical event and historical event partition profiles

You can configure these profiles to specify the window of time in which events can be correlated. You can also modify the profiles to specify the following:

- configure historical retention behavior
- configure the maximum database size and length of a historical interval

11 Service Navigator

11.1 Overview

11.1.1

The Service Navigator application shows a dashboard of the operational health of the service objects in a specified administrative domain. Virtualized services within VSAP are grouped by their customer, domain, and zone ID, allowing for easy searchability and navigation by enterprise from the application.

You can use the Service Navigator application to perform in-depth forensic analysis such as root cause and impact analysis. You can also perform an underlay ping test to assess network health or a data path audit to receive information on the NSG V-Switch.

Integrated help

The Service Navigator application has integrated help to guide you through the features and explain use case workflows. This integrated help includes product tours and use case videos. Click on the Help (?) button for a list of tours available in the application.

11.1.2 Reachability monitoring

You can specify an enterprise and domain to view a list of the V-Ports within that domain. The list includes V-Port functional state and BGP reachability state. In cases where the functional or reachability state is down, you can hover over the BGP state flag to view correlated alarms causing the administrative down state.

If there are software gateway bridge ports in the network, VSAP creates a bare metal device child object for associated BGP events and reachability monitoring. You can view bare metal objects from the Bare Metal Device tab.

If there are NSG access routes in the network, they are displayed in the NSG Access Routes tab. The icon on the tab displays as green if all listed routes are reachable, red if some routes are unreachable, and grey if there are no routes listed.

V-Port reachability audit

You can perform an on-demand audit of V-Port prefix reachability using VSAP EVPN prefix lists. After a significant network event, such as VSC failure or BGP event loss, you may wish to confirm V-Port reachability state by querying the EVPN prefix list

The V-Port audit retrieves EVPN routes to update V-Port reachability state after a network change. When the audit is complete, you can refresh the V-Port list to see any state changes.

11.1.3 Fault management

The fault management window allows you to perform alarm management and forensic event tracking on the selected domain or V-Port. It consists of an Alarms and Historical Events tab.

The Alarms tab allows you to view all alarms on the selected domain or V-Port. It provides alarm monitoring, correlation, and troubleshooting for virtual network objects and virtualized services in the network. It allows you to filter, identify root causes, and determine the impact of alarms. It includes the data center correlation framework to correlate faults unique to virtual network objects. You can perform alarm management functionality, such as alarm acknowledgment or severity configuration. You can also view alarm statistics and correlation trees from the fault management window.

The Historical Events tab allows you to perform root cause and historical impact analysis on events in the past. You can query the event log for a list of DC network events that occurred in a specified time window and then determine the causes or impacts of an event.

11.1.4 Underlay ping

You can use the Service Navigator application to perform an underlay test. You can use this test to troubleshoot a service-attached VM to assess the underlay health of the data center network. This functionality is useful if, for example, VSAP statistics show a decline in performance statistics for a V-Port.

You must create the Nuage OAM System script bundle before you can execute it in the VSAP Java GUI or Service Navigator web application. The Nuage OAM System script bundle includes the control script and CLI script use to execute the OAM ping test between two endpoints. The script is included as an example script from which you can create an underlay test script bundle.

11.1.5 Topology maps

You can open the map window by selecting a domain in the Domain panel and clicking the View Map button. You can use the map to highlight services within a domain or to show advertising and underlay routers for a selected V-Port. You can also select an endpoint on the map to view virtual component information and interface statistics. You must enable IP interface statistics in the VSAP Java GUI before you can view interface statistics in the Service Navigator application, and create a VSD client before you can view BGP peer information for NSG nodes.

Icons

The topology map uses the following icons to distinguish data center network elements.

Icon	Network element
	Router

Icon	Network element
	7850 VSG
	VSC
	MC LAG
	NSG-BR
	NSG-UBR

Overlay highlights

The multi-layer map allows you to view more than one overlay highlight at once. Select the V-Ports from the Virtual Port panel and click one or more of the highlight buttons to display the highlight overlay.

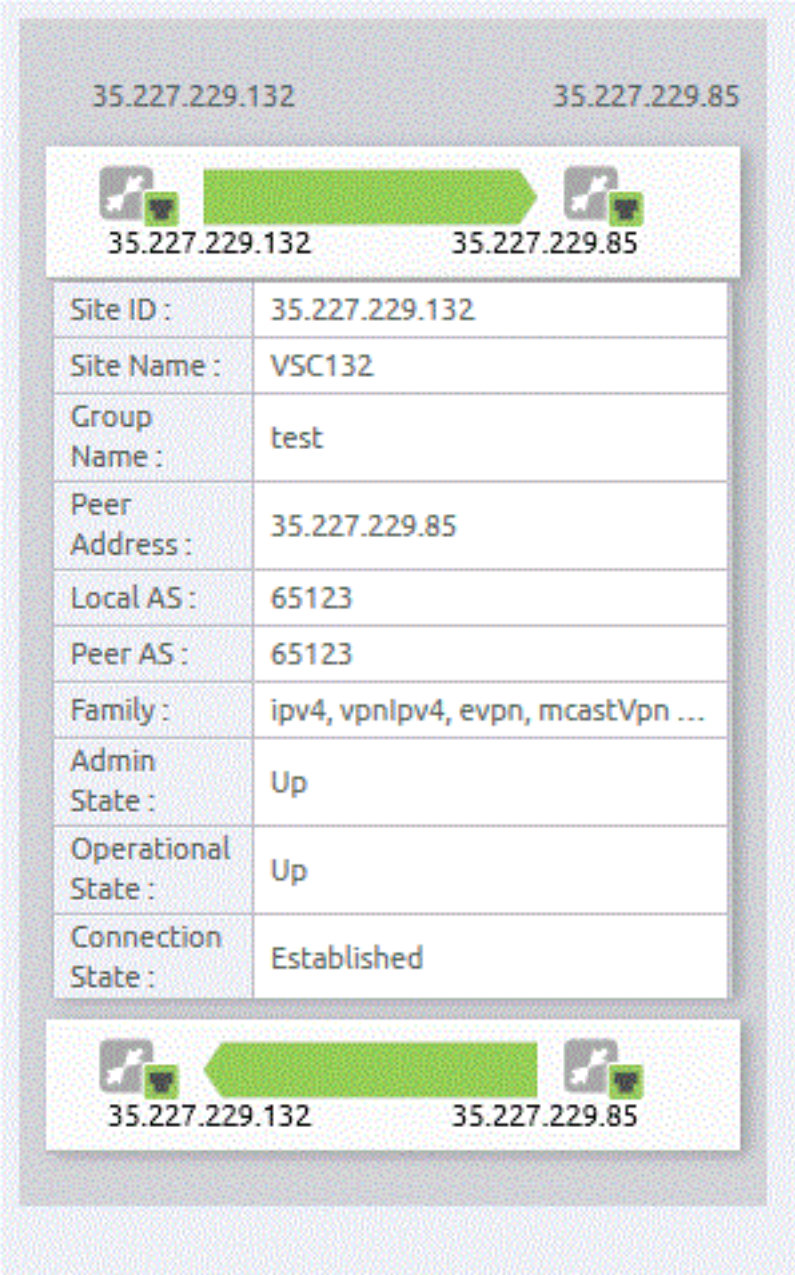
- Service topology—magenta
- Advertizing router—blue

Figure 11-1 IGP multi-layer map with overlay highlights

Peer/link group panel

You can click on a link in the BGP map to open the peer group panel, or a link in the IGP map to open the link group panel. The BGP peer group is displayed as green (up) or red (not up) based on the connection state of the peer group. The IGP peer group displays the same colors based on the operational state. Depending on whether you selected an IGP or BGP peer/link group, the group panel displays different information.

Figure 11-2 Peer group display



Expand in place

You can click a network element to expand its associated components on the map. On a data center topology map, you can view the associated V-Switch, VM, Container, or V-Port. On a WAN topology map, you can view the WAN cloud and associated NSG V-Switches. You can click any

expanded component to open the information panel and view more details.

This functionality allows you to view specific endpoints on the map when viewing a highlighted service. Rather than a service highlight showing upstream routers as an endpoint, the map automatically expands the network element and highlights the service to the associated VM.

Layout persistence

The Service Navigator retains the NE layout from the previous user session. You can manually refresh the map to ensure you have the latest layout. You can enable Auto Refresh to allow the map to periodically update the layout automatically. The automatic refresh setting applies to the topology map only. The V-Port panel is not automatically refreshed. If service highlighting is enabled, the highlight is redrawn according to the updated NE layout.

Linked domains and underlays

When the selected domain is linked to one or more domains using an NSG-BR, you can use the domain linking map to view the link topology and the status of the cross-domain links. You can also view BGP links into other domains through an NSG-BR using the BGP topology map.

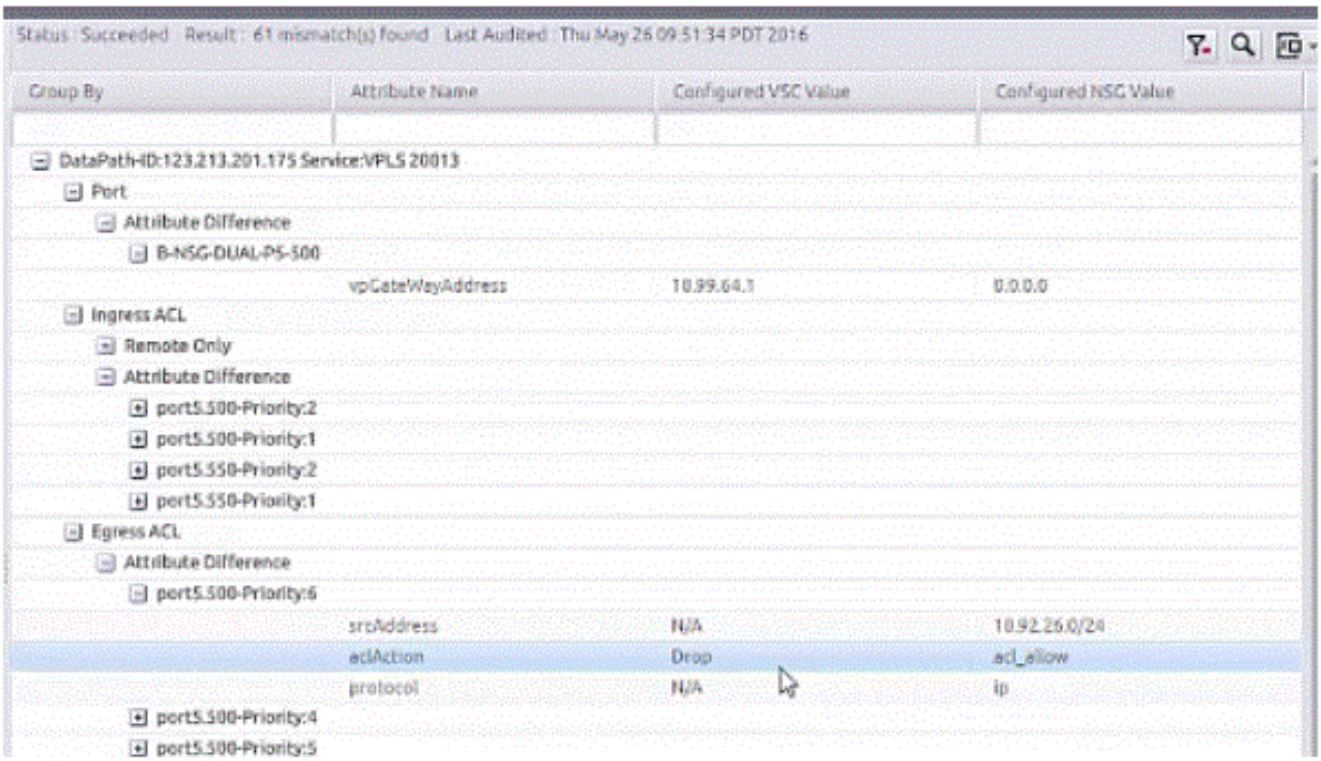
When the selected domain contains underlays that are linked using an NSG-UBR, you can use the BGP topology map to view the links. Selecting multiple V-Ports will display underlay elements that the V-Ports have in common, and the links between them.

11.1.6 Data path audit

The Audit tab allows you to perform a data path audit on an NSG or an entire domain. The audit results include attribute differences for ingress and egress ACL as well as access ports. Where attribute differences are discovered, the audit results list the configured VSC and NSG values. When you audit a domain, the audit results for all NSGs in the domain are listed.

You can hover over a V-Switch service site to see the data path ID. Sites with a locked icon have IPSec disabled.

Figure 11-3 Domain data path audit



In the above example, the aclAction attribute is configured differently on the VSC and NSG. This means they are not performing the same forwarding actions.

12 Wireless NE Views

12.1 The NFM-P Wireless NE Views application

12.1.1 Overview

The NFM-P Wireless NE Views application provides a graphical representation of wireless equipment and logical entities. The application displays the following:

- Cards—control board, modem board
- Radio modules—RRH, TRDU, RFME
- Ports—SFP, antenna ports, cell antenna ports
- Links
- LteCells
- Sectors

Alongside the graphical representation of the eNodeB hardware is a contextual alarm list that allows operators to perform alarm management and drill-down.

12.1.2 Views and functions

The display of the Wireless NE Views application is divided into two areas:

- **Graphical View**

  The Graphical View is a circular display of the eNodeB NE, connected hardware, and logical objects. The Graphical View displays NE components as a wedge shape when the eNodeB has fewer than 3 cells. The view features the following:
  - named sections for modems, boards, radio modules, and LteCells
  - contextual tooltips that display identifying and state information for each section
  - directional port-to-port link information
  - color-coded health and state information for components and links
  - selection of specific components to display specific fault management information
  - right-click contextual options to navigate to the logical view (for LteCell) or components view (for all others)

- **Alarm List**

  The Alarm List displays a filterable list of alarms currently raised against the selected hardware or object. You can expand alarms to view specific alarm fields, and perform right-click actions including:
  - view impact, root cause, and object point of view diagrams
  - assign OLC state
  - acknowledge, delete, clear, and assign severity/urgency
  - navigate to the affected object in the NFM-P GUI
  - view alarm and object alarm histories

- view current and historical alarm snapshots

You can add/remove, sort, and autofit columns in the Alarm List by right-clicking on a column and selecting the options in the Columns list. You can reposition columns by clicking and dragging.

12.1.3 Object and link health indicators

Objects in Wireless NE Views are colored according to their health status. The application uses the following rules:

- Objects are light gray by default.
- If the Administrative State of an object is “locked” or in shutdown, the object is dark gray.
- If the Administrative State of an object is “unlocked”, the following logic applies:

  IF there is a critical alarm OR the operational state is disabled OR the availability status is “off duty”, THEN the object border is red.

  ELSE

  IF there is a major alarm OR the availability status is “degraded” THEN the object border is orange.

  ELSE

  The border is green.

Links in Wireless NE Views are colored according to the health status of the connected objects. The application uses the following rules:

- CPRI links: the health of the link is equal to the lowest health of the connected radio equipment.
- Antenna links: the health of the link is equal to the antennaPort health

12.1.4 General features and behavior

The following statements describe general Wireless NE Views features and behavior:

- You can select an eNodeB to display using the search bar in the top-right of the application.
- The search bar also features a drop-down list to select an eNodeB directly.
- There is a refresh button next to the search bar.
- When the central eNodeB object is selected, or no object is selected, all alarms are displayed by the Alarm List. Selecting an object displays the alarms for that object only.
- You can rotate sections of the NE view by clicking and dragging components, which is useful for aligning links in the display.
- You can zoom in and out using the mouse scroll wheel.
- Tooltips display the following information:
  - identifiers (name, alias, ID, hardware number, management IP)
  - state and status indicators
  - the number of major and critical alarms
  - the Site Name of RFMs
- Tooltips are refreshed every 8 seconds.
- Antenna ports and cell antenna ports are displayed with their rdnId.

- SFPs are displayed with (and in order of) their position number.
- Pre-provisioned NEs are not available for display by the Wireless NE Views.

12.1.5 User preferences

The Wireless NE Views application features a preferences menu with the following options:

- Show all links—enable or disable the display of all links by default.
- Show unhealthy links—enable or disable health indicators for links.
- Show highlighted links—enable or disable highlighting for links on selected components.
- Show tooltips—enable or disable tooltips.

13 Wireless Supervision

13.1 Overview

13.1.1 Features

The NFM-P Wireless Supervision application provides an at-a-glance view of LTE RAN network fault status in a dynamic web-based GUI. You can perform the following tasks using the Wireless Supervision application:

- view full and regional network status quickly and efficiently
- view network KPIs and prioritize network problems accordingly
- investigate network alarms and view fault correlation
- perform alarm management tasks such as alarm acknowledgement and clearing
- launch the NFM-P GUI to perform more detailed troubleshooting tasks such as eNodeB and cell reset
- drill down to eNodeB objects for more detailed status information
- view trace status information for all supported trace types

13.1.2 Wireless Supervision views and functions

The Wireless Supervision application GUI features the following views:

- **Summary View**

  The Summary View panel displays the following set of supervision group KPIs for the all managed eNodeBs in the selected summary view:
  - number of unacknowledged critical alarms
  - percentage of non-operational eNodeBs—percentage of eNodeBs with an Administrative State of “unlocked” and an Operational State of “disabled”
  - percentage of non-operational cells—percentage of cells with an Administrative State of “unlocked” and an Operational State of “disabled”

  Clicking on a KPI number opens the relevant details view for the KPI type (Alarm List, eNodeBs view, or LteCells view). Clicking on the All Groups icon returns to the Matrix view.

