Juniper Networks | Engineering Simplicity

Contrail Service Orchestration Administration Portal User Guide

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Contrail Service Orchestration Administration Portal User Guide
5.3.0
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About the Documentation

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Use this guide to understand the features and tasks that you can configure and perform from the Cloud-based Contrail Service Orchestration (CSO) Administration Portal UI . This guide provides feature overviews and procedures that help you understand the features and perform CSO configuration tasks.

Documentation and Release Notes

To obtain the most current version of all Juniper Networks® technical documentation, see the product documentation page on the Juniper Networks website at https://www.juniper.net/documentation/.

If the information in the latest release notes differs from the information in the documentation, follow the product Release Notes.

Juniper Networks Books publishes books by Juniper Networks engineers and subject matter experts. These books go beyond the technical documentation to explore the nuances of network architecture, deployment, and administration. The current list can be viewed at https://www.juniper.net/books.

Documentation Conventions

Table 1 on page xix defines notice icons used in this guide.

Table 1: Notice Icons

Icon	Meaning	Description
	Informational note	Indicates important features or instructions.
	Caution	Indicates a situation that might result in loss of data or hardware damage.
	Warning	Alerts you to the risk of personal injury or death.
	Laser warning	Alerts you to the risk of personal injury from a laser.
	Tip	Indicates helpful information.
	Best practice	Alerts you to a recommended use or implementation.

Table 2 on page xix defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

Convention	Description	Examples
Bold text like this	Represents text that you type.	To enter configuration mode, type the **configure** command: user@host> **configure**
`Fixed-width text like this`	Represents output that appears on the terminal screen.	`user@host>` **show chassis alarms** `No alarms currently active`
Italic text like this	• Introduces or emphasizes important new terms. • Identifies guide names. • Identifies RFC and Internet draft titles.	• A policy *term* is a named structure that defines match conditions and actions. • *Junos OS CLI User Guide* • RFC 1997, *BGP Communities Attribute*

Table 2: Text and Syntax Conventions *(continued)*

Convention	Description	Examples
Italic text like this	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name: [edit] root@# **set system domain-name** *domain-name*
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	• To configure a stub area, include the **stub** statement at the **[edit protocols ospf area area-id]** hierarchy level. • The console port is labeled **CONSOLE**.
< > (angle brackets)	Encloses optional keywords or variables.	**stub <default-metric *metric*>;**
| (pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	**broadcast | multicast** **(*string1* | *string2* | *string3*)**
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	**rsvp { # Required for dynamic MPLS only**
[ ] (square brackets)	Encloses a variable for which you can substitute one or more values.	**community name members [*community-ids*]**

Indention and braces ({ })	Identifies a level in the configuration hierarchy.	[edit]
		routing-options {
		static {
		route default {
		nexthop *address*;
		retain;
		}
		}
		}

; (semicolon)	Identifies a leaf statement at a configuration hierarchy level.	
GUI Conventions		

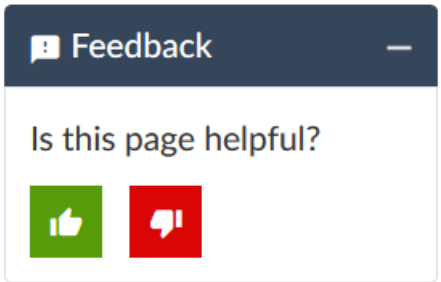
Table 2: Text and Syntax Conventions *(continued)*

Convention	Description	Examples
Bold text like this	Represents graphical user interface (GUI) items you click or select.	• In the Logical Interfaces box, select **All Interfaces**. • To cancel the configuration, click **Cancel**.
> (bold right angle bracket)	Separates levels in a hierarchy of menu selections.	In the configuration editor hierarchy, select **Protocols>Ospf**.

Documentation Feedback

We encourage you to provide feedback so that we can improve our documentation. You can use either of the following methods:

- Online feedback system—Click TechLibrary Feedback, on the lower right of any page on the Juniper Networks TechLibrary site, and do one of the following:



  - Click the thumbs-up icon if the information on the page was helpful to you.
  - Click the thumbs-down icon if the information on the page was not helpful to you or if you have suggestions for improvement, and use the pop-up form to provide feedback.
- E-mail—Send your comments to techpubs-comments@juniper.net. Include the document or topic name, URL or page number, and software version (if applicable).

Requesting Technical Support

Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active Juniper Care or Partner Support Services support contract, or are

covered under warranty, and need post-sales technical support, you can access our tools and resources online or open a case with JTAC.

- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at https://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf.
- Product warranties—For product warranty information, visit https://www.juniper.net/support/warranty/.
- JTAC hours of operation—The JTAC centers have resources available 24 hours a day, 7 days a week, 365 days a year.

Self-Help Online Tools and Resources

For quick and easy problem resolution, Juniper Networks has designed an online self-service portal called the Customer Support Center (CSC) that provides you with the following features:

- Find CSC offerings: https://www.juniper.net/customers/support/
- Search for known bugs: https://prsearch.juniper.net/
- Find product documentation: https://www.juniper.net/documentation/
- Find solutions and answer questions using our Knowledge Base: https://kb.juniper.net/
- Download the latest versions of software and review release notes: https://www.juniper.net/customers/csc/software/
- Search technical bulletins for relevant hardware and software notifications: https://kb.juniper.net/InfoCenter/
- Join and participate in the Juniper Networks Community Forum: https://www.juniper.net/company/communities/
- Create a service request online: https://myjuniper.juniper.net

To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool: https://entitlementsearch.juniper.net/entitlementsearch/

Creating a Service Request with JTAC

You can create a service request with JTAC on the Web or by telephone.

- Visit https://myjuniper.juniper.net.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

For international or direct-dial options in countries without toll-free numbers, see https://support.juniper.net/support/requesting-support/.

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CHAPTER

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About the Administration Portal User Guide

This guide provides an understanding of how to use the Contrail Service Orchestration (CSO) Administration Portal to implement your CSO use cases. This guide is appropriate for network administrators and operators who need to know how to use Administration Portal.

Refer to Table 3 on page 25 for additional CSO documentation resources.

Table 3: Additional CSO Documentation Resources

Title	Available At
What is SD-WAN?	https://www.juniper.net/us/en/products-services/what-is/sd-wan/
What is Network Functions Virtualization (NFV)?	https://www.juniper.net/us/en/products-services/what-is/network-functions-virtualization/
Learn About NFV	https://www.juniper.net/documentation/en_US/learn-about/LearnAbout_NFV.pdf
Customer Portal User Guide	https://www.juniper.net/documentation/product/en_US/contrail-service-orchestration (User Guides section)
Designer Tools User Guide	https://www.juniper.net/documentation/product/en_US/contrail-service-orchestration (User Guides section)
Deployment Guide	https://www.juniper.net/documentation/product/en_US/contrail-service-orchestration (Getting Started section)
Design and Architecture Guide	https://www.juniper.net/documentation/en_US/release-independent/solutions/information-products/pathway-pages/sg-007-sd-wan-sd-lan-design-arch-guide.html
Other Resources	https://www.juniper.net/documentation/product/en_US/contrail-service-orchestration

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Administration Portal Overview

The Administration Portal in Contrail Service Orchestration (CSO) provides a Web-based UI that service providers (SPs) and operating companies (OpCos) can use to manage physical and virtual resources, add and manage tenants, monitor system performance, perform administrative tasks (such as manage users and roles), and so on.

Administration Portal supports role-based access control (RBAC), which means that the roles assigned to users determine their access privileges and the actions that they can perform. The following predefined roles are available in Administration Portal:

- SP Admin (SP Administrator)
- SP Operator
- OpCo Admin (OpCo Administrator)
- OpCo Operator

Administrator users have read access and write access to the Administration Portal UI and API capabilities, whereas operator users only have read access. Administrators can also create more users with specific roles and access privileges.

> **NOTE:** In the cloud-hosted version of CSO (managed by Juniper Networks), the SP Admin and SP Operator roles are available only for Juniper Networks.

Administration Portal supports both local authentication and Security Assertion Markup Language (SAML)-based authentication for single sign-on (SSO). When you log in to Administration Portal, the main menu (left sidebar) that is displayed and the actions that you can perform depend on your access privileges. Table 4 on page 26 displays the main menu available in the Administration Portal and a brief description of each menu item, and a link to the relevant topic in the *Contrail Service Orchestration Administration Portal User Guide*.

Table 4: Administration Portal Main Menu

Main Menu	Description
Favorites	View the list of pages that you have marked as favorite. You can mark pages that you frequently visit to Favorites. To mark a page as favorites, click the star icon on the right corner of each page.

Table 4: Administration Portal Main Menu *(continued)*

Main Menu	Description
Dashboard	Access a user-configurable dashboard that you can customize with available widgets (also known as dashlets). For more information, see "About the Administration Portal Dashboard" on page 34.
Monitor	Monitor or view the following: • POPs: See "About the Monitor Overview Page" on page 425. • Alerts and alarms: See "About the Generated Alerts Page" on page 427 and "About the Alarms Page" on page 434. • Service-level agreement (SLA) performance (only for SD-WAN tenants): See "About the SLA Performance of All Tenants Page" on page 437. • Jobs (ongoing or completed): See "About the Jobs Page" on page 406.
Resources	Manage the following resources: • POPs: See "About the POPs Page" on page 120. • Sites: See "About the Sites Page" on page 141. • Tenant and provider hub device: See "About the Tenant Devices Page" on page 144 and "About the Provider Hub Devices Page" on page 147. • Device and virtualized network function (VNF) images, and packages: See "About the Device Images Page" on page 274. • Device templates: See "About the Device Template Page" on page 201. • Configuration templates: See "About the Configuration Templates Page" on page 236.

Table 4: Administration Portal Main Menu *(continued)*

Main Menu	Description
Configuration	Configure or manage the following: • SLA-based and path-based steering profiles: See "About the SLA-Based Steering Profiles Page" on page 335and "About the Path-Based Steering Profiles Page" on page 348 • Application traffic type profiles: See "About the Application Traffic Type Profiles Page" on page 319. • SD-WAN breakout profiles • Shared objects (for example, application signatures): See "About the Application Signatures Page" on page 299. • Network services: See "About the Network Services Page" on page 284. **NOTE:** You use the Network Designer tool (part of the Designer Tools) to create and publish network services.
Tenants	Manage tenants and OpCos: See "About the Tenants Page" on page 69 and "About the Operating Companies Page" on page 111.

Table 4: Administration Portal Main Menu *(continued)*

Main Menu	Description
Administration	Perform various administrative tasks including the following: • Set up authentication: See "About the Authentication Page" on page 56. • Manage users and roles: See "About the Users Page in Administration Portal" on page 381 and "About the Roles Page" on page 392. • Monitor audit logs: See "About the Audit Logs Page" on page 413. • Configure dynamic mesh thresholds: See "Configuring Dynamic Mesh Tunnels Threshold for Tenants" on page 99. • Manage device and CSO licenses: See "About the Device License Files Page" on page 363 and "About the CSO Licenses Page" on page 368. • Download signature databases: See "About the Signature Database Page" on page 293. • Configure SMTP server: See "Configuring SMTP Settings" on page 51. • Update terms of use: See "Updating the Terms of Use" on page 101. • Customize e-mail templates: See "Customizing E-mail Templates" on page 52. • Personalize the portals: See "Personalize the Administration Portal and Customer Portal" on page 43.

Table 5 on page 29 lists the icons on the top right corner of the Administration Portal and a brief description of each icon.

Table 5: Administration Portal Icons

Icons	Description
Running Jobs	Displays the list of jobs that are currently in progress. Click **Review All** to view the list of all jobs on the Jobs page. For more information on the Jobs page, see "About the Jobs Page" on page 406.

Table 5: Administration Portal Icons *(continued)*

Icons	Description
Scheduled Jobs	Displays the list of jobs that are scheduled. Click **Review All** to view the list of all scheduled jobs on the Jobs page. For more information on the Jobs page, see "About the Jobs Page" on page 406.
Scope	Displays the scope of a user. If you are an SP administrator or an OpCo administrator, you can change the scope from All Tenants to a specific tenant. For more information on switching the scope, see "Switching the Tenant Scope" on page 34.
Alarms and Alerts	Displays the following two tabs: • Alarms—Displays the list of alarms that are generated by the device along with the timestamp and the severity of the alarm. Click **Review All** to view the details about the generated alarms on the Alarms page. For more information about the Alarms page, see "About the Alarms Page" on page 434. • Alerts—Displays the list of alerts that are generated by the device along with the timestamp and the severity of the alert. Click **Review All** to view the details about the generated alerts on the Alerts page. For more information about the Alerts page, see "About the Generated Alerts Page" on page 427
Feedback	Click this icon to provide feedback about the product or report any issues that you are facing.
User Name	Displays the user name of the user who has currently logged into CSO.
Resize	Click this icon to resize the page to full screen.

Table 5: Administration Portal Icons *(continued)*

Icons	Description
Help Menu (?)	Click this icon to access the following panels and online help documentation: • Getting Started panel • What's New panel • Quick Help panel • Help Center • Release Notes • About Panel

Optionally, you can personalize the navigation mode and the theme in the portal. To personalize the portal:

1. Click the icon on the lower left corner of the portal. You have an option to personalize the following settings:
   - Navigation Mode
   - Theme
   - Invert colors
2. Select one of the following navigation modes:
   - Side Menu (default option)—Click this option if you want the main menu items to appear on the left pane.
   - Horizontal Menu—Click this option if you want the main menu items to appear horizontally on the top bar.
3. Select one of the following themes:
   - Default—Click this option if you prefer the background color of the portal to be blue.
   - Grey—Click this option if you prefer the background color of the portal to be grey.
4. Enable the toggle button if you prefer to invert the colors.

The changes are immediately applied to the portal.

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Accessing Administration Portal

To access Administration Portal:

1. If you are an SP administrator, skip to 3.

   If you are an OpCo administrator and logging in to Administration Portal for the first time, do the following. If not, skip to 2.

   > **NOTE:** When your administrator creates a CSO account for you, an e-mail (with the subject line CSO Account Created) is sent. This e-mail contains a URL that allows you to log in to Administration Portal. The URL is active for only 24 hours and is valid only for the first log in.

   a. Click the URL that you have received in the e-mail.

      The Change Password page appears with a message that you must change your password for security purposes.

   b. Change your password following the guidelines provided in Table 6 on page 33.

   c. (Optional) Click the Terms of Use link to view the Terms of Use document.

   d. Click the check box to accept CSO terms of use.

   e. Click **OK**.

   The login password is changed and you are logged out of the system. When you log in you must use the changed password.

2. Login to Administration Portal using the link provided in the account activation e-mail.

   > **NOTE:** We recommend that you use Google Chrome (Version 60 or later) or Firefox (Version 78 or later) to access the Contrail Service Orchestration (CSO) GUIs.

3. Enter your username and password.

   If you are an SP administrator, login with the username *cspadmin* and the password that you specified for Contrail OpenStack.

The Welcome page appears listing the key features of the release.

4. (Optional) If you want to hide the Welcome page on your next login, select the **Hide this on next login** check box.

5. Click **Go to Dashboard**. The menu bar on the left-hand side of the every page allows you to access the different tasks easily. The top-level menu items are listed in Table 7 on page 33.

Table 6: Fields on the Change Password Page

Field	Description
New Password	Enter your new password. The password must be between 6 and 21 characters long, and must include at least one lowercase letter, one uppercase letter, one special character, and one number. **NOTE:** The password strength indicator displays the efficiency of the password that you enter. You cannot proceed to the next step if the password strength indicator shows that the password is weak.
Confirm Password	Reenter the password for confirmation. You can select **Show Password** to view the password.

Table 7: Administration Portal Menu

Menu Name	Description
Dashboard	Configurable dashboard that offers you a customized view of cloud services through its widgets.
Monitor	Monitor alerts and alarms, tenants SLA performance and jobs.
Resources	Manage POPs, tenant devices, provider hub devices, device templates, and device image.
Configuration	Configure network services, SLA-based steering profiles, path-based steering profiles, application traffic profiles and network services.
Tenants	Create tenants and Operating Companies (OpCos).
Administration	Manage users, roles, audit logs, licenses, display preferences, email templates, and the signature database.

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Switching the Tenant Scope

Administration Portal users can change the tenant scope from all tenants to a specific tenant by using the tenant switcher displayed on the banner.

When you switch scope from all tenants to a specific tenant, the menu and pages displayed are almost the same as those displayed for Customer Portal users, with some additional actions visible to the Administration Portal users. When you switch back to the **All Tenants** scope, the menu and pages for the Administration Portal are displayed.

To switch from one scope to another:

- From the top right corner of the page, select the **All Tenants** scope to access Administration Portal or select a specific tenant (for example, aaa) to access Customer Portal. The menu and pages for Administration Portal or Customer Portal are displayed based on the scope selected from the drop-down list.

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About the Administration Portal Dashboard

To access this page, click **Administration Portal > Dashboard**.

The user-configurable dashboard offers you a customized view of network services through its widgets.

You can drag these widgets from the carousel at the top of your dashboard to your workspace, where you can add, remove, and rearrange them to meet your needs. For example, you can configure a widget to display a graph with the top five tenants receiving alerts, the status of alerts, and the name of tenant sites.

The dashboard automatically adjusts the placement of the widgets to dynamically fit on your browser window without changing their order. You can manually reorder the widgets using the drag and drop option. In addition, you can press and hold the top portion of the widget to move it to a new location.

Tasks You Can Perform

You can perform the following tasks from this page:

- Customize the dashboard by adding, removing, and rearranging the widgets.
- Update the dashboard or an individual widget by clicking the refresh icon.
- Show or hide widget thumbnails in the carousel by selecting the category of widgets that you want to view from the list at the top left of the carousel; the default is **All Widgets**.
- Add a widget to the dashboard by dragging the widget from the palette or thumbnail container into the dashboard.
- Delete a widget from the dashboard page by clicking the delete icon (**X**) in the title bar of the widget and confirming the delete operation.
- Add a dashboard tab by clicking the **+** icon, (optionally) entering a name, and pressing Enter.

  You can then add widgets to the dashboard as needed.
- Rename a dashboard by double-clicking on the title bar of the dashboard, entering a name, and pressing Enter.
- Delete a dashboard by clicking the delete icon (**X** icon) in the title bar of the dashboard and confirming the delete operation.
- Search for a widget by clicking the search icon (magnifying glass) at the top left of the carousel, entering search text, and pressing Enter.

Field Descriptions

You can quickly view important data using the widgets in your dashboard.

Table 8 on page 35 describes the dashboard widgets.

Table 8: Widgets on the Dashboard

Widget	Description
Device Count By Platform	Displays the number of devices based on the device type (SRX Series devices, NFX Series devices, EX Series switches, and vSRX).
Device Count By OS	Displays the number of the devices based on Junos OS releases.
Device Count By Status	Displays the total number of devices and its status (Up or Down).

Table 8: Widgets on the Dashboard *(continued)*

Widget	Description
Tenant Sites: Total Alarms	Displays the total number of alarms grouped by severity level. Click each alarms name to view the total number of tenant sites receiving alarms that are critical, major, or minor.
Top 5 POPs with Alerts	Displays the top five POPs receiving alerts. • **POP**—Name of the POP. • **Tenant**—Number of tenants in the POP. • **Location**—Location of the POP. • **Status**—Type of alerts received that are critical, major or minor.
Top 5 Sites with Alarms	Displays the top five tenant sites receiving alerts. • **Name**—Name of the tenant site. • **Location**—Location of the tenant site. • **Status**—Type of alarms received that are critical, major, or minor.
Top 5 Tenants with Alarms	Displays the top five tenants receiving alarms. • **Name**—Name of the tenant. • **Sites**—Number of sites in the tenant location. • **Status**—Type of alarms received that are critical, major, or minor.

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Changing the Administration Portal Password

To change the Administration Portal password:

1. Click the administrative username that is located at the right side of the Administration Portal banner.

   The drop-down list appears.

2. Click **Change Password**.

   The Change Password page appears.

> **NOTE:** If you change the password for Administration Portal, the new password is saved in Contrail and applies to other GUIs, such as Network Service Designer.

3. Enter the current password.

4. In the New Password text box, enter your new password.

   The login password that you set must conform to a particular set of requirements such as minimum length of 6 characters, a maximum length of 21 characters, and that includes at least one lowercase letter, one uppercase letter, an alpha-numeric character, and a numeric character.

5. In the Confirm Password text box, enter your new password again to confirm it.

   You can select the **Show Password** option to view the password.

6. Click **OK**.

   You are logged out of the system. To log in to Administration Portal again, you must use your new password. Other sessions logged in with the same username are unaffected until the next login.

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Resetting Your Password

If you have forgotten your password, you can reset the password from the Contrail Service Orchestration (CSO) login page.

> **NOTE:** If you have entered an incorrect password, your account will be locked after five consecutive unsuccessful login attempts.

To reset your password:

1. On the login page, enter the username, and then press **Enter**.

   The Forgot Password link appears on the login page.

2. Click the **Forgot Password** link.

   An e-mail (with the subject Forgot CSO Account Password) is sent to your e-mail address. This e-mail contains a URL (active for 24 hours) to reset your password.

3. Click the **Reset your password** link in the e-mail.

   The Set Password page appears.

4. Change your password following the guidelines provided in Table 9 on page 38.

   NOTE: Fields marked with * are mandatory.

5. Click **OK** to reset the password.

   A confirmation message appears indicating the status of the reset password operation.

If the password reset operation is successful, you can use the new password for subsequent logins to CSO.

Table 9: Fields on the Set Password Page

Field	Description
Password	Enter your new password. The password must be between 6 and 21 characters long, and must include at least one lowercase letter, one uppercase letter, one special character, and one number. **NOTE:** The password strength indicator displays the efficiency of the password that you enter. You cannot proceed to the next step if the password strength indicator shows that the password is weak.
Confirm Password	Reenter the password for confirmation. You can select **Show Password** to view the password.
Terms of Use	Select the check box to agree to the terms of use document.

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Changing the Password on First Login

To enhance the security related to login credentials, you are prompted to change the password when you login to the portal for the first time.

To change the password when you log in for the first time:

1. Log in to the portal with the default login credentials.

   The Change Password page appears with a message that you must change your password for security purposes.

   > **NOTE:** The Change Password page appears only if you are logging in to the portal for the first time.

2. Change your password following the guidelines provided in Table 6 on page 33.

3. Click **Ok**.

   > **NOTE:** It is mandatory to change the login password when you log in to the portal for the first time. If you click **Cancel**, you are redirected to the login page.

The login password is changed and you are logged out of the system. To log in to the portal again, you must use your new password.

Table 10: Fields on the Change Password Page

Field	Description
New Password	Enter your new password. The password must be between 6 and 21 characters long, and must include at least one lowercase letter, one uppercase letter, one special character, and one number. **NOTE:** The password strength indicator displays the efficiency of the password that you enter. You cannot proceed to the next step if the password strength indicator shows that the password is weak.
Confirm Password	Reenter the password for confirmation. You can select **Show Password** to view the password.

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Resetting the Password for OpCo and Tenant Users

Users with the OpCo administrator role (or MSP Administrator role) or a tenant administrator role can reset the password for OpCo user and tenant users respectively. Also, users with the Update capability for Users objects can reset the password for both OpCo and tenant users.

To reset the password:

1. Select **Administration > Users** in Administration Portal.

   The Users page appears, displaying a list of users.

2. Select the username for which you want to reset the password, and then select **More > Reset Password**.

   An alert message appears, asking you to confirm the reset password operation.

3. Click **Yes** to confirm the reset password operation.

An e-mail (with the subject Reset Your CSO Password) is sent to the user's e-mail address. This e-mail contains a URL (active for 24 hours) to reset the password. Users can click the URL link in the e-mail and change the password

Setting Password Duration

To enhance the security related to login credentials, you can specify the duration (in days) after which the password expires and must be changed. You must set the duration while you are adding a tenant.

To set the duration (in days) after which the password expires:

1. Log in to Administration Portal.

2. Select **Tenants** > **All Tenants** > **+**.

   The Add Tenant page appears.

3. In the Tenant Info > Password Policy section >Password Expiration Days, specify the duration (in days) after which the password expires and must be changed. You can specify the duration (in days) from 1 through 365. The default value is 180 days.

4. Complete the remaining steps for adding a tenant. For more information about adding a tenant, see "Adding a Single Tenant" on page 72.

If the tenant user (Tenant Administrator role or Tenant Operator role) has the password expiration days specified, then the tenant user must change the password after the specified duration elapses.

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Extending the User Login Session

In the unified portal, a login session expires in 60 minutes. After 55 minutes, the **Extend Session** page is displayed and, prompting you to enter your password. You must enter your password to extend the session. The **Extend Session** page is displayed when the **Local** authentication method is configured.

If you have logged in to the portal with SSO authentication, the **Extend Session** page is displayed and you can authenticate with the external SSO server. However, the SSO expiration is not under the control of CSO and the following can happen:

- If the external SSO session is expired, you will be authenticated in the **Extend Session** page. After successful authentication, the **Extend Session** page is closed automatically.
- If the external SSO session is not expired, the **Extend Session** page is closed automatically.

To extend the login session:

1. On the **Extend Session** page, enter your password in the **Password** field. If you want to end your session and exit from the portal, click **Cancel** instead and you are redirected to the Login page.

2. Click **OK**.

   The success message **Your Session has been successfully extended** is displayed.

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Personalize the Administration Portal and Customer Portal

Use this page to personalize the CSO Administration Portal and Customer Portal. You can personalize the following elements:

- Login page for the portals.
- Logo on the top-left corner of the portals.
- Typeface for the GUI.
- Logo, typeface, company name, and background colors for reports.
- Color palette for the primary and secondary navigation panels, icons, and buttons on the GUI.

> **NOTE:** This topic is applicable only for users with the SP admin role who are assigned the Update Preferences capability.

To personalize the portals:

1. Click **Administration > Display Preferences**.

   The **Display Preferences** page appears.

2. Complete the configuration according to the guidelines in Table 11 on page 44.

   > **NOTE:** Fields marked with an * are mandatory.

3. (Optional) Click **Preview** to view the custom color theme before you apply the settings.

   A confirmation message appears.

4. Click **Apply** to apply the settings.

   A confirmation message appears and the settings are applied to the portals.

Table 11: Fields on the Display Preferences Page

Field	Action
Logo	
Portal (top-left corner)	Upload an image for the logo that appears on the top-left corner of the portals: 1. Click **Select**. The File Upload dialog box appears. 2. Browse to navigate to the file location and select the file. 3. Click **Open** to upload the file. You are returned to the Display Preferences page. Supported file formats: PNG and SVG. Recommended image size: 25x25 pixels.
Login Page	
Logo	Upload an image for the logo that appears on the top-left corner of the login page. See "Step-by-Step Procedure" on page 44 for details. Supported file formats: PNG and SVG. Recommended image size: 240x25 pixels.
Background	Select a background image or background color for the login page: • If you select **Image**, click **Select** to upload a background image for the login page. See "Step-by-Step Procedure" on page 44 for details. Supported file formats: PNG and SVG. Recommended image size: 1440x780 pixels. • If you select **Fill Color (Gradient)**, select two colors (**Color 1** and **Color 2**) from the palette for a gradient effect.
Font	

Table 11: Fields on the Display Preferences Page *(continued)*

Field	Action
Typeface	Select a typeface (**Arial**, **Helvetica**, or **Antenna**), for the CSO GUI, from the list or upload a custom typeface. The default typeface is Helvetica. 1. To upload a custom typeface file, click **Upload Custom Typeface**. The Upload Custom Typeface page appears. 2. Click **Select** to upload a customized typeface file (zip file). The zip file contains four formats of custom font styles (EOT, SVG, WOFF, and WOFF2) and a CSS file. You must add all four font files to the CSS file. The zip filename should be same as the CSS filename. 3. Click **OK**. A confirmation message **The font added** appears and the custom typeface file is saved in CSO. (Optional) To view the different formats of files to be uploaded to customize your font, click **Download Sample Font File**. The sample font file is downloaded to your local file system.
Report	
Logo	Click **Select** to upload a logo that appears in the SD-WAN reports and security reports. Supported file formats: PNG. Recommended image size: 111x116 pixels.
Company Name	Enter a company name. This name appears in the SD-WAN and Security reports. **NOTE:** If you enter any company's name other than Juniper Networks, the Juniper branding page is automatically hidden.

Table 11: Fields on the Display Preferences Page *(continued)*

Field	Action
Typeface	Select a typeface (**Arial**, **Helvetica**, or **Antenna**) from the list or upload a custom typeface for the reports. The default typeface is Helvetica. See "Step-by-Step Procedure" on page 45 for details.
Background Color	Select colors (**Background Color 1** and **Background Color 2**) from the palette for a gradient effect. This effect is visible in the background of the report.
Color Palette	

Table 11: Fields on the Display Preferences Page *(continued)*

Field	Action
Color Palette	Use the default color palette or create a customized palette. To create a customized palette, click **Create Custom**. The **Create Custom Color Palette** section appears. See Table 12 on page 47 for information on the fields that appear in the **Create Custom Color Palette** section. After you create the custom color palette: 1. Click **Save Palette** to save the custom color palette. The color palette appears on the Display Preferences page. Click the check mark icon near the palette to select it. Alternatively, if you want to discard your changes, click **Cancel**. • If you want to modify the settings of the custom color palette, click the edit icon (pencil symbol) next to the color palette and update the settings as needed. • If you want to delete the custom color palette, click the delete icon (trash can symbol) next to the color palette. **NOTE:** The edit icon and delete icon appear only when you hover over the color palette. • The **Confirm Color Palette Deletion** page appears. • Click **Yes** to confirm the deletion. The custom color palette is deleted.