  KPIs are colored as follows:
  - alarms—red when at least one unacknowledged critical alarm is raised on an eNodeB in the group, otherwise green.
  - eNodeB—red for 10% or more non-operational, orange for 5%-9%, green for below 5%.
  - LteCell—same criteria as eNodeB.

  New supervision group are automatically added to the Matrix View of the selected Summary View at the end of each polling period.
- **Matrix View**

The Matrix View displays at-a-glance KPIs of all supervision groups in the current summary view. Each group displays three colored bars that display the status of the critical alarm, non-operational eNodeB, and non-operational cell KPIs.

The group icons in the Matrix View and Summary View are colored to reflect the combined overall KPI status as follows:

- red—more than 75% of KPIs are not green
- orange—all but one KPI are not green, or one KPI is red
- yellow—one KPI is not green
- green—all KPIs are green

The Matrix View displays groups from worst to best KPI status, which is the same order listed above. You can mouse-over a group to view a status tooltip, and click to expand the group for details on KPIs and eNodeB/LteCell counts. The Matrix View features a group navigation menu that can be accessed by clicking on the top right corner of a group and provides access to all group views.

- **Alarm List**

  The Alarm List displays a filterable list of alarms currently raised against the selected supervision group, eNodeB, or cell. Selecting the Group Alarms View or clicking on the alarm KPI for a supervision group displays the full group view. The Alarm List is also displayed (collapsed by default) at the bottom of the eNodeBs, LteCells, and Sites Views and displays the alarms raised against the selected object. You can expand alarms to view specific alarm fields, and perform right-click actions including:

  - view impact, root cause, and object point of view diagrams
  - update OLC state
  - acknowledge, delete, clear, and assign severity/urgency of alarms
  - navigate to the affected object in the NFM-P GUI
  - view alarm and object alarm histories
  - view current and historical alarm snapshots

  The Alarm List features a pause button in the bottom-left corner of the panel. This button enables or disables alarm polling, which is 30 seconds by default and can be changed in the global User Preferences menu at the application selection screen. All alarm list views feature an export to CSV option.

- **eNodeBs View**

  The eNodeB View displays a filterable list of eNodeBs with columns for state, status, and SW version information. You can perform an in-context launch of the Wireless NE Views application by right-clicking on an eNodeB and choosing Show in Wireless NE Views.

- **LteCells View**

  The LteCell View displays a filterable list of LteCells with columns for state and status information. You can perform an in-context launch of the Wireless NE Views application by right-clicking on an LteCell and choosing Show in Wireless NE Views. The LteCells view features an advanced filter that can be used to filter out LteCells in the shutdown state, for example:

  Availability Status equal "offline offDuty" OR *Availability Status equal "offDuty offLine"*

- **Sites View**

  The Sites View displays a filterable list of eNodeBs, RFMs, and SMMs with columns for state, status, and SW version information. Elements are displayed in the Sites View when they share a

site name with another component. Components with unique site names are not displayed. The Sites View features right-click contextual menus to the NFM-P client or SMM management interface.

- **Traces Dashboard View**

  The Traces Dashboard View displays filterable status information for all trace types in the supervision group. Right-click contextual menus provide navigation to relevant properties forms in the NFM-P client.

You can add/remove, sort, and autofit columns in the eNodeB/LteCell View and Alarm List by right-clicking on a column and selecting the options in the Columns list. You can reposition columns by clicking and dragging.

The Wireless Supervision features a global pause button in the bottom-left corner of the window.

13.2 To launch the Wireless Supervision application

13.2.1 Before you begin

You can launch the Wireless Supervision application:

- by specifying a browser path and launching from the NFM-P client GUI
- by navigating to the NFM-P launch panel URL with a compatible web browser

13.2.2 Steps

1

To specify the browser path for launching the Wireless Supervision application from the NFM-P client GUI, perform the following. This step only needs to be performed once.

Specifying a browser path is not required when navigating to the NFM-P launch panel URL.

1. Choose Application→User Preferences from the NFM-P main menu. The User Preferences form opens.
2. Scroll to the bottom of the form and specify the Browser Path by performing one of the following:
   - Click Browse, navigate to the web browser executable file on the local workstation, and click Open. The Browser Path is updated.
   - Click Reset and manually specify the path to the web browser executable file.
3. Save the changes and close the form.

2

To launch from the NFM-P client GUI, choose Application→Wireless Supervision from the NFM-P main menu. The NFM-P opens the specified web browser and launches the Wireless Supervision application.

3

To navigate to the NFM-P launch panel using a compatible web browser, open the web browser on the local workstation and perform the following:

1. Navigate to the following URL:

   server/login

   where

   server is the NFM-P server IP address
2. Enter login credentials and click Login.

4

Click the Launch Wireless Supervision application icon. The Wireless Supervision application launches.

END OF STEPS

13.3 Configuring supervision objects

13.3.1 Object types

The NFM-P Wireless Supervision application organizes eNodeBs using the following configurable network objects:

- **Supervision groups**

  A supervision group is a logical set of NEs that is specified by user-defined filters. Supervision groups can be used to partition NEs into distinct categories and are associated with summary views. There is no limit to the number of supervision groups that an eNodeB can belong to.

  Note: For performance reasons, do not exceed 500 eNodeBs per supervision group.
- **Summary views**

  A summary view is a collection of one or more supervision groups that provides a summarized, high-level view of a group of network objects. There is no limit to the number of summary views that a supervision group can belong to.

13.3.2 Monitoring eNodeBs with the Wireless Supervision application

The view of eNodeBs in the Wireless Supervision application GUI is based on the currently selected summary view. You can populate summary views with managed eNodeBs using the following methods:

- **Automatically** using the “Create Automatically by Using Topology Group” option in the Supervision Group Settings menu of the Wireless Supervision application. Applying this option creates a supervision group for each equipment group in the NFM-P and adds them to the Default Wireless Summary View. This method provides a view of all eNodeBs in the managed network organized by equipment group. After applying, automatic creation does not take subsequent equipment group changes into account and must be re-applied.
- **Manually** using the NFM-P client GUI. You can configure supervision groups that include eNodeB-specific inclusion filters and associate the groups with a summary view. This method allows the creation of a targeted view of a specific subset of managed eNodeBs.

13.4 To configure a supervision group

13.4.1 Before you begin

Supervision groups include NEs based on inclusion filters. The inclusion filters used to specify the eNodeBs in the supervision group must exclude pre-provisioned NEs and all other non-eNodeB NE types to avoid misleading alarms and KPI numbers.

13.4.2 Steps

1

Choose Administration→Supervision Settings from the NFM-P main menu. The Supervision Settings (Edit) form opens.

2

Click on the Supervision Groups tab.

3

Click Create. The Supervision Group (Create) form opens.

4

Configure the parameters:

- Displayed Name
- Description
- Category—must be set to “NE Access” for eNodeB supervision

Note: The Supervised Alarms Severities parameter does not apply to eNodeB supervision. All eNodeB alarms are displayed in the Wireless Supervision application regardless of severity.

5

Click on the Inclusion Filters tab.

6

Click Add. The Select Form opens.

7

Perform one of the following:

a. To create an inclusion filter, go to Step 8.

b. To apply an existing inclusion filter, go to Step 16.

8

Click Inclusion Filter. The Inclusion Filter Creation form opens.

9

Configure the filter properties.

1. Choose an item from the Attribute drop-down menu.
2. Choose an item from the Function drop-down menu.
3. Configure the Value parameter.
4. Choose a Boolean Operator from the Operators drop-down menu, if applicable.
5. Click Add.

10

To add a filter that excludes pre-provisioned NEs:

1. Select “General: Network Element (Network)→State” as the Attribute.
2. Set the Function to “NOT EQUAL” and the Value to “Pre-provisioned”.
3. Click Add.

11

Perform one of the following:

a. To filter additional properties, repeat Step 9.

b. If you are finished filtering properties, go to Step 12.

12

Click Save. The Save Filter form opens.

13

Configure the parameters:

- Filter Name
- Description
- Public

14

Click Save. The filter is saved.

15

Close the Inclusion Filter Creation form.

16

Click Search in the Supervision Group form. A list of inclusion filters is displayed.

17

Choose an inclusion filter in the list and click OK. The filter is added to the supervision group.

18

Add additional filters, as required.

19

Save the changes and close the forms.

END OF STEPS

13.5 To configure a summary view

13.5.1 Steps

1

Choose Administration→Supervision Settings from the NFM-P main menu. The Supervision Settings (Edit) form opens.

2

Click on the Summary Views tab.

3

Click Create. The Supervision View (Create) form opens.

4

Configure the parameters:

- Displayed Name
- Description

5

For the Application parameter, select “Wireless Supervision”.

Note: If “Wireless Supervision” is not specified as the Application, the summary view is not available for in the Wireless Supervision application.

6

Click on the Supervision Groups tab.

7

Click Add. The Select form opens.

8

Configure the filter criteria, if required, and click Search. A list of supervision groups in displayed.

9

Select one or more supervision groups from the list and click OK. The Select form closes and the Supervision View (Create) form reappears with the selected supervision group(s) in the list.

10

Add more supervision groups to the summary view, as required.

11

Save the changes and close the form.

End of steps

14 Policy Management

14.1 About

14.1.1

The Policy Management application enables customized, policy-driven behavior. It also maintains rules that allow the NSD and NRC modules to customize network policies such as global or domain rules for routing algorithms selection and execution. The Policy Management application provides service definitions that describe services in highly abstract, customizable ways while supporting mapping (mediation) of these definitions to the low-level network concepts.

14.2 Template and policy provisioning

14.2.1

This section describes the provisioning of templates and policies using the Policy Management application.

14.2.2 To create an E-Line service template

1

In the Policy Management application, click on Service Templates to expand the template type list and then click E-Line. The system displays the list of existing E-Line service templates.

2

Click CREATE TEMPLATE. The Create E-Line Service Template form opens.

3

Configure the required parameters in the PROPERTIES panel.

Note: During the service template configuration, you can click CANCEL at any time to close the form without saving the template.

Parameter	Description
Name	The name of the E-Line Service template
Admin State	Specifies the administrative state required for the service
Mediation Profile	Specifies a Mediation Profile to apply
Tunnel Profile	Specifies a Tunnel Profile to apply
Endpoint QoS Template	Specifies an Endpoint QoS template to apply
Bidirectional	Specifies whether or not a return path is required, and if so, what type of return path should be determined
Optimize on (Objective)	Specifies the primary goal when identifying resources and/or paths for service creation
Max Hops (Span)	Specifies the maximum number of hops to consider
Max Latency (microseconds)	Specifies the maximum latency to consider
Max Cost	Specifies the maximum cost to consider
Monitor Bandwidth	Specifies whether or not to monitor bandwidth
MTU	Specifies the MTU for the service. The range is 0 to 9194
Description	Describes the E-Line service template
VC Type	Specifies the type of pseudowire for the E-Line service template.

Parameter	Description
Tunnel Type	Specifies the type of tunnel to be used by the E-Line service to which the template is applied. • For pseudowire-based E-Line services, select NONE. • For EVPN-based E-Line services, select a specific tunnel type or ANY.

4

To assign tenants to the service template, click TENANT PERMISSIONS. Add and remove tenants with the permission to use the service template when creating a service, as required.

5

Click CREATE. The system creates the E-Line service template and closes the form.

END OF STEPS

14.2.3 To create an E-LAN service template

1

In the Policy Management application, click on Service Templates to expand the template type list and then click E-LAN. The system displays the list of existing E-LAN service templates.

2

Click CREATE TEMPLATE. The Create E-LAN Service Template form opens.

3

Configure the required parameters in the PROPERTIES panel.

Note: During the service template configuration, you can click CANCEL at any time to close the form without saving the template.

Parameter	Description
Name	The name of the E-LAN Service template
Admin State	Specifies the administrative state required for the service
Mediation Profile	Specifies a Mediation Profile to apply
Tunnel Profile	Specifies a Tunnel Profile to apply
Endpoint QoS Template	Specifies an Endpoint QoS template to apply

Parameter	Description
Bidirectional	Specifies whether or not a return path is required, and if so, what type of return path should be determined
Optimize on (Objective)	Specifies the primary goal when identifying resources and/or paths for service creation
Max Hop (Span)	Specifies the maximum number of hops to consider
Max Latency (microseconds)	Specifies the maximum latency to consider
Max Cost	Specifies the maximum cost to consider
Monitor Bandwidth	Specifies whether or not to monitor bandwidth
MTU	Specifies the MTU for the service. The range is 0 to 9194
Description	Describes the E-LAN service template
VC Type	Specifies the type of pseudowire for the E-LAN service template
Tunnel Type	Specifies the type of tunnel to be used by the E-LAN service to which the template is applied. • For pseudowire-based E-LAN services, select NONE. • For EVPN-based E-LAN services, select a specific tunnel type or ANY.

4

To assign tenants to the service template, click TENANT PERMISSIONS. Add and remove tenants with the permission to use the service template when creating a service, as required.

5

Click CREATE. The system creates the E-LAN service template and closes the form.

END OF STEPS

14.2.4 To create a C-Line service template

1

In the Policy Management application, click on Service Templates to expand the template type list and then click C-Line. The system displays the list of existing C-Line service templates.

2

Click CREATE TEMPLATE. The Create C-Line Service Template form opens.

3

Configure the required parameters in the PROPERTIES panel.

Note: During the service template configuration, you can click CANCEL at any time to close the form without saving the template.

Parameter	Description
Name	The name of the C-Line Service template
Admin State	Specifies the administrative state required for the service
Tunnel Profile	Specifies a Tunnel Profile to apply
Bidirectional	Specifies whether or not a return path is required, and if so, what type of return path should be determined
Optimize on (Objective)	Specifies the primary goal when identifying resources and/or paths for service creation
Max Hop (Span)	Specifies the maximum number of hops to consider
Max Latency (microseconds)	Specifies the maximum latency to consider
Max Cost	Specifies the maximum cost to consider
MTU	Specifies the MTU for the service. The range is 0 to 9194
Description	Describes the C-Line Service template
VC Type	Specifies the type of pseudowire for the C-Line service.

4

To assign tenants to the service template, click TENANT PERMISSIONS. Add and remove tenants with the permission to use the service template when creating a service, as required.

5

Click CREATE. The system creates the C-Line service template and closes the form.

End of steps

14.2.5 To create an L3 VPN service template

1

In the Policy Management application, click on Service Templates to expand the template type list and then click L3 VPN. The system displays the list of existing L3 VPN service templates.

2

Click CREATE TEMPLATE. The Create L3 VPN Service Template form opens.

3

Configure the required parameters in the PROPERTIES panel.

Note: During the service template configuration, you can click CANCEL at any time to close the form without saving the template.

Parameter	Description
Name	The name of the L3 VPN Service template
Admin State	Specifies the administrative state required for the service
Mediation Profile	Specifies a Mediation Profile to apply
Tunnel Profile	Specifies a Tunnel Profile to apply
Endpoint QoS Template	Specifies an Endpoint QoS template to apply
Tunnel Type	Specifies the tunnel to be used by the service
Bidirectional	Specifies whether or not a return path is required, and if so, what type of return path should be determined
Optimize on (Objective)	Specifies the primary goal when identifying resources and/or paths for service creation
Max Hop (Span)	Specifies the maximum number of hops to consider
Max Latency (microseconds)	Specifies the maximum latency to consider
Max Cost	Specifies the maximum cost to consider
MTU	Specifies the MTU for the service. The range is 0 to 9194
Description	Describes the L3 VPN Service template

4

To assign tenants to the service template, click TENANT PERMISSIONS. Add and remove tenants with the permission to use the service template when creating a service, as required.

5

Click CREATE. The system creates the L3 VPN service template and closes the form.

END OF STEPS

14.2.6 To create an IES service template

1

In the Policy Management application, click on Service Templates to expand the template type list and then click IES. The system displays the list of existing IES service templates.

2

Click CREATE TEMPLATE. The Create IES Template form opens.

3

Configure the required parameters in the PROPERTIES panel.

Note: During the service template configuration, you can click CANCEL at any time to close the form without saving the template.

Parameter	Description
Name	The name of the IES Service template
Admin State	Specifies the administrative state required for the service
Mediation Profile	Specifies a Mediation Profile to apply
Endpoint QoS Template	Specifies an Endpoint QoS template to apply
MTU	Specifies the MTU for the service. The range is 0 to 9194
Description	Describes the IES Service template

4

To assign tenants to the service template, click TENANT PERMISSIONS. Add and remove tenants with the permission to use the service template when creating a service, as required.

5

Click CREATE. The system creates the IES service template and closes the form.

END OF STEPS

14.2.7 To create an Endpoint QoS template

1

In the Policy Management application, click on Service Templates to expand the template type list and then click Endpoint QoS. The system displays the list of existing Endpoint QoS service templates.

2

Click CREATE TEMPLATE. The Create Endpoint QoS Template form opens.

3

Configure the required parameters:

Note: During the service template configuration, you can click CANCEL at any time to close the form without saving the template.

Parameter	Description
Name	The name of the Endpoint QoS template
Description	Describes the Endpoint QoS template
Import QoS Profile	
QoS Profile	Specifies the Generic QoS Profile to be used
QoS Profile Description	Describes the Generic QoS Profile that is in use
QoS Settings	
Ingress QoS	These parameter groups are filled automatically when a QoS profile is imported. Each group includes CoS, CIR, PIR, CBS and MBS values. The system also displays the Ingress Scheduler and Egress Scheduler details associated with the QoS profile.
Egress QoS	

4

Click CREATE. The system creates the Endpoint QoS service template and closes the form.

End of steps

14.2.8 To create a Generic QoS policy

1

In the Policy Management application, click on Service Templates to expand the template type list and then click Generic QoS Policies. The system displays the list of existing Generic QoS Policies.

2

Click CREATE POLICY. The Create Generic QoS Policy form opens.

3

Configure the required parameters:

Note: During the service template configuration, you can click CANCEL at any time to close the form without saving the template.

Parameter	Description
Name	The name of the Generic QoS policy
Description	Describes the Generic QoS policy
GQP Id	Specifies the Generic QoS policy identifier
INGRESS panel	
Queue Configurations	Add and configure one or multiple queue configurations, as required.
Ingress Scheduler	Configure an ingress scheduler. Select a scheduler type and configure the CIR and PIR parameters.
Ingress Policies	Select an ingress policy.
EGRESS panel	
Queue Configurations	Add and configure one or multiple queue configurations, as required.
Egress Scheduler	Configure an egress scheduler. Select a scheduler type and configure the CIR and PIR parameters.
Egress Policies	Select an egress policy.

4

Click CREATE. The system creates the Generic QoS Policy and closes the form.

END OF STEPS

14.2.9 To modify the RD/RT Range policy

1

In the Policy Management application, click on Service Policies to expand the policy type list and then click RD/RT Range. The system displays a list that contains the RD/RT Range default policy.

2

Point to the RD/RT Range default policy and then click the EDIT button. The Edit RD/RT Range Policy form opens.

3

Edit the RD/RT Range default policy, as required:

Note: During the policy editing, you can click CANCEL at any time to close the form without saving the changes.

Parameter	Description
Name	The name of the policy cannot be edited.
Description	Describes the RD/RT Range policy.
Route Distinguisher (RD)	
Type	Specifies the RD type.
Use Provider AS	Specifies whether or not the NSP uses the AS number from the provider network configuration. If confederation is used, then confederation AS will be used.
Administrative Number	Specifies the RD administrative number. Is you enabled the Use Provider AS parameter, the administrative number cannot be edited.
Assigned Number (Min)	Specifies the minimum assigned number. For Type-0, the value must be between 0 and 4294967295, inclusive. For Type-2, the value must be between 0 and 65535, inclusive
Assigned Number (Max)	Specifies the maximum assigned number. For Type-0, the value must be between 0 and 4294967295, inclusive. For Type-2, the value must be between 0 and 65535, inclusive.
Route Target (RT)	
Type	Specifies the RT type.

Parameter	Description
Use Provider AS	Specifies whether or not the NSP uses the AS number from the provider network configuration. If confederation is used, then confederation AS will be used.
Administrative Number	Specifies the RT administrative number. Is you enabled the Use Provider AS parameter, the administrative number cannot be edited.
Assigned Number (Min)	Specifies the minimum assigned number. For Type-0, the value must be between 0 and 4294967295, inclusive. For Type-2, the value must be between 0 and 65535, inclusive
Assigned Number (Max)	Specifies the maximum assigned number. For Type-0, the value must be between 0 and 4294967295, inclusive. For Type-2, the value must be between 0 and 65535, inclusive.

4

Click SAVE. The system saves the RD/RT Range default policy and closes the form.

END OF STEPS

14.2.10 To create a Tunnel Profile policy

1

In the Policy Management application, click on Service Policies to expand the policy type list and then click Tunnel Profile. The system displays a list that contains existing Tunnel Selection policies.

2

Click CREATE POLICY. The Create Tunnel Profile form opens.

3

Configure the required parameters:

Note: During the policy creation, you can click CANCEL at any time to close the form without saving the policy.

Parameter	Description
Name	The name of the Tunnel Selection policy

Parameter	Description
Description	Describes the Tunnel Selection policy
Tunnel Selection Rules	
Use existing tunnels	Specifies whether or not services can ride on top of previously-created NSP tunnels
Expand existing tunnels	Specifies whether or not services can grow previously-created NSP tunnels and get more bandwidth without forcing a re-route (works only if the Use existing tunnels parameter is enabled)
Redirect existing tunnels	Specifies whether or not services can force a re-route of previously-created NSP tunnels (works only if the Use existing tunnels parameter is enabled)
Create new tunnels	Specifies whether or not services can create new tunnels
Avoid operational state down	Specifies whether or not the tunnel avoids routers that are operationally down
Book bandwidth in core for ELINE	Specifies whether or not the service can reserve bandwidth in the core (applies only to E-Line services)
Tunnel Creation Rules	
Consumable	Specifies whether or not new services can ride this tunnel
Auto Deletable	Specifies whether or not the tunnel is deleted automatically when the last service is removed from it
Auto Modifiable	Specifies whether or not the tunnel parameters are modifiable due to changes in the services that are riding it
Protected	Specifies whether or not the tunnel has a protection path. The protection path is signaled only after the primary path fails.
Protection Type	You can set the value of this parameter if the Protected parameter was enabled. Specifies the path protection type. The protection path is pre-signaled and available for immediate recovery after a primary path failure.
FRR Enabled	Enables and disables the FRR protection

Parameter	Description
Steering Parameters	
Included	Select steering parameter values to include or to exclude, or both, as required.
Excluded	
Tunnel Type Prioritization The Tunnel Type Prioritization panel lists the available tunnel types in the order of their priority level, starting with the highest priority (0). You can modify the tunnel type priority for tunnel profiles. Click and drag a tunnel type to a new position in the list and then release it, as required. To remove a tunnel type from the priority list, drag it under the Not applicable line.	
Strict RSVP	Specifies the priority level for Strict RSVP LSPs
Strict RSVP (PCC)	Specifies the priority level for Strict RSVP PCC LSPs
SR-ISIS	Specifies the priority level for SR-ISIS LSPs
SR-OSPF	Specifies the priority level for SR-OSPF LSPs
LDP	Specifies the priority level for LDP tunnels
BGP	Specifies the priority level of BGP tunnels
GRE	Specifies the priority level of GRE tunnels
Strict SR-TE	Specifies the priority level of Strict SR-TE tunnels
Strict SR-TE (PCC)	Specifies the priority level for Strict SR-TE PCC LSPs
Loose RSVP	Specifies the priority level for Loose RSVP LSPs
Loose SR-TE	Specifies the priority level for Loose SR-TE LSPs

4

Click SAVE. The system saves the Tunnel Selection policy and closes the form.

END OF STEPS

14.2.11 To create a Steering Parameter

1

In the Policy Management application, click on Service Policies to expand the policy type list and then click Steering Parameters. The system displays a list that contains existing Steering Parameter policies.

2

Click CREATE POLICY. The Create Steering Parameter form opens.

3

Configure the name of the Steering Parameter.

Note: You can click CANCEL at any time to close the form without saving the Steering Parameter.

4

Click SAVE. The system saves the Steering Parameter and closes the form.

END OF STEPS

14.2.12 To modify the IP/MPLS Configuration policy

1

In the Policy Management application, click on IP/MPLS Policies to expand the policy type list and then click Configuration. The system displays a list that contains a single entry: the System IP MPLS Configuration default policy.

2

Point to the the System IP MPLS Configuration default policy and then click the EDIT button. The Edit the System IP MPLS Configuration form opens.

3

Edit the System IP MPLS Configuration default policy, as required.

Parameter	Description
Description	Specifies the description of the System IP MPLS Configuration default policy
Maintenance Mode	Specifies the IP/MPLS maintenance mode: Manual or Automatic

END OF STEPS

14.2.13 To create a Router ID Mapping policy

1

In the Policy Management application, click on IP/MPLS Policies to expand the policy type list and then click Router ID Mapping. The system displays a list that contains existing Router ID Mapping policies.

2

Click CREATE POLICY. The Create Router ID Mapping Policy form opens.

3

Configure the required parameters:

Note: During the policy creation, you can click CANCEL at any time to close the form without saving the policy.

Parameter	Description
Name	Specifies the name of the Router ID Mapping template
System IP Address	Specifies the system IP address of the router
System Name	Specifies the router system name
PCC Address	Specifies the address of the PCC associated with the router
Description	Specifies the router description
Router Info	Click ADD to add as many Router Info entries, as required. For each Router Info entry, you must specify the following information: • Network Identifier • AS Number • BGP-LS ID (topology identifier) • Router ID • Protocol (the protocol that the IGP router is using)

4

Click SAVE. The system saves the Router ID Mapping policy and closes the form.

END OF STEPS

14.2.14 To create a Path Profile policy

1

In the Policy Management application, click on IP/MPLS Policies to expand the policy type list and then click Path Profile. The system displays a list that contains existing Path Profile policies.

2

Click CREATE POLICY. The Create Path Profile Policy form opens.

3

Configure the required parameters:

Note: During the policy creation, you can click CANCEL at any time to close the form without saving the policy.

Parameter	Description
Reserved Profile ID	When this parameter is enabled, the Path Profile template assumes the Name and role of the default Path Profile template
Name	The name of the Path Profile template
Profile ID	The Profile ID of the paths to be included in path computation
Bidirectional	The bidirectional mode to be used in path computation
Disjoint	The Disjoint mode to be used in path computation
Optimize on (Objective)	Specifies the primary goal when identifying paths for path computation
Explicit Route Strategy	Specifies the explicit route strategy for the service
Control Reroute Strategy	Specifies the control reroute strategy to apply to the service
Max Hop (Span)	Specifies the Max Hops constraint to be used in path computation
Max Cost	Specifies the Max Cost constraint to be used in path computation
Max TE Metric	Specifies the Max TE Metric constraint to be used in path computation
Max Latency	Specifies the maximum latency to consider

Parameter	Description
Description	Describes the Path Profile template
Exclude Route Objects	Click ADD to add as many route objects to exclude as you need. You must specify the IP address and the hop type for each route object.
Include Route Objects	Click ADD to add as many route objects to include as you need. You must specify the IP address for each route object.

4

Click SAVE. The system saves the Path Profile policy and closes the form.

END OF STEPS

14.2.15 To create a Mediation Profile

The creation of mediation profiles is possible only if the appropriate augmentation files are predefined and available on the NSD. Before you start creating a mediation profile, complete the following steps:

1. Create the json augmentation files that describe the additional properties required for the mediation profile.
2. Store the json augmentation files in the NSD database by using the REST endpoint defined for this purpose.
3. Create a custom script to implement the desired service configuration. The script uses the augmented properties defined in the json files to apply the service configuration.
4. Copy the custom script to the appropriate location and install it.

Note: The prerequisite steps can be different for your deployment, depending on the system that manages your NEs: MDM or NFM-P.

1

In the Policy Management application, click on Mediation Profiles to expand the policy type list, and then click on Mediation Profile. The system displays a list that contains existing mediation profiles.

2

Click CREATE PROFILE. The Create Mediation Profile form opens.

3

Configure the required parameters.

Parameter	Description
Name	Specifies the name of the Router ID Mapping template
Description	Specifies the router description
Service Type	Select a service type: • E-LAN • E-Line • L3 VPN
Mediation Info	Click ADD to add as many Mediation Info items as you need. You must specify the following details for each Mediation Info item: • Mediation Profile • Mediation Version • Global Template Name

4

Click SAVE. The system saves the Mediation Profile and closes the form. The NSD adds the new mediation profile to the list of profiles that you can select when creating a service template for the selected service.

END OF STEPS

15 Service Fulfillment

15.1 About

15.1.1

The Service Fulfillment application allows for multi-vendor service provisioning and activation across all networks accessible to the NSD. It authorizes northbound interface (NBI) service requests, executes routing algorithms that allocate network resources for these services, and then deploys the services to the network. Network deployment is performed through the mediation framework. The Service Fulfillment application can use existing tunnels or create new tunnels to satisfy service demands. The services that can be provisioned from the Service Fulfillment application include L3 VPN, C-Line, E-LAN and E-Line services.

The Service Fulfillment application also provides an abstract, real-time view of the network resources that can be consumed by services, allowing service providers and end users to interact with the network through simple APIs, and to programmatically control the network. Network abstraction is used to simplify how the network appears to the IT/OSS layer. This allows services to be defined and enhanced more quickly by presenting only the subset of network services and endpoints that are relevant to a specific application, thereby greatly reducing the complexity the application is exposed to.

After a service request has been communicated through simple RESTful APIs, or through the Service Fulfillment application, the NSD uses operator-defined policies to guide dynamic network resource selection and automated provisioning. These policies use a real-time view of the network (including link and tunnel utilization) to map service connection requests to the best available tunnels/paths (Layer 0 to Layer 3) that meet the customer's Service Level Agreement (SLA) requirements and the operator's network efficiency goals. For example, the NSD can track booking and use real-time network KPIs to assess whether existing tunnels/paths are congested. If so, the NSD uses operator-defined policies to bind incoming service requests to less utilized paths that provide approximately the same connection attributes. It can revert the services to the optimal paths when demand subsides. If no path that meets the requested attributes is available, the NSD asks the relevant NRC module to compute a new path.

Note: For IP-only deployments, the NSD must integrate with the NFM-P, CPAM, vCPAA, and VSR-NRC. For optical-only deployments, the NSD must integrate with NFM-T.

15.2 Getting started

15.2.1 To create physical links between ports

You can use the Service Fulfillment application to create a physical link between ports. You can also use the REST APIs of the NSD and NRC modules for the same purpose. For more information, see the *NSP Developer portal*.

Physical links exist only in the NSD database; nothing is provisioned to the NFM-P or NFM-T. The operational state of one or both the linked ports determines the operational state of the physical link. Updates to the link may be required when the port operational state changes. The NSD can

also be used to delete physical links that have been created using the NSD.

1

On the Inventory page of the Service Fulfillment application, click Physical Links. The application displays a list of existing physical links.

2

Click CREATE LINK. The Create Physical Link form opens.

3

Click on SELECT PORTS, and search for available ports. You can search for a specific port by NE Name or Port Name.

4

Select the desired ports one at a time and click DONE after you added all the required ports..

5

Click CREATE. The system creates the physical link.

END OF STEPS

15.3 Service provisioning

15.3.1

This section describes the provisioning of services using the Service Fulfillment application.

15.3.2 To enable service CAC

1

On your NSD and NRC server, navigate to the following directory: */opt/nsp/server/tomcat/webapps/sdn/WEB-INF/config/*

2

Modify the system.config file as follows:

```
algo

{

serviceCAC="on"

multiVendorServiceCAC = "on"

}
```

3

Save your changes and close the system.config file.

END OF STEPS

15.3.3 To provision E-LAN services

1

In the Service Fulfillment application, click on the SERVICES tab and then click on START SERVICE CREATION.

Note: You can also enter the general configuration information for the service, such as the service name and type, before clicking START SERVICE CREATION. If you do that, then skip the next step.

General configuration

2

Enter the general configuration information for the new service.

1. Type a name for the service.
2. Select E-LAN as the Service Type.
3. Select a tenant for the service, as required.
4. If required, select a template to apply to the service.

Service parameters

3

Click ADDITIONAL PROPERTIES to configure the service parameters. The Additional Properties form opens. Configure the parameters, as required.

Parameter	Description
Tunnel Profile	Specifies the Tunnel Profile (also known as a policy) to apply to the service.

Parameter	Description
Path Profile	Specifies the path profile to be used by the service.
Admin State	Specifies the current administrative state of the service.
Bidirectional	Specifies whether or not a return path is required, and if so, what type of return path should be determined. Select one of the following options: Symmetric Reverse Route Preferred or Any Reverse Route.
Objective	Specifies the primary goal when identifying resources and/or paths for service creation. Select one of the following options: Latency, Hops (Span) or Cost.
MTU	Specifies the MTU for the service. The range is 0 to 9194.
Maximum Hops	Specifies the maximum number of hops to consider.
Maximum Latency	Specifies the maximum latency to consider.
Maximum Cost	Specifies the maximum cost to consider.
Enable EVPN Tunnel Selection	Enables the configuration of an EVPN-based E-LAN service, so that you can select a tunnel type from the following options: LDP, RSVP-TE, SR-ISIS, SR-OSPF, SR-TE, and BGP. The ANY option indicates to the NSD that any supported tunnel type in the EVPN context can be selected in the order of preference.

4

Click OK. The Additional Properties form closes.

5

Click CONTINUE. The service configuration focus moves to the endpoint configuration area.

Endpoints

6

Select a topology type. Your topology type selection (Full Mesh or Hub and Spoke) determines the endpoint selection.

7

Select the service endpoints.

1. Click SELECT PORTS to display the list of available endpoints.
2. If required, use the drop-down menu and the text box at the top of the list to filter the available endpoints by NE name or port.

3. Select a service endpoint: move the mouse pointer to the right of the endpoint entry and click the required selection icon.

   Perform this step to select additional endpoints, as required.

4. Click DONE after selecting the endpoints.
5. If required, click VIEW ENDPOINT LIST to display the list of selected endpoints. To return to the map view, click VIEW SERVICE MAP.

8

Click CONTINUE. The system checks the selected endpoints and informs you that the endpoint is missing required values. You need to perform additional configuration on each endpoint.

9

Click the endpoint entry and click the Edit icon. The port configuration form opens.

10

Configure the required endpoint parameters.