Table 12: Fields in the Custom Color Palette Section

Create Custom Palette	
Palette Name	Enter a unique name for your color palette. You can use alphanumeric characters, space, and underscore (_). The maximum length allowed is 32 characters.
Background Colors	

Table 12: Fields in the Custom Color Palette Section *(continued)*

Primary Navigation Background	Select a background color for the primary navigation panel.
Primary Navigation Active Background	Select a background color for the active element in the primary navigation panel.
Primary Navigation Hover Background	Select a color to appear in the background of an element, on the primary navigation panel, when you hover on the element.
Secondary Navigation Background	Select a background color for the secondary navigation panel.
Selected Tabs	Select a color for the active tab in a tab container; the tab name changes to the selected color when it is active.
Icons	
Grid (Table) Action	Select a color for the icons on top of a grid.
Grid (Table) Action Hover	Select a color for an icon on top of a grid; the icon changes to the selected color when you hover over it.
Buttons	
Primary Action Button	Select a color for the primary action button in its default state.
Primary Action Button Hover	Select a color that the primary action button changes to, when you hover over it.
Secondary Action	Select a color for the secondary action button in its default state.
Secondary Action Button Hover	Select a color that the secondary action button changes to, when you hover over it.
Secondary Action Border	Select a color for the border on the secondary action button.
Secondary Action Border Hover	Select a color that the border on the secondary action button changes to, when you hover over it.
Secondary Action Font	Select a color for the font on the secondary action button.

Setting Up the Cloud CPE Distributed Deployment Model with Administration Portal

> **NOTE:** This topic is applicable only for users with the SP admin role.

In the Cloud CPE Distributed Deployment Model, end users at a specific customer site access network services in both a regional point of presence (POP) and a central POP.

You use the following workflow to set up the Cloud CPE Distributed Deployment Model with Administration Portal:

1. Add data for the POPs and provider edge (PE) router. See "Creating a Single POP" on page 121 and "Importing Data for Multiple POPs" on page 123.
2. Upload images for devices used in the deployment, such as the vSRX gateway and the NFX 250 platform to the central activation server. See "Uploading a Device Image" on page 280.
3. Upload VNF images. See "Uploading a Device Image" on page 280.
4. Create customers. See "Adding a Single Tenant" on page 72 and "Importing Data for Multiple Tenants" on page 86.
5. If you add customers one at a time, rather than importing data for multiple tenants, create and configure sites for each customer. .
6. Allocate network services to customers. See "Allocating a Service to Tenants" on page 289.

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2

CHAPTER

Managing E-Mail

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Configuring SMTP Settings

Use this page to configure an SMTP e-mail server. The SMTP server is the local server that forwards your e-mail to the destination server. After you log in to the unified Administration or Customer portal for the first time, you must configure the SMTP settings for your deployment.

To configure SMTP settings:

1. Click **Administration > SMTP**.

   The SMTP page appears.

2. Specify the SMTP settings that you want to configure to user for the mail server. See Table 13 on page 51.

3. Click **Save**.

   The status of the save operation is displayed.

Table 13: SMTP Settings

Field	Description
SMTP Server	
Server Address	Enter the hostname for the SMTP server.
TLS	Enable Transport Layer Security (TLS) protocol to ensure that the e-mail messages are transmitted over an encrypted channel.
Port Number	Enter the port number for the SMTP server. Check with your e-mail service provider for the SMTP port number. By default, the port number is set to 587 when TLS is enabled and to 25 when TLS is not enabled. However, you can modify the port number.
SMTP Authentication	
SMTP Authentication	Enable this option if the e-mail server requires authentication before an e-mail can be sent. The **Username** and **Password** fields are displayed when you enable this option. Disable this option if you want to configure an unauthenticated e-mail server. The **From Name** and **From E-Mail Address** fields are displayed when you disable this option.

Table 13: SMTP Settings *(continued)*

Field	Description
User Name	Enter the username that you want to use for authentication.
Password	Enter the password that you want to use for authentication.
Confirm Password	Reenter the password for confirmation.
From Name	Enter your name. This name will appear as **from name** to the e-mail recipient.
From E-Mail Address	Enter your e-mail address in the user@domain format. This e-mail address will appear as the sender's e-mail address to the e-mail recipient.
Test SMTP Settings	
E-mail Address	Enter your e-mail address in the user@domain format.
Send Test E-mail	Enter the e-mail address and click **Send Test E-mail** to test the SMTP server connection. If the settings are correct, you will receive an e-mail, which confirms that the SMTP Server is working.

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Customizing E-mail Templates

Contrail Service Orchestration (CSO) provides default e-mail templates that are used to send e-mails for the following operations:

- When a new user account is created.
- When a user's account is locked.
- When a user has forgotten the password.
- When a password is reset.
- When a new password is generated.

Use this page to customize an e-mail template as per your requirements.

To customize an e-mail template:

1. Select **Administration > Email Templates**.

   The Email Templates page appears.

2. Select an e-mail template and click the edit icon (pencil symbol) to modify the content of the template.

   The Edit Template page appears.

3. Modify the e-mail template for the following:
   - Add new context keywords.

     To insert a context keyword into e-mail template, place double curly braces around the keyword.

     Example:

     ```
     {{ user_name }}
     ```

     > **NOTE:** You must not change the existing context keywords— user_first_name, user_last_name, user, and email.

   - Edit the title of the e-mail.

     The title field will be used in the subject of the e-mail

   - Address the user by their first name or last name in the e-mail.

     Examples:

     - ```
       Hi {{ user_first_name }},
       ```
     - ```
       Hi {{ user_last_name }},
       ```

   - Edit the body of the e-mail.
4. After you modify the template:
   - Click **Save** to save the changes.

     The modified template is used to send e-mail to the user. A message indicating the status of the operation is displayed.

   - Click **Cancel** to discard the changes.

The changes to the e-mail templates are discarded and you are returned to the E-mail Templates page.

- Click **Restore Default Content** to restore the e-mail template to default template.

  The e-mail template is restored to the default version that is generated by CSO.

3

CHAPTER

Managing Authentication

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Authentication Methods Overview

Contrail Service Orchestration supports single sign-on (SSO) authentication for the unified portal.

You can authenticate and authorize users by using one of the following authentication methods:

- **Local**—User accounts are maintained locally in CSO, and users are authenticated and authorized by CSO.
- **Authentication by using an SSO server**—User accounts are maintained in the OpCo's SSO server, but authorization information is stored in CSO. Users are authenticated by using the credentials stored in the SSO server.
- **Authentication and authorization by using an SSO server**—User accounts and user roles are maintained in the OpCo's SSO server. Users are authenticated by the SSO server and authorized by CSO by using Security Assertion Markup Language (SAML) attributes.

When you log in to the unified Administration and Customer Portal, the login page is displayed. To log in to the unified Administration and Customer Portal, enter the username on the login page. If the username matches the username pattern configured for SSO, then you are redirected to the SSO page. If the username does not match the username pattern, you must enter the password.

For each SSO authentication method, a list of permitted roles must be provided to the SSO server. Only users with permitted roles in the SAML attribute are allowed to log in to CSO. Also, a mapping between the roles defined in CSO and the roles defined in the external SSO server (Identity Provider) must be provided.

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About the Authentication Page

To access this page, click **Administration > Authentication**.

Use this page to configure the authentication method for OpCo and tenant users. You can also use this page to add, edit, and delete SSO servers, and modify the authentication method.

Tasks You Can Perform

You can perform the following tasks from this page:

- Configure an SSO server. See "Configuring a Single Sign-On Server" on page 60.
- Edit and delete an SSO server. See "Edit and Delete SSO Servers" on page 63.

Field Descriptions

Table 14 on page 57 provides guidelines on using the fields on the Authentication page.

Table 14: Fields on the Authentication Page

Field	Description
Authentication Method	
Users	View the user's type. Example : SP Users or Tenant Users
Authentication Method	View the type of authentication method. Example: Local Authentication
Owner	View the user (Global or OpCo) who configured the authentication method.
SSO Server	View the name of the SSO server.
Username Pattern	View the username pattern. Example: **@aaa-example.com*
Permitted Roles	Displays the permitted role names.
Single Sign-On (SSO) Servers	
SSO Server	View the name of the SSO server.
Description	View the description of SSO server.
Metadata URL	View the URL of the identity provider metadata. Example: https://aaa-example.com/saml/metadata/64000

Table 14: Fields on the Authentication Page *(continued)*

Field	Description
Usage	View the information about whether the SSO server is used for authenticating SP users or tenant users. Example: SP Users

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Editing the Authentication Method

Users with the SP administrator role can use the Authentication page to modify the authentication method for service provider and tenant users.

To modify the authentication method:

1. Select **Administration > Authentication**.

   The Authentication page appears.

2. Select the user type (SP User or Tenant User) for which you want to change the authentication method, click the edit icon.

   The Authentication Type page appears.

3. Select any one of the following authentication methods that you want to configure for the user.

   - Local Authentication
   - Authentication with SSO Server
   - Authentication and Authorization with SSO Server

   For more information about authentication methods, see "Authentication Methods Overview" on page 56.

4. If you select the **Authentication with SSO Server** or **Authentication and Authorization with SSO Server** method, then you must enter the configuration described in Table 15 on page 59.

Table 15: Fields on the Authentication Type Page

Field	Description
SSO Server	Select the SSO server name from the list.
SSO Initiated By	Select the SSO initiation method. • **Service Provider (CSO)**—Select this method if SSO authentication is initiated by CSO. For example, when the user tries to use CSO application without authentication, the user is redirected to the SSO Server. After authentication with the SSO Server, the user is directed to CSO. • **Identity Provider (SSO Server)**—Select this method to authenticate users by using the identity provider. When you login to the identity provider, it provides a list of applications that are integrated with the identity provider and you can access any of the applications. For example, if you click on the CSO application, you are directed to CSO and you can access the CSO application.
If you select the **Service Provider (CSO)** method, then the following field is displayed:	
Username Pattern	Enter a list of username patterns separated by a comma, space, or semicolon. For example, **@aaa-example.com*; *@xyz-example.com. **NOTE:** If the username matches the username pattern, the user is redirected to the SSO server to complete the authentication process. If the username does not match with any of the username patterns, then the local authentication is assumed.
When you select **Identity Provider (SSO Server)** method, the following fields are displayed:	
Direct CSO Login Message	Enter the message to display when a user tries to directly access CSO without being authenticated by the SSO server.
Logout Message	Enter the message to be displayed when the user logs out from CSO.
Tenant Identifier	Select the identifier to correlate the tenant Security Assertion Markup Language (SAML) attribute with the tenant. Whenever the tenant is onboarded into the system, the tenant is uniquely identified by any one of the following identifiers: • **Use Tenant Name**—Select this option to identify the tenants by using the tenant name. • **Use OSS Tenant ID**—Select this option to identify the tenants by using the tenant ID.

Table 15: Fields on the Authentication Type Page *(continued)*

Field	Description
Permitted Roles and Mapping	Roles used in the SSO server (external system) are different from the roles used in CSO. Therefore, you must map the roles defined in CSO with the roles defined in the external SSO server (Identity Provider). To map the roles: 1. Click add icon (+). A new row appears under the header in the table. If you want to delete the row, click the delete icon (X). 2. Select the role from the **Role in CSO** column, and then enter one or more matching roles (separated by commas) in the **Mapped External Role** column. 3. Click **OK** to save the changes. If you want to cancel, The user role in CSO is matched with the role in the SSO server. You can also modify the permitted role and delete one or more permitted roles.

NOTE: If you select the **Local Authentication** type, the **SSO Server**, **SSO Initiated By**, and **Username Pattern** fields are not displayed.

5. Click **Save** to save the changes. If you want to discard the changes, click **Cancel** instead.

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Configuring a Single Sign-On Server

Use this page to configure a single sign-on server (SSO) that is used for authenticating users. There are two entities involved during the SSO configuration:

- **SSO Server or Identity Provider**—An external server integrated with CSO.

- **OpCo**—Acts as an service provider and receives the SAML assertion sent by the SSO server in a response to a login request.

Both the identity provider and OpCo trust each other and configuration is required for both the entities. Two use cases are possible:

- **Identity provider is configured first before SSO server is added in CSO**—The identity provider is configured first. Then, at the OpCo level, you can add the SSO server in CSO for tenant users, and enter the server name and metadata URL.
- **IdP is configured after SSO server is added in CSO**—Enter the SSO server name and then click the **Next** button. CSO provides a list of URLs to be configured in the identity provider. After the identity provider is configured with the URLs, you can edit the SSO server name and enter the metadata URL.

> **NOTE:** For both the use cases, the metadata URL is required before you use the SSO server.

To configure an SSO server:

1. Select **Administration > Authentication**.

   The Authentication page appears.

2. Click the plus icon (+) in the Single Sign-On Server section.

   The Add Single Sign-On Server page appears.

3. Complete the configuration according to the guidelines Table 16 on page 62.

4. Click **Save** to save the changes. If you want to discard the changes, click **Cancel** instead.

5. After you configure both the SSO Server and CSO, click the **Test Login** button from the Authentication page.

   The SSO login page appears and shows the SAML attributes.

   > **NOTE:** You must specify the metadata URL before you click the **Test Login** button. If you click the **Test Login** button without entering the metadata URL, an error message indicating that the metadata URL must be specified is displayed.

Table 16: Fields on the Single Sign-On Server Page

Field	Description
Basic Info	
SSO Server Name	Specify the name of the SSO server. You can use a string of alphanumeric characters, special characters such as the underscore (_) or the period (.), and spaces. The maximum length is 40 characters.
Description	Enter a meaningful description for the SSO server.
Metadata URL	Enter the URL from where the application metadata needs to be downloaded.
User Identification	Specify how a user is identified from the SAML assertion: • Name ID: The user is identified from the Name ID field that is present in the subject of the SAML assertion. • SAML attribute: The user is identified from the fixed value attribute.
SAML Settings	
SAML URLs	CSO displays the SAML URL settings. The administrator use this information to configure the IdP.
Single Sign-On URL	Displays the SAML Assertion Consumer Service (ACS) URL for the application. Example: https://*aaa-example.com*/ssol/*sso server name*/SAML2/POST
Audience URI (SP Entity ID)	Displays the service provider entity ID of the application. Example: https://*aaa-example.com*/Shibboleth
Metadata URL	Displays the metadata URL of the application. Example: https://*aaa-example.com*/saml/metadata/64000
Download Metadata	Click this option to download metadata from the application. The administrator can download the CSO metadata and use the metadata to configure the identity provider instead configuring individual identity provider fields at a time.
SAML Attributes	The identity provider needs to provide the SAML attributes if the authentication method is configured as **Authentication and Authorization with SSO Server**. **NOTE:** No SAML attributes are required if the authentication method is configured as **Authentication with SSO Server**.

Table 16: Fields on the Single Sign-On Server Page ***(continued)***

Field	Description
tenant	This attribute is required when the Tenant User is authenticated. The value of this attribute should match with the tenant name used when the tenant was onboarded.
role	This attribute has four values. See Table 17 on page 63.

Table 17: Attribute Values and Roles

Attribute Value	Role
cloud-admin	SP Admin
cloud-operator	SP Operator
tenant-admin	Tenant Admin
tenant-operator	Tenant Operator

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Edit and Delete SSO Servers

IN THIS SECTION

- Edit SSO Server Configuration | 64
- Delete SSO Server Configurations | 64

From the **Administration** > **Authentication** page, you can edit the information of an SSO server, and delete one or more SSO servers.

Edit SSO Server Configuration

To edit the SSO server configuration:

1. Select **Administration > Authentication**.

   The Authentication page appears.

2. From the Single Sign-On (SSO) Servers section, select the check box of the SSO server name that you want to modify, and click the edit icon.

   The Edit Single Sign-On page appears. The options available on the Add Single Sign-On Server page are available for editing.

3. Update the configuration as needed.

4. Click **Next** to save the changes. If you want to discard your changes, click **Cancel** instead.

Delete SSO Server Configurations

Use the delete icon (X) at the top right corner of a page to delete one or more SSO servers.

To delete the SSO server configuration:

1. Select **Administration > Authentication**.

   The Authentication page appears.

2. Select the SSO server name that you want to delete and click the delete icon (X).

   The Confirm Delete page appears.

3. Click **Yes** to delete the SSO server or **No** to cancel the deletion.

   If you click **Yes**, then the SSO server is deleted. After an SSO server is deleted, you cannot use that SSO server for authenticate or authorize users.

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4

CHAPTER

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Tenant Overview

A tenant in a Contrail Service Orchestration represents a customer who accesses virtualized network functions (VNFs) in a service provider's or an OpCo's cloud through a Layer 3 VPN. You assign administrative users and sites to customers in the Administration Portal to represent the staff in the customer's organization and the geographical locations in the customer's network. You also use Administration Portal to allocate network service profiles to customers.

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Full Mesh Topology Overview

Contrail Service Orchestration (CSO) supports the full mesh topology on tenants in a software-defined WAN (SD-WAN) implementation. In a full mesh topology, all sites of a tenant are connected to one another. The sites are connected to one another through GRE and GRE_IPsec overlay tunnels. The default overlay tunnel encapsulation is GRE_IPsec.

In the full mesh topology, a WAN interface of one type is connected to a WAN interface of a different type if these WAN interfaces are associated with same mesh tags. A mesh tag is a label that you associate with a WAN link of a site. Mesh tags provide you the flexibility to establish overlay tunnels between WAN links of two different sites

> **NOTE:** With mesh tags, you can connect two WAN links even if the link types (MPLS and Internet) are different.

The following requirements must be satisfied for connections between WAN interfaces:

- IP addresses of Internet WAN interfaces must be reachable on the Internet. Also, IP addresses must be preserved and change in IP addresses is not supported.
- WAN links that are associated with same mesh tags must be reachable on the Internet.

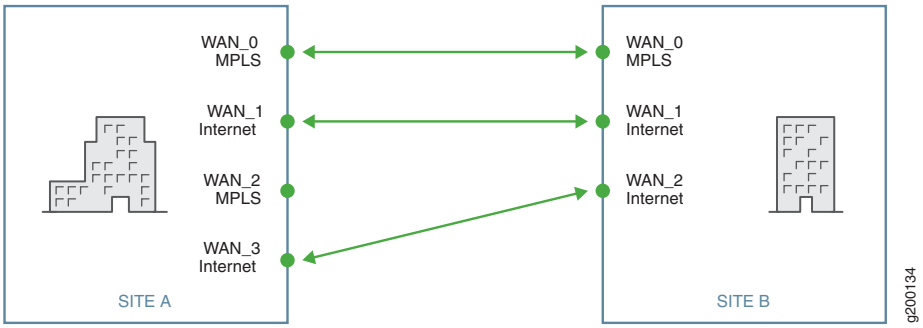
For more information about mesh tags, see *Mesh Tags Overview*.

The full mesh topology supports the following:

- Static policies and Application Quality of Experience (AppQoE)
- Dynamic mesh
- Mesh tags
- LAN segmentation
- Departments
- Multiple VPNs

CSO supports only sparse mode connections in full mesh topology. In sparse mode, a WAN interface of a specific type in a site is connected to only one other interface of the same type (see Figure 1 on page 68). This configuration reduces the number of overlay tunnels formed and is easy to maintain. However, sparse mode is susceptible to SD-WAN network performance deterioration due to connectivity disruptions because if connectivity on one tunnel is lost, then the respective connected WAN interfaces become unreachable.

Figure 1: Sparse Mode



Local Breakout in Full Mesh Topology

Local breakout is supported on all sites in the full mesh topology. Local breakout is the ability of a site to route Internet traffic directly from the site. A site can have multiple WAN interfaces, but only the WAN interfaces (up to a maximum of three) that are *not* enabled exclusively for local breakout traffic are chosen for connecting to the full mesh network. For instance, consider a site that has four WAN interfaces enabled. If WAN_1 on the site is enabled exclusively for local breakout traffic, then only WAN_0, WAN_2, and WAN_3 can be chosen for forming a full mesh.

WAN interfaces that are enabled exclusively for local breakout traffic cannot be used for non-Internet traffic and this makes those WAN interfaces essentially unusable in the full mesh topology. For WAN interfaces that are chosen to connect to the full mesh network, you do not need to provide overlay tunnel information while configuring the site; the overlay tunnel information is computed automatically.

CPE Devices Behind NAT in Full Mesh Topology

CSO supports site-to-site tunnels for WAN links of CPE devices behind NAT in full mesh topology. You can now provide private IP addresses for WAN links behind NAT and create the tunnels to hub or spoke sites. The support for CPE devices behind NAT in full mesh topology is applicable only for spoke devices. The OAM hubs, data hubs, and enterprise hubs or on-premise gateways require static public IP addresses for their WAN interfaces.

The supported NAT types are listed in Table 18 on page 69.

Table 18: CPE Behind NAT in Full Mesh Topology

WAN IP Address	NAT Type	Spoke-to-Hub Tunnel	Spoke-to-Spoke Tunnel
Public IP address	No NAT	Supported	Supported
Private IP address	Full cone NAT	Supported	Supported
Private IP address	Restricted NAT	Supported	Supported
Private IP address	Symmetric NAT	Supported	Not supported

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About the Tenants Page

To access this page, click **Tenants**.

A tenant in Contrail Service Orchestration is a customer who can use one or more services (SD-WAN, Next Gen firewall, or LAN). You can use this page to add tenants, view tenant details, delete tenants, and

add CSO license to a tenant. You can add tenants by importing tenant-related data through a JSON file. See "Tenant Overview" on page 67.

Tasks You Can Perform

You can perform the following tasks from this page:

- View details about a tenant. Click the details icon for the tenant, or you can select a tenant and click **More > Detail View**.
- Add a single tenant. See "Adding a Single Tenant" on page 72.
- Delete a tenant. See "Delete a Tenant" on page 94
- Import multiple tenants. See "Importing Data for Multiple Tenants" on page 86.
- Assign Network Services. See "Allocating Network Services to a Tenant" on page 91.
- View tenant import history. See "Viewing the History of Imported Tenant Data" on page 92.
- View tenant delete history. See "Viewing the History of Deleted Tenant Data" on page 95.

Field Descriptions

Table 19 on page 70 provides guidelines on using the fields on the Tenants page.

Table 19: Fields on the Tenants Page

Field	Description
Name	Name of the tenant. Click the name to view full information about a tenant.
Deployment Type	Displays the SD-WAN mode (real-time optimized) of the tenant. A hyphen (-) is displayed if the site type is Next Gen Firewall or LAN.
Site Types	Displays one or more site capabilities (SD-WAN, Next Gen Firewall, LAN) that the tenant can add.
Sites	Total number of sites that are available for the tenant.

Table 19: Fields on the Tenants Page *(continued)*

Field	Description
Assigned Services	Number of services that are assigned to the tenant. To assign services to the tenant: 1. Click the Allocate Network Services link in Assigned Service column. The Allocate Network Services to *Tenant-Name* page appears. All network services that are available for the customer are listed. 2. Select the network services and click **Ok**. The network services are assigned to the tenant.
Activated Service Instances	Number of services that have been deployed by the administrator on a connection in the network.
Certificate Renewal	Displays the certificate renewal type (Auto or Manual).
Administrator	Administrative user for the tenant.
Last Modified	Date and time when the tenant was last modified.

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Adding a Single Tenant

You can use the Add Tenant page to add tenant data and other objects associated with a tenant, such as tenant user, network details, deployment scenario, service profiles, and custom properties. A single tenant can support one or more of the following services:

- SD-WAN service
- Next Gen Firewall service
- LAN service

> **TIP:** A single tenant with SD-WAN service supports both full mesh or hub-and-spoke topologies.
>
> To connect sites in hub-and-spoke topology,
>
> - Disable **Dynamic Mesh** on the Add Tenant page.
> - Enable the **Use For Fullmesh** toggle button on Add On-Premise Spoke Site and Add Enterprise Hub pages. You much select matching mesh tag for both enterprise hub and on-premise spoke sites.
>
> To connect sites in full mesh topology,
>
> - Enable **Dynamic Mesh** on the Add Tenant page.
> - Enable the **Use For Fullmesh** toggle button on Add On-Premise Spoke Site and Add Enterprise Hub pages and select an appropriate mesh tag.

In earlier versions of Contrail Service Orchestration (CSO), when a tenant user logs in to the Customer Portal for the first time, the user is assigned the Tenant Administrator role by default. With the introduction of object-based custom roles, the tenant user that logs in to Customer Portal for the first time might have customized roles and the role is not restricted to Tenant Administrator.

The information listed on the Tenants page changes depending on the authentication mode configured:

- **Local Authentication**—You can add the administrative user information as the first step from the Tenants page.
- **Authentication and Authorization with SSO Server**—The **Admin User** information is not displayed on the Tenants page because users are not created in CSO and they are managed in the SAML identity provider. In addition, users are dynamically authorized to the CSO role based on the mapping rules configured in the SAML authentication.

- **Authentication with SSO Server**—When you create the administrative user, the login page does not require you to configure a password because the user is created in the SSO without the password and you can enter only the username.

To add a tenant:

1. Select **Tenants**.

   The Tenants page appears.

2. Click the add (+) icon.

   The Add Tenant page appears.

3. Add the tenant information by completing the configuration according to the guidelines provided in Table 20 on page 73.

   > **NOTE:** Fields marked with an asterisk (*) are mandatory.

4. Click **OK**.

   A job to add the tenant is triggered and you are returned to the Tenants page. A confirmation message appears at the top of the page indicating that the job was created. You can click the link in the message to view the details of the job. (Alternatively, you can check the status of the job on the Jobs (**Monitor > Jobs**) page. After the job completes successfully, the tenant that you added is displayed on the Tenants page.

   If the SMTP server is configured, an e-mail is sent to the tenant, which includes a URL to access Customer Portal. The URL is active for only 24 hours and is valid only for the first log in.

Table 20: Fields on the Add Tenant Page

Field	Description
Tenant Info	
Name	Enter a unique name for the tenant. You can use alphanumeric characters and hyphen (-); the maximum length is 32 characters. Example: test-tenant
Admin user	
First Name	Enter the first name of the user.

Table 20: Fields on the Add Tenant Page *(continued)*

Field	Description
Last Name	Enter the last name of the user.
Username (Email)	Enter the e-mail address of the user. The e-mail address is used as the username for the user for logging in to CSO.
Roles	Select one or more roles (both predefined and custom roles) that you want to assign to the tenant user. **NOTE:** In the **Available** column, all tenant scope roles are listed. Click the right arrow(>) to move the selected role or roles from the **Available** column to the **Selected** column. Note that you can use the search icon on the top right of each column to search for role names. To preview the access privileges assigned to a role, click the role name.
Password Policy	
Password Expiration Days	Specify the duration (in days) after which the password expires and must be changed. The range is from 1 through 365. The default value is 180 days. Click **Next** to continue.
Deployment Info	

Table 20: Fields on the Add Tenant Page *(continued)*

Field	Description
Services for Tenant	Select one or more services for the tenant: • **SD-WAN**—Select this option if you want the tenant to add SD-WAN sites. SD-WAN sites can have up to 4 WAN links, and the tenant can define intent policies to intelligently route different applications through different WAN links. • **Next Gen Firewall**—Select this option if you want the tenant to add a standalone firewall site for the CPE device. • **LAN**—Select this option if you want the tenant to provision and monitor switches to optimize performance and maintain SLAs in a LAN. The switch can be provisioned as a standalone device or connected to a CPE device. **NOTE:** The options listed in **Customer Portal > Resources > Site Management > Add** are filtered based on the service that you have selected for a tenant. For example, if you have selected SD-WAN and LAN for a tenant, in **Customer portal > Resources > Sites Management > Add > On-Premise Spoke**, only the following capabilities are listed: • SD-WAN • LAN

Table 20: Fields on the Add Tenant Page *(continued)*

Field	Description
SD-WAN Mode	**NOTE:** This field appears only if you selected the **SD-WAN** in the Services for Tenant field. Select the SD-WAN mode: • **Bandwidth-optimized**—CSO uses link-level probes to switch traffic from links that do not meet SLA criteria to links that meet SLA. This is selected by default. If you select the bandwidth-optimized option, all sites in the tenant are connected to the hub (hub-and-spoke topology). • **Real time-optimized**—CSO monitors application-level traffic and delegates the application-level probes and link switching to CPE. Select this mode if you want to implement AppQoE. In real time-optimized mode, all sites in the tenant are connected in full mesh or hub-and-spoke topology. Click **Next** to continue.
Tenant Properties	
SSL Settings **NOTE:** This setting is applicable only to the SD-WAN deployment scenario.	
Default SSL Proxy Profile	Click the toggle button to enable a default SSL proxy profile for the tenant. If you enable this option, the following items are created when a tenant is added: • A default root certificate with the certificate content specified (in the **Root Certificate** field) • A default SSL proxy profile • A default SSL proxy profile intent that references the default profile This option is disabled by default. **NOTE:** You use this option to create a tenant-wide default profile; enabling or disabling this option does *not* mean that SSL is enabled or disabled. If you enable this option, you must add a root certificate.