Parameter	Description
Admin State	Specifies the current administrative state of the endpoint
Outer Tag	Specifies the outer tag. Applicable to Dot1Q or QinQ ports.
Inner Tag	Specifies the inner tag. Applicable to Dot1Q or QinQ ports.
QoS Profile Name	Specifies the QoS Profile to be used

11

If a QoS Profile was specified in the previous step, click SHOW QOS SETTINGS to view the QoS settings applied by the profile.

12

Click OK. The endpoint configuration form closes.

Perform the additional configuration steps for each service endpoint. When all the service endpoints are correctly configured, continue to the next step.

13

Click CONTINUE. The system displays the service configuration summary so that you can review it.

Configuration review

14

Review the service configuration summary. You can click the Map icon to view the service representation in the map.

15

Perform one of the following tasks:

a. If the service configuration is correct, click DEPLOY. The system attempts to deploy the service, and displays a message to inform you that the service was successfully created or that there are service configuration errors. Investigate the errors, correct the service configuration and deploy the service again.

b. If you want to save the service without deploying it, click SAVE. A saved service does not reserve any bandwidth and network resources, and the system checks the availability of resources for a saved service only at deployment time.

c. If you need to modify the service configuration, click BACK to go to previous service configuration steps, as required.

END OF STEPS

15.3.4 To provision E-Line services

1

In the Service Fulfillment application, click on the SERVICES tab and then click on START SERVICE CREATION.

Note: You can also enter the general configuration information for the service, such as the service name and type, before clicking START SERVICE CREATION. If you do that, then skip the next step.

General configuration

2

Enter the general configuration information for the new service.

1. Type a name for the service.
2. Select E-Line as the Service Type.
3. Select a tenant for the service, as required.
4. If required, select a template to apply to the service.

Service parameters

3

Click ADDITIONAL PROPERTIES to configure the service parameters. The Additional Properties form opens. Configure the parameters, as required.

Parameter	Description
Tunnel Profile	Specifies the Tunnel Profile (also known as a policy) to apply to the service
Path Profile	Specifies the path profile to be used by the service.
Diverse From	Specifies an existing NSD-managed E-Line service for the new E-Line service to be diverse from. As a result, the new E-Line creates LSPs with the same path profile and group ID as the LSPs used in the specified E-Line.
Admin State	Specifies the current administrative state of the service
Bidirectional	Specifies whether or not a return path is required, and if so, what type of return path should be determined. Select one of the following options: Symmetric Reverse Route Preferred or Any Reverse Route.
Objective	Specifies the primary goal when identifying resources and/or paths for service creation. Select one of the following options: Latency, Hops (Span) or Cost.
MTU	Specifies the MTU for the service. The range is 0 to 9194.
Maximum Hops	Specifies the maximum number of hops to consider
Maximum Latency	Specifies the maximum latency to consider
Maximum Cost	Specifies the maximum cost to consider

Parameter	Description
Enable EVPN Tunnel Selection	Enables the configuration of an EVPN-based E-Line service, so that you can select a tunnel type from the following options: LDP, RSVP-TE, SR-ISIS, SR-OSPF, SR-TE, and BGP. The ANY option indicates to the NSD that any supported tunnel type in the EVPN context can be selected in the order of preference.

4

Click OK. The Additional Properties form closes.

5

Click CONTINUE. The service configuration focus moves to the endpoint configuration area.

Endpoints

6

Select the service endpoints.

1. Click SELECT PORTS to display the list of available endpoints.
2. If required, use the drop-down menu and the text box at the top of the list to filter the available endpoints by NE name or port.
3. Select a service endpoint: move the mouse pointer to the right of the endpoint entry and click the required selection icon.

   Perform this step to select additional endpoints, as required.
4. Click DONE after selecting the endpoints.
5. If required, click VIEW ENDPOINT LIST to display the list of selected endpoints. To return to the map view, click VIEW SERVICE MAP.

7

Click CONTINUE. The system checks the selected endpoints and informs you that the endpoint is missing required values. You need to perform additional endpoint configuration.

8

Move the mouse pointer to the right of the endpoint entry and click the Edit icon. The port configuration form opens.

9

Configure the required endpoint parameters.

Parameter	Description
Admin State	Specifies the current administrative state of the endpoint
Outer Tag	Specifies the outer tag. Applicable to Dot1Q or QinQ ports.
Inner Tag	Specifies the inner tag. Applicable to Dot1Q or QinQ ports.
QoS Profile Name	Specifies the QoS Profile to be used

10

If a QoS Profile was specified in the previous step, click SHOW QOS SETTINGS to view the QoS settings applied by the profile.

11

Click SAVE. The endpoint configuration form closes.

Perform the additional configuration steps for each service endpoint. When all the service endpoints are correctly configured, continue to the next step.

12

Click CONTINUE. The system displays the service configuration summary so that you can review it.

Configuration review

13

Review the service configuration summary. You can click the Map icon to view the service representation in the map.

14

Perform one of the following tasks:

a. If the service configuration is correct, click DEPLOY. The system attempts to deploy the service, and displays a message to inform you that the service was successfully created or that there are service configuration errors. Investigate the errors, correct the service configuration and deploy the service again.

b. If you want to save the service without deploying it, click SAVE. A saved service does not reserve any bandwidth and network resources, and the system checks the availability of resources for a saved service only at deployment time.

c. If you need to modify the service configuration, click BACK to go to previous service

configuration steps, as required.

End of steps

15.3.5 To provision C-Line services

1

In the Service Fulfillment application, click on the SERVICES tab and then click on START SERVICE CREATION.

Note: You can also enter the general configuration information for the service, such as the service name and type, before clicking START SERVICE CREATION. If you do that, then skip the next step.

General configuration

2

Enter the general configuration information for the new service.

1. Type a name for the service.
2. Select C-Line as the Service Type.
3. Select a tenant for the service, as required.
4. If required, select a template to apply to the service.

Service parameters

3

Click ADDITIONAL PROPERTIES to configure the service parameters. The Additional Properties form opens. Configure the parameters, as required.

Parameter	Description
Tunnel Profile	Specifies the Tunnel Profile to apply to the service
Include RTP Header	Enables the inclusion of CEM RTP across the IP/MPLS core network
Admin State	Specifies the current administrative state of the service
Bidirectional	Specifies whether or not a return path is required, and if so, what type of return path should be determined
Maximum Hops	Specifies the maximum number of hops to consider

Parameter	Description
Maximum Latency	Specifies the maximum latency to consider
Maximum Cost	Specifies the maximum cost to consider
Objective	Specifies the primary goal when identifying resources and/or paths for service creation. Select one of the following options: Latency, Hops (Span) or Cost.
MTU	Specifies the MTU for the service. The range is 0 to 9194.

4

Click OK. The Additional Properties form closes.

5

Click CONTINUE. The service configuration focus moves to the endpoint configuration area.

Endpoints

6

Select a VC Type option. This specifies the type of pseudowire for the C-Line service.

7

Select the service endpoints.

1. Click SELECT PORTS to display the list of available endpoints.
2. If required, use the drop-down menu and the text box at the top of the list to filter the available endpoints by NE name or port.
3. Select a service endpoint: move the mouse pointer to the right of the endpoint entry and click the required selection icon.

   Perform this step to select additional endpoints, as required.
4. Click DONE after selecting the endpoints.
5. If required, click VIEW ENDPOINT LIST to display the list of selected endpoints. To return to the map view, click VIEW SERVICE MAP.

8

Click CONTINUE. The system checks the selected endpoints and informs you that the endpoint is missing required values. You need to perform additional endpoint configuration.

9

Click on the endpoint. The port configuration form opens.

10

Configure the required endpoint parameters.

Parameter	Description
Admin State	Specifies the current administrative state of the endpoint
Time Slots	Specifies the time slot to be used by the service.
QoS Profile Name	Specifies the QoS Profile to be used

11

If a QoS Profile was specified in the previous step, click SHOW QOS SETTINGS to view the QoS settings applied by the profile.

12

Click SAVE. The endpoint configuration form closes.

Perform the additional configuration steps for each service endpoint. When all the service endpoints are correctly configured, continue to the next step.

13

Click CONTINUE. The system displays the service configuration summary so that you can review it.

Configuration review

14

Review the service configuration summary. You can click the Map icon to view the service representation in the map.

15

Perform one of the following tasks:

a. If the service configuration is correct, click DEPLOY. The system attempts to deploy the service, and displays a message to inform you that the service was successfully created or that there are service configuration errors. Investigate the errors, correct the service configuration and deploy the service again.

b. If you want to save the service without deploying it, click SAVE. A saved service does not reserve any bandwidth and network resources, and the system checks the availability of resources for a saved service only at deployment time.

c. If you need to modify the service configuration, click BACK to go to previous service configuration steps, as required.

END OF STEPS

15.3.6 To provision L3 VPN services

1

In the Service Fulfillment application, click on the SERVICES tab and then click on START SERVICE CREATION.

Note: You can also enter the general configuration information for the service, such as the service name and type, before clicking START SERVICE CREATION. If you do that, then skip the next step.

General configuration

2

Enter the general configuration information for the new service.

1. Type a name for the service.
2. Select L3 VPN as the Service Type.
3. Select a tenant for the service, as required.
4. If required, select a template to apply to the service.

Service parameters

3

Click ADDITIONAL PROPERTIES to configure the service parameters. The Additional Properties form opens. Configure the following parameters, as required.

Parameter	Description
Tunnel Profile	Specifies the Tunnel Profile to apply to the service.
Path Profile	Specifies a path profile for the service.
Admin State	Specifies the current administrative state of the service
Bidirectional	Specifies whether or not a return path is required, and if so, what type of return path should be determined
Objective	Specifies the primary goal when identifying resources and/or paths for service creation. Select one of the following options: Latency, Hops (Span) or Cost.
Encryption	Specifies whether or not IP VPN encryption is enabled.

Parameter	Description
Tunnel Type	Specifies the type of tunnel to be used by the E-Line service.
MTU	Specifies the MTU for the service. The range is 0 to 9194
Maximum Hops	Specifies the maximum number of hops to consider
Maximum Latency	Specifies the maximum latency to consider
Maximum Cost	Specifies the maximum cost to consider

4

Click OK. The Additional Properties form closes.

5

Click CONTINUE. The service configuration focus moves to the endpoint configuration area.

Endpoints

6

Select the Topology Type for the service. Your topology type selection (Full Mesh or Hub and Spoke) determines the endpoint selection.

7

Select the service endpoints.

1. Click SELECT PORTS to display the list of available endpoints.
2. If required, use the drop-down menu and the text box at the top of the list to filter the available endpoints by NE name or port.
3. Select a service endpoint: move the mouse pointer to the right of the endpoint entry and click the required selection icon.

   Perform this step to select additional endpoints, as required.
4. Click DONE after selecting the endpoints.
5. If required, click VIEW ENDPOINT LIST to display the list of selected endpoints. To return to the map view, click VIEW SERVICE MAP.

8

Click CONTINUE. The system checks the selected endpoints and informs you that the endpoint is missing required values. You need to perform additional endpoint configuration.

9

Click on the endpoint entry. The port configuration form opens.

10

Configure the required endpoint parameters.

Note: The endpoint configuration supports both IPv4 and IPv6 addresses.

Parameter	Description
Interface Name	The name of the service interface. Maximum of 32 characters. Must begin with a letter.
Admin State	Specifies the current administrative state of the endpoint
Outer Tag	Specifies the outer tag. Applicable to Dot1Q or QinQ ports.
Inner Tag	Specifies the inner tag. Applicable to Dot1Q or QinQ ports.
Primary IP Address	Specifies the primary IP address assigned to the service endpoint.
Secondary Addresses	Add as many valid IP addresses as required using the Add (+) icon.
Static Routes	Add as many static routes as required using the Add (+) icon. Specify the destination network IP address and subnet mask of the static route assigned to the service endpoint
eBGP Peers	Add as many eBGP peers as required using the Add (+) icon, and specify the IP address and the AS for each eBGP peer.
QoS Profile Name	Specifies the QoS Profile to be used

11

If a QoS Profile was specified in the previous step, click SHOW QOS SETTINGS to view the QoS settings applied by the profile.

12

Click SAVE. The endpoint configuration form closes.

Perform the additional configuration steps for each service endpoint. When all the service endpoints are correctly configured, continue to the next step.

13

Click CONTINUE. The system displays the service configuration summary so that you can review it.

Configuration review

14

Review the service configuration summary. You can click the Map icon to view the service representation in the map.

15

Perform one of the following tasks:

a. If the service configuration is correct, click DEPLOY. The system attempts to deploy the service, and displays a message to inform you that the service was successfully created or that there are service configuration errors. Investigate the errors, correct the service configuration and deploy the service again.

b. If you want to save the service without deploying it, click SAVE. A saved service does not reserve any bandwidth and network resources, and the system checks the availability of resources for a saved service only at deployment time.

c. If you need to modify the service configuration, click BACK to go to previous service configuration steps, as required.

END OF STEPS

15.3.7 To provision IES services

1

In the Service Fulfillment application, click on the SERVICES tab and then click on START SERVICE CREATION.

Note: You can also enter the general configuration information for the service, such as the service name and type, before clicking START SERVICE CREATION. If you do that, then skip the next step.

General configuration

2

Enter the general configuration information for the new service.

1. Type a name for the service.
2. Select IES as the Service Type.
3. Select a tenant for the service, as required.
4. If required, select a template to apply to the service.

Service parameters

3

Click ADDITIONAL PROPERTIES to configure the service parameters. The Additional Properties form opens. Configure the following parameters, as required.

Parameter	Description
Admin State	Specifies the current administrative state of the service
MTU	Specifies the MTU for the service. The range is 0 to 9194

4

Click OK. The Additional Properties form closes.

5

Click CONTINUE. The service configuration focus moves to the endpoint configuration area.

Endpoints

6

Select the service endpoints.

1. Click SELECT PORTS to display the list of available endpoints.
2. If required, use the drop-down menu and the text box at the top of the list to filter the available endpoints by NE name or port.
3. Select a service endpoint: move the mouse pointer to the right of the endpoint entry and click the required selection icon.

   Perform this step to select additional endpoints, as required.
4. Click DONE after selecting the endpoints.
5. If required, click VIEW ENDPOINT LIST to display the list of selected endpoints. To return to the map view, click VIEW SERVICE MAP.

7

Click CONTINUE. The system checks the selected endpoints and informs you that the endpoint is missing required values. You need to perform additional endpoint configuration.

8

Click on the endpoint entry. The port configuration form opens.

9

Configure the required endpoint parameters.

Note: The endpoint configuration supports both IPv4 and IPv6 addresses.

Parameter	Description
Interface Name	The name of the service interface. Maximum of 32 characters. Must begin with a letter.
Admin State	Specifies the current administrative state of the endpoint
Primary IP Address	Specifies the primary IP address assigned to the service endpoint.
Secondary Addresses	Add as many valid IP addresses as required using the Add (+) icon.
Static Routes	Add as many static routes as required using the Add (+) icon. Specify the destination network IP address and subnet mask of the static route assigned to the service endpoint
QoS Profile Name	Specifies the QoS Profile to be used

10

If a QoS Profile was specified in the previous step, click SHOW QOS SETTINGS to view the QoS settings applied by the profile.

11

Click SAVE. The endpoint configuration form closes.

Perform the additional configuration steps for each service endpoint. When all the service endpoints are correctly configured, continue to the next step.

12

Click CONTINUE. The system displays the service configuration summary so that you can review it.

Configuration review

13

Review the service configuration summary. You can click the Map icon to view the service representation in the map.

14

Perform one of the following tasks:

a. If the service configuration is correct, click DEPLOY. The system attempts to deploy the service, and displays a message to inform you that the service was successfully created or that there are service configuration errors. Investigate the errors, correct the service configuration and deploy the service again.

b. If you want to save the service without deploying it, click SAVE. A saved service does not reserve any bandwidth and network resources, and the system checks the availability of resources for a saved service only at deployment time.

c. If you need to modify the service configuration, click BACK to go to previous service configuration steps, as required.

END OF STEPS

15.4 Service management

15.4.1

This section describes the management of existing services and service components using the Service Fulfillment application.

15.4.2 “To view and edit a service” (p. 150)

15.4.3 “To view all services and edit a service” (p. 152)

15.4.4 “To manage service tunnel bandwidth” (p. 152)

15.4.2 To view and edit a service

1

On the SERVICES tab, click in the Search for a service box. The system displays a drop-down list of the existing services.

If you know the service name or part of it, start typing it in the Search for a service box. The system filters the list of services and shows only the service names that contain the characters that you typed.

2

Click on a service. The system displays general information about the service in the Service Info panel and highlights the service on the map.

3

You can now view and modify service details. Click one of the following buttons:

a. EDIT

The Edit Service page opens. You can modify the service properties and endpoints.

b. SERVICE MAP

The Service Map page opens. You can click on the map elements to view information about the service and its components.

c. SERVICE ENDPOINTS

The Service Endpoints page opens. The endpoints defined are listed in a table. Click on an endpoint to view details about it.

d. OPEN IN NFM-T

The service is displayed in the NFM-T application.

Note: Some of the listed options might not be available on your system.

END OF STEPS

15.4.3 To view all services and edit a service

1

On the SERVICES tab, click on the All Services icon. The system displays the list of all created services.

2

Click on a service. The system displays general information about the service in the Info panel.