Table 20: Fields on the Add Tenant Page *(continued)*

Field	Description
Root Certificate	You can add a root certificate (X.509 ASCII format) by importing the certificate content from a file or by pasting the certificate content: • To import the certificate content directly from a file: 1. Click **Browse**. The **File Upload** dialog box appears. 2. Select a file and click **Open**. The content of the certificate file is displayed in the **Root Certificate** field. • Copy the certificate content from a file and paste it in the text box. After the tenant is successfully added, a default root certificate, a default SSL proxy profile, and a default SSL proxy profile intent are created. **NOTE:** • The root certificate must contain both the certificate content and the private key. • For full-fledged certificate operations, such as certificates that need a passphrase, or that have RSA private keys, you must use the Certificates page (**Administration > Certificates**) to import the certificates and install on one or more sites.
VPN Authentication **NOTE:** This setting is applicable only to the SD-WAN deployment scenario.	

Table 20: Fields on the Add Tenant Page *(continued)*

Field	Description
Authentication Type	

Table 20: Fields on the Add Tenant Page *(continued)*

Field	Description

	Select the VPN authentication method to establish a secure IPsec tunnel:
	• Preshared Key—Select this option if you want CSO to establish IPsec tunnels using keys.
	NOTE: Preshared Key is the default VPN authentication method.
	• PKI Certificate—Select this option if you want CSO to establish IPsec tunnels using public key infrastructure (PKI) certificates. Specify the following:
	  • CA Server URL—Specify the Certificate Authority (CA) Server URL. For example, http://*CA-Server-IP-Address*/certsrv/mscep/mscep.dll/pkiclient.exe.
	  The CA server manages the life cycle of a certificate. The CA server also publishes revoked certificates to the certification revocation list (CRL) server. To obtain trusted CA certificates, CSO communicates with the CA server using the Simple Certificate Enrollment Protocol (SCEP).
	  • Password—Specify the password for the CA server. This field is optional.
	  • CRL Server URL—Specify the certificate revocation list (CRL) server URL. For example, http://*Revocation-List-Server-IP-Address*/certservices/abc.crl. CSO retrieves the list of revoked certificates from the CRL server.
	  • Auto Renew CA Certificates—Click the toggle button to enable automatic renewal of certificates.
	  If you enable the Auto Renew toggle button, certificates are automatically renewed for all sites in the tenant.
	  By default, the Auto Renew toggle button is disabled. If you disable the Auto Renew toggle button, certificates must be manually renewed.
	  NOTE: If the certificate is expired before the renewal, CSO might not be able to reach the device.
	  • Renew before expiry—This field appears only if you enabled the automatic renewal of certificates.

Table 20: Fields on the Add Tenant Page *(continued)*

Field	Description
	Select the period (3 days, 1 week, 2 weeks, or 1 month) before the expiration date when the certificates get automatically renewed. **NOTE:** The default value is 2 weeks. You can also change the duration in the VPN Authentication page in Customer Portal (**Administration > Certificate Management > VPN Authentication**) page.
Overlay Tunnel Encryption **NOTE:** This is applicable only to the SD-WAN deployment scenario.	
Encryption Type	For security reasons, all data that passes through the VPN tunnel must be encrypted. Select the encryption type: • 3DES-CBC—Triple Data Encryption Standard with Cipher-Block Chaining (CBC) algorithm. • AES-128-CBC—128-bit Advanced Encryption Standard with CBC algorithm. • AES-128-GCM—128-bit Advanced Encryption Standard with Galois/Counter Mode (GCM) algorithm. • AES-256-CBC— 256-bit Advanced Encryption Standard with CBC algorithm. • AES-256-GCM—256-bit Advanced Encryption Standard with GCM algorithm. The default encryption type is AES-256-GCM.
Network Segmentation	
Network Segmentation	Click the toggle button to enable or disable network segmentation on the tenant. You enable network segmentation to create layer 3 VPNs per department.
Dynamic Mesh This setting is applicable only to the SD-WAN deployment scenario in real-time optimized mode.	
Threshold for Creating a Tunnel Set a threshold value, above which a tunnel is created between two sites.	

Table 20: Fields on the Add Tenant Page *(continued)*

Field	Description
Number of sessions	Specify the maximum number of sessions closed (for a time duration of 2 minutes) between two spoke sites. The dynamic mesh tunnel is created between two spoke sites if the number of sessions closed (for a time duration of 2 minutes) is greater than or equal to the value that you specified. The default threshold value (the number of sessions for 2 minutes) is 5. For example, if you specify the number of sessions as 5, dynamic mesh tunnels are created if the number of sessions closed between two spoke sites in 2 minutes exceeds 5.
Threshold for Deleting a Tunnel Set a threshold value, below which a tunnel is deleted between two sites.	
Number of sessions	Specify the minimum number of sessions closed (for a time duration of 15 minutes) between two spoke sites. The dynamic mesh tunnel is deleted between two spoke sites if the number of sessions closed (for a time duration of 15 minutes) is lesser than or equal to the value that you specified. The default threshold value (the number of sessions for 15 minutes) is 2. For example, if you specify the number of sessions as 2, the dynamic mesh tunnels are deleted if the number of sessions closed is lesser than or equal to 2.
Max Dynamic MeshTunnels	

Table 20: Fields on the Add Tenant Page *(continued)*

Field	Description
Max tunnels per CSO	Displays the maximum number of dynamic mesh tunnels that can be created in CSO. The total number of dynamic mesh tunnels that can be created by all tenants in CSO is limited to 125000. A major alarm is raised if the number of dynamic mesh tunnels created by all tenants reaches seventy percent of the maximum value. A critical alarm is raised if the number of dynamic mesh tunnels created by all tenants reaches ninety percent of the maximum value. To view alarms, see **Monitor > Alerts & Alarms > Alarms** in Administration Portal. For more information about alarms, see "About the Alarms Page" on page 434.
Max tunnels per tenant	Specify the maximum number of dynamic mesh tunnels that the tenant can create. Range: 1 through 50,000. A major alarm is raised if the number of dynamic mesh tunnels created by all sites in a tenant reaches seventy percent of the maximum value. A critical alarm is raised if the number of dynamic mesh tunnels created by all sites in a tenant reaches ninety percent of the maximum value. To view alarms, see **Monitor > Alerts & Alarms > Alarms** in Customer Portal. For more information about alarms, see *About the Alarms Page*.
Dynamic Mesh	Click the toggle button to disable dynamic meshing between sites in the tenant. Dynamic meshing is enabled by default.
Cloud Breakout Settings **NOTE:** This setting is applicable only to the SD-WAN deployment scenario.	

Table 20: Fields on the Add Tenant Page *(continued)*

Field	Description
Customer Domain Name	Enter the domain name of the tenant. The domain name is used in cloud breakout profiles to generate the fully qualified domain name (FQDN). The cloud security providers use the FQDN to identify the IPsec tunnels. Example:test.gmail.com
Advanced Settings (Optional)	
Tenant-Owned Public IP Pool	You can add one or more public IPv4 subnets that are part of the tenant's pool of public IPv4 addresses. The tenant IP pool addresses are assumed to be public IP addresses and represent public LAN subnets in SD-WAN on-premise spoke sites. To add an IPv4 subnet: 1. Click the add (+) icon. An editable row appears inline in the table. 2. In the Addresses field, enter a valid, public IPv4 prefix. **NOTE:** Ensure that the IP addresses configured for a tenant are unique. 3. Click ✓ (check mark) to save your changes. The prefix that you entered is displayed in the table. You can enter more IPv4 subnets by following the preceding procedure. You can also modify subnets that you entered by selecting a row and clicking the edit (pencil) icon.
Tenant-specific Attributes	If you have set up a third-party provider edge (PE) device by using software other than CSO, then configure settings on that router by specifying custom parameters and its corresponding values.
Name	Specify any information about the site that you want to pass to a third-party router. Example: Location

Table 20: Fields on the Add Tenant Page *(continued)*

Field	Description
Value	Specify a value for the information about the site that you want to pass to a third-party device. Example: Boston Click **Next** to continue.
Summary	You can review the configuration in the Summary tab and modify the settings, if required. You can also download the settings that you configure as a JavaScript Object Notation (JSON) file by clicking the **Download as JSON** link at the bottom of the page.

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Edit Tenant Parameters

You, as an SP administrator or OpCo administrator, can modify the parameters configured for a tenant from the Tenants page.

To modify the parameters configured for a tenant:

1. Select **Tenants**.

   The Tenants page appears.

2. Select the tenant whose parameters you want to modify and click the **Edit** icon (pencil).

   The Edit Tenant page appears, displaying the same fields that are presented when you add a tenant.

3. Modify the tenant parameters as needed. For more information on these parameters, see "Adding a Single Tenant" on page 72.

4. Click **Save** to save the changes or click **Cancel** to discard the changes.

   If you click Save, the changes that you made for the tenant are saved.

Subsequently, a tenant edit job is triggered and a confirmation message, indicating that a tenant edit job is created successfully, appears on the Tenant Settings page.

5. (Optional) You can click the job name in the message to view details of the job (including job status, start date and time, and end date and time) on the **Update tenant settings Details** page. Alternatively, you can view the status of the job on the Jobs (**Monitor > Jobs**) page.

   If the job is completed successfully, a confirmation message appears on top of the Tenants page.

Table 21 on page 85 describes the tenant parameters that you can modify.

Table 21: Tenant parameters

Tenant Capability	Tenant Parameters
Tenant Info	
Basic Information	
Name	You cannot modify the name of the tenant.
Password Policy	
Password Expiration Days	The settings are applicable to all new users and users whose password has expired.
Deployment Info	
Services	You can add or remove one or more services for the tenant. **NOTE:** The changes are applied to newly-added sites only.
SD-WAN Mode	This field is read-only.
Tenant Properties	

Table 21: Tenant parameters ***(continued)***

Tenant Capability	Tenant Parameters
Tenant with SD-WAN capability	You can modify the following parameters only before SD-WAN sites are added by the tenant: • SSL Settings • VPN authentication NOTE: If **PKI Certificate** is configured as the authentication type during tenant onboarding, you can modify the PKI properties (CA Server URL, Password, CRL Server, and Auto Renew) even after SD-WAN sites are added by the tenant. • Overlay Tunnel Encryption • Network Segmentation You can modify the following parameters even after SD-WAN sites are added by the tenant: • Dynamic Mesh > Threshold for Creating a Tunnel and Threshold for Deleting a Tunnel • Cloud Breakout Settings • Tenant-Specific Attributes
Tenant with Next Gen Firewall capability	Tenant-Specific Attributes
Tenant with LAN capability	Tenant-Specific Attributes

Importing Data for Multiple Tenants

IN THIS SECTION

- Creating a Tenant Data File | **87**
- Importing Tenant Data | **90**

You can use the Import Tenants page to import tenant data and other objects associated with the tenant, such as administrative users, sites, and topology. You can start by downloading a JSON template and using it to customize the data file that you want to import.

Creating a Tenant Data File

To create a tenant data file:

1. On the Tenants page, click **Import Tenants > Import**.

   The Import Tenants page appears.

2. Click **Download Sample JSON** to download a sample JavaScript Object Notation (JSON) template.

   The sample tenant template file is downloaded to your system.

3. On the Import Tenants page, click **Cancel**.

4. Open the template file.

5. Save the template file to your computer with an appropriate name.

6. Customize the file with your tenant data, using Table 22 on page 87 as a reference.

7. Save the customized tenant data file.

You can add tenants using the customized tenant data file.

Table 22: Tenant Configuration Fields

Field	Description
tenant_name	Specify the name of the tenant. You can only use alphanumeric characters and hyphens; the maximum length allowed is 32 characters. Example: tenant-a
password_expiration_radio	Specify the duration (in days) after which the password expires and must be changed.
tenant_admin	

Table 22: Tenant Configuration Fields *(continued)*

Field	Description
admin_user_name	Specify a unique name for the tenant administrator. Example: admin-tenant-a
first_name	Enter the first name of the tenant.
last_name	Enter the second name of the tenant.
password_expiration_interval	Specify the duration (in days) after which the password expires and must be changed. The range is from 1 through 365.
topology_type	Specify the topology type (SD-WAN)
default_ssl_proxy_profile	Specify whether you want to enable or disable SSL proxy profile for the tenant
properties	If you have set up a third-party provider edge (PE) device by using software other than Contrail Service Orchestration, then configure settings on that router by specifying custom parameters and its corresponding values. Specify information (name and value) about the site that you want to pass to a third-party router.
vpn	Specify the VPN authentication method to establish a secure IPsec tunnel.
departments	Specify if you want to enable network segmentation on the tenant.
managed_wan_topology	
network_name	Specify a unique name for the customer Layer 3 VPN network. You can use an unlimited number of alphanumeric characters, including symbols. Example: vcpe-tenant-a-l3vpn
router_info (cloud_site_info)	
router_name	Specify the router name that connects to the tenant site. This value matches the interface that you configure for the MX Series router physical network element (PNE). Example: PNE-MX10

Table 22: Tenant Configuration Fields *(continued)*

Field	Description
route_target	Specify the route target of the transit network for the tenant. Example: 8888:889
right_network_name	Specify the name of the transit network for the tenant. Example: internet, corp-vpn-right
subnet	Specify the subnet of the transit network for the tenant. Example: 10.154.0.0/24
route_target (internet-info)	Specify the route target of the site virtual network. Example: 8888:887
subnet (internet-info)	Specify the IP address of the subnet that connects the site to the Internet. Example: 10.155.0.0/24
pop_info (cloud_site_info)	
pop_name	Specify the name of the POP that manages the site. You can use an unlimited number of alphanumeric characters, including symbols. Example: pne-pop10
route_target	Specify the route target of the transit network for the tenant. Example: 8828:889
right_network_name	Specify the name of the transit network for the tenant. Example: corp-vpn-right
subnet	Specify the subnet of the transit network for the tenant. Example: 10.151.0.0/24
route_target (internet-info)	Specify the route target of the site virtual network. Example: 8888:887

Table 22: Tenant Configuration Fields *(continued)*

Field	Description
subnet (internet-info)	Specify the IP address of the subnet that connects the site to the Internet. Example: 10.155.0.0/24
pop_info (data_center_site_info)	
pop_name	Specify the name of the POP. You can use an unlimited number of alphanumeric characters, including symbols. Example: pne-pop10
route_target	Specify the route target for the corporate data center network. Example: 65412:772
subnet	Specify the subnet of the corporate data center network. Example: 10.155.0.0/24
route_target (internet-info)	Specify the route target for the Internet network. Example: 8888:887
subnet (internet-info)	Specify the subnet IPv4 address for the Internet network. Example: 10.155.0.0/24

Importing Tenant Data

To import tenant data:

1. Click **Tenants > All Tenants > Import Tenants**.

   The Import Tenants page is displayed.

2. Click **Browse** and navigate to the directory where the tenant file is located.

3. Select the tenant file and click **Open**.

4. Click **Import**.

The status of the import operation is displayed. You can click **View Details** for more information about the import operation. If the import operation state is successful, then proceed to Step 4 or verify the tenant file format.

5. Click **OK**.

   The new tenants are displayed on the Tenants page. You can click any tenant to view more information about the tenant.

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Viewing the History of Imported Tenant Data | 92

Allocating Network Services to a Tenant

Use the Tenants page to assign the network services to a tenant. Network services are created and saved in Network Service Designer. When setting up a tenant with Administration Portal, you must import the network services and assign them to customers. After the allocation, tenants can see and activate the network services in Customer Portal.

Before You Begin

To assign network services:

1. Click **Tenants**.

   The Tenants page appears.

2. Select a customer and click **Allocate Network Services**.

   The Allocate Network Services to *Tenant-Name* page appears. All network services that are available for the customer are listed.

3. Select the network services and click **Ok**.

   The network services are assigned to the tenant.

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Viewing the History of Imported Tenant Data

You can use the Import History page to view the imported tenant data, status of the import operation, and log details.

To view the history of imported tenant data:

1. Click **Tenants > Import Tenants > Import History**.

   The Import History page is displayed. Table 23 on page 92 describes the fields on the Import History page.

2. Click the task name.

   The Import Tenants Task page appears. Table 24 on page 93 describes the fields on the Import Tenants Task page.

3. Click the task ID on the Job Status page to view the job details, such as whether this job succeeded or failed.

   Table 25 on page 93 describes the fields on the Job Status page for imported tenant data.

Table 23: Fields on the Import History Page

Field	Description
In progress	View the number of import tasks that are in progress.
Success	View the number of import tasks that succeeded.
Failure	View the number of import tasks that have failed.
Name	View the name of the task.
Start Date	View the start date and time of the task.
End Date	View the end date and time of the task.
Status	View the status of the task to know whether the task succeeded or failed.
Log	View the import logs. Click a log to access more detailed information about the imported log.

Table 24: Fields on the Import Tenants Task Page

Field	Description
Success	View the number of times the import operations succeeded for a tenant.
Failure	View the number of times the import operations failed for a tenant.
Task ID	View the ID created for the task. Click the task ID to view the import log details corresponding to a tenant.
Status	View the status of the task to know whether the task succeeded or failed.

Table 25: Fields on the Job Status Page for Imported Tenant Data

Field	Description
Name	View the name of the task.
User	View the name of the user who imported the task.
State	View the status of the task to know whether the task succeeded or failed.
Actual Start Time	View the start date and time of the task.
End Time	View the end date and time of the task.

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Delete a Tenant

Users with the SP (Service Provider) Administrator or OpCo (Operating Company) Administrator role can delete a tenant and its associated sites.

> **NOTE:** Before triggering the deletion of a tenant, ensure that you delete the allocated network services and deployed policies for all the associated sites.

To delete a tenant:

1. Select **Tenants**.

   The Tenants page appears.

2. Select the tenant that you want to delete.

   > **NOTE:**
   > - You can delete only one tenant at a time.
   > - When a tenant is deleted, the sites, users, devices, and all other data associated with the tenant are deleted.

3. Click the delete (trash can) icon.

   The Confirm Delete dialog box appears.

4. Click **Yes**.

   The Confirm dialog box appears indicating that the sites associated with the tenant will also be deleted.

5. Click **Yes**.

   A job to delete the tenant is triggered and you are returned to the Tenants page.

   A confirmation message appears (with the job link) at the top of the page indicating that the job was created. You can click the job link to view the status of the job. Alternatively, you can check the status of the job on the Jobs (**Monitor** > **Jobs**) page.

   After the job completes successfully, the tenant is removed on the Tenants page.

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Viewing the History of Deleted Tenant Data

You can use the Delete History page to view the deleted tenant data, status of the delete operation, and log details.

To view the history of deleted tenant data:

1. Click **Tenants > Import Tenants > Delete History**.

   The Delete History page is displayed. Table 26 on page 95 describes the fields on the Delete History page.

2. Click the task name.

   The Delete Tenants Tasks page appears. Table 27 on page 96 describes the fields on the Delete Tenants Tasks page.

3. Click the task ID in the Job Status page to view the job details, such as whether this job succeeded or failed.

   Table 28 on page 96 describes the fields on the Job Status page for deleted tenant data.

Table 26: Fields on the Delete History Page

Field	Description
In progress	View the number of delete tasks that are in progress.
Success	View the number of delete tasks that succeeded.
Failure	View the number of delete tasks that failed.
Name	View the name of the task.
Start Date	View the start date and time of the task.
End Date	View the end date and time of the task.

Table 26: Fields on the Delete History Page *(continued)*

Field	Description
Status	View the status of the task to know whether the task succeeded or failed.
Log	View the delete logs. Click a log to access more detailed information about deleted logs.

Table 27: Fields on the Delete Tenants Tasks Page

Field	Description
Success	View the number of delete operations that succeeded for a tenant.
Failure	View the number delete operations that failed for a tenant.
Task ID	View the ID created for the task. Click the task ID to view the delete log details corresponding to a tenant.
Status	View the status of the task to know whether the task succeeded or failed.

Table 28: Fields on the Job Status Page for Deleted Tenant Data

Field	Description
Name	View the name of the task.
User	View the name of the user who deleted the task.
State	View the status of the task to know whether the task succeeded or failed.
Actual Start Time	View the start date and time of the task.
End Time	View the end date and time of the task.

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Dynamic Mesh Tunnels Overview

In releases earlier than CSO 4.1.0, all static tunnels are established between spoke sites during the Zero Touch Provisioning (ZTP) process.

However, starting with Release 4.1.0, during ZTP, only the following static tunnels are established:

- Between an on-premise spoke site and the corresponding enterprise hub (primary enterprise hub or secondary enterprise hub)
- Between an on-premise spoke site and the provider hub (primary provider hub or secondary provider hub)
- Between two enterprise hubs

Therefore, the communication between two on-premise spoke sites is established only through the enterprise hub or the provider hub.

CSO dynamically creates or deletes a mesh tunnel (without passing through an enterprise hub or a provider hub) between two spoke sites, if:

- The number of sessions closed between two spoke sites crosses the configured threshold value, and
- The WAN links of spoke sites have matching mesh tags. For more information, see *Mesh Tags Overview*.

> **NOTE:** The dynamic mesh feature is applicable only for SD-WAN sites in real-time optimized mode (Full mesh).

The SP administrator, OpCo administrator, or tenant administrator can modify the default threshold value on the following pages:

- The **Administration > Dynamic Mesh** page of Administration Portal.

> **NOTE:** Only the SP administrator or OpCo administrator can modify the default threshold value on this page.

- The Add Tenant page (Tenant-level)
- The **Administration > Tenant Settings** page (Dynamic Mesh section) of Customer Portal (global level)
- The Add On-Premise Spoke Site page (site-level)
- The Add Enterprise page (site-level)

The threshold value that you specify at site-level takes precedence over the tenant-level and global-level threshold values.

That is, the threshold value that you specify on the Add Tenant page overrides the threshold value that you specified on the Dynamic Mesh page of Administration Portal.

Similarly, the threshold value that you specify in the Add Site page overrides the threshold value that you specified on the Dynamic Mesh page and Add Tenant page.

> **NOTE:** Changes that OpCo and SP administrators make at global level do not apply to already-created tenants. The changes are applied only to tenants created after the changes have been made at the global level.

CSO allows you to manually create or delete dynamic mesh tunnels between a source site and a destination site by using Add On-Demand Mesh Tunnel or Delete On-Demand Mesh Tunnel pages in Customer Portal.

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Configuring Dynamic Mesh Tunnels Threshold for Tenants

CSO dynamically creates or deletes a mesh tunnel (without passing through a enterprise hub or provider hub) between two spoke sites , if:

- The number of sessions closed between two spoke sites crosses the threshold value, and
- The WAN links of spoke sites have matching mesh tags.

For more information on dynamic mesh tunnels, see "Dynamic Mesh Tunnels Overview" on page 97.

> **NOTE:** Changes to the dynamic VPN threshold settings are not applied to already-created tenants. Changes are applicable only to tenants that created after the settings have been modified.

To modify threshold values at the global-level (for all tenants):

1. Select Administration > Dynamic Mesh.

   The Dynamic Mesh page appears.

2. Complete the configuration according to the guidelines in Table 29 on page 100.

NOTE: Fields marked with * are mandatory.

3. Click **Save** to save the changes. A confirmation message appears indicating that the threshold values are saved.

   The threshold values that you specify here are applicable for all tenants that you add after modifying the threshold value.

   You can also modify the threshold values while adding a tenant. The threshold value that you specify on the Add Tenant page overrides the threshold value that you specified on the Dynamic Mesh page of Administration Portal.

Table 29: Fields on the Dynamic VPN page

Field	Description
Threshold for Creating a Tunnel	
Sessions Closed	Specify the number of sessions closed (for a duration of 2 minutes) between two spoke sites. If the number of sessions closed (for a duration of 2 minutes) is greater than or equal to the value that you specified, a dynamic mesh tunnel is created between two spoke sites. The default threshold value (the number of sessions closed for 2 minutes) is 5. For example, if you specify the number of sessions closed as 10, dynamic mesh tunnels are created if the number of sessions closed between two spoke sites in 2 minutes is greater than or equal to 10.
Threshold for Deleting a Tunnel	
Sessions Closed	Specify the number of sessions closed (for a duration of 15 minutes) between two spoke sites. If the number of sessions closed (for a duration of 15 minutes) is lesser than or equal to the value that you specified, a dynamic mesh tunnel is deleted between two spoke sites. The default threshold value (the number of sessions for 15 minutes) is 2. For example, if you specify the number of sessions closed as 20, dynamic mesh tunnels are deleted if the number of sessions closed is lesser than or equal to 20.

RELATED DOCUMENTATION

Updating the Terms of Use

When you create a CSO account for a tenant, an e-mail (with the subject line CSO Account Created) is sent. This e-mail contains a URL that allows the tenant to log in to Customer Portal. The URL is active for only 24 hours and is valid only for the first log in.

When the tenant logs in to Customer Portal for the first time, the tenant must read and agree to the terms of use document.

The terms of use document is a policy document (pdf format) that is hosted on Juniper Networks site.

In this page you can specify the URL from which an OpCo admin or a tenant can view or download the Terms of Use document. If there is an update to the Terms of Use document, you can specify the date from which you want the terms of use document to be effective.

To update the information related to the Terms of Use document:

1. Select **Administration** > **Terms of Use**.

   The Terms of Use page appears.

2. Update the fields according to the guidelines in Table 30 on page 101.

   NOTE: Fields marked with * are mandatory.

3. Click **Save** to save the changes.

   A confirmation message appears indicating that the URL and the effective date that you have specified are saved.

Table 30: Fields on the Terms of Use Page

Field	Description
Document URL	Specify the URL from which the tenant can view or download the Terms of Use document. For example, https://www.juniper.net/assets/us/en/local/pdf/legal/*Document-Name*.pdf

Table 30: Fields on the Terms of Use Page *(continued)*

Field	Description
Effective date	If there is an update to the Terms of Use document, you can schedule a date to notify tenants about the change. Select the date from which the Terms of Use document is effective. The format is, YYYY-MM-DD. On the specified date, the Terms of Use page pops up in Customer Portal. The Terms of Use page includes the link to the updated document. By selecting the check box in the Terms of Use page the tenant agrees to the terms and conditions mentioned in the updated document.

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5

CHAPTER

Managing Operating Companies

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Operating Companies Overview

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- OpCo Authentication and Authorization | 105
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- Benefits of Operating Companies | 111

Contrail Service Orchestration (CSO) supports operating companies in a service provider environment. An operating company (OpCo) is a region-specific service provider that can create and manage its own tenants and provide services to them—thus an OpCo is a subset of the global service provider and functions as a service provider for its own tenants.

A global service provider can create one or more operating companies and share resources (cloud hub devices, device templates, and so on) with the operating companies. The global service provider manages its own tenants as well as the operating companies.

For example, the Global SP administrator can create operating companies such as OpCo_Spain, OpCo_Italy, and OpCo_France under the global service provider V1_Global and share the resources with these operating companies.

Tenants managed by one OpCo are isolated from tenants of another OpCo—that is, resources from one OpCo cannot be shared with other operating companies.

> **NOTE:** When an SP administrator creates one or more operating companies under the service provider, the service provider is called a global service provider and the SP administrator is called the Global SP administrator.

This topic contains the following sections:

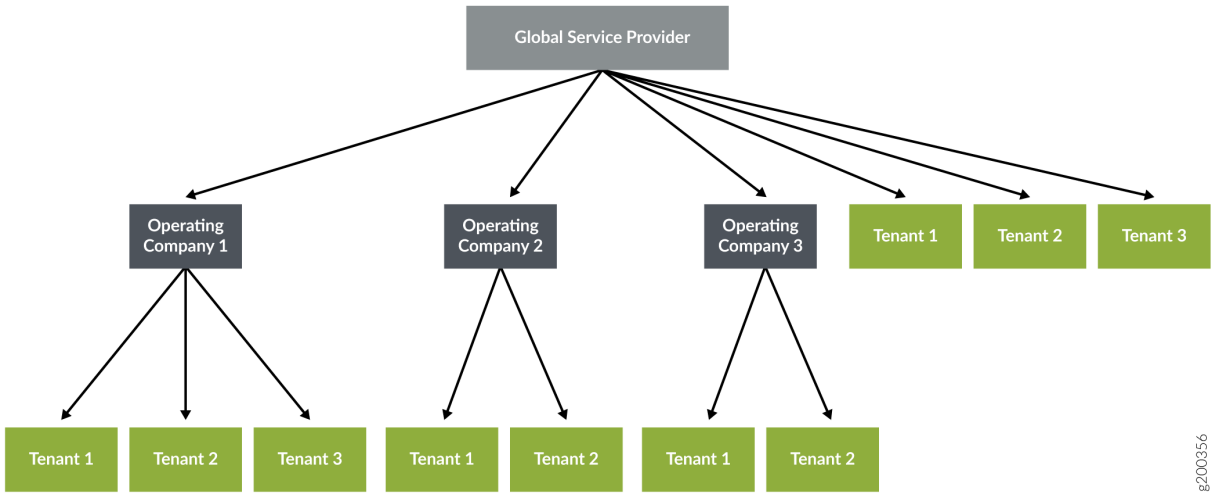
OpCo Hierarchy Management

The CSO multitenant hierarchy has the following levels:

- **Global service provider**—Contains one or more operating companies and its tenants, manages resources at the service provider level, and shares common resources with operating companies and tenants. The Global SP administrator has the required access privileges to view and access resources across operating companies.
- **Operating company**—A region-specific service provider that can manage its tenants and provide services to them. Tenants managed by one OpCo are isolated from tenants of another OpCo. A global service provider share resources (cloud hub devices, device templates, and so on) with the operating companies and their tenants.
- **Tenant**—A tenant uses the resources that the global service provider or the tenant's OpCo shares with it.