3

Point to a service and then click one of the following buttons:

a. Edit

The Edit Service page opens. You can modify the service properties and endpoints.

b. View Service Map

The Service Map page opens. You can click on the map elements to view information about the service and its components.

c. View Endpoints

The Service Endpoints page opens. The endpoints associated with the service are listed in a table. Click on an endpoint to view details about it.

d. More...→Manage Tenants

The system opens the Manage Tenants form, in which you can add tenants to the service.

e. More...→Delete

The system prompts you to confirm your choice and then deletes the service.

f. More...→Open in Service Supervision

The service is displayed in the Service Supervision application. For details about the tasks that you can perform on the service, see the documentation for the Service Supervision application.

END OF STEPS

15.4.4 To manage service tunnel bandwidth

You can modify the parameters of a discovered brownfield service tunnel in the Service Fulfillment application. This enables you to support services with bandwidth booking in the core and to restrict or to allow for consumption, modification and deletion in a different way from how the service tunnels were discovered.

Note: The brownfield service tunnel are tunnels created previously in the NFM-P that you can discover and then use with services created in the NSD and NRC.

You can manage the service tunnel bandwidth by modifying the values of the following parameters:

- Consumable

  This parameter controls whether the tunnel can be used or not for creating services in the NSD and NRC. By default, all greenfield and brownfield service tunnels have the Consumable parameter enabled. Disable the Consumable parameter to prevent the services created in the NSD and NRC from using the service tunnel.

- Auto Modifiable

  This parameter allows you to give the NSD and NRC full control of the available bandwidth on the service tunnel. When you enable the Auto Modifiable parameter, the NSD and NRC calculates the available bandwidth automatically and, as a result, the Available Bandwidth parameter is not modifiable anymore. Now the NSD and NRC treat the brownfield service tunnel as a green field tunnel, except the tunnel cannot be deleted in the NSD and NRC.

- Available Bandwidth

  This parameter allows you to set how much bandwidth is available to the NSD and NRC to use on a brownfield service tunnel. Then you must use the same bandwidth values when creating a service that uses the service tunnel. When the service is deleted, the available bandwidth on the service tunnel reverts to the previous value.

Note: You must perform the bandwidth management tasks on the service tunnel for both tunnel directions.

1

In the Service Fulfillment application, click on the INVENTORY tab, and then click Service Tunnels. The system displays a table with the available service tunnels.

2

Search for the service tunnel that you need to manage.

You can filter the service tunnels displayed in the list by Tunnel Name, Source Node, Destination Node and Transport type. Just type numbers or characters, or both, in the search boxes and the system filters dynamically the services that meet your criteria.

3

Click on a service tunnel. The system displays information about the service tunnel in the Info panel.

4

Click Edit. The Manage Service Tunnel form opens.

5

Modify the bandwidth management parameters of the service tunnel, as required.

6

Click SAVE. The service tunnel modifications are saved.

END OF STEPS

16 Task Scheduler

16.1 About

16.1.1

The Task Scheduler application enables users to do CRUD operations with respect to scheduling bandwidth modification requests/tasks on an existing E-Line service. The user is able to schedule a one time, or repeatable service modification request (such as bandwidth modification) for their E-Line service. After accepting a scheduled task, the application allows the end user to view, modify, or delete existing tasks. In the case of modification, the user can change both the start date and the task execution intervals. The user can view all of their current requests and the state of those requests (Scheduled / Running / Disabled). The user can see a historical log of all executed tasks and their Success/Fail status and results.

16.2 Bandwidth modification

16.2.1

This section describes the scheduling of bandwidth modification tasks using the Task Scheduler application.

16.2.2 “To schedule bandwidth modification tasks” (p. 155)

16.2.2 To schedule bandwidth modification tasks

1

In the Task Scheduler application, click CREATE TASK. The Create Bandwidth Modifications Task form opens.

2

Configure the required parameters:

Parameter	Description
Task Name	The name of the task
Start Time	The execution time of the task
End Time	The termination time of the task
Repeat	Specifies at what interval the task repeats, if at all

3

If the Repeat parameter was set to *Never* in Step 2, configure the following parameters:

Parameter	Description
Starts At	The execution date of the task
Ends At	The termination date of the task

4

If the Repeat parameter was set to *Daily* or *Weekly* in Step 2, configure the following parameters:

Parameter	Description
Expiry Type	The termination policy of the task
Recur Every	The interval between every recurrence
Recurrence Start Date	The start date of the recurrence

5

If the Repeat parameter was set to *Monthly* in Step 2, configure the following parameters:

Parameter	Description
Expiry Type	The termination policy of the task
Recur Every [month(s)]	The interval between every recurrence
Recur Every (day of month)	The day of the month on which the task is executed
Recurrence Start Date	The start date of the recurrence

6

Select a service for which to schedule a bandwidth modification task.

7

Configure the required parameters for both Endpoint 1 and Endpoint 2:

Parameter	**Description**
Generic QoS Profile	Specifies the Generic QoS Profile to be used
CIR	Specifies the Committed Information Rate in Kbps.
PIR	Specifies the Peak Information Rate in Kbps.
CBS	Specifies the Committed Burst Size in KB.

Parameter	Description
MBS	Specifies the Maximum Burst Size in KB.

8

Click Submit. The bandwidth modification task is scheduled.

END OF STEPS

17 Autonomous System Optimizer

17.1 About

17.1.1

The Autonomous System Optimizer application is used to steer traffic on monitored routers, on a per-destination-AS-basis, to alternate next hops. Steering per destination AS implies that steering will be performed for all prefixes associated with a given destination AS. The NRC-P will automatically correlate the destination AS number to the set of prefixes associated with it. Steering is accomplished using the NRC-P OpenFlow controller, by automatically adding an OpenFlow flow rule per destination subnet. This allows the user to offload high traffic usage from the uplinks onto alternate paths on a per-AS-basis.

Users can monitor traffic distribution on a set of uplinks so that link congestion and/or high bandwidth utilization can be identified per AS. The traffic monitoring is accomplished by collecting flow statistics, per AS, on Nokia 7750, 7450, and 7950 routers. These flow statistics are then communicated to the collector with IPFIX record encoding.

The application allows users to identify the set of top bandwidth consumption per destination AS, while the set of destination subnets associated with a given AS are automatically identified. Threshold Crossing Alarms (TCAs) on the monitored links can be tracked and a user can plot both real-time and historical port utilization.

17.2 Flow steering

17.2.1

This section describes the steering of flows using the Autonomous System Optimizer application.

17.2.2 “To steer flows to next hops for autonomous systems” (p. 159)

17.2.3 “To steer flows to next hops for VIP customers” (p. 160)

17.2.4 “To configure next hop trackers” (p. 161)

17.2.5 “To create next hop trackers” (p. 162)

17.2.2 To steer flows to next hops for autonomous systems

1

From the AS page of the Autonomous System Optimizer application, click on the Steer AS button. The Steer Flows form opens.

2

Choose one or more destination ASes from the drop-down menu and click CONTINUE.

3

Perform one of the following:

a. Choose a next hop from the Select Next Hop drop-down menu and click CONTINUE.

b. Enter a valid IPv4 IP address in the Custom Next Hop field and click CONTINUE.

4

Verify your changes and click FINISH. The new flow is added.

END OF STEPS

17.2.3 To steer flows to next hops for VIP customers

1

Perform one of the following:

a. From the VIP customers page of the Autonomous System Optimizer application, click on the Subnets button. The Subnets page opens. Continue to Step 2.

b. From the Steering Diagram page of the Autonomous System Optimizer application, select a VIP customer from the list of Top Traffic Contributors and click on the CUSTOM STEERING button. The Steer Flows form opens. Go to step Step 3.

c. From the VIP customers page of the Autonomous System Optimizer application, click on the Steer VIP customer button. The Steer Flows form opens. Go to Step 4.

2

Click on the Steer VIP Subnets button. The Steer Flows form opens. Go to step Step 4.

3

Click on the BACK button.

4

Perform one of the following:

a. Click CONTINUE.

b. Enable the *Steer all subnets not already steered* checkbox and click CONTINUE.

c. With the *Steer all subnets not already steered* checkbox enabled, delete subnets from the Selected Subnets drop-down menu to achieve partial steering of the VIP customer. Click CONTINUE.

d. With the *Steer all subnets not already steered* checkbox disabled, choose one or more subnets from the Subnet(s) to steer drop-down menu and click CONTINUE.

5

Perform one of the following:

a. Choose a next hop from the Select VIP Next Hop drop-down menu and click CONTINUE.

b. Choose a next hop from the Select Next Hop drop-down menu and click CONTINUE.

c. Enter a valid IPv4 IP address in the Custom Next Hop field and click CONTINUE.

6

Verify your changes and click FINISH. The new flow is added.

END OF STEPS

17.2.4 To configure next hop trackers

1

From the Settings page of the application, click on Tracker Settings.

2

As required, configure the following parameters:

Parameter	Description
AS Tracker Measurement Period (sec)	The frequency (in seconds) of reachability tests destined for non-VIP next hops
VIP Tracker Measurement Period (sec)	The frequency (in seconds) of reachability tests destined for VIP next hops
AS Tracker Measurement Threshold	Within a test destined for a non-VIP next hop, specifies the number of failed packets that will constitute reachability failure and trigger automatic unsteering (if configured)
VIP Tracker Measurement Threshold	Within a test destined for a VIP next hop, specifies the number of failed packets that will constitute reachability failure and trigger automatic unsteering (if configured)

3

Toggle AS Automatic Steering ON or OFF. When set to ON, AS traffic is automatically unsteered when the next hop is determined to be unreachable, as per the AS Tracker Measurment Period (sec) and AS Tracker Measurement Threshold parameter values.

Note: If traffic is automatically unsteered, manual re-steering will be available once the next hop is again determined to be reachable. Prior to this, the next hop will be unavailable for steering.

4

Toggle VIP Automatic Steering ON or OFF. When set to ON, VIP traffic is automatically unsteered when the next hop is determined to be unreachable, as per the VIP Tracker Measurment Period (sec) and VIP Tracker Measurement Threshold parameter values.

Note: If traffic is automatically unsteered, manual re-steering will be available once the next hop is again determined to be reachable. Prior to this, the next hop will be unavailable for steering.

END OF STEPS

17.2.5 To create next hop trackers

1

From the Settings page of the application, click on Next Hop Trackers, then click on Add Next Hop Trackers. The Add Next Hop Trackers form opens.

2

Configure the following parameters:

Parameter	Description
Monitored Router	The unique identifier for the monitored router
Next Hop IP Address/Next Hop Router IP Address	The unique identifier for the next hop bundle

3

Click SAVE. The Next Hop Tracker is created.

END OF STEPS

18 Ingress Peer Optimizer

18.1 Overview

18.1.1

The Ingress Peer Optimizer application controls and optimizes incoming traffic by monitoring statistics provided through the Deepfield system. The application monitors the traffic utilization on EBGP peering links and routers. If a link becomes congested, the Ingress Peer Optimizer moves the traffic between peer routers to a less used link. The traffic move is based on the selection of corresponding routes with the selected statistical information, such as prefix and community, according to predefined policies.

18.2 To set up the application

18.2.1

The first time you start the Ingress Peer Optimizer, the application opens the Application Setup page. At the setup stage you need to select the Inbound Peering Model that fits your traffic steering needs and the Steering Template that the application uses to control the congestion in your network.

1

Select one of the following inbound peering models:

- Peering Only
- Extended Peering

2

Select a steering template option:

- Automated Ingress Peer Optimizer
- Manual Ingress Peer Optimizer

Note: After you selected a steering template, you can view more information about the selected option by clicking DETAILS in each template panel.

3

Click BUILD APPLICATION. The application opens the Ingress Links page.

END OF STEPS

18.2.2

You can return to the Application Setup page at any time if you need to review the configured inbound peering model and the steering template. Then click RETURN TO APPLICATION to leave the Application Setup.

You can also change the inbound peering model and the steering template, but you must first reset the application.

18.3 To configure the BGP peering topology

18.3.1

After performing the initial setup, the application opens the Ingress Links page. This is the main page of the Ingress Peer Optimizer application.

The Ingress Links page shows the topology of the peer routers whose traffic the Ingress Peer Optimizer monitors and optimizes, but is empty after the application setup. You need to configure your BGP peering topology.

1

Click SET BGP PEERING TOPOLOGY. The BGP Peer Topology page opens.

On this page, you can configure the optimization slices, border routers, neighbors and links that make up you network topology. When you open the page for the first time, it contains only a default slice.

Adding an optimization slice

2

Click ADD OPTIMIZATION SLICE. The Add Optimization Slice form opens.

3

Configure the required slice parameters.

Parameter	Description
Slice Name	Type the name of the slice.
Site	Click ADD SITE, and type a site name. You can add one or multiple sites to a slice.

4

Click CREATE. The application creates the optimization slice and returns to the BGP Peer Topology page.

Adding a border router

5

Click ADD above the Border Routers graphic. The Add Border Router to: *SliceName* form opens.

6

Configure the required border router parameters.

Parameter	Description
Router	Select a border router.
Site	Select the router site.
AS Number	Type the number of the AS that includes the border router.

7

Click ADD. The application adds the border router to the slice.

Adding a neighbor

8

Click ADD above the Neighbors graphic. The Add Neighbor form opens.

9

Configure the required neighbor parameters.

Parameter	Description
Name	Type the name of the neighbor.
AS Number	Type the number of the AS that includes the neighbor.

10

Click ADD. The application adds the neighbor to the topology.

Adding a link

11

Click ADD above the Links graphic. The Add Link to: *SliceName* form opens.

12

Configure the required link parameters.

Parameter	Description
Border Router	Select a border router.
Local Export Policy Name	Type the name of the local export policy that you need to use. The name must match that of the BGP policy that you defined on the router.
Local Interface IP Address	Type the IP address of the interface configured on the router.
Local Interface Id (optional)	Type the index of the interface configured on the router.
Neighbor	Select a neighbor to peer with the border router.
Remote Interface IP Address	Type the IP address of the interface configured on the neighbor router.
Remote Interface Id (optional)	Type the index of the interface configured on the neighbor router.
Color Id (optional)	Type the value of the link group configured on the server.
ECMP Group Id (optional)	Type the ID of the ECMP (Equal Cost Multipath) configured on the router.

13

Click ADD. The application adds the link to the slice.

14

Click the left arrow in the top left corner of the BGP Peer Topology page to return to the Ingress Links page.

END OF STEPS

18.4 To configure traffic optimization automation

18.4.1

The automation of traffic optimization enables the Ingress Peer Optimizer application to steer the traffic automatically when a link utilization reaches a threshold.

1

On the Ingress Links page, click the More... menu and choose Automation. The Automation page of the Ingress Peer Optimizer application opens.

2

Turn the Automation ON or OFF, as required.

Automation parameters

3

Configure the required automation parameters.

Parameter	Description
BGP policy deployment time (sec)	The time between BGP policy deployment and traffic steering.
Alternate route selection rules	Choose an option to set what links the automation considers.
Enable hierarchy for alternative route selection	Select this check box to enable automation to prefer alternative links hierarchically: first links on the same router, next on the same site, and then on the same slice. If no preferred alternative links are found on a slice, the preference mechanism moves to the next slice.
Path redundancy limit	Configure the number of redundant paths allowed for a steering entity, in addition to the primary path. The default is 0, which means that the path redundancy is disabled.
Use same-color alternate link	Select this check box to restrict the selection of an alternate link only to the same color group when a link is congested.

Global Thresholds

4

Configure the required Global Thresholds parameters.

Parameter	Description
Trigger utilization (%)	When utilization exceeds the specified utilization level on a link, the application triggers automation to move traffic from that link.

Parameter	Description
Target utilization (%)	The automation attempts to reduce the utilization to just above the specified level. If this is not possible, then automation attempts to reduce the utilization to just below the specified level.
Max utilization on alternate (%)	When traffic is offloaded onto any link, the link utilization does not exceed the defined level.
Use simplified threshold colors	Select this check box to use only the red and green colors for the links.

Custom Thresholds

5

Click ADD. The Add Custom Thresholds form opens.

6

Configure the required custom threshold parameters, and save your changes.

Save Automation changes

7

Review your Automation parameter configuration and save your changes. The application also allows you to discard the changes a and revert to the initial Automation parameter configuration.

END OF STEPS

18.5 Ingress Peer Optimizer component description

18.5.1 Ingress Links page

The Ingress Links page is the main page of the Ingress Peer Optimizer application, and shows a graphical representation of your network topology. You can view your defined slices, border routers, external routers, and the links between the routers. On this page, you can perform the following tasks:

- Filter the displayed information.

  The default graphic shows all the existing peers links in your topology. You can select the High utilization links filtering option to show only the most utilized links.
- View detailed information about each topology component.

  Click an object, and the application displays all the applicable details in the Info panel.

- Navigate to other pages of the Ingress Peer Optimizer application.
  Choose a page entry from the More... menu, or click on a page icon on the title bar to navigate to that page.

18.5.2 More... menu options

The More... menu provides links to the following application pages:

- BGP Peering Topology
- BGP Communities
- Automation
- Application Setup
- Help

18.5.3 Title bar icons

The icons on the application title bar allow you to navigate to the following pages:

- Ingress Links
- Community Status
- Event History

18.6 Ingress Peer Optimizer pages

18.6.1 BGP Peering Topology

On the BGP Peering Topology page, you can build your network topology. See 18.3 “To configure the BGP peering topology” (p. 164).