Figure 2 on page 105 shows the relationship between the global service provider, operating companies, and tenants. A global service provider can have one or more operating companies and tenants, and each OpCo can be assigned one or more tenants.

Figure 2: OpCo Hierarchy Management



OpCo Authentication and Authorization

A newly created OpCo can use either the same authentication method used by the global service provider or its own SSO server to authenticate its users. If the OpCo uses its own SSO server, the SSO server details need to be added in the Authentication (**Administration > Authentication**) page. For more information about configuring a SSO server, see "Configuring a Single Sign-On Server" on page 60.

The following authentication methods are available for OpCo users:

- Local authentication

- Authentication using an SSO server
- Authentication and authorization using an SSO server

For more information about authentication methods, see "Authentication Methods Overview" on page 56.

Access Privileges for Global SP, OpCo, and Tenant Users

Global SP, OpCo, and tenant users can perform tasks based on the access privileges assigned to these roles.

- An OpCo administrator, Global SP administrator, tenant administrator, or users with administrator role privileges can can perform an administrator's tasks.
- Global SP users cannot access operating companies and tenants automatically. An OpCo administrator, a tenant administrator, or users with administrator role privileges need to provide the required access privileges to the Global SP users. Therefore, global users can view and access operating companies and tenants.
- An OpCo administrator, tenant administrator, or users with the administrator role privileges can add global SP users to the OpCo or to the tenant. Therefore, global SP users can perform tasks specific to an OpCo or a tenant by switching the scope to a specific OpCo or tenant.

For more information about roles, see "Role-Based Access Control Overview" on page 380.

Table 31 on page 106 shows the access privileges of Global SP, OpCo, and Tenant Users.

Table 31: Access Privileges for Global SP, OpCo, and Tenant Users.

Main Menu	Submenu	Access Privileges
Dashboard—Display widgets for both global SP and an OpCo users when they log in to CSO. However, for OpCo users, the following information is filtered based on OpCo tenants.		
	Tenant Sites – Total Alerts	Global SP users can view alerts across all tenants. OpCo users can view alerts across their tenants.
	POPs – Capacity Used	Global SP users can create and manage all POPs and share the POPs with operating companies. Global SP and OpCo users can view POPs usage (CPU, Memory, and Storage).
	Cloud Services: POP Resources Used	Global SP and OpCo users can view POPs usage (CPU, Memory, and Storage).
	Top 5 POPs with Alerts	Global SP and OpCo users can view POPs alerts. However, OpCo users can only view POP alerts across their tenants.

Table 31: Access Privileges for Global SP, OpCo, and Tenant Users. ***(continued)***

Main Menu	Submenu	Access Privileges
	Top 5 Tenants with Alerts	Global SP users can view alerts across all tenants. OpCo users can only view alerts across their tenants.
	Top 5 Sites with Alerts	Global SP users can view alerts across their tenant sites. OpCo users can only view alerts across their tenant sites.
Monitor—Displays a geographical map of all POPs and alerts associated with each POP. Global SP users can create and manage all POPs and share the POPs with operating companies. Both Global SP and OpCo users can view POPs and their associated alerts. However, tenants can view only the alerts of their sites.		
	Alerts	Alerts are generated for a tenant's site or device and the alerts are shared with its tenant's OpCo and global service provider. The tenant user can only view tenant-specific alerts and the OpCo users can view alerts of the OpCo's tenants. Global SP users can view all alerts across all tenants.
	Alert Definition – SD-WAN Alert	Global SP users can create SD-WAN alert definitions. OpCo users and tenants can view SD-WAN alert definitions.
	Alert Definition – Security Alert	Tenants can create security alert definitions. OpCo and Global SP users can view security alert definitions.
	Alarms	Alarms are generated for a specific tenant and shared with an OpCo's tenant and Global SP users. Global SP users can view alarms across all tenants and the OpCo users can view alarms specific to their tenants. Global SP users can view alarms specific to global devices (for example, cloud hub devices).
	Tenants SLA Performance	SLA performance is measured for each tenant. Global SP users can view the SLA performance of all tenants. OpCo users can view the SLA performance of their tenants.
	Jobs – All	Global SP users can view and edit the scheduled jobs across all tenants. OpCo users can view and edit scheduled jobs of the OpCo's tenants. Tenants can view and edit their scheduled jobs.
	Jobs – Scheduled	Global SP users can view scheduled jobs across all tenants. OpCo users can view scheduled jobs specific to their tenants.

Table 31: Access Privileges for Global SP, OpCo, and Tenant Users. ***(continued)***

Main Menu	Submenu	Access Privileges
Resources—Global SP and OpCo users can create and manage POPs, tenant devices, cloud hub devices, device profiles, and device images. POPs and cloud hub devices are shared globally. Both Global SP and OpCo users can view all POPs and cloud hub devices.		
	POP	Global SP users can create POPs and share the POPs with all operating companies and their tenants. Operating companies and tenants of global service provider have read-only access to POPs.
	Tenant Devices	Tenants own tenant devices and share the devices with the tenant's OpCo and global service provider.
	Cloud Hub Devices	Global SP users can create and manage all cloud hub devices and share the devices with operating companies and tenants. Operating companies and tenants have read-only access to cloud hub devices.
	Virtual Route Reflector (VRR)	The VRR is created during CSO deployment and is available to all operating companies and tenants. A virtual route reflector (VRR) resides on a virtual machine (VM) on each regional microservices server. During the CSO installation, a VRR is installed on the regional servers. The VRR has a fixed configuration that you cannot modify. Use of a VRR enhances scaling of the BGP network with low cost and removes the need for hardware-based route reflectors that require space in a data center and ongoing maintenance. **NOTE:** VRR is not a UI element.
	Device Profiles	Device profiles can be managed by: • Global SP—Global SP users can create, modify, and share device profiles with operating companies and tenants. Operating companies and tenants have read-only access to the global service provider's device profiles. • Operating companies—OpCo users can create, modify, and share device profiles with the OpCo's tenants. The global SP users have read-only access to the OpCo's device profiles.
	Images	Global SP users can upload all device images, and the images are available to all operating companies and tenants associated with global service provider and operating companies.

Table 31: Access Privileges for Global SP, OpCo, and Tenant Users. ***(continued)***

Main Menu	Submenu	Access Privileges
Configuration—Global SP and OpCo users can create and manage application traffic types, application SLA profiles, shared objects, and network services and share them with other operating companies.		
	Application Traffic Type Profiles	Global SP users can create and manage application traffic type profiles. Operating companies and tenants have read-only access to application traffic type profiles.
	Application SLA Profiles	Application SLA profiles can be managed by: • Global SP—Global SP users can create application SLA profiles. Operating companies and tenants have read-only access to application SLA profiles. • Operating companies—OpCo users can create SLA application profiles. Global SP users and OpCo tenants have read-only access to SLA application profiles. • Tenants—Both global service provider and OpCo tenants can create SLA application profiles. Global SP and operating companies have read-only access to their tenants SLA application profiles.
	Shared Objects	Global SP users can create and manage shared objects. Operating companies and tenants have read-only access to the shared objects of the global service provider.
	Network Services (VNF and NSD)	Global SP users can create and manage network services and share them with operating companies and tenants.
Tenants—Global SP and OpCo users can create and manage tenants for the global service provider and operating companies.		
	Global Tenants	Global SP users can create and manage their tenants. However, if the global service provider user has privilege to access an OpCo, then the user can switch to OpCo scope and manage OpCo tenants.
	Operating companies	Operating companies can be managed only by the Global SP users. OpCo users are not allowed to create operating companies.
	OpCo Tenants	OpCo users can create and manage their tenants. The Global SP user has read-only access to the OpCo's tenants.
Administration—Global SP and OpCo users can create and manage users, and manage application databases, licenses, and preferences. Both Global SP and OpCo users can configure authentication methods and SMTP settings, and customize e-mail templates for their tenants.		

Table 31: Access Privileges for Global SP, OpCo, and Tenant Users. ***(continued)***

Main Menu	Submenu	Access Privileges
	Users	Users can be managed by: • Global SP—Global SP users can create and manage users for their scope (service provider, tenant, and OpCo). • OpCo—OpCo users are created with appropriate access privileges by switching the scope to an OpCo.
	Authentication	Authentication methods can be configured at: • Global SP—Global SP users can configure an authentication method for service provider and tenant users. • Operating companies—OpCo users can use the same authentication method used by the global service provider or use their SSO server for their tenant users.
	Licenses	Global SP users can upload and manage licenses. OpCo and tenant users can upload their licenses.
	Signature Database	Global SP users can manage and share application signature database with all operating companies and tenants.
	SMTP	SMTP settings can be configured for: • Global SP—Global SP users can configure SMTP settings to send e-mails to their users (service provider, tenant, and OpCo) and tenants. • Operating companies—OpCo users can configure their SMTP settings to send e-mails to their users (both service provider and tenant) and tenants.
	Preferences (Portal Customization)	Global SP users can create and manage themes for all operating companies and tenants. Operating companies can use the same theme used by the global service provider. Only the Global SP users can view and modify the theme settings.
	E-mail Templates	Global SP users can customize e-mail messages. OpCo users can create their e-mail templates for their tenants.

Benefits of Operating Companies

- An OpCo relieves the global service provider of the responsibility of tenant management for a specified region. For example, the OpCo can look after a country-specific regulatory, billing, or operational need for the global service provider.
- With the creation and configuration of operating companies, the Global SP administrator needs to define only a single solution across various regions and countries, and yet enable the operating companies to manage their assigned sets of tenants.
- Each OpCo can use a shared CSO cloud-hosted solution instead of using its own CSO installation. OpCo administrators can access a centrally deployed CSO instance, and local resources, and offer SD-WAN services to their tenants.

About the Operating Companies Page

To access this page, click **Tenants > Operating Companies (OpCos)** in Administration Portal.

Use this page to view and manage operating companies of a Global SP. You can add, edit, and delete operating companies. Each operating company can have its own set of tenants.

Tasks You Can Perform

You can perform the following tasks from this page:

- Create an operating company. See "Creating Operating Companies" on page 112.
- Edit or delete an operating company. See "Editing and Deleting Operating Companies" on page 115.

Field Descriptions

Table 32 on page 111 describes fields on the Operating Companies page.

Table 32: Fields on the Operating Companies Page

Field	Description
OpCo Name	Name of the operating company.

Table 32: Fields on the Operating Companies Page *(continued)*

Field	Description
Authentication Method: OpCo users	A authentication method that the operating company uses to authenticate its users.
Authentication Method: OpCo Tenant users	A authentication method that the operating company uses to authenticate its OpCo tenant users.
Administrator	Name of the administrator that created the operating company.

RELATED DOCUMENTATION

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Creating Operating Companies | 112
Editing and Deleting Operating Companies | 115

Creating Operating Companies

Use the Operating Companies (OpCos) page to create operating companies. The Global SP administrator or users with Create OpCo privilege can create one or more operating companies.

> **NOTE:** Only users with the OpCo administrator role can create its tenants. However, they cannot create further operating companies.

To create an operating company:

1. Select **Tenants > Operating Companies**.

   The Operating Companies (OpCos) page appears, displaying the details of the available operating companies.

2. Click the add icon (+) to create a new operating company.

   The Create Operating Companies (OpCos) page appears.

3. Complete the configuration according to the guidelines provided in Table 33 on page 113.

4. Click **OK**.

   A new operating company is created and listed on the Operating Companies (OpCos) page.

Table 33: Fields on the Create Operating Company Page

Field	Description
Name	Enter a unique name for the operating company. The name can contain alphanumeric characters, underscore, period, and space. The maximum length is 15 characters.
Portal URLs	
Admin Portal	Enter the URL of the Administration portal. End users can use this URL to access the administration portal.
Tenant Portal	Enter the URL of the Customer Portal. End users can use this URL to access the customer portal.
Authentication Method	
OpCo Users	Select the authentication method to authenticate OpCo users. The default method is local authentication. • **Same as Global**—Select this option to use the authentication method which is used by the Global SP. • **Allow OpCo to decide**—Select this option to use OpCo's own authentication method.
OpCo Tenant Users	Select the authentication method to authenticate OpCo's tenant users. The default method is local authentication. • **Same as Global**—Select this option to use the authentication method which is used by the Global SP. • **Allow OpCo to decide**—Select this option to use OpCo's own authentication method.
Admin User	
First Name	Enter the first name of the administrative user.
Last Name	Enter the last name of the administrative user.
Username (Email)	Enter the e-mail ID of the administrative user. The e-mail ID is the username for the administrative user.

Table 33: Fields on the Create Operating Company Page *(continued)*

Field	Description
Role	Select one or more roles (both predefined and custom roles) that you want to assign to the OpCo user. You can assign both service provider and tenant roles to OpCo users. Click the greater-than icon (>) to move the selected role or roles from the **Available** column to the **Selected** column. You can use the search icon on the top right of each column to search for role names. The following are the predefined roles for OpCo users: • **OpCo Admin**—Users with the OpCo Admin role have full access to the OpCo's Administration Portal UI or API capabilities. They can use the UI or APIs to add one or more users with OpCo Admin, OpCo Operator, and custom roles. They can onboard tenants and add the first tenant user during the OpCo's tenant onboarding process. They can also add tenant administrators or operators by switching the scope to a specific tenant. • **OpCo Operator**—Users with the OpCo Operator role have read-only access to the OpCo's Customer Portal UI and APIs.
Password Policy	
Password Expiration Days	Specify the duration (in days) after which the password expires and must be changed. The range is from 1 through 365. The default value is 180 days.

RELATED DOCUMENTATION

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About the Operating Companies Page | **111**

Editing and Deleting Operating Companies | **115**

Editing and Deleting Operating Companies

IN THIS SECTION

- Editing Operating Companies | 115
- Deleting Operating Companies | 116

You can edit and delete operating companies from the Operating Companies (OpCos) page. This topic has the following sections:

Editing Operating Companies

To modify the parameters of an operating company.

> **NOTE:** You cannot modify the operating company name.

1. Select **Tenants > Operating Companies**.

   The Operating Companies (OpCos) page appears, displaying the details of the available operating companies.

2. Select the operating company name that you want to edit and click the edit icon (represented by the pencil graphic on the page).

   The Edit Operating Company(OpCo) page appears.

3. Modify the admin and tenant portal URLs as needed.

4. Click **OK** to save your changes.

   A confirmation message appears, indicating the status of the edit operation.

Deleting Operating Companies

To delete an operating company:

> **NOTE:** You cannot delete an OpCo if any tenant is associated with an OpCo.

1. Select **Tenants > Operating Companies**.

   The Operating Companies (OpCos) page appears, displaying the details of the available operating companies.

2. Select the operating company that you want to delete and then click the delete icon (X) from the top right corner of the page.

   An alert message appears, asking you to confirm the delete operation.

3. Click **Yes** to delete the selected operating company.

   A confirmation message appears, indicating the status of the delete operation. If you do not want to delete, click **Cancel** instead.

RELATED DOCUMENTATION

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Creating Operating Companies | 112

6

CHAPTER

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About the POPs Page

To access this page, select **Resources > POPs**.

Use the POPs page to view the list of available POPs in your network . You can also view and manage each POP in your network.

Tasks You Can Perform

- View details of a POP. Hover over the POP name and click the Detailed View icon or click **More > Detail View**.

  The Detail pane for the selected POP appears on the right side of the POPs page, displaying information such as the sites connected to the POPs and alarms on the POP.

  Click the close icon (X) to close the pane.

- Show or hide columns that contain details of the POP. Click the **Show Hide columns** icon in the top right corner of the page and select columns that you want to view on the page.
- Search for a POP. Click the Search icon in the top right corner of the page to search for a POP.

  You can enter partial text or full text of the keyword in the text box and press Enter.

  The search results are displayed on the same page.

- Create a POP. See "Creating a Single POP" on page 121.
- Import data for multiple POPs. See "Importing Data for Multiple POPs" on page 123.
- View the history of POP data imports. See "Viewing the History of POP Data Imports" on page 127.
- View the history of POP data deletions. See "Viewing the History of POP Data Deletions" on page 129.
- Delete a POP. Click the Delete icon (trash can) to delete a POP.
- Manage resources for a POP. Click a POP from the list of available POPs.

  The<*Pop-name* > page appears. You can view and manage resources for the POP from the tabs that appear.

> **NOTE:** From CSO Release 5.0.0 onward, virtualized infrastructure manager (VIM) and element management system (EMS) are not supported as resources for POPs.

Field Descriptions

Table 34 on page 121 describes the fields on the POPs page.

Table 34: Fields on the POPs Page

Field	Description
Name	Name of the POP. Example: AWS
Location	Location of the POP. Example: Sunnyvale, CA
Routers	Number of routers provisioned in the POP. Example: 1
Tenants	List of tenants in the POP. Example: Softbank, ATT, and Juniper
Sites	Number of tenant sites in the POP. Example: 4
Region	Region selected to manage services in the POP. Example: Regional (default)

RELATED DOCUMENTATION

Creating a Single POP | 121

Creating a Single POP

IN THIS SECTION

- Adding Information About the POP | 122

You can use the POPs page to create a network point of presence (POP) and its associated resources.

Creating a single POP involves adding several types of objects. The sections in this topic describe how to add each type of object to a POP in Administration Portal. You must finish the steps in each section to create the objects that you need for a single POP and to save the POP successfully.

Adding Information About the POP

To add a single POP and to add basic information to the POP:

1. Click **Resources > POPs**.

   The POPs page appears.

2. Click the plus icon (+) .

   The Add POP page appears.

3. Complete the configuration settings according to the guidelines provided in Table 35 on page 122.

4. (Optional) Click **Download as JSON** to save a JSON file of the POP configuration settings that you configured.

5. Click **OK** to save the POP configuration. If you want to discard your changes, click **Cancel** instead.

   A confirmation message appears at the top of the page indicating that the job was created. You can click the link in the message to view the details of the job.

Table 35: Fields on the Add POP page

Field	Description
Region	Regions are used to group services for various business reasons such as location, proximity, service distribution and load. The default region is selected and cannot be modified. Example: regional **NOTE:** The administrator must not delete the region name.
Name	Enter the name of the POP. You can use an unlimited number of alphanumeric characters, including special characters. Example: north-east.

Table 35: Fields on the Add POP page *(continued)*

Field	Description
Street Address	Enter the street address. You can use an unlimited number of alphanumeric characters, including special characters. Example: 1133 Innovation Way
City	Enter the name of the city. You can use an unlimited number of alphanumeric characters, including special characters. Example: Sunnyvale
State/Province	Enter the name of the state. You can use an unlimited number of alphanumeric characters, including special characters. Example: California
ZIP/Postal Code	Enter the zip code or postal code for the country. You can use an unlimited number of alphanumeric characters, including special characters. Example: 94089
Country	Select the name of the country. Example: USA

RELATED DOCUMENTATION

About the POPs Page | 120
About the Routers Page | 131

Importing Data for Multiple POPs

IN THIS SECTION

Customizing a POP Data File | 124
Uploading a POP Data File | 126

You can use the Import POPs page to import a POP and its associated resources, such as a provider edge device for the POP, a virtualized infrastructure manager (VIM), a container for management network for the VIM, and an element management system (EMS).

Customizing a POP Data File

To customize a POP data file:

1. Select **Resources > POPs**.

2. Click **Import POPs > Import**.

   The Import POPs page appears.

3. Click the **Download Sample JSON** link to open and save the sample JSON data file.

   The sample file opens at the bottom of the page.

4. Save the file to your computer with an appropriate name.

   Example: sample-pop-data.json

   > **NOTE:** You need to retain the file format as .json to successfully upload the POP details to the Administration Portal.

5. Customize the sample JSON file using the guidelines in Table 36 on page 124.

6. Save the customized file.

Table 36: Fields on the POPs Page

Field	Description
POP Information	
dc_name	Specify the name of the region for this POP. Example: regional **NOTE:** Administrator should not delete the region name.

Table 36: Fields on the POPs Page *(continued)*

Field	Description
name	Specify the name of the POP. You can use an unlimited number of alphanumeric characters, including special characters. Example: pne-pop10
street	Specify the street address. Example: 1133 Innovation Way
city	Specify the name of the city. Example: Sunnyvale.
state	Specify the name of the state. Example: CA
zip_code	Specify the zip code or postal code for the state. Example: 94089.
country	Specify the name of the country. Example: USA
Device Information	
name	Specify the name of the device. You can use any number of alphanumeric characters, including special characters. Example: pnf-import123
device_ip	Specify the management IP address of the device. Example: 192.0.2.15.

Table 36: Fields on the POPs Page *(continued)*

Field	Description
pne_package	Specify the name of the package providing metadata and configuration templates needed to program a PNE device for service chain attachments in the case of a vCSO solution. If you configure a PNE for the POP in a centralized deployment, select a software image from the menu: • MX as Gateway for vCPE—Customized device profile with MX configuration that prevents the creation of null routes when an administrative user activates a service at a site. You must specify the PNE package only for a data center gateway device. Do not use the SRX Series package for the PE router or the SDN gateway.
assigned_device_profile	Select the name of the configuration image for the SDN gateway or the PE router. • MX as Gateway for vCPE—Customized device profile with MX Series configuration that prevents the creation of null routes when an administrative user activates a service at a site. • SRX as SDWAN Hub—Device profile for an SRX Services Gateway used as a CPE device that offers basic SD-WAN functionality in a distributed deployment. Select this option only if you have been advised to do so by Juniper Networks.
username	Specify the username of the device administrator for logging into the device. Example: root
password	Specify the password for logging into the device. Example: pwd123

Uploading a POP Data File

You can use the Administration Portal to import POP data to support tenant services.

To upload a POP data file:

1. Select **Resources > POPs**.

2. Click **Import POPs > Import**.

   The Import POPs page appears.

3. Click **Browse** and navigate to the directory containing the POP data file.

4. Select the file and click **Open**.

5. Click **Import**. If you want to discard the import process, click **Cancel** instead.

   A success message is displayed indicating that the job was uploaded successfully.

SEE ALSO

Creating a Single POP | **121**
Viewing the History of POP Data Imports | **127**
Viewing the History of POP Data Deletions | **129**

Viewing the History of POP Data Imports

You can use the Import History page to view the imported POP data. You can also view the details of the imported logs and their status.

To import your POP data, see "Importing Data for Multiple POPs" on page 123.

To view the history of imported POP data:

1. Click **Resources > POPs > Import POPs > Import History**.

   The Import History page is displayed. Table 37 on page 127 describes the fields on the Import History page.

2. Click a task name.

   The Import POPs Tasks page appears. Table 38 on page 128 describes the fields on the Import Task page.

3. Click the Task ID.

   The Job Status page appears. Table 39 on page 128 describes the fields on the Job Status page.

4. Click **OK** to return to the previous page.

Table 37: Fields on the Import History Page

Field	Description
In progress	View the number of import tasks that are in progress.

Table 37: Fields on the Import History Page *(continued)*

Field	Description
Success	View the number of import tasks that are successful.
Failure	View the number of import tasks that have failed.
Name	View the name of the task. Example: import_pop_csp.topology_service.import_pop_28c93be6325f4e87a440be096c7e4b58
Start Date	View the start date and time of the task.
End Date	View the end date and time of the task.
Status	View the status of the task to know whether the task succeeded or failed.
Log	View the import logs. Click a log to access more detailed information about the imported log.

Table 38: Fields on the Import POPs Tasks Page

Field	Description
Task ID	View the ID created for the task.
Status	View the status of the task to know whether the task succeeded or failed.

Table 39: Fields on the Job Status Page

Field	Description
Name	View the name of the task.
Actual Start Time	View the start date and time of the task.
User	View the name of the user who imported the task.
End Time	View the end date and time of the task.

Table 39: Fields on the Job Status Page *(continued)*

Field	Description
State	View the status of the task to know whether the task succeeded or failed.

RELATED DOCUMENTATION

Importing Data for Multiple POPs | **123**
Viewing the History of POP Data Deletions | **129**

Viewing the History of POP Data Deletions

You can use the Delete History page to view the deleted POP data, status of the delete operation, and log details.

To view the history of deleted POP data:

1. Click **Resources > POPs > Import POPs > Delete History**.

   The Delete History page is displayed. Table 40 on page 129 describes the fields on the Delete History page.

2. Click a task name.

   The Delete POPs Tasks page appears. Table 41 on page 130 describes the fields on the Delete Task page.

3. Click the Task ID.

   The Job Status page appears. Table 42 on page 130 describes the fields on the Job Status page.

4. Click **OK** to return to the previous page.

   Table 40: Fields on the Delete History Page

Field	Description
Name	View the name of the task.

Table 40: Fields on the Delete History Page *(continued)*

Field	Description
In progress	View the number of delete tasks that are in progress.
Success	View the number of delete tasks that are successful.
Failure	View the number of delete tasks that have failed.
Start Date	View the start date and time of the task.
End Date	View the end date and time of the task.
Status	View the status of the task to know whether the task is succeeded or failed.
Log	View the import logs. Click on a log to access more detailed information about the deleted log.

Table 41: Fields on the Delete POPs Tasks Page

Field	Description
Success	View the number of times the delete operations has been successful for a POP.
Failure	View the number of times the delete operations has failed for a POP.
Task ID	View the ID created for the task. Click on the task ID to view the delete log details corresponding to a POP.
Status	View the status of the task to know whether the task succeeded or failed.

Table 42: Fields on the Job Status Page

Field	Description
Name	View the name of the task.
Actual Start Time	View the start date and time of the task.
User	View the name of the user who deleted the task.

Table 42: Fields on the Job Status Page *(continued)*

Field	Description
End Time	View the end date and time of the task.
State	View the status of the task to know whether the task succeeded or failed.

RELATED DOCUMENTATION

Importing Data for Multiple POPs | **123**

Viewing the History of POP Data Imports | **127**

About the Routers Page

To access this page, click **Resources > POPs >** ***POP Name*** **> Routers**.

You can use the Routers page to view information about the gateway router configured in the POP and to create and configure physical network elements (PNEs) associated with a specific customer site. A PNE is a device in the network that you can provision and configure through Contrail Service Orchestration.

Tasks You Can Perform

You can perform the following tasks from this page:

- Create a device. See "Creating Devices" on page 133.
- Configure a device. See "Configuring Devices" on page 135.
- Select a different POP from the drop-down list above the top left of the table to view router details in grid view.
- View details about a router—Hover over the router name and click the Detailed View icon or click **More > Detail View**.
- Show or hide columns about the routers—Click the **Show Hide columns** icon in the top right corner of the page and select columns that you want to view on the page.

- Search an object about the router—Click the Search icon in the top right corner of the page to search for a router.
- Delete a device—Select the device that you want to delete and click the delete icon.

Field Descriptions

Table 43 on page 132 describes the fields on the Routers page.

Table 43: Fields on the Routers Page

Field	Description
Name	View the name of the device configured in the POP. Example: blue_device
IP Address	View the IP address of the device. Example: 10.155.67.6
Serial Number	View the serial number of the device. Example: JN116548FAFC
Management Status	View the management status of the device. Example: ACTIVE

RELATED DOCUMENTATION

About the POPs Page | 120
Creating a Single POP | 121

Creating Devices

You can use the Routers page to create a provider edge (PE) router or IPsec concentrator in a distributed deployment.

> **NOTE:** This topic is applicable only to users with an SP Administrator role.

To create a device:

1. Click **Resources > POPs >** ***POP Name*** **> Routers**.

2. Click the plus icon(+).

   The Add Device page appears.

3. Complete the configuration according to the guidelines provided in Table 44 on page 133.

4. Click **Save**. If you want to discard your changes, click **Cancel** instead.

Table 44: Fields on the Add Device Page

Field	Description
Name	Specify the name of the device, which can be: • An MX Series router used as a provider edge (PE) router in a distributed deployment. • An SRX Series Services Gateway used as an IPsec concentrator in a distributed deployment. You can use any number of alphanumeric characters, including special characters. Example: MX-router-10
Family	Select the product series for the device. Example: MX

Table 44: Fields on the Add Device Page *(continued)*

Field	Description
Device Template	Select the name of the device template for the device: • MX as Gateway for vCPE—Customized device template for an MX Series router that prevents the creation of null routes when an administrative user activates a service at a site. Select this option only if you have been advised to do so by Juniper Networks. • SRX as SDWAN Hub—Device template for an SRX Services Gateway used as a hub that offers basic SD-WAN functionality in a distributed deployment. Select this option only if you have been advised to do so by Juniper Networks. • SRX as Managed Internet CPE—Device template to manage an SRX Services Gateway devices for a managed internet service.
Type of Device	Select the type of device: • PE/IPsec—Use this option to add an MX Series router as a PE router, an IPsec concentrator or both, or to add an SRX Series gateway as an IPsec concentrator in a distributed deployment.
Management Type	If you specified that the device is a PE router, IPsec concentrator, or both, specify whether Contrail Service Orchestration manages the device: • Managed—Select this option if you use Contrail Service Orchestration to manage the device. • Unmanaged—Select this option if you use an application other than Contrail Service Orchestration to manage the device. In this case, Contrail Service Orchestration uses the device object that you configure for presentation purposes only.
Device IP	Specify the IPv4 address of the management interface for the device. Example: 192.0.2.15
Internet Gateway (optional)	Specify one or more Internet gateway IPv4 addresses if the device connects to CPE devices that have access to the Internet. An Internet gateway IPv4 address may be the same as the IPv4 address of the endpoint of the IPsec tunnel on the IPsec concentrator for a CPE device. Example: 192.0.2.20
User Name	Specify the username that you configured when you set up the device. You use this username to log into the device. Providing login credentials gives Contrail Service Orchestration access to the device. Example: root
Password	Specify the password that you configured when you set up the device. You use this password to log into for the device. Providing login credentials gives Contrail Service Orchestration access to the device. Example: pwd123

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Configuring Devices

Users with the SP Administrator role can use the Routers page to configure physical network elements (PNEs) associated with a specific customer site.