18.6.2 BGP Communities

The BGP Communities page shows a table that lists all the BGP communities defined in your network. On the BGP Communities page, you can perform the following tasks:

- Add a new community
  Click ADD COMMUNITY, configure the parameters on the Add BGP Community form, and save your changes.
- Edit an existing community
  In the BGP Communities table, point to the community that you need to edit, and click Edit BGP Community. Modify the parameters in the Edit BGP Community form, as required, and save your changes.
- Delete a community
  In the BGP Communities table, point to the community that you need to delete, and click Delete BGP Community.

18.6.3 Automation

On the Automation page, you configure the Ingress Peer Optimizer application to steer the traffic when a link utilization reaches a threshold. See 18.4 “To configure traffic optimization automation” (p. 166).

18.6.4 Application Setup

On the Application Setup page, you select the Inbound Peering Model that fits your traffic steering needs and the Steering Template that the application uses to control the congestion in your network. See 18.2 “To set up the application” (p. 163).

18.6.5 Help

When you choose Help from the More... menu, the Ingress Peer Optimizer application opens a dialog box that provides instructions about accessing the online help for the application.

18.6.6 Ingress Links

The Ingress Links page shows a diagram of the slices, border routers, external routers and links configured in your network topology. On the Ingress Links page, you can perform the following tasks:

- View details about your network topology components.

  Point to any component (border router, external router or peer link) to display general information about the component.

  Click on a link, and the application displays details about the selected peer link in the Info panel, including the link capacity and current utilization, and the community traffic breakdown
- Filter the links shown in the diagram. The filtering options are All peer links and High utilization links.

18.6.7 Community Status

The Community Status page shows a table that lists all the BGP communities defined in your network. On the Community Status page, you can perform the following tasks on each link:

- View details about a community.

  Click on a community entry, and the Ingress Peer Optimizer application displays details about the community in the Info panel.
- Steer the community to a preferred link.

  Point to a community and click Steer. The Steer to Preferred Link form opens. Review the information on the form and, if required, select the Ignore utilization constraints check box. Click STEER.

18.6.8 Event History

The Event History page shows a table that lists steering events that occurred in your network. On the Community Status page, you can perform the following tasks:

- View details about an event. Click on an event in the table, and the Ingress Peer Optimizer application displays details about the event in the Info panel.
- Filter the events by the period they occurred. The filtering options are: Last hour, Last 4 hours, Last 8 hours, Last 24 hours and Last week.

You can use the Event History details to review and analyze the steering events that happened in your network during the selected interval.

19 Latency Steering Optimizer

19.1 About

19.1.1

The Latency Steering Optimizer application allows for traffic from an entry point router to a specific destination to be routed onto a path with the least possible latency.

19.2 Getting started

19.2.1

This section describes the configuration of various objects using the Latency Steering Optimizer application.

19.2.2 To add an NE point

1

From the Settings page of the Latency Steering Optimizer application, click on NE points.

2

Perform one of the following:

a. To delete an NE point, click on the Delete button inline with the desired NE point. No further action is required.

b. To add an NE point, click on ADD NE POINT. The Add NE point form opens. Continue to Step 3.

3

Select a router from the list to monitor.

4

If required, select the datapath ID of the OF switch to be used from the drop-down menu.

5

If required, enable the Border Router checkbox to identify the NE point as a border router.

6

Click SAVE. The NE point is added.

END OF STEPS

19.2.3 To add or modify a destination site

1

From the Settings page of the Latency Steering Optimizer application, click on Destination sites.

2

Perform one of the following:

a. To delete a destination site, click on the Delete button inline with the desired site. No further action is required.

b. To add a destination site, click ADD DESTINATION SITE. The Add Destination Site form opens. Continue to Step 3.

c. To modify a destination site, click on the Edit button inline with the desired site. The Edit Destination Site form opens. Continue to Step 3.

3

Configure the Site Name parameter.

4

If required, click ADD POINT to add a destination point, then configure the Name and Probe IP Address parameters.

Alternatively, click on the Delete Point button inline with any point to delete that point.

5

Click on the Add Subnet(s) button.

6

Click ADD SUBNET, then enter a subnet prefix in the provided field.

Alternatively, click on the Delete Subnet button inline with any subnet to delete that subnet.

7

Click DONE. Subnet configurations are saved.

8

Click SAVE. The Destination site is added/modified.

END OF STEPS

19.2.4 To modify an internal connection

1

From the Settings page of the Latency Steering Optimizer application, click on Internal connections.

2

To modify an internal connection, click on the Edit button inline with the desired connection. The Edit connection form opens.

3

Choose whether or not to set latency for the connection by enabling the appropriate option.

4

If you chose to set latency for the connection in Step 3, enter a latency value (in milliseconds) in the provided field.

5

Click UPDATE. The internal connection is modified.

END OF STEPS

19.2.5 To add or modify an external connection

1

From the Settings page of the Latency Steering Optimizer application, click on External connections.

2

Perform one of the following:

a. To delete an external connection, click on the Delete button inline with the desired connection. No further action is required.

b. To add an external connection, click ADD CONNECTION. The Add connection form opens. Continue to Step 3.

c. To modify an external connection, click on the Edit button inline with the desired connection. The Edit connection form opens. Continue to Step 5.

3

Select a Border Router from the drop-down menu.

4

Select a Destination site from the drop-down menu, then select a Destination point.

5

Choose whether or not to set latency for the connection by enabling the appropriate option.

6

If you chose to set latency for the connection in Step 5, enter a latency value (in milliseconds) in the provided field.

7

Click SAVE or UPDATE. The external connection is added/modified.

END OF STEPS

19.2.6 To configure Latency optimization settings

1

From the Settings page of the Latency Steering Optimizer application, click on Latency optimization settings.

2

Perform one of the following:

a. Toggle Automatic Steering ON or OFF.

b. Toggle Automatic Latency Measurement ON or OFF. If ON, enter an Automatic latency measurement interval (in seconds) in the provided field.

c. Specify (in percentage) the Latency Steering Optimization Threshold.

3

Click SAVE. Your configurations are saved.

END OF STEPS

20 Traffic Steering Controller

20.1 About

20.1.1

The Traffic Steering Controller application allows for the manipulation of flow rules, such as the addition or deletion of flow rules using the NRC-P OpenFlow controller. The application also allows flow tables from the OpenFlow switches of any 7x50 router within a network to be displayed. Nokia SROS OpenFlow Experimenters are supported, and can redirect traffic to alternate next hops, using plugins.

20.2 Flow management

20.2.1

This section describes the management of flows using the Traffic Steering Controller application.

20.2.2 “To add a flow entry” (p. 177)

20.2.2 To add a flow entry

1

Perform one of the following:

a. To add a flow from the Switches page of the application, perform the following:
   1. Select a switch from the list. The Switch Details form opens.
   2. Click on the Actions button and choose Add Flow Entry from the contextual menu. The Add Flow Entry form opens.

b. From the Flows page of the application, click on the Add Flow Entry button. The Add Flow Entry form opens.

2

Configure the following parameters:

Parameter	Description
Application ID	The ID of the application that deployed the flow. Negative numbers are reserved and should not be used.
Cookie	The hexadecimal, controller-issued ID for the flow
Priority	The priority of the flow

3

As required, click on the Add Match Criteria button and choose one or more of the followingmatch criteria to add.

4

Populate the corresponding field for any added match criteria, then click CONTINUE.

5

Choose an instruction type from the drop-down list.

6

As required, click Add Action to add additional actions, then click Finish. The flow entry is created.

END OF STEPS

20.2.3 To view flow entries

1

Perform one of the following:

a. To search for a flow from the Switches page of the application, perform the following:
   1. Select a switch from the list. The Switch Details form opens.
   2. Click on the Actions button and choose View Flow Entries from the contextual menu. The View Flow Entries form opens.

b. From the Flows page of the application, click on the View Flow Entries button. The View Flow Entries form opens.

2

Click Add Filter to add one or more attributes for which to filter.

3

From the drop-down menu, select one or more table columns to display on the results screen.

4

To undo any previous selections, click RESTORE DEFAULT.

5

Click APPLY. The results are displayed on the Flows page of the application.

6

If required, click Add Filter to apply attributes for which to filter.

End of steps

21 IP/MPLS Optimization

21.1 About

21.1.1

The IP/MPLS Optimization application provides a view of the IGP topology and PCE LSPs. It also displays the status of the IGP network and provides functionality to optimize the network resources.

21.2 Getting started

21.2.1

This section describes the tasks you must perform in order to use the IP/MPLS Optimization application.

21.2.2 To find a path

1

From the Network Map page of the application, click on the Path Finder icon.

2

Configure the following parameters:

Parameter	Description
Source	The network element that will serve as the source for the path
Destination	The network element that will serve as the destination for the path
Secondary Source	The network element that will serve as the secondary source for the path
Secondary Destination	The network element that will serve as the secondary destination for the path

Parameter	Description
Objective	The primary goal when identifying paths for path computation
Path Type	The signalling type to be used for the path
Disjoint	The Disjoint mode to be used in path computation
Bidirectional	The birdirectional mode to be used in path computation
Max Hops (span)	The Max Hops constraint to be used in path computation
Max Cost	The Max Cost constraint to be used in path computation
Max Latency	The Max Latency constraint to be used in path computation
Max TE Metric	The Max TE Metric constraint to be used in path computation
Bandwidth (Mbps)	Specifies the bandwidth required for the path

3

Click SHOW. The optimal path is highlighted on the topology map.

END OF STEPS

21.2.3 To create PCE-initiated LSPs

1

From the LSPs page of the application, click on the Create PCE LSP icon.

2

Configure the required parameters:

Parameter	Description
Path Name	The name of the PCE-initiated LSP
PCC Address	The address of the PCC
Objective (Optimize on)	Specifies the primary goal when identifying path resources
Max Hops (Span)	Specifies the maximum number of hops to consider

Parameter	Description
Bandwidth (Mbps)	Specifies the bandwidth required for the LSP
Include Any Bit Pos	Specifies any bit between 0 and 31 to exclude
Exclude Any Bit Pos	Specifies any bit between 0 and 31 to exclude
Path Type	Specifies the type of path (must be Segment Routing)
Source	Specifies the source node for the path
Destination	Specified the destination node for the path
Profile ID	Specifies the identifier of the path profile to apply
Group ID	Specifies the identifier of the group to which this LSP belongs

3

Click SAVE. The PCE-initiated LSP is created.

END OF STEPS

21.2.4 To place a link set into maintenance mode

When a link set is placed into maintenance mode, the LSPs riding the link set must be rerouted. This can be done manually or automatically.

In order for the NRC-P to reroute these LSPs automatically, the nrcp block of the */opt/nsp/configure/config/arm-system.conf* file must be modified as follows:

```
nrcp {

nrcp_link_maintenance_policy="swift"

bgpLs

{

  isTopoSourceBgpLS=true

}

}
```

When maintenance mode is deactivated for a link set, and the above modification has been made, the LSPs will automatically return to their original link set.

1

Perform one of the following:

a. From the Network Map page of the application, select an IGP link on the map and click on the Info button.

b. From the Link List page of the application, select an IGP link from the list.

2

Click on the More... button and choose Activate Maintenance Mode for Link Set. A confirmation window opens.

3

Click OK. The confirmation window closes and the link set is placed into maintenance mode.

Note: If the NRC-P has not been configured to automatically reroute LSPs whose link set has been placed into maintenance mode, these LSPs will need to be manually rerouted.

4

To deactivate maintenance mode for a link set, click on the More... button and choose Deactivate Maintenance Mode for Link Set. A confirmation window opens.

5

Click OK. The confirmation window closes and maintenance mode is deactivated for the link set.

Note: If the NRC-P has not been configured to automatically reroute LSPs whose link set has been placed into maintenance mode, these LSPs will need to be manually returned to their original link set.

END OF STEPS

21.2.5 To create a path profile policy

1

From the Policy List page of the application, choose Path Profiles from the drop-down menu and click CREATE POLICY. The Create Path Profile policy form opens.

2

Configure the required parameters:

Parameter	Description
Reserved Profile ID	When this parameter is enabled, the Path Profile template assumes the Name and role of the default Path Profile template

Parameter	Description
Name	The name of the Path Profile template
Profile ID	The Profile ID of the paths to be included in path computation
Bidirectional	The bidirectional mode to be used in path computation
Disjoint	The Disjoint mode to be used in path computation
Optimize on (Objective)	Specifies the primary goal when identifying paths for path computation
Bandwidth Strategy	Specifies the strategy to use for LSP bandwidth in the path computation
Explicit Route Strategy	Specifies the explicit route strategy for the service
Control Route Strategy	Specifies the strategy to use when recomputing the path
Max Hops (span)	Specifies the Max Hops constraint to be used in path computation
Max Cost	Specifies the Max Cost constraint to be used in path computation
Max TE Metric	Specifies the Max TE Metric constraint to be used in path computation
Max Latency	Specifies the maximum latency to consider
Description	Describes the Path Profile template

3

As required, Exclude Route Objects by adding the IP address(es) of the object(s) to be excluded.

4

As required, Include Route Objects by adding the IP address(es) of the object(s) to be included. You must also specify Hop Type.

5

Click CREATE. The Path Profile policy is created.

END OF STEPS

21.2.6 To create a router ID mapping policy

1

From the Policy List page of the application, choose Router ID Mapping from the drop-down menu and click CREATE POLICY. The Create Router ID Mapping Policy form opens.

2

Configure the required parameters:

Parameter	Description
Name	Specifies the name of the Router ID Mapping template
System IP Address	Specifies the system IP address of the router
System Name	Specifies the router system name
PCC Address	Specifies the address of the PCC associated with the router
Description	Specifies the router description
Router Info	Click ADD to add as many Router Info entries, as required. For each Router Info entry, you must specify the following information: • Network Identifier • AS Number • BGP-LS ID (topology identifier) • Router ID • Protocol (the protocol that the IGP router is using)

3

Click CREATE. The Router ID Mapping policy is created.

END OF STEPS

21.2.7 To modify the system IP MPLS configuration policy

1

Perform one of the following:

a. From the Policy List page of the application, choose System IP MPLS Configuration from the drop-down menu and click CREATE POLICY. The Edit System IP MPLS Configuration form opens.

b. From the Policy List page of the application, click on the Edit button inline with the System IP MPLS Configuration policy. The Edit System IP MPLS Configuration form opens.

2

Configure the required parameters:

Parameter	Description
Description	Describes the System IP MPLS Configuration policy
Maintenance Mode	Specifies whether or not links are placed into maintenance mode automatically or manually

3

Click SAVE. The System IP MPLS Configuration policy is modified.

END OF STEPS

22 IP/MPLS Simulation

22.1 About

22.1.1

The IP/MPLS Simulation application allows for modifications to IGP topology, PCE LSPs, links, and a variety of policies within a simulated environment.

22.2 Getting started

22.2.1

This section describes the tasks you must perform in order to use the IP/MPLS Simulation application.

22.2.2 “To find a path” (p. 189)

22.2.3 “To create PCE-initiated LSPs” (p. 190)

22.2.4 “To turn down a link set” (p. 191)

22.2.5 “To create a path profile policy” (p. 192)

22.2.6 “To create a router ID mapping policy” (p. 193)

22.2.2 To find a path

1

From the Network Map page of the application, click on the Path Finder icon.

2

Configure the following parameters:

Parameter	Description
Source	The network element that will serve as the source for the path
Destination	The network element that will serve as the destination for the path
Secondary Source	The network element that will serve as the secondary source for the path
Secondary Destination	The network element that will serve as the secondary destination for the path

Parameter	Description
Objective	The primary goal when identifying paths for path computation
Path Type	The signalling type to be used for the path
Disjoint	The Disjoint mode to be used in path computation
Bidirectional	The birdirectional mode to be used in path computation
Max Hops (span)	The Max Hops constraint to be used in path computation
Max Cost	The Max Cost constraint to be used in path computation
Max Latency	The Max Latency constraint to be used in path computation
Max TE Metric	The Max TE Metric constraint to be used in path computation
Bandwidth (Mbps)	Specifies the bandwidth required for the path

3

Click SHOW. The optimal path is highlighted on the topology map.

END OF STEPS

22.2.3 To create PCE-initiated LSPs

1

From the LSP List page of the application, click on the Create PCE LSP icon.

2

Configure the required parameters:

Parameter	Description
Path Name	The name of the PCE-initiated LSP
PCC Address	The address of the PCC
Objective (Optimize on)	Specifies the primary goal when identifying path resources
Max Hops (Span)	Specifies the maximum number of hops to consider

Parameter	Description
Bandwidth (Mbps)	Specifies the bandwidth required for the LSP
Include Any Bit Pos	Specifies any bit between 0 and 31 to exclude
Exclude Any Bit Pos	Specifies any bit between 0 and 31 to exclude
Path Type	Specifies the type of path (must be Segment Routing)
Source	Specifies the source node for the path
Destination	Specified the destination node for the path
Profile ID	Specifies the identifier of the path profile to apply
Group ID	Specifies the identifier of the group to which this LSP belongs

3

Click SAVE. The PCE-initiated LSP is created.

END OF STEPS

22.2.4 To turn down a link set

1

Perform one of the following:

a. To turn down a link set from the Network Map page of the application, perform the following:
   1. Select an IGP link on the map and click on the Info button.
   2. Click on the More... button and choose Turn Link Set Down. The link set is turned down.

b. To turn down a link set from the Link List page of the application, perform the following:
1. From the Link List page of the application, select an IGP link from the list.
2. Click on the Turn Link Down button inline with the desired link. The link, and the other member of its set, is turned down.

2

Click SIMULATE. The Simulation Results form opens.

3

Click DETAILS to view a list of LSPs affected by the configuration.