To configure a device:

1. Click **Resources > POPs > *POP Name* > Routers**.
2. Select the router that you want to configure.
3. Click **More > PNE Configure**.

   The PNE Configure page appears.
4. Click the + icon to add interface configuration details.
5. Complete the configuration according to the guidelines provided in Table 45 on page 135.
6. Click **Ok**. If you want to discard your changes, click **Cancel** instead.

Table 45: Fields on the PNE Configure Page

Field	Description
Interface Configuration	
Name	Specify the identifier of the physical interface of the device that acts as the management interface. This interface connects to the management network in Contrail. You either configure this network in Contrail or in Administration Portal when you create the virtualized infrastructure manager (VIM). Example: xe-1/1/1

Table 45: Fields on the PNE Configure Page *(continued)*

Field	Description
Vlan	(Optional) If you use VLANs to segment the VPN, specify the identifier of the VLAN interface that connects to the management network in Contrail. The identifier is an integer in the range 1–4096. Example: 100
Addr	Specify an IPv4 prefix for the management interface. Example: 192.0.2.15
BGP Configuration	
AS Number	Specify the autonomous system (AS) number for BGP routing with the Contrail Controller node. Example: 64512
Local Address	Specify an IPv4 address, such as the loopback address, that the router uses for BGP sessions. Example: 192.0.2.15
Remote Address (Contrail Controller)	Select the IPv4 address of the data interface for the Contrail Controller node. Example: 192.0.2.25.
Contrail Compute Prefix	Select one or more IPv4 prefixes that define the subnets between the SDN gateway and the Contrail Compute nodes. Example: 192.0.2.0/24.
Management VRF Configuration	
Interface Name	Reenter the management interface identifier that you specified in the Interface Configuration Name field. In the Management VRF Configuration section, you associate this interface with a virtual routing and forwarding instance (VRF). Example: xe-1/1/1.

Table 45: Fields on the PNE Configure Page *(continued)*

Field	Description
Interface VLAN	(Optional) If you use VLANs to segment the VPN, reenter the identifier that you specified in the Interface Configuration VLAN field. In the Management VRF Configuration section, you associate this interface with a virtual routing and forwarding instance (VRF). Example: 100
Default Gateway	(Optional) Specify the IPv4 address on the router that provides the default route for management traffic. Example: 192.0.2.40.
Route Target	Specify the route target for the management network used in Contrail. Example: 64512:10000.
Route Distinguisher	Specify the route distinguisher for the management network used in Contrail. Example: 64512:10000.
Internet VRF Configuration	
Interface Name	Specify one or more physical interfaces on the router that connect to the Internet. Example: xe-2/2/2
Interface VLAN	(Optional) If you use VLANs to segment the VPN, specify the identifiers of the VLAN interfaces that connect to the Internet. A VLAN identifier is an integer in the range 1–4096. Example:500
Default Gateway	(Optional) Specify the IPv4 address on the router that provides the default route for Internet traffic. Example: 192.0.2.50
Route Target	Specify the route target for Internet traffic on this interface. This value matches the Route Target value that you configure for the VPN associated with the site. Example: 64512:12000.

Table 45: Fields on the PNE Configure Page *(continued)*

Field	Description
Route Distinguisher	Specify a unique route distinguisher for traffic on this interface. This value matches the Route Distinguisher value that you configure for the VPN associated with the site. You can specify any unique route distinguisher, such as the route target for Internet traffic. Example: 64512:12000

You can also configure the devices from the POPs landing page.

To configure a device:

1. Select **Resources > POPs > *Pop-Name***.

   The Pop-Name page appears.

2. Click the **Routers** tab.

3. Select the device that you want to configure and click the **Configure Device** button.

   The Stage 2 Config page appears. This page is dynamically rendered based on stage-2 configuration specified in the device profile.

4. Enter the configuration data on the page.

5. Click **Save** to save the configuration.

   A confirmation message is displayed and the deployment status changes to pending deployment.

6. Click **Deploy** to save and deploy the configuration.

   A confirmation message is displayed indicating that the job is created and subsequently that the job was successful. You can click Deploy History to view the job logs.

7. Click **Cancel** to go back to the Pop-Name page.

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View the History of Device Data Deletions

You can use the Delete History page to view the deleted device data, status of the delete operation, and log details.

> **NOTE:** This topic is applicable only to users with the SP Administrator role.

To view the history of deleted device data:

1. Click **Resources > POPs > *POP Name* > Routers > More > Delete History**.

   The Delete History page is displayed. Table 46 on page 139 describes the fields on the Delete History page.

2. Click a task name.

   The Delete Device Tasks page appears. Table 47 on page 140 describes the fields on the Delete Task page.

3. Click the Task ID.

   The Job Status page appears. Table 48 on page 140 describes the fields on the Job Status page.

4. Click **OK** to return to the previous page.

Table 46: Fields on the Delete History Page

Field	Description
Name	View the name of the task.
In progress	View the number of delete tasks that are in progress.
Success	View the number of delete tasks that are successful.
Failure	View the number of delete tasks that have failed.
Start Date	View the start date and time of the task.
End Date	View the end date and time of the task.
Status	View the status of the task to know whether the task succeeded or failed.

Table 46: Fields on the Delete History Page *(continued)*

Field	Description
Log	View the import logs. Click a log to access more detailed information about the deleted log.

Table 47: Fields on the Delete Device Tasks Page

Field	Description
Success	View the number of times the delete operations succeeded for a device.
Failure	View the number of times the delete operations failed for a device.
Task ID	View the ID created for the task. Click the task ID to view the delete log details corresponding to a device.
Status	View the status of the task to know whether the task succeeded or failed.

Table 48: Fields on the Job Status Page

Field	Description
Name	View the name of the task.
Actual Start Time	View the start date and time of the task.
User	View the name of the user who deleted the task.
End Time	View the end date and time of the task.
State	View the status of the task to know whether the task succeeded or failed.

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About the Sites Page

IN THIS SECTION

- Tasks You Can Perform | 141
- Field Descriptions | 142

To access this page, click **Resources > Site Management > Sites**.

Use the Sites page to view or manually import provider hub sites, view device activation logs, view the history of the addition and deletion of provider hubs, and view detailed information about each provider hub in the network.

The provider hub devices that are owned by an OpCo administrator are shared with the tenants within that OpCo.

Tasks You Can Perform

You can perform the following tasks from this page:

- Add provider hub sites—See "Manually Importing Provider Hub Sites" on page 143
- View details of a provider hub site—Hover over the site name and click the Detailed View icon or click **More > Detail View**.

  The Detailed View pane appears on the right side of the sites page, displaying information about the cloud hub site. Click the close icon (X) to close the pane.
- View device activation logs. See "Viewing the History of Tenant Device Activation Logs" on page 178.
- View the jobs executed to add and delete provider hub sites. see *Viewing the Sites History*.
- Search for a provider hub site—Click the Search icon in the top right corner of the page to search for a particular cloud hub site. You can enter partial text or full text of the keyword in the text box and press Enter. The search results are displayed on the same page.

Field Descriptions

Table 49 on page 142 describes the fields on the **Sites** page.

Table 49: Fields on the Sites Page

Field	Description
Alert Icon	Alert associated with the site. The alert can be critical (indicated by a red icon), major (indicated by an orange icon), or minor (indicated by a yellow icon). **NOTE:** The alert icon is displayed only if there is an alert associated with the site. If there is no alert, no icon is displayed.
Site Name	Name of the provider hub site. Click the name of the provider hub site to go to the *Site-Name* page where you can view the site details and configure parameters related to the site.
Location	Location of the provider hub site.
Operational Status	Operational status (Up or Down) of the site.
Devices	Displays the number of devices. By default, the value is always 1.
Type	Displays the site type (provider hub).
Site Status	The current status of the site: • Created—Indicates that the site is added but not configured. • Configured—Indicates that the site is configured but not activated. • Provisioned—Indicates that the site is provisioned (activated). • Upgrade-Required—Indicates that the site needs to be upgraded. • Maintenance—Indicates that the site upgrade is in progress; any deployments that might occur because of other jobs are skipped when the site status is Maintenance.
Version	Contrail Service Orchestration (CSO) version in which the provider hub site was added.

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Add a Provider Hub Device | 150

Manually Importing Provider Hub Sites

A provider hub site represents an automation endpoint that is part of a data center or POP that is owned by the service provider. The provider hub site is connected to multiple spoke sites using the overlay connections. Provider hubs sites are logical entities in a multi-tenant device (provider hub device). Users with the OpCo Administrator role can add a provider hub site from the **Sites** page.

To manually import a provider hub site:

1. Select **Resources > Site Management**.

   The Sites page appears.

2. Click **Add** and select **Add Provider Hub**.

   The **Add Provider Hub for *OpCo-Name*** page appears.

3. Complete the configuration settings according to the guidelines provided in Table 50 on page 143.

   NOTE: Fields marked with * are mandatory.

4. Click **OK**.

   The newly created provider hub site is displayed on the **Sites** page.

Table 50: Fields on the Add Provider Hub for OpCo-Name Page

Field	Description
Configuration	
Service POP	Select the name of the point of presence (POP) for the site. A network POP is a location at which a service provider instantiates a network function, such as a virtualized network function (VNF).
Hub Device Name	Select the provider hub device for the OpCo.

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About the Tenant Devices Page

To access this page, click **Resources > Tenant Devices**.

You can use the Tenant Devices page to view the list of available CPE devices in the OpCo network. You can also view information about each CPE device in the network.

Tasks You Can Perform

You can perform the following tasks from this page:

- Quickly view activation data created for CPEs in the widgets that appear at the top of the page. See Table 51 on page 145.
- View the history of tenant device activation logs. See "Viewing the History of Tenant Device Activation Logs" on page 178.
- Reboot a CPE device. See "Rebooting Tenant Devices and Provider Hub Devices" on page 186.
- Push licenses to devices. Select the devices and click **Push License**.

  The Push License page appears displaying the list of licenses uploaded in CSO. Select the license(s) which you want to push to the selected devices. Click **Push Licenses** to push the licenses to the selected devices. To cancel the action, click **Cancel**.

  See "Pushing a License to Devices" on page 367.
- View Stage-1 configuration. Click **Resources > Tenant Devices >** ***Device-Name*** **> Stage 1 Config** to view the stage-1 configuration for the device.
- View the device audit logs. Click **Resources > Tenant Devices >** ***Device-Name*** **> Device Audit Logs** to view the audit logs for the device.
- View details about a CPE device. Click the details icon that appears when you hover over the name of a device or click **More > Details**.
- Deleting a CPE—Select the CPE device that you want to delete and click the delete icon.
- Show or hide columns about the CPE—Click the **Show Hide columns** icon in the top right corner of the page and select columns that you want to view on the page.
- Search for a CPE device—Click the Search icon in the top right corner of the page to search for a CPE device. You can enter partial text or full text of the keyword in the text box and press Enter. The search results are displayed on the same page.

Field Descriptions

- Table 51 on page 145 describes widgets on the Tenant Devices page.
- Table 52 on page 145 describes the fields on the Tenant Devices page.

Table 51: Widgets on the Tenant Devices Page

Widget	Description
Cloud CPEs by Status	Displays the management status of the CPE devices deployed in the cloud. • Pending Activation—Number of CPE devices that are yet to connect to the regional server. • Activation Failed—Number of CPE devices that could not connect to the regional server. • Expected—Number of CPE devices that have yet to connect to the regional server. • Active—Number of CPE devices that have downloaded images, but are not yet configured. • Provisioned—Number of CPE devices on which IPsec tunnels are fully operational. • Provision Failed—Number of CPE devices failed if the vSRX was not instantiated properly.

Table 52: Fields on the Tenant Devices Page

Field	Description
Device Name	Displays the name of the device. Example: sunny-NFX-250
Tenant	Displays the name of the tenant. Example: tenant-blue
Site Name	Displays the name of the tenant site. Example: site-blue-white
Location	Displays the name of the location. Example: San Jose, CA

Table 52: Fields on the Tenant Devices Page ***(continued)***

Field	Description
Status Message	Displays the latest status message. Example: IPsec provision success
WAN Links	Displays the number of WAN links. Example: 2
POP Name	Displays the name of the POP. Example: pop_blue
Management Status	Displays the management status of the CPE devices deployed in the cloud. • Expected—Regional server has activation details for the CPE device, but CPE device has not yet established a connection with the server. • Active—CPE device has downloaded images, but is not yet configured. • Provisioned—IPsec tunnel on NFX250 device is operational. • Provision Failed—CPE device failed when the vSRX was not instantiated properly.
Model	Displays the name of the device model. Example: NFX
Active Services	Displays the number of services that are activated for the device. Example: 3
Image Name	Displays the name of the device image file. Example: install_nfx_fmpm_agent_1_0.sh
OS Version	Displays the Junos OS Release version. Example: 15.1X49-D40
Serial Number	Displays the serial number of the device. Example: DD0416AA0117

RELATED DOCUMENTATION

Viewing the History of Tenant Device Activation Logs | 178

About the Provider Hub Devices Page

To access this page, select **Resources > Provider Hub Devices**.

Use the Provider Hub Devices page to view the list of provider hub devices that are owned by the administrator in the OpCo network. You can add or delete a provider hub with DATA_ONLY capability. You can also view detailed information about each provider hub device in the network.

CSO uses the provider hub devices as SD-WAN hubs to setup tunnels and provision site-to-site or site-to-hub traffic. All other configurations such as Internet breakout, hub meshing, and so on must be configured manually on the device.

Tasks You Can Perform

You can perform the following tasks from the Provider Hub Devices page:

- Add a provider hub device with DATA_ONLY capability. See "Add a Provider Hub Device" on page 150.
- View details of a provider hub device—Hover over the device name and click the Detailed View icon or click **More > Detail View**.

  The Detailed View pane appears on the right side of the Provider Hub Devices page, displaying information (such as hardware and software) about the provider hub device.

  Click the close icon (X) to close the pane.
- Edit provider hub site parameters. See "Edit Provider Hub Site Parameters" on page 156.
- Upgrade the provider hub device. See "Upgrading a Provider Hub Device" on page 160.
- Perform Return Material Authorization (RMA) to replace a device that is faulty or not reachable. From Administration Portal, you can perform RMA for provider hub devices. See "Perform Return Material Authorization (RMA) for a Provider Hub Device" on page 160 for details.
- Delete a provider hub device with DATA_ONLY capability—Select the hub device that you want to delete and click the delete icon.
- Show or hide columns that contain details of the provider hub device—Click the **Show Hide columns** icon in the top right corner of the page and select columns that you want to view on the page.

- Search for a provider hub device—Click the Search icon in the top right corner of the page to search for a particular provider hub device.

  You can enter partial text or full text of the keyword in the text box and press Enter.

  The search results are displayed on the same page.

- Filter the available devices on the page based on the specified criteria—Select the filter icon at the top right corner of the table to apply a filter. For example, you can filter information based on the management status or site name. The table displays only the data that fits the filtering criteria.

  Click the Clear All icon to remove the applied filter.

Field Descriptions

- Table 53 on page 148 describes the fields on the Provider Hub Devices page.

Table 53: Fields on the Provider Hub Devices Page

Field	Description
Device Name	Name of a provider hub device. Example: srx-provider-hub
Tenant	Name of the tenant. Example: tenant-blue
Site Name	Name of the tenant site. Example: site-blue-white
Location	Name of the location. Example: San Jose, CA
Status Message	Latest status message. Example: IPsec provision success
WAN Links	Number of WAN links for a device. Example: 2

Table 53: Fields on the Provider Hub Devices Page *(continued)*

Field	Description
POP Name	Name of the POP. Example: pop_blue
Capabilities	Type of capability configured for the provider hub device. Example: OAM
Management Status	Management status of the provider hub devices deployed in the cloud: • **Expected**—The regional server has activation details for the device, but the device has not yet established a connection with the server. Click **Activate** to activate the provider hub device. If the activation process is successful, then the management status changes to **Provisioned**. • **Active**—Provider hub device is yet to be configured. • **Provisioned**—Provider hub device is ready to be used. • **Provision** Failed—Provider hub device is not yet ready to be used.
Authentication Type	Authentication method used for the device—Preshared Key (PSK) or Public Key Infrastructure (PKI).
Version	CSO version in which the provider hub device was added.
Model	Name of the device model. Example: SRX
OS Version	Junos OS Release version. Example: 15.1X49-D40
Serial Number	Serial number of the device. Example: DD0416AA0117

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Add a Provider Hub Device

Users with the SP (Service Provider) Administrator role or an OpCo (Operating Company) Administrator role can add provider hub devices with different capabilities as indicated in Table 54 on page 150.

Table 54: Provider Hub Capabilities and Roles

Capability	Description	Role
OAM_ONLY	Transmits only OAM traffic. IPsec OAM tunnels are configured between the spoke and the hub.	SP Administrator
DATA_ONLY	Transmits only data traffic. IPsec data tunnels are configured between spoke and data hub. IPsec OAM tunnels are not configured between spoke and data hub.	SP Administrator OpCo Administrator
OAM AND DATA	Transmits both data and OAM traffic. Both IPsec OAM and data tunnels are configured between the spoke and the hub.	SP Administrator OpCo Administrator

You can add an SRX Series services gateway or a vSRX instance as a provider hub device with DATA_ONLY capability in a hub-and-spoke topology or full mesh topology.

The device template that is currently supported for provider hub devices is SRX as SD-WAN Hub.

> **NOTE:** Before you add a provider hub, a user with an SP Administrator role must create all the resources required for the network point of presence (POP) because specifying a POP is mandatory. For more information, see "Creating a Single POP" on page 121.

To add a provider hub device:

1. Select **Resources > Provider Hub Devices**.

   The Provider Hub Devices page appears.

2. Click the add icon **(+)**.

   The Add Provider Hub Device page appears.

3. Complete the configuration according to the guidelines provided in Table 55 on page 151.

> **NOTE:** Fields marked with an asterisk (*) are mandatory.

4. (Optional) Review the configuration in the Summary tab and modify the settings, if required.

5. Click **OK**.

   You are returned to the Provider Hub Devices page.

   - If you have enabled automatic activation, the provider hub device is automatically activated.
   - If you have disabled automatic activation, the provider hub device must be manually activated. To initiate the manual activation process, select the device on the Provider Hub Devices page and click **Activate Device** to activate the device.

   After the device is successfully activated, the provider hub device is discovered and the required details are stored in CSO.

Table 55: Fields on the Add Provider Hub Device Page

Field	Description
Name	Enter the name of the provider hub device. You can use alphanumeric characters, including special character(-). The maximum length is 15 characters. Example: provider-hub-1
Management Region	Displays the regional server with which the device communicates. The management region name is populated based on the information from the device template. Example: regional
POP	Select the POP where the hub device needs to be added. Example: pop_blue

Table 55: Fields on the Add Provider Hub Device Page *(continued)*

Field	Description
Site Capability	Select the site capability of the provider hub device: • **OAM_ONLY** (Available only for SP Administrator users) • **DATA_ONLY** • **OAM AND DATA** For provider hubs added with with data only capability, CSO establishes a secure OAM tunnel between the provider hub with data capability and a provider hub with OAM_ONLY or OAM AND DATA capability).
Authentication Type	Select the IPsec tunnel authentication method—Preshared Key (PSK) or Public Key Infrastructure (PKI).
Advanced Configuration	
Name Server IP List	Specify one or more IPv4 addresses of the DNS server. To enter more than one DNS server address, type the address, press Enter, and then type the next address, and so on. DNS servers are used to resolve hostnames into IP addresses.
NTP Server	Specify the fully qualified domain names (FQDNs) or IP addresses of one or more NTP servers. Example: ntp.example.net The site must have DNS reachability to resolve the FQDN during site configuration.
Select Timezone	Select the time zone of the site.
Click **Next** to continue.	
Device Template	

Table 55: Fields on the Add Provider Hub Device Page *(continued)*

Field	Description
Device Series	Select the device series to which the provider hub belongs—SRX. Based on the device series that you select, the supported device templates (containing information for configuring devices) are listed. Select a device template.
Device Information	
Serial Number	Enter the serial number of the provider hub device. Serial numbers are case-sensitive.
Auto Activate	Click the toggle button to enable or disable automatic activation of the provider hub device. When you enable this field, zero-touch provisioning (ZTP) of the provider hub device is automatically triggered after the site is added to CSO. The device template that you select determines whether this option is enabled or disabled by default.
Activation Code	If the automatic activation is disabled, enter the activation code to be used to manually activate the device.
Boot image	Select the boot image from the drop-down list if you want to upgrade the image for the provider hub device. The boot image is the latest build image uploaded to the image management system. The boot image is used to upgrade the device when the CSO starts the ZTP process. If the boot image is not provided, then the device skips the procedure to upgrade the device image. The boot image (NFX or SRX) is populated based on the device template that you have selected while creating a site. .
Management Connectivity	The fields in this section are displayed based on the capability that you select for the provider hub device

Table 55: Fields on the Add Provider Hub Device Page *(continued)*

Field	Description
Loopback IP Prefix	By default, CSO assigns the IPv4 address prefix for the loopback interface on the device. If you prefer to use a specific loopback address, you can enter an IPv4 address prefix for the loopback interface on the CPE device. The IP address prefix must be a /32 IP address prefix and must be unique across the entire management network.
OAM Interface	Select an interface on the provider hub device to connect to the CSO. The interface is used only for OAM connectivity. The interface names are listed based on the configuration in device template.
OAM VLAN	Enter an OAM VLAN ID for in-band management of the hub device. If you specify an OAM VLAN ID, then in-band OAM traffic reaches the device through the selected OAM interface.
OAM IP Prefix	Enter an IPv4 address prefix for the OAM interface in the provider hub device. The prefix must be unique across the entire management network.
OAM Gateway	Enter the IP address of the next-hop through which the CSO connectivity is established.
EBGP Peer AS	Enter the autonomous system (AS) number of the external BGP (EBGP) peer.
WAN Links	
WAN_0 *WAN-Interface-Name*	This field is enabled by default. Enter parameters related to WAN_0. Fields marked with an asterisk (*) must be configured to proceed.
Local Interface	Displays the interface name configured in the device template. You cannot modify this field.
Link Type	Select the underlay network type (MPLS or Internet) of the WAN link.

Table 55: Fields on the Add Provider Hub Device Page *(continued)*

Field	Description
Address Assignment	Displays the address assignment used for the WAN link (STATIC). You cannot modify this field.
Static IP Prefix	Enter the IP address prefix of the WAN link.
Gateway IP Address	Enter the gateway IP address of the default route.
Public IP Address	For Internet links, enter the public IPv4 address for the link. This IP address should be provided only if the static IP prefix is private and 1:1 NAT is configured.
VLAN ID	Enter the VLAN ID that is associated with the data link.
WAN_1 WAN-Interface-Name	Click the toggle button to enable or disable the WAN link. When you enable the WAN link, fields related to the WAN link appear. Fields marked with an asterisk (*) must be configured to proceed. Refer to the fields described for WAN_0 *WAN-Interface-Name* for an explanation of the fields
WAN_2 WAN-Interface-Name	Click the toggle button to enable or disable the WAN link. When you enable the WAN link, fields related to the WAN link appear. Fields marked with an asterisk (*) must be configured to proceed. Refer to the fields described for WAN_0 *WAN-Interface-Name* for an explanation of the fields
WAN_3 WAN-Interface-Name	Click the toggle button to enable or disable the WAN link. When you enable the WAN link, fields related to the WAN link appear. Fields marked with an asterisk (*) must be configured to proceed. Refer to the fields described for WAN_0 *WAN-Interface-Name* for an explanation of the fields
Click **Next** to continue.	

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Edit Provider Hub Site Parameters

The Edit Provider Hub page enables the Service Provider (SP) or Operating Company (OpCo) Administrator users to modify the parameters of a provider hub site with DATA_ONLY capability and the following management status:

- Configuration-Failed
- Partially-Provisioned
- Provisioned

> **NOTE:**
> - You cannot edit provider hub sites with OAM_ONLY or OAM_AND_DATA capability because such modifications can impact the connectivity of the entire network.
> - To edit a provisioned or a partially-provisioned provider hub site, the Operational Status must be UP.
> - SP and OpCo Administrator users can only edit the parameters of provider hub sites that they added.

You can add or delete WAN links, or modify the site parameters without affecting the connectivity between the provider hub site and Contrail Service Orchestration (CSO).

When a WAN link is added to a provider hub site, CSO creates secure OAM tunnels and enables the monitoring of the new WAN link.

> **NOTE:** Before you delete a WAN link on a provider hub site, ensure that:
> - At least one Operations, Administration, and Maintenance (OAM) WAN link is enabled for the site.
> - There are no spoke or enterprise hub sites connected to the WAN link.

When you delete a WAN link from the provider hub site, the associated secure OAM tunnels are also deleted.

What should you do if adding or deleting a WAN link fails?

When the addition or deletion of a WAN link fails, PARTIALLY DEPLOYED is displayed next to the WAN link name.

You can do one of the following:

- Retry the specific edit site job to execute the failed tasks from the Jobs page (**Monitor** > **Jobs**). For more information, see *Retrying a Failed Job on Devices*.
- Redeploy the WAN link by clicking the **Re-Deploy WAN Link** toggle button and updating the WAN link parameters, which first deletes the WAN link and then adds it again.
- Leave the WAN link as is and redeploy the WAN link later.

To edit the parameters configured for a provider hub site:

1. Select **Resources > Provider Hub Devices**.

   The Provider Hub Devices page appears.

2. Select the provider hub site whose parameters you want to modify and click the **Edit** icon (pencil).

   The Edit Provider Hub page appears.

3. Modify the provider hub site parameters as described in Table 56 on page 158.

4. (Optional) Review the configuration in the Summary tab and modify the settings, if required.

5. Do one of the following:

   - Click **Finish** to save the changes that you made to the provider hub site.
   - Click **Previous** to make changes in the previous page.
   - Click **Cancel** to discard the changes. A dialog box appears asking for your confirmation. Click **Yes**. The changes you made are lost and you are returned to the Provider Hub Devices page.

   If you click Finish, an Edit Site job is triggered and a job link appears on the Provider Hub Devices page.

   You can click the job link to view details of the job (including job status, start date and time, and end date and time). Alternatively, you can view the status of the job on the Jobs page.

   After the job completes successfully, a confirmation message appears on top of the Provider Hub Devices page.

NOTE: The following operations take several minutes (greater than 15 minutes) based on the number of sites connected to the provider hub:

- Deleting a WAN link.
- Editing the Link Type, Address Assignment, or VLAN ID of a WAN link.
- Re-deploying a partially deployed WAN link.

Table 56: Editable Fields for a Provider Hub Site

Editable Parameters	Description
General **NOTE:** • To edit the WAN parameters of a provider hub site, ensure that the site version is 5.3.0 or higher. If the site version is of an earlier release, you must upgrade the site. For more information, see "Upgrading a Provider Hub Device" on page 160. • For provider hub sites with 5.2.0 or earlier site versions, only advanced configuration fields are editable. You can find the version of a provider hub site in the Version column on the Provider Hub Devices page.	
Advanced Configuration	Edit the Domain Name Server (DNS) IP address, NTP Server IP address, and the selected Timezone.
WAN You can do one of the following: • Edit the WAN parameters (specified below) of an existing WAN link. • Add a new WAN link by clicking the toggle button next to the WAN link name and specifying the WAN parameters. For more information on WAN link parameters, see Table 55 on page 151. • Delete an existing WAN link by clicking the enabled toggle button next to the WAN link name.	
Re-Deploy WAN Link	For partially deployed WAN links, click the toggle button to enable editing the WAN parameters.
Link Type	Edit the link type by selecting **MPLS** or **Internet**.
Address Assignment	STATIC is the only option for assigning an IP address to the WAN link. You can edit the **Static IP Prefix** and **Gateway IP** address of the site.
Data VLAN ID	Edit the VLAN ID. Range: 0 through 4049 (4050 to 4094 is reserved by CSO).

RELATED DOCUMENTATION

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About the Provider Hub Devices Page | 147

Manage a Provider Hub Device

Users with the SP (Service Provider) Administrator role (on-premises installation only) or OpCo (Operating Company) Administrator role can use the ***Device-Name*** page (**Resources > Provider Hub Devices > *Device-Name***) to view details of and manage a provider hub device.

To manage a provider hub device:

- Click the **Overview** tab to perform the following operations:
  - View the geographical location of the device at the tenant site.
  - View the aggregate throughput of the device.
  - View the recent alerts for the device.
  - View the details of the device, such as serial number, management IP address, OS version, device template, tenant name, site name, and site location.
- Click the **Configuration Template** tab to perform the following operations:
  - Save a configuration template, for the device, in the database.
  - Deploy a configuration template to the device.
  - Undeploy a configuration template from the device.

    Undeploying a configuration template removes the configuration pushed to the device when the configuration template was deployed.
  - Dissociate a configuration template from the device.

    Dissociating a configuration template removes only the references to the configuration template from the device but does not remove the configuration pushed to the device.
  - Roll back a configuration template for the device.
  - View the deployment history of the configuration template for the device.