Note: This list can be revisited by clicking on the Simulation Results tab. Only the results of the most recent configuration are displayed.

4

As required, perform one of the following:

a. To return a link set to an operational state from the Network Map page of the application, perform the following:

1. On the map, select an IGP link that is operationally down and click on the Info button.
2. Click on the More... button and choose Turn Link Set Up. The link set is turned down.

b. To return a link set to an operational state from the Link List page of the application, perform the following:

1. From the Link List page of the application and select an operationally down IGP link from the list.
2. Click on the Turn Link Up button inline with the desired link. The link, and the other member of its set, is turned up.

END OF STEPS

22.2.5 To create a path profile policy

1

From the Policy List page of the application, choose Path Profiles from the drop-down menu and click CREATE POLICY. The Create Path Profile policy form opens.

2

Configure the required parameters:

Parameter	Description
Reserved Profile ID	When this parameter is enabled, the Path Profile template assumes the Name and role of the default Path Profile template
Name	The name of the Path Profile template
Profile ID	The Profile ID of the paths to be included in path computation
Bidirectional	The bidirectional mode to be used in path computation
Disjoint	The Disjoint mode to be used in path computation
Optimize on (Objective)	Specifies the primary goal when identifying paths for path computation

Parameter	Description
Bandwidth Strategy	Specifies the strategy to use for LSP bandwidth in the path computation
Explicit Route Strategy	Specifies the explicit route strategy for the service
Control Route Strategy	Specifies the strategy to use when recomputing the path
Max Hops (span)	Specifies the Max Hops constraint to be used in path computation
Max Cost	Specifies the Max Cost constraint to be used in path computation
Max TE Metric	Specifies the Max TE Metric constraint to be used in path computation
Max Latency	Specifies the maximum latency to consider
Description	Describes the Path Profile template

3

As required, Exclude Route Objects by adding the IP address(es) of the object(s) to be excluded.

4

As required, Include Route Objects by adding the IP address(es) of the object(s) to be included. You must also specify Hop Type.

5

Click CREATE. The Path Profile policy is created.

END OF STEPS

22.2.6 To create a router ID mapping policy

1

From the Policy List page of the application, choose Router ID Mapping from the drop-down menu and click CREATE POLICY. The Create Router ID Mapping Policy form opens.

2

Configure the required parameters:

Parameter	Description
Name	Specifies the name of the Router ID Mapping template
System IP Address	Specifies the system IP address of the router
System Name	Specifies the router system name
PCC Address	Specifies the address of the PCC associated with the router
Description	Specifies the router description
Router Info	Click ADD to add as many Router Info entries, as required. For each Router Info entry, you must specify the following information: • Network Identifier • AS Number • BGP-LS ID (topology identifier) • Router ID • Protocol (the protocol that the IGP router is using)

3

Click CREATE. The Router ID Mapping policy is created.

END OF STEPS

23 Modeled Device Configurator

23.1 Overview

23.1.1

The MDC allows the user to configure parameters and view state information defined in the NE adaptation schema.

The schemas displayed by MDC may vary based on the adaptors that are installed. For example, an SR device will have a config schema and a state schema. The state schema is read-only.

The MDC displays the NE parameters. Choose Show Configured from the drop-down menu at the top of the page to view only the configured parameters on the NE. Choose Show All to view all of the available parameters, including parameters with default values.

23.1.2 Performing configuration

You can configure multiple parameters on the displayed branch of the NE schema. When changing levels within the schema, you will be prompted if there are un-submitted changes. When a configuration change is submitted, a progress bar appears and then a success or failure message is returned by the NE.

The MDC reads and writes NE data through the MDM adaptation. The MDC performs syntax checks according to what is defined in the device adaptation YANG model, e.g. string length, max value, etc. Further validation may be handled by the device at commit time.

If configuration is committed successfully, it is applied to the running configuration on the NE through the device adaptation. Persistence may require device specific configuration on the NE; see the NE documentation.

If the commit operation fails, the failure message will provide the reason for the failure. The application will continue to display your configured values, allowing you to edit and commit again.

23.2 To create an object

23.2.1

1

In the MDC application, click in the Search field. A list of NEs that were discovered using the Device Administrator application and have deployed MDC adaptors appears.

You can use the filter to find a specific NE using NE ID, NE Name, Node Type, or Version.

2

Double-click on an NE. A list of available schemas for the NE appears.

3

Click on a schema in the list to view the specific attributes of the schema.

4

Navigate through the different branches of each schema to the object you want to create.

To navigate to a previous configuration window, click on the desired object in the Root > path.

5

Click CREATE *n* and configure the applicable parameters.

6

Once the desired object instance parameters are configured, click CREATE.

The newly created object appears in the list.

END OF STEPS

23.3 To modify an existing object

23.3.1

1

In the MDC application, click in the Search field. A list of NEs that were discovered using the Device Administrator application and have deployed MDC adaptors appears.

You can use the filter to find a specific NE using NE ID, NE Name, Node Type, or Version.

2

Double-click on an NE. A list of available schemas for the NE appears.

3

Click on a schema in the list to view the specific attributes of the schema.

4

Navigate through the different branches of each schema to the object you want to modify.

To navigate to a previous configuration window, click on the desired object in the Root > path.

5

Configure the applicable parameters and click SUBMIT to commit the changes.

END OF STEPS

23.4 To delete an object

23.4.1

1

In the MDC application, click in the Search field. A list of NEs that were discovered using the Device Administrator application and have deployed MDC adaptors appears.

You can use the filter to find a specific NE using NE ID, NE Name, Node Type, or Version.

2

Double-click on an NE. A list of available schemas for the NE appears.

3

Click on a schema in the list to view the specific attributes of the schema.

4

Navigate through the different branches of each schema to the object you want to delete.

To navigate to a previous configuration window, click on the desired object in the Root > path.

5

Delete the object.

END OF STEPS

24 Cross Domain Coordinator

24.1 About

24.1.1

The Cross Domain Coordinator application enables the automatic discovery of cross domain links between IP and optical networks. In addition, it realizes a fine-grained, multi-layer correlation of topology properties such as Shared Risk Groups (SRG) and latency to improve the IP service performance and resiliency. The application can be manually synchronized with other NSP applications, thereby achieving full integration.

24.2 Getting started

24.2.1

This section describes procedures that are required to use the Cross Domain Coordinator application.

24.2.2 To configure the Network Map

1

Choose Network Map from the drop-down menu, then choose a domain from the Domains drop-down menu. The chosen domain is visualized on the map.

2

As required, click on any of the following map control buttons/sliders to customize your view:

- Fit To Screen - Automatically lay out the network map to fit within the confines of your screen
- Adjust Vertexes - Open the Vertex Controls panel
- Vertex labels - Toggles vertex labels on or off
- Vertex size - Increases or decreases the size of on-screen vertexes
- Clustering - Toggles clustering on or off
- Dynamic cluster size - Specifies whether or not the size of on-screen clusters should scale dynamically
- Cluster distance - Increases or decreases the amount of vertexes that can be contained within a single cluster
- Cluster threshold for network - Increases or decreases the number of network elements the network will support before clustering is implemented
- Cluster threshold for screen - Increases or decreases the number of network elements the application will allow to appear on screen before clustering is implemented
- Adjust Links - Opens the Link Controls panel
- Show Links - Toggles the appearance of links on the map on or off
- Link curvature - Increases or decreases the curvature of links on the map
- Link grouping threshold - Specifies the number of links that can exist between the same two vertexes before grouping is implemented
- Link increment factor - Increases or decreases the distance between links that exist between the same two vertexes
- Show link count - Toggles link counts on or off
- Zoom in - Zooms in on the map as centered
- Zoom out - Zooms out from the map as centered

3

Select an object on the map to view more information about the selected object.

4

Click on the Legend button to learn more about the icons and colors used on the map.

5

Click on the View Options button and perform any of the following:

1. Enable highlighting for one or more of the following:
   - Cross Domain Links
   - IP Domain
   - Optical Domain
2. If Link Layer Interconnects are present, click on the ADD LINK LAYER INTERCONNECT(S) button. A form opens:

- Enable the Identify individual links radio button to search for individual LLI links by name, or enable the Identify all links in a group radio button to search for groups of LLI links by name.
- Select up to five LLI links, then click DONE. The LLI links are highlighted on the map.

3. If optical services are present, click on the ADD OPTICAL SERVICES button. A form opens:
   a. Enable the Identify individual services radio button to search for individual optical services by name, or enable the Identify all services in a group radio button to search for groups of optical services by name.
   b. Select up to five optical services, then click DONE. The optical services are highlighted on the map.

6

Click on the Refresh Map button to reload the page.

Note: The UI, including the map, is automatically updated.

END OF STEPS

24.2.3 To manage clustered objects

This procedure can be used to perform a variety of actions on clustered objects. For more information about enabling clustering, see 24.2.2 “To configure the Network Map” (p. 199).

1

To hide a cluster, perform the following:

1. Select a cluster, then right-click and choose Hide from the contextual menu. The cluster is hidden from the network map.
2. Click on the icon that appears at the bottom of the screen to toggle cluster visibility on or off.

2

To expand a cluster, perform the following:

1. Select a cluster, then right-click and choose Expand from the contextual menu. The cluster is expanded on the network map.
2. Close the popup that appears at the bottom of the screen to return the objects to a clustered state.

3

To filter on a cluster, perform the following:

1. Select a cluster, then right-click and choose Filter from the contextual menu. The cluster is isolated on the network map.
2. Close the popup that appears at the bottom of the screen to stop filtering on the cluster.

END OF STEPS

24.2.4 To import existing cross domain links

1

Choose Cross Domain Links from the drop-down menu, then click on the Sync with Network icon. All existing cross domain links are imported into the Cross Domain Coordinator application and appear in the list.

2

As required, perform 24.2.7 “To delete cross domain links” (p. 203) to delete a cross domain link.

END OF STEPS

24.2.5 To automatically discover cross domain links

1

Choose Cross Domain Links from the drop-down menu, then click on the Discover Cross Domain Links icon. The Discover Cross Domain Links form opens.

2

Specify one of more LLDP discovery methods and click CONTINUE.

3

Choose a Context Type and, if required, select one or more Discovery Targets from the displayed list. Click CONTINUE.

4

Click START and monitor the Discovery Progress until completion. Close the Discover Cross Domain Links form.

5

As required, perform 24.2.7 “To delete cross domain links” (p. 203) to delete a cross domain link.

6

As required, click on the Commit button inline with any discovered cross domain link to commit that link.

END OF STEPS

24.2.6 To manually create cross domain links

1

Choose Cross Domain Links from the drop-down menu, then click on the Create Physical Links icon. The Create Physical Links form opens.

2

Configure the parameters:

Parameter	Description
Description	A custom description of the cross domain link
Latency	The amount of latency for the cross domain link

3

Choose an NE and Port to serve as the First Endpoint.

4

Choose an NE and Port to serve as the Second Endpoint.

5

Click CREATE. The manually-created cross domain link appears in the list.

6

As required, perform 24.2.7 “To delete cross domain links” (p. 203) to delete a cross domain link.

END OF STEPS

24.2.7 To delete cross domain links

1

Choose Cross Domain Link from the drop-down menu. A list of existing Cross Domain Links is displayed.

2

Click on the Delete button inline with any Cross Domain Link to delete that link. A dialog box opens. Perform one of the following:

a. If a Link Layer Interconnect link is riding on the link, perform Step 3.

b. If no Link Layer Interconnect link is riding on the link, perform Step 4.

3

As required, enable the Delete Optical Infrastructure radio button. When this button is enabled, the underlying infrastructure of the LLI link (such as the optical services) is also deleted. If this button is not enabled, the underlying infrastructure is preserved for future use. Continue to Step 4.

4

Click DELETE. The specified action is taken.

END OF STEPS

24.2.8 To upload or withdraw optical SLRG and/or latency

1

Perform one of the following:

a. To upload or withdraw optical SLRG and/or latency on an IGP running over the optical network, choose Network Map from the drop-down menu. Proceed to Step 2.

b. To upload or withdraw optical SLRG and/or latency on an IGP link running over the optical network, choose IP-Optical Correlation from the drop-down menu. Go to Step 4.

2

Select a link on the map and click on the Info button. Information for that link is displayed.

3

Click on the Navigate to IGP Links button. A list of IGP links riding over the selected link is displayed.

4

Perform one of the following:

a. Click on the IP-Optical Upload/Withdraw icon at the top of the screen to perform a bulk modification of IGP links.

b. Click on the IP-Optical Upload/Withdraw icon inline with an IGP link to modify that link.

5

Choose one of the following from the contextual menu:

- **Upload SRLG** - optical Shared Risk Link Groups (SRLGs) are retrieved from transport controllers, correlated with the corresponding IP links, and exported into the NRC-P in order to ensure optical diversity
- **Upload Latency** - optical latency information is retrieved from the NRC-T, correlated with the corresponding IP links, and propagated into the NRC-P in order to circumvent delay measurements within the IP layer
- **Upload SRLG and Latency** - both SRLGs and Latency information are retrieved and uploaded

- **Withdraw SRLG** - previously-uploaded SRLGs are withdrawn
- **Withdraw Latency** - previously-uploaded Latency is withdrawn
- **Withdraw SRLG and Latency** - previously-uploaded SRLGs and Latency are withdrawn

END OF STEPS

24.2.9 To place link sets into maintenance mode

1

Perform one of the following:

a. Choose Network Map from the drop-down menu, then select a link on the map. Proceed to step Step 2.

b. Choose IP-Optical Correlation from the drop-down menu. Go to Step 3.

2

Click on the Navigate to IGP Links button. A list of IGP links riding over the selected link is displayed.

3

Click on the Activate Maintenance Mode for Link Set button inline with an IGP link to place the link set into maintenance mode. A dialog box opens.

4

Click OK. The link set is placed into maintenance mode.

END OF STEPS

24.2.10 To import existing Link Layer Interconnect links

1

Choose Link Layer Interconnect from the drop-down menu, then click on the Sync with Network icon. All existing LLI links are imported into the Cross Domain Coordinator application and appear in the list.

2

As required, click on the Delete button inline with any imported LLI link to delete that link.

END OF STEPS

24.2.11 To manually create Link Layer Interconnect links

1

Choose Link Layer Interconnect from the drop-down menu, then click on the Create Link Layer Interconnect icon. The Create Link Layer Interconnect form opens.

2

Configure the parameters:

Parameter	Description
Description	A custom description of the LLI link
Group	The name of the group to which the LLI link will belong

3

Choose an NE and Port to serve as the First Endpoint.

4

Choose an NE and Port to serve as the Second Endpoint.

5

Click CREATE. The manually-created Link Layer Interconnect appears in the list.

6

As required, click on the Delete button inline with any created LLI link to delete that link.

END OF STEPS

24.2.12 To view Link Layer Interconnect links on a multi-layer map

1

Choose Link Layer Interconnect from the drop-down menu. A list of existing Link Layer Interconnect links is displayed.

2

Click on the Multi-Layer View button inline with any LLI link to view that link on a multi-layer map, which can include the following layers (depending on the selected link):

- LLI
- Switched Ethernet
- DSR
- Physical

3

See 24.2.2 “To configure the Network Map” (p. 199) for more information about the on-screen controls that can be used to configure the multi-layer map.

END OF STEPS

24.2.13 To view existing optical services

1

Choose Optical Service from the drop-down menu. A list of existing optical services is displayed.

2

As required, click on the View on Map button inline with any optical service to highlight that service on the network map.

3

As required, click on the Delete button inline with any optical service to delete that service.

END OF STEPS

24.2.14 To view transport controllers

1

Choose Controllers from the drop-down menu. The controllers with which NRC-X is interfacing are displayed.

2

Click on any controller to view additional details for that controller.

END OF STEPS

24.2.15 To perform a diversity analysis

1

Perform one of the following:

a. Choose Network Map from the drop-down menu, then click on the Diversity Analysis button. A form opens.

b. Choose Link Layer Interconnect from the drop-down menu, then click on the Diversity Analysis button. A form opens.

2

Specify the scope of the analysis, then click CONTINUE.

3

Click START and monitor the Diversity Progress until completion, then select a diversity group from the list to view Group Details.

4

Click on the Export button to export the results to CSV.

END OF STEPS

24.2.16 To export lists to CSV

1

Choose Cross Domain Link, IP-Optical Correlation, or Link Layer Interconnect from the drop-down menu.

2

Click on the More... button and choose Export. The displayed list is saved as a .csv file.

END OF STEPS

25 Supervision Manager

25.1 About

25.1.1

The Supervision Manager allows administrators to create and manage supervision groups and views for use in the Network Supervision application. The Supervision Manager can be accessed only by users with administrative access rights.

A supervision group is a logical set of monitored objects, in this case NEs and VNFs, that is specified by user-defined filters. Supervision groups can be used to partition objects into distinct categories and are associated with views. There is no limit to the number of supervision groups to which an object can belong. The criteria for monitored objects in a supervision group are based on inclusion filters. The inclusion filter is the rule on whether to include an object in a supervision group.

A view is a collection of one or more supervision groups that provides a summarized, high-level view of a group of network objects. There is no limit to the number of views to which a supervision group can belong, but each view can contain only up to 200 supervision groups.

25.2 Getting Started

25.2.1

This section describes the tasks you must perform in order to use the Supervision Manager application.

25.2.2 “Creating Supervision Groups” (p. 209)

25.2.3 “ Creating Views” (p. 210)

25.2.2 Creating Supervision Groups

1

On the Views list on the left-hand side of the GUI, click on the view to which you want to add a supervision group.