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Upgrading a Provider Hub Device

A provider hub device is created by the SP Administrator and is shared with multiple tenants. To upgrade a cloud hub device:

1. In Administration Portal, select **Resources > Provider Hub Devices**.

   The Provider Hub Devices page appears.

2. Select a provider hub device, and click **More > Upgrade**.

   > **NOTE:** provider

   The Upgrade Provider Hub Device page appears. This page displays the following information:

   - Prerequisites for upgrading a provider hub device.
   - Impact of upgrading the provider hub device.
   - Affected tenants and sites.
   - Time required to upgrade the provider hub device.
   - Post-upgrade tasks.

3. Choose the upgrade time.
   - Select **Run** if you want to upgrade the provider hub device immediately.
   - Select **Schedule at a later time** if you want to schedule the upgrade for a later date and time.

4. Click **Upgrade**.

A job is created. Click the job ID to go to the Jobs page and view the status of the provider hub device upgrade.

Perform Return Material Authorization (RMA) for a Provider Hub Device

Sometimes, due to hardware failure, a device managed by Contrail Service Orchestration (CSO) needs to be returned to the vendor for repair or replacement. In such situations, as a Service Provider (SP)

Administrator or Operating Company (OpCo) Administrator with the RMA privilege, you can perform Return Material Authorization (RMA) for the faulty device.

The RMA process includes actions to:

1. Back up the configuration of the faulty device.
2. Recall the faulty device and replace it with a new or restored device.
3. Push the required configuration to the new or restored device.
4. Activate the new or restored device in order for CSO to recognize and manage the device.

> **NOTE:**
> - When you request RMA for a provider hub device associated with a site that has a version earlier than the CSO version, the site version is not upgraded to the CSO version as part of the device activation and zero touch provisioning (ZTP) process of the replacement device that is performed after RMA.

To perform RMA for a faulty provider hub device:

1. Select **Resources** > **Provider Hub Devices**.

   The **Provider Hub Devices** page appears.

2. Select the faulty device and click **More** > **Initiate RMA**.

   A confirmation page appears requesting for confirmation to initiate the RMA process for the device.

   > **NOTE:**
   > - The **Initiate RMA** option is enabled only for a device with the management status **PROVISIONED**.

3. Click **Yes** to confirm RMA for the device.

   You are returned to the Provider Hub Devices page where a confirmation message appears, indicating that the RMA process is initiated.

4. After the management status of the device changes to **RMA**, raise a device replacement request. This process is performed outside of CSO.

5. After you receive the new device, click **More** > **Grant RMA**.

   The Grant RMA for Device page appears. Provide details of the new device on this page. See "Grant Return Material Authorization (RMA) for a Provider Hub Device" on page 162 for details.

> **NOTE:**
> - The **Grant RMA** option is enabled only for a device with the management status **RMA**.

6. To complete the RMA process and start using the new device, the device must be activated.
   - If you enabled the Auto-activate toggle button on the Grant RMA for Device page, the device is activated automatically and its **Management Status** changes to **PROVISIONED**.
   - If you disabled the Auto-activate toggle button on the Grant RMA for Device page, you must manually activate the new device after the grant RMA job completes successfully.

     To manually activate the new device:

     a. On the Provider Hub Devices page, select the new device and click **Activate Device**.

        The Activate Device page appears.

     b. Enter the activation code for the device and click **Next**.

        The progress of device activation is displayed.

        After the device is activated, its **Management Status** changes to **PROVISIONED**.

The RMA process is now complete. You can start using the new device.

RELATED DOCUMENTATION

Grant Return Material Authorization (RMA) for a Provider Hub Device | 162

Grant Return Material Authorization (RMA) for a Provider Hub Device

As a Service Provider (SP) Administrator or Operating Company (OpCo) Administrator with the RMA privilege, you can grant RMA for a device that is in the RMA state.

When you grant RMA, the device-related configuration is backed up to the CSO database, the existing device is recalled, and the new device is added to the network.

Before you grant RMA for a device, ensure that:

- You have received a new device to replace the faulty device.
- You have the serial number and activation code for the new device.

To grant RMA for a provider hub device:

1. Select **Resources** > **Provider Hub Devices**.

   The **Provider Hub Devices** page appears.

2. Select the faulty device for which you initiated RMA and click **More** > **Grant RMA**.

   The **Grant RMA for Device** page appears.

   > **NOTE:** The **Grant RMA** option is enabled only for a device with the **Management Status RMA**.

3. Complete the configuration according to the guidelines provided in Table 57 on page 163.

4. Click **OK** to perform the grant RMA process.

   You are returned to the Provider Hub Devices page where a confirmation message appears indicating that a Grant RMA job is created.

5. (Optional) Click the job link in the message to view the progress of the job. Alternatively, view the progress of this job on the Jobs (**Monitor** > **Jobs**) page.

   This job might take around 15 minutes to complete.

After the job is completed successfully, the management status of the device on the Devices page changes to **Expected**. In addition, the status of the site on the Sites page (**Resources > Site Management**), where the device for which you performed Grant RMA is installed, changes to **Expected**.

To complete the RMA process and start using the new device, the device must be activated. See step 6 in "Perform Return Material Authorization (RMA) for a Provider Hub Device" on page 160 for details.

Table 57 on page 163 provides information about the fields on the **Grant RMA for Device** page.

Table 57: Fields on the Grant RMA for Device Page

Field	Description
Customer Name	Displays the name of the tenant whose sites are connected to the provider hub.

Table 57: Fields on the Grant RMA for Device Page *(continued)*

Field	Description
Site Name	Displays the name of site in which the faulty device is present.
Device Name	Displays the name of the faulty device that will be replaced with a new device through the Grant RMA process.
Auto Activate	Click the toggle button to enable (default) or disable automatic activation of the new device.
Activation Code	If you disabled automatic activation, enter the activation code for the new device. You receive the activation code (Example: 545454) from the service provider, outside of CSO.
Serial Number	Enter the serial number of the new device. The serial number is case-sensitive. Example: DD2316AF0177
Boot Image	From the list, select the same boot image as the faulty device. If you select a different boot image for the new device, the grant RMA process may not complete successfully.

Managing a Tenant Device

You can use the Tenant Devices page to view and manage a single customer premises equipment (CPE) device and an EX Series switch at the tenant site. To access this page, click **Resources > Tenant Devices > *Device-Name***.

You can perform the following operations on the **Overview** tab:

- View the geographical location of the device at the tenant site.
- View the aggregate throughput of the device.
- View the recent alerts for the device.
- View the details of the device, such as serial number, management IP address, OS version, device template, tenant name, site name, site location, operational status, and management status of the device.
- View the recent alarms (critical, major, and minor) for the device.
- View the details of licenses, such as the license name, description, and the time when the license was pushed to the device.

You can perform the following operations on the **Configuration Template** tab:

> **NOTE:** The **Configuration** tab that was available in earlier releases for stage-2 template-based configuration is renamed as **Configuration Template**.

- Save the configuration template for the device.
- Deploy the configuration template for the device.
- Undeploy the configuration template for the device.

  Undeploying a configuration template removes the configuration pushed to the device when the configuration template was deployed.
- Dissociate the configuration template for the device.

  Dissociating a configuration template removes only the references to the configuration template from the device but does not remove the configuration pushed to the device.
- Rollback to the previous configuration template for the device.
- View the deployment history of the configuration template for the device.

You can also perform the following operations on the **Configuration** tab.

- Click **Physical Interfaces** tab to view and manage the physical interfaces for the device.
- Click **Security Zone** tab to view and manage the security zones for the device.
- Click **Routing Instance** tab to view and manage the routing instances for the device.

For information about managing an EX Series switch, see "Manage an EX Series Switch" on page 165.

RELATED DOCUMENTATION

About the Tenant Devices Page | **144**

Manage an EX Series Switch

IN THIS SECTION

View the Chassis Information of an EX Series Switch | **166**
View Information about an EX Series Switch | **169**
View Information about Ports on an EX Series Switch | **171**

You can use the *Device-Name* page to view and manage an EX Series switch (physical and virtual chassis).

To view the chassis information of a member device in an EX virtual chassis (VC), click the member device. The chassis view displays the ports and the status of the ports on the member device.

To access this page:

1. Click **Resources > Tenant Devices**.

   The Tenant Devices page appears.

2. Click an *EX Series switch* in the Device Name column of the Devices List.

   The *Device-Name* page appears.

You can perform the following actions from this page:

View the Chassis Information of an EX Series Switch

The chassis view displays the device model and all the ports on an EX Series switch.

You can perform the following actions from the chassis view dashlet that appears on this page:

> **NOTE:** The chassis view is refreshed after every 60 seconds.

- View information about ports—Hover over a port on the chassis view to view general information (such as administrative status, link status, and link mode) about the port.

  SeeTable 58 on page 167 for more details.

  > **NOTE:** The ports on the chassis view are color coded depending on the admin and link statuses:
  >
  > - Green—If the admin status and link status are up.
  > - Red—If the admin status is up and the link status is down.
  > - Dark Gray—If the admin status and link status are down.
  > - Light Gray—If the port is not configured as part of any LAN segment.

- View additional details of a port—Click a port to view additional details of the port.

  The Port Overview tab appears. Table 63 on page 174 describes the fields on the Port Overview tab.

- View details of system meters—Hover over a system meter to view more information from the trays that appear. SeeTable 59 on page 168 for more details.
- Perform various actions on an EX Series switch—Click **Actions** on the chassis view dashlet.

  A list of all actions that you can perform on the switch is displayed. See Table 60 on page 168 for more details.

Table 58 on page 167 describes the fields on the port view pane.

Table 58: Fields on the Port View Pane

Field	Description
Admin Status	Administrative status of the port: • Green—Indicates that the admin status is up (enabled). • Gray—Indicates that the admin status is down (disabled).
Link Status	Operational status of the link or connection to the port: • Green—Indicates that the connection to the port is up. • Red—Indicates that the connection to the port is down.
Port Mode	Indicates the mode in which the port operates: • Access (default)—Only one VLAN is configured on the port. • Trunk—One or more VLANs are configured on the port. (Optional) A native VLAN may also be configured.
Link Mode	Mode in which the link to the port operates—Half-duplex or Full-duplex.
Power Consumption	Power consumed by the port, in watts (W).
PoE Status	Indicates whether the port is configured to transmit electrical power through an Ethernet cable (ON) or not (OFF).
Negotiated Speed	Current negotiated speed (in Kbps, Mbps, and Gbps) of the port.
VLAN	ID of the VLAN configured on the port. Range: 1 through 4094.
Input Bandwidth Utilization	Bandwidth (in %) consumed by the incoming packets on the port.
Output Bandwidth Utilization	Bandwidth (in %) consumed by the outgoing packets on the port.
Input Drops	Number of incoming packets dropped by the port due to congestion.

Table 58: Fields on the Port View Pane *(continued)*

Field	Description
Output Drops	Number of outgoing packets dropped by the port due to congestion.
Input Errors	Number of errors in the incoming packets.
Output Errors	Number of errors in the outgoing packets.

Table 59 on page 168 describes the system meters available on the chassis view dashlet. The system meters display current data.

> **NOTE:** The UI polls the CSO database every 30 seconds and the database polls the devices every five minutes.

Table 59: System Meters on the Chassis View Dashlet

System Meter	Description
CPU	CPU utilization (in %) in the switch.
Memory	Memory (in %) utilized in the switch.
Storage	Storage space (in %) allocated to the logical partitions of the switch.
Fan	Details of the fan used on the switch.
Temperature	Temperature details of the components in the available FPC.
LEDs	Severity level of the Alarms, System, and Primary LEDs.
Power	Details of the power supplies for the switch.

Table 60 on page 168 describes the actions that you can perform on an EX Series switch.

Table 60: Options on the Actions List

Action	Description
Ping	Select this option to ping a remote host to verify the connectivity between the EX Series switch and the remote host. See "Identifying Connectivity Issues by Using Ping" on page 188 for more information.

Table 60: Options on the Actions List *(continued)*

Action	Description
Traceroute	Select this option to execute the traceroute command from the EX Series switch, to view the path a packet travels to reach the remote host. See "Identifying Connectivity Issues by Using Traceroute" on page 192 for more information.
Reboot Device	Select this option to reboot the switch. See "Rebooting Tenant Devices and Provider Hub Devices" on page 186 for more information. **NOTE:** This option is available only for a physical EX Series switch.
Reboot Member	Select a member device in the VC that you want to reboot and click **Reboot Member**. A reboot job is triggered to reboot the selected member. (Optional) You can view the status of the job on the Jobs (**Monitor > Jobs**) page. **NOTE:** This option is available only for an EX VC.
Reboot All	Select this option to reboot all member devices in the VC. A reboot job is triggered to reboot all the members. (Optional) You can view the status of the job on the Jobs (**Monitor > Jobs**) page. This option is available only for an EX VC.
View ARP Table	The switch uses the ARP table to map MAC addresses to IP addresses of the ports on the switch. If you select this option, the View ARP Details page appears with details, such as MAC addresses, IP addresses, Interface names, and flags associated with the switch.
View MAC Table	The switch uses the MAC table to map MAC addresses to specific ports on the switch. If you select this option, the View MAC Details page appears with details, such as MAC addresses, Interface names, and flags associated with the switch.

View Information about an EX Series Switch

Click the **Overview** tab to view information about an EX Series switch.

You can select one of the following options as the time span to view details about the recent alarms, PoE, resource utilization, and physical box storage:

- Past 1 hour
- Past 8 hours
- Past 1 day
- Past 1 week
- Past 1 month

Table 61 on page 170 describes the dashlets on the Overview tab. The graphical representations on this tab display trends based on historical data.

Table 61: Dashlets on the Overview Tab

Dashlet	Description
Port Link Status	Graphical representation (Donut chart) of the link status. Hover over the chart to view the number and percentage of links that are up and down. You can click the chart to view all the ports on the switch, on the Port Details page. You can also search for a port or filter the list based on port name and link status (up or down).
Recent Alarms	Recent alarms (Critical, Major, and Minor) generated on the switch. Click the *View All Alarms* link to view information about all the alarms, on the Alarms page. See "About the Alarms Page" on page 434 for more information.
Details	Details (such as serial number, management IP address, OS version, and device template) of the switch.
Resource Utilization	Graphical representation of memory and CPU utilized in the switch, for the selected time span.
Current System Users	Details (such as name, duration, and login time) of the system users who are currently logged in to the switch. Click the *More Details* link on this dashlet to view additional information (such as username and session type) about the current users, on the View Details page. You can search and sort the information on this page as per your requirement, by using the Search and Filter icons, respectively.

Table 61: Dashlets on the Overview Tab *(continued)*

Dashlet	Description
PoE	Graphical representation of the power consumed by each PoE interface, in Watts (W). **NOTE:** This graph is displayed only for P models of EX Series switches.
Top Ports by Input Bandwidth	Graphical representation of the top 10 ports on which the incoming packets consume the maximum bandwidth.
Top Ports by Output Bandwidth	Graphical representation of the top 10 ports on which the outgoing packets consume the maximum bandwidth.
Top Ports with Input Errors	Graphical representation of the top 10 ports with the highest number of errors in incoming packets.
Top Ports with Input Errors	Graphical representation of the top 10 ports with the highest number of errors in outgoing packets.
Top Ports with Input Packet Loss	Graphical representation of the top 10 ports that drop the highest number of incoming packets.
Top Ports with Output Packet Loss	Graphical representation of the top 10 ports that drop the highest number of outgoing packets.
Licenses	Details of licenses (such as license name and description) installed on the switch. Click the *More Details* link on this dashlet to view additional information about the licenses, on the Device License Files page. . See "About the Device License Files Page" on page 363 for more information.
Physical Box Storage	Graphical representation of the storage space (in %) allocated to the logical partitions of the switch.

View Information about Ports on an EX Series Switch

Click the **Ports** tab to view information about each port on an EX Series switch.

Table 62 on page 172 describes the fields on the Ports tab.

You can perform the following tasks on this tab:

- Search for a specific port by using keywords—Click the Search icon to search for a port by entering partial or full text of the keyword in the text box.

  The search results are displayed on the same tab.
- Filter the data displayed on the tab—Click the Filter icon to apply a quick filter. The filtered results are displayed on the same tab.
- Show or hide columns that contain information about the ports—Click the Show or Hide Columns icon to select or clear columns that you want to display or hide on the tab.
- View additional details of a port—Click a port in the Port column to view additional details of the port, on the Port Overview tab that appears.

  Table 63 on page 174 describes the fields on the Port Overview tab.

Table 62: Fields on the Ports Tab

Field	Description
Interface List	
Port	Name of the port. Click each port to view additional information about the port, on the Port Overview page. SeeTable 63 on page 174 for details of dashlets that appear on the Port Overview page.
Admin Status	Indicates the administrative status of the port: • Up—if the port is enabled. • Down—If the port is disabled.
Link Status	Indicates the status of the link or connection to the port: • Up—If the connection to the port is up. • Down—If the connection to the port is down.
MTU	Maximum transmission unit (MTU) size (in bytes) on the ports. Default: 1500 bytes.
Negotiated Speed	Current negotiated speed (in Kbps, Mbps, and Gbps) of the port.
Link Mode	Mode in which the port operates—Half-duplex or Full-duplex.

Table 62: Fields on the Ports Tab *(continued)*

Field	Description
Interface List	
Media Type	Type of transmission medium—Copper or Fiber.
Power Consumption	Power consumed by the port, in Watts (W).
VLAN ID	ID of the VLAN configured on the port. Range: 1 through 4094.
Input Bandwidth Utilization	Bandwidth (in %) consumed by the incoming packets on the port.
Output Bandwidth Utilization	Bandwidth (in %) consumed by the outgoing packets on the port.
Input Drops	Number of incoming packets dropped by the port due to congestion.
Output Drops	Number of outgoing packets dropped by the port due to congestion.
Input Errors	Number of errors in the incoming packets.
Output Errors	Number of errors in the outgoing packets.
PoE (Power Over Ethernet)	Indicates whether the port is configured to transmit electrical power through an Ethernet cable (ON) or not (OFF).
Auto Negotiation	Indicates whether the interface speed is auto-negotiated (Enabled) or is fixed based on an explicitly configured value (Disabled).

Table 63 on page 174 describes the dashlets available on the Port Overview tab.

You can select one of the following options as the time span for which you want to view the graph for these dashlets:

- Past 1 hour
- Past 8 hours
- Past 1 day
- Past 1 week
- Past 1 month

NOTE: The dashlets on the Port Overview tab are refreshed after every 30 seconds. The date and time of the last refresh appear at the bottom-left corner on each dashlet.

Table 63: Dashlets on the Port Overview Tab

Dashlet	Description
Details	Details (such as port number, admin status, and link mode) of the port that you selected.
Utilization	Graphical representation of CPU utilized by the selected port (in terms of input and output) for the selected time span.
Errors	Graphical representation of the number of errors in the incoming (input) and outgoing (output) packets for the selected time span. You can select either the past 1 hour, 8 hours, 1 day, 1 week, or 1 month as the time span for which you want to view the graph.
Packet Loss	Graphical representation of packet loss in incoming (input) and outgoing (output) packets for the selected time span. You can select either the past 1 hour, 8 hours, 1 day, 1 week, or 1 month as the time span for which you want to view the graph.
Bytes	Graphical representation of the MTU (in bytes) for incoming (input) and outgoing (output) packets for the selected time span. You can select either the past 1 hour, 8 hours, 1 day, 1 week, or 1 month as the time span for which you want to view the graph.
Packets	Graphical representation of the number of incoming (input) and outgoing (output) packets for the selected time span. You can select either the past 1 hour, 8 hours, 1 day, 1 week, or 1 month as the time span for which you want to view the graph.

RELATED DOCUMENTATION

Managing a Tenant Device | 164

Device Redundancy Support Overview

Contrail Service Orchestration (CSO) supports spoke redundancy for large enterprise SD-WAN on-premise spokes. To protect an SD-WAN site against device or link failures, you can configure the site with two CEP devices that can function as primary and secondary devices. . If the primary device fails, the secondary device takes over the traffic processing.

> **NOTE:** You must use the same device model for both primary and secondary devices and the devices must have the same version of Junos OS installed.

The following SD-WAN features are not supported for device redundancy:

- LTE WAN backup link
- Service chaining

> **NOTE:** Device redundancy is supported only for SD-WAN deployments.

Prerequisites for using SRX Series Devices for Device Redundancy

The prerequisites to configure an SD-WAN site with dual CPE SRX Series devices are as follows:

- For SRX Series, you need to form the cluster manually by connecting two SRX Series devices together using a pair of the same type of Ethernet connections. To create an SRX cluster, see Chassis Cluster Feature Guide for SRX Series Devices.
- Log in to any one of the SRX Series devices, copy the **Stage-1** configuration from the **Sites** page and paste it into the console screen and commit the configuration.

Supported Connection Plans

The following connection plans are supported for device redundancy:

- Dual NFX250 as SD-WAN CPEs—Supports NFX Series devices as CPE devices in an SD-WAN site.
- Dual SRX as SD-WAN CPEs—Supports SRX Series devices as dual CPE devices in an SD-WAN site.

- Dual SRX4x00 as SD-WAN CPEs—Supports SRX 4100 and SRX4200 devices as dual CPE devices in an SD-WAN site.

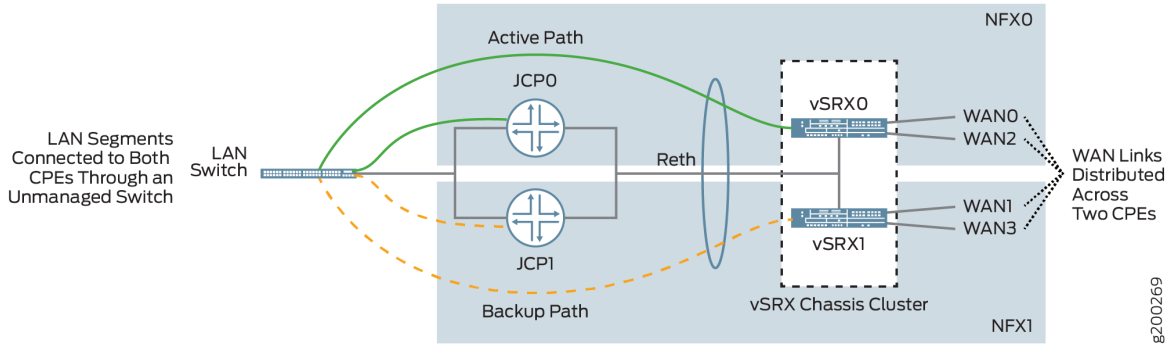
Create and Configure an SD-WAN Site

You can create and configure an SD-WAN site with dual CPE devices and the two devices back up each other, with one node acting as the primary device and the other as the secondary device. The workflow to add and configure a site with dual CPE devices is similar to the single CPE device. For more information about creating and configuring a site with dual CPE devices, see *Add an On-Premise Spoke Site with SD-WAN Capability*, *Managing a Single Site*, and *Edit On-Premise Spoke and Enterprise Hub Site Parameters*.

Dual CPE Devices Logical Topology for NFX Network Services Platform

Figure 3 on page 176 shows the logical topology of the NFX Series dual CPE devices.

Figure 3: Dual CPE Device Topology - NFX Network Services Platform



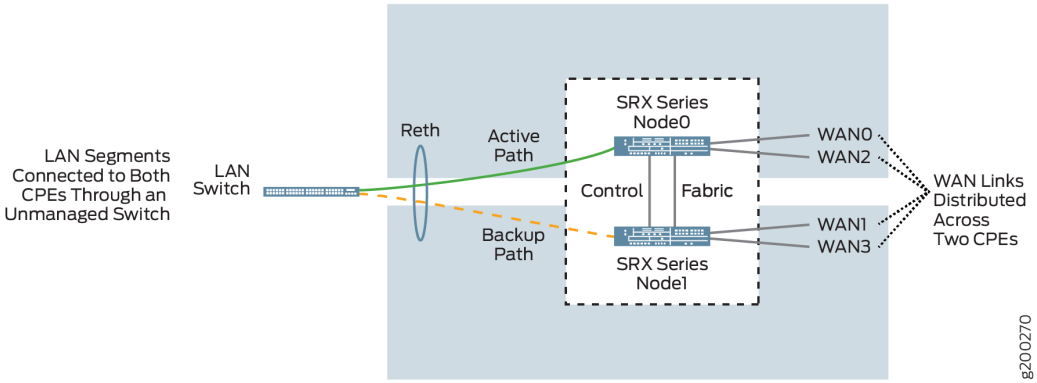
You can form a cluster using two NFX Series devices. The front panel ports of the NFX Series devices are used to interconnect two NFX Series devices and to carry the control and fabric interconnect traffic between the two NFX250 devices.

The Junos Control Plane (JCP) component acts as a switch, controls the front panel ports, and sends the traffic which arrives from the LAN or WAN to the NFX Series devices. On the LAN, the active/backup mechanism is used and if the primary device fails, the secondary device takes over processing of traffic. On the WAN, the active/active mechanism is used and all four WAN links are active and distributed across two NFX Series devices.

Dual CPE Devices Logical Topology for SRX Series Gateway Devices

Figure 4 on page 177 shows the logical topology of the SRX Series dual CPE devices.

Figure 4: Dual CPE Device Topology - SRX Series Devices



You can form a cluster using two SRX devices. A chassis cluster is formed between these nodes and performs as a single logical router. On the LAN, the active/backup mechanism is used and if the primary device fails, the secondary device takes over traffic processing. On the WAN, the active/active mechanism is used and all four WAN links are active and distributed across two SRX Series device.

> **NOTE:** On SRX 4100 and SRX4200 devices, out of the eight 1-Gigabit Ethernet/10-Gigabit Ethernet, a maximum of two ports are used for WAN links, and the remaining ports are used for LAN connectivity. The HA ports are used only for forming the cluster.

RELATED DOCUMENTATION

About the Device Template Page | 201

Viewing the History of Tenant Device Activation Logs

You can use the Activation Logs page to view the history of device activation logs. You can also view the details of the activation logs and their status.

To view the tenant device activation logs:

1. Click **Resources > Tenant Devices**.

   The Tenant Devices page appears, which list all devices.

2. Select a device and click **More > Activation Logs**.

   The Activation Logs page is displayed. Table 64 on page 178 describes the fields on the Activation Logs page.

3. Click a task name.

   The ZTP Logs page appears. Table 65 on page 179 describes the fields on the ZTP Logs page.

4. Click the Task Name.

   The Job Status page appears. Table 66 on page 179 describes the fields on the Job Status page.

5. Click **OK** to return to the previous page.

Table 64: Fields on the ZTP History Page

Field	Description
In progress	View the number of activated tasks that are in progress.
Success	View the number of activated tasks that are successful.
Failure	View the number of activated tasks that have failed.
Name	View the name of the task. Example: csp.tssm_ztp-Juniper-site-17-NFX-250-8052cc9451914be28c7c98fb64fd0db3
Start Date	View the start date and time of the task.
End Date	View the end date and time of the task.

Table 64: Fields on the ZTP History Page *(continued)*

Field	Description
Status	View the status of the task to know whether the task succeeded or failed.
Log	View the import logs. Click a log to access more detailed information about the imported log.

Table 65: Fields on the ZTP Logs Page

Field	Description
Task Name	View the ID created for the task. Example: install-license-to-device
Status	View the status of the task to know whether the task succeeded or failed.

Table 66: Fields on the Job Status Page

Field	Description
Name	View the name of the task.
Actual Start Time	View the start date and time of the task.
User	View the name of the user who activated the task.
End Time	View the end date and time of the task.
State	View the status of the task to know whether the task succeeded or failed.

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Secure OAM Network Overview

IN THIS SECTION

- Topology of a Secure OAM Network | 180
- Workflow for Establishing a Secure OAM Network | 181
- Benefits of Secure OAM Network | 182

The management and control plane traffic between a customer premises equipment (CPE) device associated with an SD-WAN on-premise spoke site and Contrail Service Orchestration (CSO) consists of the following:

- SSH and HTTPS sessions between the CPE device and CSO.
- BGP session between the CPE device and a virtual route reflector (VRR).
- System log traffic between the CPE device and CSO.

This traffic must be carried across the network through a secure and redundant communication channel. To provide such a secure and redundant communication channel, you must configure a secure Operation, Administration, and Maintenance (OAM) network between the SD-WAN on-premise spoke sites and CSO.

This topic provides an overview of the secure OAM network, explains the workflow for configuring a secure OAM network, and benefits of a secure OAM network in an SD-WAN deployment.