2

On the right-hand side of the GUI, click on the Add Supervision Group (+) button. The Add Supervision Group form appears.

3

Specify a name for the supervision group and follow the instructions in the form, clicking Continue to navigate through the pages.

In order to add NEs to the supervision group, you will need to specify inclusion filters to list the NEs. You can filter the NEs based on NE attributes, or you can create advanced filter expressions. Alternatively, you can manually add NEs to the group by specifying individual NE management IP addresses, or by importing a comma-separated list of NE management IP addresses.

4

When you have reviewed the list of NEs to include in the supervision group, click Finish to save the group.

5

The supervision group is saved to the view.

END OF STEPS

25.2.3 Creating Views

1

On the Views list on the left-hand side of the GUI, click the Add View (+) button. The Add a New View form appears.

2

Specify a name for the view.

3

Enable the Automatically Creates Supervision Groups option.

If this option is disabled, the resulting view will contain no supervision groups. You can add groups later.

4

Choose an option to create supervision groups based on Product Type or VNF Type.

5

Click Ok. The Supervision Manager grid is populated with supervision groups, represented as tile objects.

END OF STEPS

26 VNF Manager

26.1 Overview

26.1.1

The VNF Manager application is the interface used for the NFM-P as VNF manager solution. The application allows you to instantiate, maintain, and terminate VNFs managed by the NFM-P. The NFM-P provides an interface with the cloud management entity that provisions cloud resources. The NFM-P validates these resources and provides assurance and monitoring through the VNF Manager application and other features in the NFV solution.

26.1.2 VNF lifecycle management

The NFM-P provides an interface with OpenStack Heat to allow you to perform VNF lifecycle tasks from the VNF Manager application. You can perform the following lifecycle tasks directly from within the VNF Manager application:

- Instantiation—create a VNF instance from a specified cloud access point and a VNF catalog
- Deletion—delete a VNF instance
- Deployment—deploy a VNF instance to the cloud network
- Scaling—reduce or expand processing capacity by adding VMs to a VNF
- Healing—reboot a failing VNF component
- Sync—synchronize a VNF with the OpenStack tenant

Note: Automatic scale-in is not supported.

26.1.3 Product help tours

You can click on the menu in the application toolbar or on some panel toolbars to view a list of help tours. These tours are designed to explain the application features and provide workflows for completing management and monitoring tasks.

26.1.4 VNF catalogs

You can use the VNF Manager application to create and manage VNF catalogs. A VNF catalog is a collection of VNFs with a template that determines the type of VNF managed. The catalog includes deployment specifications, KPIs, and recipes for VNF management functions that are applicable to the VNF type. These become the default VNF settings that are defined when you instantiate a VNF using the catalog. You are able to configure these settings for specific VNFs during VNF instantiation.

You can create the following types of VNF catalogs:

- Generic
- VMG

- VMM
- VSR
- VSR-I

In addition to specifying the catalog type, you must also define a directory name. The directory name specifies the VNFD directory where the HOT files are located. The VNF Manager automatically determines the catalog type and version based on the HOT files in the specified directory. You must configure a VNF catalog before you create a VNF object.

Generic VNF catalogs

While the VMG, VMM, and VSR catalog types include deployment settings and recipes specific to each NE type, the generic VNF catalog can be used for other NE types without node-specific settings. The onboarding, instantiation, and lifecycle management functions of generic VNF catalogs are the same as for the NE-specific catalogs. You must specify a VNFD directory and configure HOT template files for a generic VNF catalog.

26.1.5 Cloud access point

The VNF Manager application provides an interface with OpenStack for VNF management. You must define a cloud access point before you create a VNF object. You can use multiple cloud access points for VNFs under different tenants. For each cloud access point, you must provide login credentials for the tenant group and specify a Keystone URL. Specify an access URL, port number, and Keystone version in the format *http://127.227.135.61:5000/v2.0*.

The cloud access point defines parameters such as VNFC image/flavor and network/subnet ID, which are configurable during VNF instantiation.

26.1.6 VNF management

The VNF Manager application provides an at-a-glance view of VNFs and VNFCs in the network. VNF onboarding allows the application to archive, upload, and validate VNF software images with OpenStack Heat.

The following table describes the lifecycle management tasks that can be executed from the VNF Manager application.

Table 26-1 VNF lifecycle management tasks

Task	Description
Add	Instantiates a new VNF. You must choose a catalog and cloud access point when you create a new VNF.
Delete	Deletes a VNF.
Deploy	Deploys the VNF to OpenStack Heat. Newly instantiated VNFs are not automatically deployed. The Deployment State parameter shows whether the VNF has been deployed.

Table 26-1 VNF lifecycle management tasks (continued)

Task	Description
Scale-out	Increases processing capacity by adding a VM. You must specify the scaling template from the drop-down menu. The scale-out template defines the type and number of VNFCs to be added.
Scale-in	Decreases processing capacity by removing a VM. You must specify the scaling template from the drop-down menu. The scale-in template defines the type and number of VNFCs to be removed.
Sync	Synchronizes the VNF with OpenStack Heat.
Rescan Discovery Rule	Manually scan VNF discovery rules for new rule elements.
Reboot	Reboots the VNF component. The Reboot button is available from the VNF component list that opens when you select an VNF.

Manual scaling

CAUTION

Service Disruption

The manual scale-in function removes a VM without checking the node for subscribers. Nokia recommends you check the VM for subscribers and move them to another VM before using the scale-in function.

You can use the VNF Manager application to manually scale-in or scale-out to adjust the processing capacity of a VNF. When you use a scaling operation, you must select a scaling template to use. Each scaling template specifies a type and number of VNFCs to be scaled in or out. The scale-in and scale-out operations use the same scaling templates.

These scaling templates are defined by the *VNF_Type.userdef_chars*.grow.hot.yaml files in the grow sub-directory of the VNF catalog directory. The name of the scaling templates must specify the applicable VNF. A VMG scaling template must lead with *VMG* in the template name and a VMM scaling template must lead with *VMM*. For example, a scaling template designed to scale one load balancing VNF on a CMG might be named *CMG.1LB.grow.hot.yaml*. Nokia recommends that the template name specify the number and type of VNFCs to be scaled.

Note: The *userdef_chars* part of the template filename cannot contain a period.

For automatic scaling, the NFM-P looks for a file with the name VNF_Type.default.grow.hot.yaml.

You can include a *grow_meta_data* entry in the meta file to specify which parameters are user-configurable during a VNF scaling operation in the VNF Manager application. For example, you can include *gw_subnet* in the *grow_meta_data* entry to allow the user to specify a subnet during VNF scale-out.

26.1.7 VNF instantiation

The VNF Manager application uses VNF catalogs to instantiate VNFs on a cloud management system such as OpenStack. When you use the application to instantiate a VNF, you must specify a cloud access point which includes a cloud management system URL to which the NFM-P deploys the VNF. The VNF catalog selected during VNF instantiation defines the default settings that are required by the VNFD for lifecycle management operations. These settings are read from the catalog *.env.yaml* file. You can customize these settings for a specific VNF during instantiation, as required.

The cloud access point provides the list of available VNFC images and flavors. You can select the required images and flavors from drop-down menus during VNF instantiation.

You can also configure the System Address during VNF instantiation. These parameters uniquely identify the VNF. Alarms affecting the VNF or associated VNFCs list these parameters as System Name and Site ID.

Note: The instantiated VNF is not deployed until you click Deploy.

Note: The system address provided for the VNF should match the system address configured in the NE.

Initial configuration for CMG and VSR

During VNF instantiation, you can specify an initial configuration file for the CMG and VSR. Specify an FTP server address with the configuration file using the primary_config parameter. You must also specify the login credentials, system name, and SNMPv2 or SNMPv3 community string. The configuration file is uploaded to the file storage specified for the VNF instance. When the VNF is instantiated, it is automatically configured with the specifications in the initial configuration file.

Topology discovery rules

During VNF instantiation, you can specify a topology discovery rule for VSR, CMG, or VMM. If no discovery rules are defined, you can cross-launch the NFM-P Java GUI to create one. The NFM-P automatically creates a discovery rule element for the VNF once the VNF is successfully deployed. You can also manually trigger a discovery rule scan by clicking the Rescan Discovery Rule button. The ready-only Managed State identifies whether the VNF is managed by a discovery rule.

When the VNF is deleted, the NFM-P automatically removes the discovery rule element.

26.1.8 VNF component reboot

You can use the Reboot function to manually reboot a VNF component from the application GUI. To view a list of VNF components associated with a VNF, double-click the VNF. When you click the Reboot button, you can select a soft or hard reboot.

The read-only Task State parameter on the VNF component shows whether the component has any NFM-P component operations in progress. VNF component can be triggered only if the Task State parameter is Deployed. The read-only VM State parameter displays the OpenStack VM state. VNF component operations — such as reboot — can be performed only if the VM State parameter is Active, ShutOff, or Rescued.

26.1.9 VNF component evacuation

You can perform VNF component evacuation to move a VNF component to a new compute host. This functionality is useful if a VNF component goes down due to a compute host failure. This action does not reboot the VNF.

VNF component evacuation is available from the VNF Manager REST API only.

26.1.10 VNFD redundancy

The NFM-P supports redundancy for the HOT files that define the lifecycle management tasks performed by the VNF Manager application. These files are kept in the *<NFMP_INSTALL_DIR>/os* directory and require NFM-P administrator read/write privileges. Whenever an rsync operation is triggered, files in the directory with a *yaml, .txt, .sh,* and *.json* extension are duplicated into a standby file server. Changes in the *<NFMP_INSTALL_DIR>/os* directory on the active server are duplicated every 30 minutes by default.

26.1.11 REST API

The VNF Manager application publishes a set of URLs which point to resources, or web services, managed by them. The URLs that are available to users are documented. These URLs can be accessed through a browser by any authorized user, including OSSs which can use them to cross launch from their own application. To view the published URLs of a given application:

`http(s)://<host>/VNFManager/api-docs`

Where *host* is the hostname or IP address which hosts the application.

27 Device Administrator

27.1 Overview

27.1.1

The Device Administrator application allows a user to define mediation policies and discovery rules so that network elements can be discovered through MDM in NSP and used by MDM-aware NSP applications. See the *NSP Deployment and Installation Guide* for information about how to manage device adaptation in MDM.

Network scans are performed at intervals configured in NE discovery rules, or discovery can be triggered manually.

27.2 Workflow for using the Device Administrator application

27.2.1

This workflow outlines the sequence of actions required to discover NEs in Device Administrator.

1

Configure the node to enable discovery by NSP; see the node documentation.

2

Create an NE Reachability Policy; see 27.3 “To create an NE reachability policy” (p. 218).

3

Create a mediation policy for each protocol you will use to communicate with the NE; see 27.4 “To create a mediation policy” (p. 219).

NOTE: A mediation policy is required for each protocol that will be used to manage the NE, regardless of which protocols will be used for the discovery.

4

Create an NE discovery rule; see 27.5 “To create an NE discovery rule” (p. 220).

5

View discovered NEs; see 27.6 “To view discovered NEs” (p. 222).

6

View or edit policies; see 27.7 “To view or edit policies” (p. 222).

7

View or edit discovery rules; see 27.8 “To view or edit NE discovery rules” (p. 223).

End of steps

27.3 To create an NE reachability policy

27.3.1

1

In the Device Administrator application, click on Reachability Policies. The system displays the list of existing reachability policies.

2

Click CREATE REACHABILITY POLICY. The Create Reachability Policy form opens.

3

Configure the required parameters.

Parameter	Description
Policy Name	The name of the Reachability policy
Reachability Type	Specifies the communication type to be used to confirm reachability, for example, ping
Interval (minutes)	Specifies the length of time, in minutes, to wait before repeating an attempt to reach the NE
Timeout (seconds)	Specifies the length of time, in seconds, to wait for a response after attempting to reach the NE
Admin State	Specifies the administrative state for the new policy
Description	User-provided description of the policy

4

Click Create. The reachability policy is auto-assigned a policy ID and added to the list.

End of steps

27.4 To create a mediation policy

27.4.1

A mediation policy is required for each network communication protocol that will be used to manage the NE. Mediation policies for all required protocols must be created before discovery, regardless of which protocols will be used to discover the NE.

A mediation policy consists of a network user and a network communication profile, or set of communication parameters. You can associate users or communication profiles with multiple policies. For example, if two different network users (that is, two sets of credentials) might be used to log in to the same port using CLI over Telnet, create a policy of type CLI for each user. When you create the second policy, associate the communication profile you created for the first policy. This will apply the same CLI parameters to the policy for the other user.

1

In the Device Administrator application, click on Mediation Policies. The system displays the list of existing mediation policies.

2

Click CREATE MEDIATION POLICY. The Create Mediation Policy form opens.

3

Configure the required parameters.

Parameter	Description
Left panel	
Mediation policy type	Specifies the communication type the mediation policy is for, for example, SNMPv3.
Mediation policy name	The name of the mediation policy
Description	User-provided description of the policy
Middle panel	
Associate network communication profile (radio button)	Configure this radio button to use the communication profile parameters from an existing mediation policy. Use the Search field to find the name of the associated profile you want to use.
Create new network communication profile (radio button)	Configure this radio button to configure new communication protocol parameters. The parameters will vary based on the mediation policy type.
Right panel	

Parameter	Description
Associate network user (radio button)	Configure this radio button to use a network user from an existing mediation policy. Use the Search field to find the name of the network user you want to use.
Create new network user (radio button)	Configure this radio button to configure a new network user. The parameters will vary based on the mediation policy type.

4

Click Create. The mediation policy is auto-assigned a policy ID and added to the list.

END OF STEPS

27.5 To create an NE discovery rule

27.5.1

1

In the Device Administrator application, click on NE Discovery Rules. The system displays the list of existing discovery rules.

2

Click CREATE DISCOVERY RULE. The Create NE Discovery Rule step form opens.

3

Configure the required parameters. Click Continue to proceed to the next set of parameters.

Parameter	Description
1: Settings and Discovery Protocol Order	
Settings	
Rule name	The name of the discovery rule
Description	User-provided description of the discovery rule
Network Scan Interval (minutes)	Specifies the interval, in minutes, at which the network scan repeats
Admin State	Specifies the administrative state for the discovery rule
Discovery Protocol Order	

Parameter	Description
(First|Second|Third|Fourth) discovery protocol	Specify the protocols to be used to communicate with the NE, in the order in which they should be used to attempt to reach the NE for discovery Enter all the protocols that will be used for communication, regardless of whether they will be used for discovery.
2: Set Discovery IP Range	
Include	Click Add IP Range to specify an IP address and mask bits to include. Repeat to add additional ranges.
Exclude	Click Add IP Range to specify an IP address and mask bits to exclude from discovery. Repeat to add additional ranges.
3: Associate Mediation Policies	
Mediation Policies	Click on each protocol listed in the left panel. Mediation policies for the protocol are listed in the right panel. Select a policy for each protocol by clicking the plus sign at the right of the panel. You can create a mediation policy from this view if needed; see 27.4 “To create a mediation policy” (p. 219).
4: Associate Reachability Policies	
Reachability Policies	Click on each reachability type listed in the left panel. Reachability policies are listed in the right panel. Select a policy for each type by clicking the plus sign at the right of the panel. You can create a reachability policy from this view if needed; see 27.3 “To create an NE reachability policy” (p. 218).

4

Click Finish. The NE discovery rule is auto-assigned a rule ID and added to the list.

END OF STEPS

27.6 To view discovered NEs

27.6.1

1

In the Device Administrator application, click on Discovered Nodes. The system displays the list of discovered NEs.

2

To filter the list, enter information in any filter field in the top panel.

3

To remove a filter, delete information from the filter field.

4

Hover your mouse over an NE to see the Unmanage and Resync icons at the right of the screen. Click on an icon to unmanage or resync the NE.

If a device is unmanaged, it is removed from the list. The NE can be discovered again if a compatible discovery process is performed.

END OF STEPS

27.7 To view or edit policies

27.7.1

1

In the Device Administrator application, click on Mediation Policies or Reachability Policies. The system displays the list of configured policies of the selected policy type.

2

To filter the list, enter information in any filter field in the top panel.

3

To remove a filter, delete information from the filter field.

4

Hover your mouse over an NE to see the Edit, Delete, and Show Detail icons.

- Click Edit to change policy parameters.
  Click Update to save your changes.
- Click Delete to delete the policy.
- Click Show Detail to display a read-only panel with the policy parameters.

Mediation policy details include the number of NEs using the policy as a read, read and write, or trap policy. Click on an item to display a filtered list of NEs using the policy in the selected manner.

END OF STEPS

27.8 To view or edit NE discovery rules

27.8.1

1

In the Device Administrator application, click on NE Discovery Rules. The system displays the list of configured NE discovery rules.

2

To filter the list, enter information in any filter field in the top panel.

3

To remove a filter, delete information from the filter field.

4

Hover your mouse over an NE to see the Edit, Delete, Show Detail, and More icons.

- Click Edit to change discovery rule parameters.
  Click Update to save your changes.
- Click Delete to delete the rule.
- Click Show Detail to display a read-only panel with the rule parameters. Click on the icons at the top of the panel to display IP ranges or policies.
- From the More menu you can edit, delete, or show detail. The More menu also includes Discover and Show Discovered NEs.
  - Choose Discover to manually launch a discovery.
  - Choose Show Discovered NEs to display a filtered list of NEs discovered using the selected NE discovery rule.

END OF STEPS