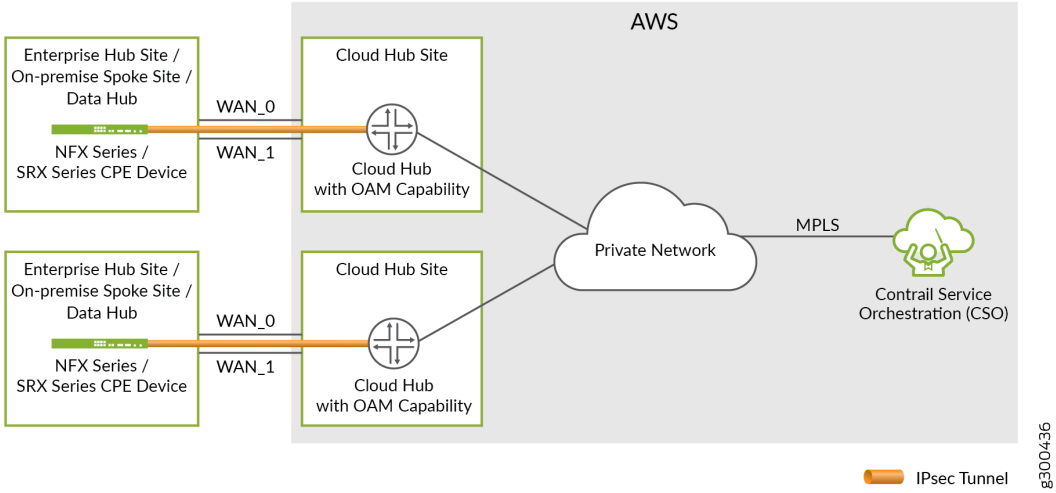
Topology of a Secure OAM Network

CSO uses the provider hub devices as SD-WAN hubs to set up IPsec tunnels and provision site-to-site or site-to-hub traffic. The provider hub acts as a concentrator for terminating the IPsec tunnels from SD-WAN on-premise spoke sites. The provider hub device is located in the service provider's point of presence (POP). A provider hub device can be a SRX Series services gateway, or a vSRX instance. In CSO Release 5.0, provider hub devices are owned and managed by the Juniper Network team that hosts the cloud-based CSO.

> **NOTE:** In CSO Release 5.0, the OAM hub is instantiated within the CSO. You do not need a provider hub for OAM network.

Figure 5 on page 181 shows the connections between the SD-WAN on-premise spoke site, provider hub, and CSO.

Figure 5: Secure OAM Network



The secure OAM network is built using a dedicated IPsec tunnel (overlay connection) that is established between the CPE device associated with the SD-WAN on-premise spoke site and a provider hub with OAM capability. The provider hub is connected to CSO through a secure private network (underlay connection) that is owned by the service provider.

Because the loopback IP address of the CPE device is used for OAM communication, it is fixed and unique across the entire deployment, and is always reachable from CSO over the IPsec tunnel. Even if the WAN interfaces are behind NAT and are assigned private IP addresses (by using DHCP), the OAM connectivity between the SD-WAN on-premise spoke site and the provider hub is not impacted. The IPsec tunnel can still be established over the Internet WAN link including the LTE access type.

The secure OAM network is supported on both hub-and-spoke and full-mesh topologies.

Workflow for Establishing a Secure OAM Network

Use the following workflow to establish a secure OAM network between the SD-WAN on-premise spoke site and the provider hub. As the provider hub is located in the service provider's POP, it has a private and secure connectivity to CSO.

To establish a secure OAM network between SD-WAN sites and the provider hub:

1. Log in to Customer Portal, and add a provider hub site. Associate the provider hub site with one of the available provider hub devices.

2. In Customer Portal, add an on-premise spoke site for the CPE device in SD-WAN deployment.

3. When you create the site, specify the IP address prefix for the site and select at least one WAN link for OAM traffic. The WAN link with the **Use for OAM traffic** option enabled is used to set up the secure OAM tunnel to the provider hub device.

   > **NOTE:** For an NFX250 CPE device, specify at least one WAN link with traffic type as OAM and Data. If device redundancy is enabled, then specify one WAN link for each CPE device with the traffic type as OAM and Data.

   The CPE device is detected and activated. The Zero Touch Provisioning (ZTP) process is triggered over the secure OAM tunnel and the device is moved to provisioned state. The management and control plane traffic is carried across the secure OAM tunnel.

Benefits of Secure OAM Network

- IPsec tunnel redundancy—The secure OAM network supports a maximum of two IPsec tunnels between each SD-WAN on-premise spoke site and the provider hub, thus providing redundancy and ensuring that OAM traffic is not lost even in the case of a WAN link failure.
- Hub device redundancy—In case of multihoming at the spoke sites, each CPE device at the site is connected to two provider hubs, and the IPsec tunnels are established from the SD-WAN on-premise spoke site to both the primary and secondary provider hub devices. This hub device redundancy ensures that the OAM traffic is not lost even if a hub fails.

Secure OAM Network Redundancy Overview

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- Logical Topology | 183
- BGP Configuration | 184
- Adding and configuring provider hub devices | 184
- Adding and configuring an on-premise spoke site | 185

Failure Detection and Recovery | 185
Benefits of Secure OAM Network Redundancy | 185

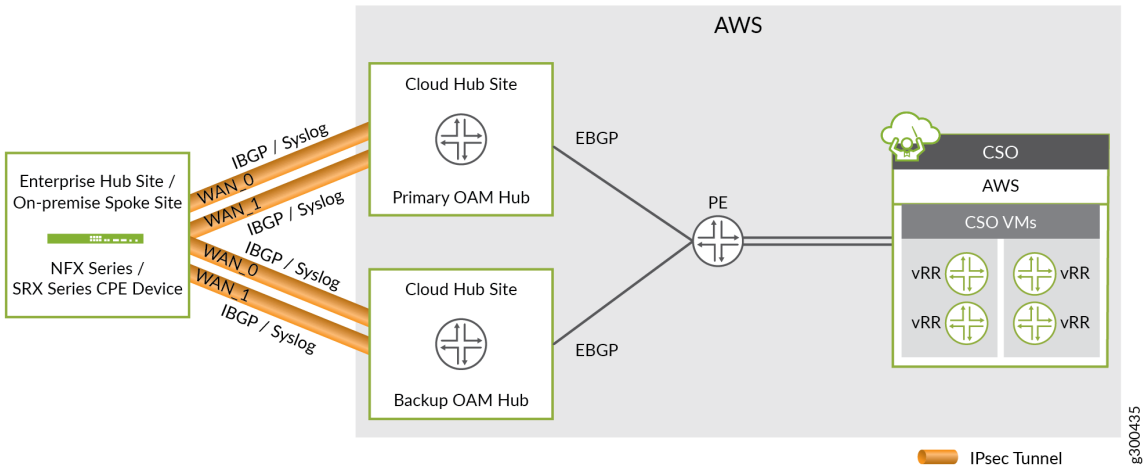
Contrail Service Orchestration (CSO) supports secure Operation, Administration, and Maintenance (OAM) network redundancy for provider hub devices in an SD-WAN deployment. You can configure two provider hub devices to act as the primary and secondary OAM hub devices and protect the site against device and link failures (WAN link between the CPE and the provider hub). If a fault or an outage occurs at the OpCo's OAM network beyond the primary OAM hub, the OAM connectivity is automatically restored through the secondary OAM hub without any user intervention.

The following sections explain the topology and benefits of secure OAM network redundancy in an SD-WAN deployment.

Logical Topology

Figure 6 on page 183 shows the topology for secure OAM network redundancy.

Figure 6: Secure OAM Network Redundancy



The CPE device at the on-premise spoke site is connected to two provider hub devices that are configured as OAM hubs. The OAM hub devices are in turn connected to the OAM gateway router. During Zero Touch Provisioning (ZTP), two separate IPsec tunnels are established from the CPE device to the primary and secondary OAM hub devices. The CPE device has a static route (loopback lo0.1) to both the OAM hubs through the IPsec tunnels.

BGP Configuration

When the provider hub device is onboarded, the BGP sessions are established. During the BGP sessions, the OAM hub device advertises the CSO subnet to the CPE device and the CPE device advertises the OAM subnet to the OAM hub device.

BGP supports primary and backup OAM hub by using local preference(hub-primary-select option) on the CPE device at the on-premise spoke site. The CPE device decides whether the OAM hub is primary or secondary based on the hub-primary-select option. If the primary OAM hub fails or losses the CSO routes from the OAM gateway, then the secondary OAM hub is used. The CPE device advertises the OAM subnet to the OAM hubs. The OAM hubs, in turn, advertises the OAM subnet to the OAM gateway router.

> **NOTE:** In case the SINGLE_SSH feature is enabled in the device template, then only one IP address (loopback ip) is advertised. In case the SINGLE_SSH feature is disabled in the device template, then the OAM subnet is advertised.

The details of the BGP session that is established during ZTP are as follows:

- External BGP (eBGP) session is established between the OAM hub device and the OAM gateway router. During the eBGP session, the OAM gateway router advertises the CSO route reachability (CSO prefix and VRR prefixes) to both primary and secondary OAM hubs.
- Internal BGP (iBGP) session is established between the CPE device at the on-premise spoke site and the OAM hub device. During this session the OAM hub device advertises the learned CSO route to the CPE device at the on-premise spoke site. The CPE device learns routes from both primary and secondary OAM hub devices, and configures the primary OAM hub device with a higher preference and the backup OAM hub device with a lower preference.

Adding and configuring provider hub devices

The workflow to add and configure provider hub devices to support redundant secure OAM network is similar to adding a single provider hub device. For more information about adding and configuring a provider hub device, see *Adding Provider Hub Sites for SD-WAN Deployment*.

> **NOTE:** While adding the first provider hub device in any deployment, ensure that the capability of the device is set to **DATA and OAM**.

Adding and configuring an on-premise spoke site

The workflow to configure an on-premise spoke site to support redundant secure OAM network is similar to adding a single on-premise spoke site. For more information about adding and configuring an on-premise spoke site, see *Add an On-Premise Spoke Site with SD-WAN Capability*.

> **NOTE:**
> - In real time-optimized deployments, you must enable the **Connect to Hubs** feature to establish secure OAM IPsec tunnels.
> - On NFX250 devices, you must enable the traffic type as **OAM_AND_DATA** for at least one WAN link.

Failure Detection and Recovery

In case of network failure at the OpCo's OAM network behind the primary OAM hub, the route to primary OAM hub breaks and as a result, the primary OAM hub loses the route. The route from primary OAM hub to spoke for CSO breaks. As a result, the spoke obtains the route from the secondary OAM hub. The OAM traffic then moves from primary OAM hub to secondary OAM hub.

When the primary OAM hub is active, the BGP session is established and the primary OAM hub receives the route and propogates the route to the spoke. Because the primary OAM hub is configured with a higher preference in the spoke device, when the spoke receives the traffic from primary OAM hub, the OAM traffic will switches back to primary OAM hub.

Benefits of Secure OAM Network Redundancy

Hub device redundancy—In case of multihoming at the spoke sites, each CPE device at the site is connected to two provider hubs devices, which function as primary and secondary provider hub devices. Two separate IPsec tunnels are established from the SD-WAN site to both primary and secondary provider hub devices. This hub device redundancy ensures that the OAM traffic is not lost even if a hub fails.

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Rebooting Tenant Devices and Provider Hub Devices

IN THIS SECTION

- Rebooting a Tenant Device | 186
- Rebooting a Provider Hub Device | 187

You can reboot tenant devices and provider hub devices by using CSO.

You need to reboot a tenant device or provider hub device if the device is down or if you want to fix operational errors in the device.

Rebooting a Tenant Device

To reboot a tenant device:

> **CAUTION:** If you reboot a tenant device, deployments that are in progress are stopped.

1. Select **Resources > Tenant Devices**.

   The Tenant Devices page appears.

2. Select the tenant device that you want to reboot and select **More > Reboot**.

   The Reboot Device page appears, displaying the message **Reboot Device will stop deployments in progress. Continue with reboot?**.

3. Click **Yes** to reboot the device.

   A device reboot job is triggered and the message **Device Reboot job is created** appears on the Tenant Devices page.

   You can click the Device Reboot link in the message to view the device reboot logs (including job status, start date and time, end date and time) on the Device Reboot Details page. Alternatively, you can view the status of the job on the Jobs (**Monitor > Jobs**) page.

   The Status Message column on the Tenant Devices page displays the status as **Reboot in-progress**.

- If the device is rebooted successfully, the Status Message column displays the status as **Reboot Succeeded**.
- If the device reboot fails, the Status Message column displays the status as **Reboot Failed**.

  A device reboot may fail because of various reasons such as the reboot time exceeding the timeout value that is set by CSO, or when the device is unreachable.

  You can log in to the device CLI and check the logs to identify the reason for reboot failure

Rebooting a Provider Hub Device

To reboot a provider hub device:

> **CAUTION:** If you reboot a provider hub device, deployments that are in progress are stopped.

1. Select **Resources > Provider Hub Devices**.

   The Provider Hub Devices page appears.

2. Select the Provider hub device that you want to reboot and select **More > Reboot**.

   The Reboot Device page appears, displaying the message **Reboot Device will stop deployments in progress. Continue with reboot?**.

3. Click **Yes** to reboot the device.

   A device reboot job is triggered and the message **Device Reboot job is created** appears on the Provider Hub Devices page.

   You can click the Device Reboot link in the message to view the device reboot logs (including job status, start date and time, end date and time) on the Device Reboot Details page. Alternatively, you can view the status of the job on the Jobs (**Monitor > Jobs**) page.

   The Status Message column on the Provider Hub Devices page displays the status as **Reboot in-progress**.

   - If the device is rebooted successfully, the Status Message column displays the status as **Reboot Succeeded**.
   - If the device reboot fails, the Status Message column displays the status as **Reboot Failed**.

     A device reboot may fail because of various reasons such as the reboot time exceeding the timeout value that is set by CSO, or when the device is unreachable.

     You can log in to the device CLI and check the logs to identify the reason for reboot failure

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About the Tenant Devices Page | 144

Identifying Connectivity Issues by Using Ping

You can use Contrail Service Orchestration (CSO) to perform a ping operation from a device (provider hub, tenant device, CPE device, EX switch, enterprise hubs, or next-generation firewall device) to a remote host for identifying issues in connectivity with the remote host.

When you ping a remote host from a device, an Internet Control Message Protocol (ICMP) packet is sent to the remote host. By analyzing the results of the ping operation, you can identify the possible device connectivity issues between the remote host and the device.

> **NOTE:** In Contrail Service Orchestration (CSO) Release 5.0, the following devices support ping:
>
> - EX Series: EX2300, EX3400, EX4300, EX4600, EX4650
> - NFX Series: NFX150, NFX250
> - SRX Series: SRX300, SRX320, SRX340, SRX345, SRX1500, SRX4100, SRX4200, SRX4600
> - vSRX

To perform the ping operation:

1. Do one of the following:
   - To initiate a ping from a provider hub device, select **Resources** > **Provider Hub Devices**.

     The :Provider Hub Devices page appears.
   - To initiate a ping from a tenant device, select **Resources** > **Tenant Devices**.

     The Tenant Devices page appears.
2. Select a device from the list of devices displayed and click **More** > **Ping**.

   The Ping page appears.

   > **NOTE:** You can initiate a ping from a device only when its operational status (in CSO) is Up.

3. Complete the configuration according to the guidelines provided in Table 67 on page 189.

> **NOTE:** Fields marked with an asterisk (*) are mandatory.

4. Click **Ping** to initiate the ping request.

   A job is created and a Ping Progress page appears. After the host sends the ping packets, the Ping Result page appears. If the ping operation is successful, the Ping Result page displays the parameters specified in Table 68 on page 191.

   If the ping operation fails, the Ping Result page displays an appropriate error message (such as **No response** or **No route to host**), indicating that there is an issue in the connectivity to the remote host.

Table 67: Fields on the Ping page

Field	Description
Remote Host	Enter the IPv4 address or hostname of the remote host.
Ping Request Packets	Enter the number of ping request packets to be sent to the remote host. Default: 5. Range: 1 through 300.
Advanced	
Source Interface	Select the source interface on the device through which you want to send the ping request to the remote host. If you do not select a source interface, ping requests are sent on all interfaces. To clear the selected interface, click **Clear All** and select another interface.
Hostname Resolution	Click the toggle button to enable or disable (default) the display of hostname of the hops along the path to the remote host.

Table 67: Fields on the Ping page *(continued)*

Field	Description
Rapid Ping	Click the toggle button to enable or disable (default) sending ping requests rapidly. If you enable this option, the device sends a minimum of 100 ping request packets per second or sends a packet as soon as a response to the previous packet is received, whichever is greater. • If the source device does not receive a response for 500 ms, timeout is considered. • If the source device receives a response within 500 ms, the next ping request packet is sent immediately. **NOTE:** The ping results are displayed in a single consolidated message instead of individual messages for each ping request packet sent.
Packet Fragmentation	Click the toggle button to enable or disable (default) the fragmenting of ping request packets. If packet fragmentation is disabled, ping packets with the maximum transmission unit (MTU) greater than 1500 bytes are dropped.
Packet Size (bytes)	Enter the size (in bytes) of the ping request packet. Default: 56 bytes. Range: • 1 through 1,472 bytes, if packet fragmentation is disabled. • 1 through 65,468 bytes, if packet fragmentation is enabled.
Wait Time (seconds)	Enter the time (in seconds) for which the source device waits for a response to the ping request packet. The source device considers the remote host as not reachable after the wait time elapses. Default: 10 seconds. Range: 0 through 600 seconds.
Incoming Interface	Click the toggle button to include or exclude (default) information (on the Ping Result page) about the interface on the source device that receives the ping responses..

Table 67: Fields on the Ping page *(continued)*

Field	Description
Routing Instance	Select a specific routing instance that the ping request packets can use to reach the remote host. The ping result displays the information about the connectivity between the source device and the remote host based on the selected routing instance. To clear the selected routing instance, click **Clear All** and select another routing instance.

Table 68: Fields on the Ping Result page

Field	Description
Packet Loss	Displays the percentage of ping packets sent for which the source device did not receive a response.
Round Trip Time Taken (in µs)	Displays the following information about the duration (in microseconds) between the time when the device sends the ping request and the time when the device receives a response from the remote host. Displays the following: • Minimum: The minimum time taken to receive a response for a ping request packet. • Maximum: The maximum time taken to receive a response for a ping request packet. • Average: The average time taken to receive a response for all the ping request packets sent in a ping operation. • Standard Deviation: The variation of the round trip time from the mean round trip time.
Details	
Sequence	Sequence number of all the ping request packets.
Result	Result of the ping request packets—Success or Failure.
Incoming Interface	Interface on the source device on which the responses are received for the ping requests. This data appears if you have enabled the Incoming Interface option on the Ping page.
Time Taken	Time taken (in microseconds) to receive response to a ping request packet.

Identifying Connectivity Issues by Using Traceroute

You can use Contrail Service Orchestration (CSO) to perform a traceroute operation from a device (provider hub, tenant device, CPE device, EX switch, enterprise hubs, or next-generation firewall device) to the remote host. Traceroute helps you view the path that a packet travels to reach the remote host. The result is useful in identifying the point of network failure in the path between the source device and remote host.

> **NOTE:** In Contrail Service Orchestration (CSO) Release 5.0, the following devices support traceroute:
>
> - EX Series: EX2300, EX3400, EX4300, EX4600, EX4650
> - NFX Series: NFX150, NFX250
> - SRX Series: SRX300, SRX320, SRX340, SRX345, SRX1500, SRX4100, SRX4200, SRX4600
> - vSRX

To perform traceroute operation:

1. Do one of the following:
   - To initiate traceroute from a provider hub device, select **Resources** > **Provider Hub Devices**.

     The Provider Hub Devices page appears.
   - To initiate traceroute from a tenant device, select **Resources** > **Tenant Devices**.

     The Tenant Devices page appears.
2. Select a device from the list of devices displayed and click **More** > **Traceroute**.

   The Traceroute page appears.
3. Complete the configuration according to the guidelines provided in Table 69 on page 193.

   > **NOTE:** Fields marked with an asterisk (*) are mandatory.
4. Click **Traceroute** to initiate the traceroute operation.

   A job is created and a traceroute progress page appears. If the traceroute operation is successful, the Traceroute Result page displays the traceroute parameters specified in Table 70 on page 194.

   If the traceroute operation fails, the Traceroute Result page displays an appropriate error message (such as **No response** or **No route to host**).

Table 69: Fields on the Traceroute page

Field	Description
Remote Host	Enter the IPv4 address or hostname of the remote host.
Maximum Hops	Specify the maximum number of network devices that a packet can pass through to reach the remote host. Default: 30. Range: 1 through 255. If the number of hops to reach the remote host exceeds the set value, the traceroute packet is dropped.
Advanced	
Source Interface	Select a source interface on the device from which you want to send the packets to the remote host. Click **Clear All** to remove the selected interface and select another interface.
Hostname Resolution	Click the toggle button to enable or disable (default) the display of hostname of the hops in the path to the remote host.
Wait Time (seconds)	Enter the time until which the device waits for a response from the remote host to a packet sent before considering timeout. Default: 10 seconds. Range: 0 through 86,399 seconds.
Routing Instance	Select a routing instance that the traceroute request packets can use to reach the remote host. The trace result displays the route information based on the configured routing instance type. To clear the selected routing instance, click **Clear All** and select another routing instance.

Table 70 on page 194 lists the parameters on the Traceroute Result page when the traceroute operation is successful.

Table 70: Fields on the Traceroute Result page

Field	Description
Hop	Hostname or IPv4 address of the network devices that the packet passed through to reach the remote host.
Time Taken by Packet 1 Time Taken by Packet 2 Time Taken by Packet 3	Duration (in microseconds) between the time from when the source device sends a packet, and the time it received a response from the hops and the remote host.

Remotely Accessing a Device CLI

You can use the Devices page to remotely access the CLI of a CPE device and EX Series switch, and run **show** operational commands.

> **NOTE:** As an OpCo administrator, you can remotely access a device CLI only if you have the tenant administrator role assigned to you.
>
> As a tenant administrator, you can remotely access the device CLI from the Devices page on the Customer Portal.

To access this page:

1. Select **Resources > Devices**.

   The Devices page appears.

2. Select a device from the Devices List.

   > **NOTE:** You can only select a device whose operational status is marked **Up**.

3. Click **More**.

   A list of actions that you can perform on the device appears.

> **NOTE:** For dual CPE devices, the **Remote Console** option is disabled for a parent cluster device. Only member devices can select this option to access the device CLI.

4. Select the **Remote Console** option to access the device CLI.

   The Remote Terminal browser window appears, displaying the **CONNECTING TO DEVICE. PLEASE WAIT FOR PROMPT** message.

   > **NOTE:** You can automatically log in to the device through the Remote Terminal browser window, without entering a username and password. If you access the device CLI through the remote terminal, root user log in is disabled.

   - If the connection is successfully established, the CLI prompt appears on the browser window. Proceed to Step 5.
   - If the connection is not established, the **Remote console connection was closed. Please close this window and open the remote console again** message appears on the browser window.

5. Enter the **show** operational command to view information about current system configuration, log files, routing tables, and so on.

   The output for the show command that you entered, appears on the same browser window.

6. Close the Remote Terminal browser window to disconnect from the device.

   The Devices page appears.

   > **NOTE:** The session times out if the session remains idle for more than two minutes (default) and you are automatically logged out of the device. The **Remote console connection was closed. Please close this window and open the remote console again** message appears on the browser window.

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Device Template Overview

IN THIS SECTION

- SD-WAN CPE | 197
- Secure Internet CPE | 198
- Managed Internet CPE | 199

A device template contains configuration and provision settings for a physical device, such as a CPE device or a router, which you manage through Contrail Service Orchestration (CSO). The CSO installation includes several default device templates for CPE devices and other physical devices. You can either use a default CPE device template as is if the template suits your specific topology requirements or customize the default CPE device template to meet your specific requirements. You can also create your own device templates and upload that to CSO. The CPE device templates are specific to the type of device and topology of the solution. The device templates for non-CPE devices are fixed and you cannot customize them. You must assign a device template to each CPE device at the site. You assign a device template to a device in CSO when you add a point of presence (POP). In some cases, you might want all CPE devices to use the same values, through device templates, you have the options to provide the values.

> **NOTE:** In CSO Release 5.0, device templates are owned and managed by the Juniper Networks team that manages the cloud installation of CSO. If you need to modify device templates, talk to your Juniper Networks representative.

The CPE device templates contain three types of information:

- Template settings information—It prepares the device for remote activation, connects the device to the peer router, and establishes an IPsec tunnel with the router.
- Stage-2 configuration template information—It specifies the additional settings that you or your customer can configure for the device. For example, you can enable configuration of LAN and firewall policies. You create these configuration templates in Configuration Designer and provide implementation details in the device template.
- Stage-2 initial configuration information—It provides the actual values for the stage-2 configuration templates. In general, your customers perform this configuration through the Customer Portal.

The CPE device templates support four deployment models: SD-WAN CPE, Secure Internet CPE, and Managed Internet CPE.

SD-WAN CPE

You can use the **NFX 150 as SDWAN CPE**, **NFX 250 as SDWAN CPE**, **Dual NFX 250 as SDWAN CPE**, **SRX as SDWAN CPE**, **SRX-1500 as SDWAN CPE**, **SRX-4x00 as SDWAN CPE**, **Dual SRX as SDWAN CPE**, **Dual SRX 1500 as SDWAN CPE**, or **Dual SRX 4x00 as SDWAN CPE** device template for a CPE device in an SD-WAN deployment.

Figure 7 on page 197 shows the topology for an SD-WAN CPE deployment model.

Figure 7: SD-WAN CPE

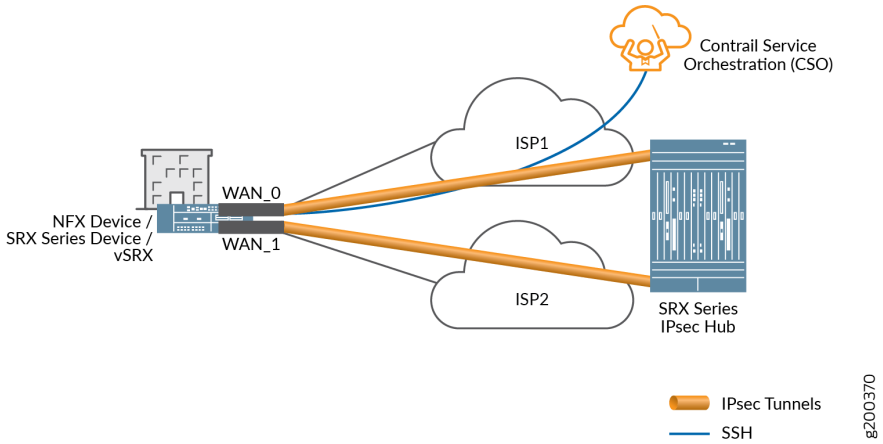

Table 71 on page 197 lists the connectivity details for an SD-WAN CPE.

Table 71: Connectivity Details for SD-WAN CPE

Link Name	Type	Default Interface	IP Assignment	Overlay	Traffic
WAN_0	MPLS, Internet	ge-1/0/1 (NFX150 ge-0/0/10 (NFX250) ge-0/0/0 (SRX) xe-0/0/0 (SRX4x00)	Static, DHCP	IPsec	Data, OAM
WAN_1	MPLS, Internet	ge-1/0/2 (NFX150) ge-0/0/11 (NFX250) ge-0/0/1 (SRX) xe-0/0/0 (SRX4x00)	Static, DHCP	IPsec	Data, OAM

Table 71: Connectivity Details for SD-WAN CPE *(continued)*

Link Name	Type	Default Interface	IP Assignment	Overlay	Traffic
WAN_2	MPLS, Internet	ge-1/0/3 (NFX150) (NFX1250) ge-0/0/2 (SRX) xe-0/0/0 (SRX4x00)	Static, DHCP	IPsec	Data, OAM
WAN_3	MPLS, Internet	ge-1/0/4 (NFX150) (NFX250) ge-0/0/3 (SRX) xe-0/0/0 (SRX4x00)	Static, DHCP	IPsec	Data, OAM

Secure Internet CPE

You can use the **NFX 150 as Secure Internet CPE** or **NFX 250 as Secure Internet CPE** device template to provide a secure Internet connection through the CPE device.

Figure 8 on page 198 shows the topology for a secure Internet CPE deployment model.

Figure 8: Secure Internet CPE

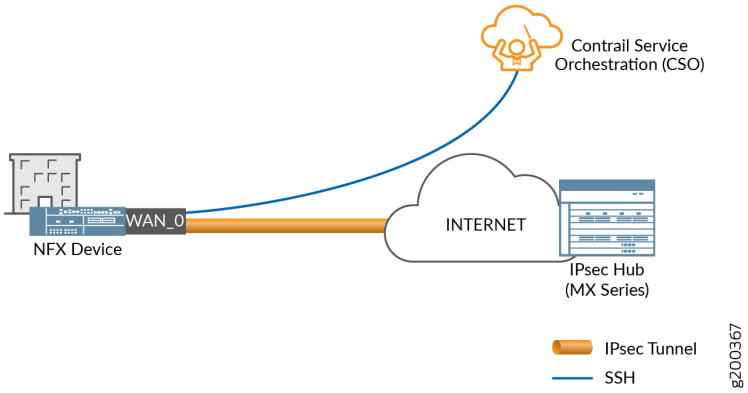

Table 72 on page 199 lists the connectivity details for secure Internet CPE.

Table 72: Connectivity Details for Secure Internet CPE

Link Name	Type	Default Interface	IP Assignment	Overlay	Traffic
WAN_0	Internet	ge-1/0/1 (NFX150) ge-0/0/8 (NFX250)	DHCP	IPsec	Data, OAM

Managed Internet CPE

You can use the **NFX Managed Internet CPE** or **SRX Managed Internet CPE** device template to provide a managed Internet connection through the CPE device.

Figure 9 on page 199 shows the topology for a managed Internet CPE deployment model.

Figure 9: Managed Internet CPE

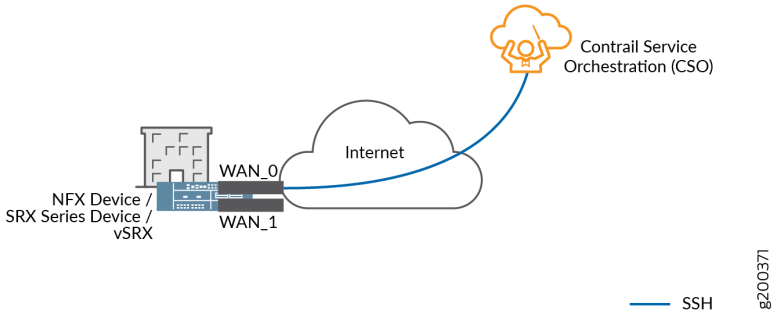

Table 73 on page 199 lists the connectivity details for a managed Internet CPE deployment model.

Table 73: Connectivity details for Managed Internet CPE

Link Name	Type	Default Interface	IP Assignment	Overlay	Traffic
WAN_0	Internet	ge-1/0/1 (NFX150) ge-0/0/8 (NFX250)	DHCP	—	Data, OAM

RELATED DOCUMENTATION

About the Device Template Page | 201

Multi-Service Shared Bearer Overview

Contrail Service Orchestration (CSO) supports the provisioning of more than one service on the same physical (bearer) interface for WAN links associated with on-premise SD-WAN spoke sites (starting from CSO Release 5.1.0) and enterprise hub sites (starting from CSO Release 5.1.1). In previous releases, each WAN link had to be configured as a separate physical interface. However, from CSO Release 5.1.0 (for on-premise spoke sites) and CSO Release 5.1.1 (for enterprise hub sites), WAN links can be configured as logical interfaces. thereby enabling the same physical interface to carry Internet and MPLS traffic on the interface with VLAN separation. The shared bearer (physical interface) supports both full-mesh and hub-and-spoke topologies.

When the same physical interface is used for multiple WAN links:

- CSO supports class of service (CoS) provisioning of the shaping rate at the logical interface level. In previous releases, CoS provisioning of the shaping rate was supported only at the physical interface level. Shaping rate controls the maximum rate at which traffic is allowed to be transmitted on an interface.
- CSO supports flexible (mixed) tagging with simultaneous tagged and untagged WAN links for single CPE devices. However, when there are multiple logical interfaces on the same physical interface, there can be only one untagged logical interface and the rest of the interfaces must be tagged. The support for simultaneous tagged and untagged logical interfaces on same physical interface is not available on dual CPE devices. Table 74 on page 200 displays the VLAN tagging support for single and dual CPE devices.

To enable the configuration of WAN links as logical interfaces in on-premise SD-WAN spoke sites, the SP Administrator user must modify the device template and configure the WAN ports as logical interfaces. See "Configuring Template Settings in a Device Template" on page 208.

Table 74: Support for VLAN Tagging for Single and Dual CPE Devices

Type of CPE	VLAN Tag	Unique Physical Interface for each WAN link	Same Physical Interface for more than one WAN link
Single CPE	Untagged	Supported	Supported. However, only one WAN link can be untagged.
Single CPE	Tagged	Supported	Supported
Dual CPE	Untagged	Supported	Not supported
Dual CPE	Tagged	Supported	Supported

RELATED DOCUMENTATION

About the Device Template Page

IN THIS SECTION

- Tasks You Can Perform | 201
- Field Descriptions | 202
- Supported Device Templates | 203

To access this page, click **Resources > Templates > Device Templates**.

Use this page to view and manage device templates.

Tasks You Can Perform

You can perform the following tasks from this page:

- Clone a device template. See "Cloning a Device Template" on page 205.
- Import a device template from a file. See "Importing a Device Template" on page 206.
- Configure device template settings. See "Configuring Template Settings in a Device Template" on page 208.
- Update stage-2 configuration template. See "Updating Stage-2 Configuration Template in a Device Template" on page 227.
- Configure stage-2 initial configuration. See "Configuring Stage-2 Initial Configuration in a Device Template" on page 232.
- Modify a device template description. See "Modifying a Device Template Description" on page 235.
- Delete a device template. See "Deleting a Device Template" on page 235.
- View details of a device template—Hover over the device template name and Click the Detailed View icon or click **More > Detail View**.

  The detailed view pane for the selected device template appears on the right side of the Device Templates page, displaying details such as the target family and tenants.

Click the close icon (X) to close the pane.

- Show or hide columns displayed on the page—Click the **Show Hide columns** icon in the top right corner of the table and select the columns that you want to view on the page.
- Search for a specific device template—Click the Search icon in the top right corner of the table and enter the search text in the text box, and press Enter. The search results are displayed on the same page.

Field Descriptions

Table 75 on page 202 describes the fields on the Device Templates page.

Table 75: Fields on the Device Templates Page

Field	Description
Name	Name of the device template
Description	Description of the device template. Example: NFX250 device deployed as a CPE device with SD-WAN capability.
Version	CSO version of the device template.
Build	CSO build name of the device template.
Assigned to	Number of tenant sites using the device template. Example: 2 Tenants (2 Sites)
Workflows	Number of workflows used in the device template. Example: 7
Target Family	Name of the device family for which the device template is created. Example: juniper-srx
Owner	Name of the owner (*OpCo Name* or default-project) who created the device template.
Last Updated	Date and time when the device template was last updated. Example: 05/23/2017 06:22

Supported Device Templates

Table 76 on page 203 describes the list of supported device templates.

Table 76: List of Supported Device Templates

No.	Device Template Name	Device Template Description
1	MX as SD-WAN Hub	Device template for an MX Series router acting as a hub device in an SD-WAN deployment(in hub-and-spoke topology).
2	NFX250 as Secure Internet CPE	Device template for an NFX250 device acting as a CPE device in a distributed deployment. This template supports outbound SSH, which is device-initiated connection, with port-forwarding capability. This device template supports the NFX250 device as CPE with one Internet WAN link that has IPsec encryption(DHCP IP address configuration).
3	NFX250 as Managed Internet CPE	Device template for an NFX250 device acting as a CPE for a managed Internet service. This device template supports managed Internet Service with one Gigabit Ethernet WAN link.
4	NFX250 as SD-WAN CPE	Device template for an NFX250 device acting as a CPE in an SD-WAN deployment with hub-and-spoke topology. This device template supports SD-WAN deployment with up to four WAN links.
5	Dual NFX250 as SD-WAN CPEs	Device template for NFX250 devices in device redundancy mode in an SD-WAN deployment. This device template supports device redundancy in SD-WAN deployment with up to four WAN links.
6	NFX150 as Managed Internet CPE	Device template for an NFX150 device as CPE for managed Internet service. This device template supports managed Internet Service with one Gigabit Ethernet WAN link.
7	NFX150 as Secure Internet CPE	Device template for an NFX150 device as CPE in a distributed deployment. This device template supports port-forwarding with device-initiated connection, one Internet WAN link with IPsec encryption (DHCP IP address configuration) and outbound SSH.

Table 76: List of Supported Device Templates *(continued)*

No.	Device Template Name	Device Template Description
8	NFX150 as SD-WAN CPE	Device template for an NFX150 device as CPE in an SD-WAN deployment with hub-and-spoke topology. This device template supports up to four WAN links.
9	SRX as SD-WAN CPE	Device template for an SRX Series Services Gateway acting as a CPE device in an SD-WAN deployment with hub-and-spoke topology. This device template supports SD-WAN deployment with up to four WAN links.
10	SRX as SDWAN Hub	Device template for an SRX Series Services Gateway acting as a hub device in an SD-WAN deployment with hub-and-spoke topology. This device template supports SD-WAN deployment with up to four WAN links.
11	Dual SRX as SD-WAN CPEs	Device template for SRX Series Services Gateways acting as CPE devices in device redundancy mode in an SD-WAN deployment. This device template supports SD-WAN deployment with up to four WAN links.
12	vSRX as SD-WAN spoke in AWS	Device template for a vSRX instance acting as spoke in AWS for SD-WAN deployment. This device template supports SD-WAN deployment with up to four WAN links.
13	SRX-4x00 as SD-WAN CPE	Device template for an SRX 4000 line Services Gateways acting as a CPE device in an SD-WAN deployment with hub-and-spoke topology. This device template supports SD-WAN deployment with up to four WAN links.
14	Dual SRX4x00 as SD-WAN CPEs	Device template for SRX 4000 line Services Gateways acting as CPE devices in device redundancy mode in an SD-WAN deployment. This device template supports SD-WAN deployment with up to four WAN links.

Table 76: List of Supported Device Templates *(continued)*

No.	Device Template Name	Device Template Description
15	SRX_Standalone_Pre_Staged_NonZTP	Device template for pre-staged SRX Services Gateways acting as a Standalone CPE device without ZTP.
16	SRX_Standalone_Pre_Staged_ZTP	Device template for pre-staged SRX Services Gateways acting as a Standalone CPE device with ZTP.
17	EX_Single_ZTP	Device template for EX devices acting as a single switch with ZTP.
18	EX_VC_Pre_Staged_NonZTP	Device template for pre-staged EX device acting as a virtual chassis system without ZTP.
19	EX_VC_ZTP	Device template for pre-staged EX device acting as a virtual chassis system with ZTP.

RELATED DOCUMENTATION

Device Template Overview | **196**

Cloning a Device Template

Cloning a device template is useful when you want to create a device template that is similar to an existing one but with small differences. You can clone a device template by using either of the methods mentioned below:

To clone a device template:

1. Select **Resources > Templates > Device Templates**.

   The Device Template page appears.

2. Select the device template that you want to clone, and click **Clone**.

   The Clone Template page appears.

3. Specify an appropriate name for your new device template. For example, SRX as SD-WAN CPE.

4. Click **Ok**.

   The cloned device template appears on the Device Template page. You can now edit the new device template and customize the configurations as needed.

You can also clone the device template by performing the following procedure:

1. Select **Resources > Templates > Device Templates**.

   The Device Template page appears.

2. Select the device template that you want to clone, and then select **Edit Device Template > Template Settings**.

   The Template Settings page appears.

3. Modify the configurations as required and click **Save As**.

   The Create Device template page appears.

4. Specify an appropriate name for your new device template. For example, SRX as SD-WAN CPE.

5. Click **Ok**.

   The cloned device template appears on the Device Template page. You can now edit the new device template and customize the configurations as needed.

RELATED DOCUMENTATION

Importing a Device Template | 206

Importing a Device Template

IN THIS SECTION

Creating a Device Template File | 207
Importing a Device Template File | 207

Use the Device Templates page (**Resources > Templates > Device Templates**) to import a device template in JSON format for the customer.

> **NOTE:** You must create a device template file before you can import a device template

Creating a Device Template File

To create a file of device information:

1. Select **Resources > Templates > Device Templates > Import Device Template**.

   The Import Device Template page appears.

2. Click the **Download Sample JSON** link to open and save the sample JSON data file.

   The sample file opens at the bottom of the page.

3. Save the template file with an appropriate name to your computer.

   > **NOTE:** You must retain the file format as .json to successfully upload the device template details to the Administration Portal.

4. Customize the sample JSON file according to the deployment.

5. Save the customized file.

Importing a Device Template File

Device templates are used to configure cloud CPE devices on a tenant site and these templates must be assigned to the device before you activate the device.

> **NOTE:** A device template data file is required before your import device templates.

To import device template configuration:

1. Select **Resources > Templates > Device Templates > Import Device Template**.

   The Import Device Template page appears.

2. Click **Browse** and navigate to the directory containing the device template configuration JSON file.

3. Select the file and click **Open**.

4. Click **Import Device Templates**. If you want to discard the import process, click **Cancel** instead.

   The Device Templates Import Completed page appears with the details of the successful import.

5. Click **OK** to complete the import process.

   The imported device template is displayed on the Device Template page.

Configuring Template Settings in a Device Template

To configure the device template settings:

> **NOTE:** This topic is applicable only to users with an SP Administrator role.

1. Select **Resources > Templates > Device Templates**.

   The Device Templates page appears.

2. Select the device template for which you want to configure the settings and then select **Edit Device Template > Template Settings**.

   The Template Settings page appears.

3. Complete the configuration settings according to the guidelines in Table 77 on page 209.

4. Click **Save**.

   The changes that you made to the device template are saved and you are returned to the Device Templates page. After you modify a device template and use that device template to add a site, the modified parameters are used in the site addition workflow. The device template modifications do not take effect on existing sites.

Table 77: Fields on the Template Settings Page for All Device Templates

Field Name	Description	Applicable To (Device Templates)
SSH Settings		
Prevent root login via SSH?	Specify whether root login (to the device) by using SSH should be allowed or not.	NFX250 NFX150 SRX4100 SRX4200
Restrict SSH access to be from CSO only	Specify whether SSH access to the device should be restricted only to Contrail Service Orchestration (CSO) or not.	NFX250 NFX150 SRX4100 SRX4200
Max number of SSH connections allowed at any time	Enter the maximum number of SSH connections allowed at any time. Range: 1 through 250.	NFX250 NFX150 SRX4100 SRX4200
Max number of SSH connections allowed per minute	Enter the maximum number of SSH connections allowed per minute. Range: 1 through 250.	NFX250 NFX150 SRX4100 SRX4200
Max number of sessions per SSH connection	Enter the maximum number of sessions allowed per SSH connection. Range: 1 through 250.	NFX250 NFX150 SRX4100 SRX4200
Policer Settings		

Table 77: Fields on the Template Settings Page for All Device Templates *(continued)*

Field Name	Description	Applicable To (Device Templates)
Bandwidth limit for ICMP traffic towards the device	Enter the bandwidth limit, in bits per second (bps), for Internet Control Message Protocol (ICMP) traffic towards the device.	NFX250
Burst-size limit for ICMP traffic towards the device	Enter the burst-size limit, in bytes, for ICMP traffic towards the device.	NFX250
Bandwidth limit for trace-route traffic towards the device	Enter the bandwidth limit, in bits per second (bps), for traceroute traffic towards the device.	NFX250
Burst-size limit for trace-route traffic towards the device	Enter the burst-size limit, in bytes, for traceroute traffic towards the device.	NFX250
Bandwidth limit for DHCP traffic towards the device	Enter the bandwidth limit, in bits per second (bps), for Dynamic Host Configuration Protocol (DHCP) traffic towards the device.	NFX250
Burst-size limit for DHCP traffic towards the device	Enter the burst-size limit, in bytes, for DHCP traffic towards the device.	NFX250
Bandwidth limit for DNS traffic towards the device	Enter the bandwidth limit, in bits per second (bps), for Domain Name System (DNS) traffic towards the device.	NFX250
Burst-size limit for DNS traffic towards the device	Enter the burst-size limit, in bytes, for (DNS) traffic towards the device.	NFX250
Log Rotation Settings		
Max size (MB) for log files	Enter the maximum size, in megabytes (MB), of the log files stored on the device.	NFX250
Max number of log files	Enter the maximum number of log files to be stored on the device at any time.	NFX250
Customer Parameters		
S2_MODEL_HUGEPAGE_COUNT	Enter the number of 1-GB huge pages usable by the virtualized network functions (VNFs) (on an NFX250-S2 device with a total memory of 32 GB.	NFX250

Table 77: Fields on the Template Settings Page for All Device Templates *(continued)*

Field Name	Description	Applicable To (Device Templates)
ADSL_VPI	Enter the Virtual Path Identifier (VPI) setting to connect to the asymmetric digital subscriber line (ADSL) service provider.	NFX150 NFX250 SRX320 SRX340 SRX345
ADSL_ENCAP	Enter the encapsulation that is used to connect to the ADSL service provider.	NFX150 NFX250 SRX320 SRX340 SRX345
VNF_OAM_TRANSLATED_PORT_START	Enter the first port number that can be used to expose (by using port translation) a VNF Operation, Administration, and Maintenance (OAM) port on the gateway router OAM interface or the WAN interface. This setting is used in cases where the VNF does not have its own OAM IP address from the in-band OAM network.	NFX250
ADSL_VCI	Enter the VCI (Virtual Channel Identifier) setting to connect to the ADSL service provider.	NFX150 NFX250 SRX320 SRX340 SRX345
AUTO_INSTALL_LICENSE_TO_DEVICE	Specify whether licenses should be automatically installed on the device during the ZTP workflow or not.	NFX250 EX Series Devices

Table 77: Fields on the Template Settings Page for All Device Templates *(continued)*

Field Name	Description	Applicable To (Device Templates)
AUTO_INSTALL_DEFAULT_TRUSTED_CERTS_TO_DEVICE	Specify whether the Junos OS default trusted certificates should be installed on the device during the ZTP workflow or not.	NFX250 EX Series Devices
NO_LOCAL_FAVOR_ECMP	Use this parameter to control the behavior of local-breakout traffic in a dual CPE cluster. The overlay traffic continues to load-balance across nodes as usual and doesn't have any dependency on this parameter. By default, this parameter is disabled. When disabled, Local-Breakout traffic will egress from the active link of the node on which the traffic has arrived. The local-breakout traffic will load-balance within this node and not across nodes. You can enable this parameter to load balance equal-cost multi path (ECMP) traffic across active-active links on both the nodes of a dual CPE cluster. Note: This parameter is available only when the devices in the cluster are running JUNOS OS Release 19.3R2-S1 or later.	NFX250 SRX Series Devices
USE_SINGLE_SSH_TO_NFX	Specify whether to manage the NFX250 device and its components by using a single SSH connection between CSO and the NFX250 device.	NFX250
ENC_ROOT_PASSWORD	Specify the Junos OS root password to be set on the device. The password that you type is masked and the password is encrypted and stored.	NFX250 EX Series Devices

Table 77: Fields on the Template Settings Page for All Device Templates *(continued)*

Field Name	Description	Applicable To (Device Templates)
GWR_VSRX_IMAGE_LOCAL_FILE_PATH	Enter the local path of the vSRX image file present on the NFX250 device; this image file is used when the gateway router virtual machine (VM) is created. For example, **./var/third-party/images/*vsrx*-15.1X*.qcow2**. If this parameter is not set or if the file is not present on the NFX250 device, then a vSRX image with the filename specified in **GWR_VSRX_IMAGE_CNAME_IN_CSO** is downloaded from the CSO file server to the NFX250 device.	NFX250
GWR_VSRX_IMAGE_CNAME_IN_CSO	Enter the name with which the vSRX image was uploaded into the Image Management Service in CSO. If the vSRX image file specified in **GWR_VSRX_IMAGE_LOCAL_FILE_PATH** is not present, then an image with the name specified is downloaded to the NFX250 device.	NFX250
ACTIVATION_CODE_ENABLED	Specify whether an activation code must be specified to activate the device or not.	NFX250 EX Series Devices
INTERNAL_OAM_SUBNET	Enter the IP address for the subnet that is used for internal OAM connectivity between various components of the NFX250 device.	NFX250
AUTO_DEPLOY_STAGE2_CONFIG	Specify whether the stage-2 configuration should be automatically deployed on the device during the ZTP workflow.	NFX250 EX Series Devices

Table 77: Fields on the Template Settings Page for All Device Templates *(continued)*

Field Name	Description	Applicable To (Device Templates)
OOB_MGMT_ENABLED	Specify whether the out-of-band (OOB) management port of the device is being used for management connectivity or not. If you enable this field, a default route must be available through the OOB interface. If you disable this field, there is no connectivity through the OOB management port of the device and the stage-1 configuration that is generated includes a static default route.	NFX250
S1_MODEL_HUGEPAGE_COUNT	Enter the number of 1-GB huge pages usable by the VNFs on an NFX250-S1 device with a total memory of 16 GB.	NFX250
CONTROL_LINK_PORT_NAME	Enter the physical port name for the control link connection for a dual CPE setup.	NFX250
FAB_LINK_PORT_NAME	Enter the physical port name for fabric link connection for a dual CPE setup.	NFX250
MAX_DVPN_TUNNELS_ON_SITE	Enter the maximum number of dynamic mesh tunnels that are allowed to create at the tenant site.	NFX150 NFX250 SRX Series
MIN_DVPN_TUNNELS_TO_START_DEACTIVATE	Enter the minimum number of dynamic mesh tunnels at the tenant site after which the dynamic mesh tunnels are dynamically deleted.	NFX150 NFX250 SRX Series
WAN_PORT_NAMES	Specify the mapping of the physical or logical port names used for WAN side connectivity. You specify logical port names if you want to configure more than one WAN link on the same physical interface. The WAN links are connected from the same physical interface to the Provider Edge (PE) nodes through logical sub-interfaces with VLAN separation.	NFX250

Table 77: Fields on the Template Settings Page for All Device Templates *(continued)*

Field Name	Description	Applicable To (Device Templates)
LAN_PORT_NAMES	Specify the mapping of the physical port names used for LAN side connectivity	NFX250
LAN_MEMBER_PORT_NAMES	Specify the physical ports on the dual CPE device that are used on the link aggregation group (LAG) interface connecting to the LAN-side switch.	NFX250
GWR_CPU_PIN	Specify the physical CPUs to which the vCPUs of the vSRX (gateway router) should be pinned. **WARNING:** We recommend that you *do not modify* the preconfigured CPU pinning values because these values are set based on Juniper's performance tests.	NFX250
AUX_Subnets	Specify the IP subnets assigned to the three auxiliary ports on the gateway router to which VNFs can be attached.	NFX250
LAN_Subnets	Specify the IP subnets assigned to the two LAN ports on the gateway router to which VNFs can be attached.	NFX250
Login Security Settings		
Login idle timeout (minutes)	Enter the time (in minutes) after which a session that is idle is timed out.	NFX250
Login attempts before locking out	Enter the maximum number of unsuccessful login attempts allowed before the user account is locked. Range: 3 through 10.	NFX250
Login lockout period in minutes	Enter the period (in minutes) for which the user account should be locked. Range: 1 through 43,200 minutes	NFX250

Table 77: Fields on the Template Settings Page for All Device Templates *(continued)*

Field Name	Description	Applicable To (Device Templates)
Login backoff factor in seconds	Specify the delay (in seconds) after each failed login attempt, which increases for each subsequent login attempt after specified login backoff threshold. Range: 5 through 10.	NFX250
Login backoff threshold	Specify the threshold for the number of failed login attempts after which each subsequent login attempt is delayed by the time specified in the login backoff factor. Range: 1 through 3	NFX250
Maximum time to enter password in seconds	Enter the maximum time allowed (in seconds) to enter a password to log in to the device after entering your username. Range: 20 through 300 seconds.	NFX250
Maintenance user account	Enter the username of the user account to be used for maintenance activities (for example, troubleshooting) on the device.	NFX250
Login Announcement	Specify the system login announcement, which is displayed after a user successfully logs in to the device.	NFX250
Login Message	Specify the system login message, which is displayed before a user logs in to the device.	NFX250
ZTP_ENABLED	Specify whether to enable ZTP for the device.	EX Series Switches SRX Series Services Gateways

Table 78: Fields on the Template Settings Page

Name	Description
Customer Parameters	
AUTO_DEPLOY_STAGE2_CONFIG	Specify whether to automatically deploy stage-2 configuration at the end of the Zero Touch Provisioning (ZTP) workflow. Example: Enabled
ZTP_ENABLED	Specify whether to enable ZTP for the device. **NOTE:** This option is supported on SRX Series Services Gateways only. Example: Enabled
PRE_STAGED_CPE	Specify whether the CPE device is pre-staged with WAN configuration. **NOTE:** This option is supported on SRX Series Services Gateways only. Example: Enabled
ACTIVATION_CODE_ENABLED	Specify whether the customer must use an activation code to activate the CPE device. Example: Enabled
OOB_OAM_Port	Specify the name of the port used for out-of-band Operation, Administration, and Maintenance (OAM) traffic. This port is used in deployments where OAM and data traffic are on separate physical ports. **NOTE:** This option is supported on SRX Series Services Gateways only. Example: fxp0
S2_MODEL_HUGEPAGE_COUNT	Specify the number of 1-GB huge pages to be used by the VNFs on an NFX250-S2 device with a total memory of 32 GB. Example: 21

Table 78: Fields on the Template Settings Page *(continued)*

Name	Description
USE_SINGLE_SSH_TO_NFX	Specify whether to enable device-initiated connections (outbound SSH) with port-forwarding capability. Port forwarding enables Contrail Service Orchestration to manage an NFX250 device through a single IP address. Example: Enabled
S1_MODEL_HUGEPAGE_COUNT	Specify the number of 1-GB huge pages to be used by the VNFs on an NFX250-S1 device with a total memory of 16 GB. Example: 21
VNF_OAM_TRANSLATED_PORT_START	Specify the first port number that can be used to expose a port on the gateway router's OAM or WAN interface through port translation. Use this option in cases where the VNF does not have its own OAM IP address from the in-band OAM network.
ENC_ROOT_PASSWORD	Specify the Junos OS root password to be set on an NFX250 device. Example: **********
WAN Port Names	Specify the mapping Junos OS interface descriptors for the hardware ports. The RJ-45 port is the default port for the NFX250 device. You can change the default port if you want to use a different type of connector, such as SFP.
GWR_LAN_PORT	Specify the mapping of the gateway router's LAN port names to the corresponding front panel physical port names on the NFX250 device. Currently, the logical ports are created on the ge-0/0/4 interface.
JCP_LAN_PORT_NAMES	Specify the port names from LAN_0 through LAN_9.
GWR_LAN_PORT_NAMES	Specify the port names from LAN_0 through LAN_9.
LAN_PORT_NAMES	Specify the port names from LAN_0 through LAN_10.
CONTROL_LINK_PORT_NAME	Enter the physical port name for control link connection. Example: xe-0/0/12

Table 78: Fields on the Template Settings Page *(continued)*

Name	Description
FAB_LINK_PORT_NAME	Enter the physical port name for fabric link connection. Example: xe-0/0/13
OOB_MGMT_ENABLED	Specify whether to use the out-of-band (OOB) management port of the device for management connectivity. If the field is enabled, a default route will be available through this interface. If the field is disabled, there is no connectivity through the OOB management port of the device and the stage-1 configuration that is generated will include a static default route.
AUTO_INSTALL_LICENSE_TO_DEVICE	Click the toggle button to enable automatic installation of the license on CPE device at the end of ZTP workflow.
GWR_VSRX_IMAGE_LOCAL_FILE_PATH	Enter the local path of the vSRX image that is installed on the NFX250 device. The image file is required when the gateway router VM is created. If this parameter is not set, or if the file is not present on the NFX250 device, then a vSRX image is downloaded from the CSO file server to the NFX250 device. Example: ./var/third-party/images/*vsrx*-15.1X*.qcow2
GWR_VSRX_IMAGE_CNAME_IN_CSO	Enter the name of the vSRX image uploaded into the Image Management Service in CSO. When creating the gateway VM, if the vSRX image file is not present locally, then the image with this name is downloaded to the NFX250 device.
INTERNAL_OAM_SUBNET	Enter the IP address for the subnet that is used for internal OAM.
ADSL_VPI	Enter the Virtual Path Identifier (VPI) setting to connect to the ADSL service provider through PPPoE. Example: 8
ADSL_ENCAP	Enter the encapsulation that is used to connect to the ADSL service provider through PPPoA. Example: llcsnap-bridged-802.1q

Table 78: Fields on the Template Settings Page *(continued)*

Name	Description
ADSL_VCI	Enter the VCI (Virtual Channel Identifier) setting to connect to the ADSL service provider through PPPoE. Example: 36
DSL_VLAN	Enter the reserved internal VLAN ID to be used as the native-vlan-id on xDSL ports to ensure that untagged control frames are processed. Example: 4087
CLUSTER_OFFSET	Enter the cluster slot number for designated secondary node.

Table 79: Fields on the Template Settings Page for SRX4100 and SRX4200 Device Templates

Field Name	Description
SSH Settings	
Prevent root login via SSH?	Click the toggle button to enable root login through SSH. Root login through SSH is disabled by default.
Restrict SSH access to be from CSO only	Click the toggle button to restrict SSH access only to connections from Contrail Service Orchestration (CSO). Default: Disabled
Max number of SSH connections allowed at any time	Enter the maximum number of concurrent SSH connections to be allowed. Range: 1 through 250 Default: 50
Max number of SSH connections allowed per minute	Enter the maximum number of SSH connections allowed per minute. Range: 1 through 250 Default: 50

Table 79: Fields on the Template Settings Page for SRX4100 and SRX4200 Device Templates *(continued)*

Field Name	Description
Max number of sessions per SSH connection	Enter the maximum number of sessions per SSH connection. Range: 1 through 65535 Default: 50
Policer Settings	
Bandwidth limit for ICMP traffic towards the device	Enter the bandwidth limit, in bits per second (bps), for Internet Control Message Protocol (ICMP) traffic towards the device. Default: 1m
Burst-size limit for ICMP traffic towards the device	Enter the burst-size limit, in bytes, for ICMP traffic towards the device. Default: 2k
Bandwidth limit for trace-route traffic towards the device	Enter the bandwidth limit, in bits per second (bps), for traceroute traffic towards the device. Default: 1m
Burst-size limit for trace-route traffic towards the device	Enter the burst-size limit, in bytes, for traceroute traffic towards the device. Default: 15k
Bandwidth limit for DHCP traffic towards the device	Enter the bandwidth limit, in bits per second (bps), for Dynamic Host Configuration Protocol (DHCP) traffic towards the device. Default: 1m
Burst-size limit for DHCP traffic towards the device	Enter the bandwidth limit, in bits per second (bps), for DHCP traffic towards the device. Default: 15k
Bandwidth limit for DNS traffic towards the device	Enter the bandwidth limit, in bits per second (bps), for Domain Name System (DNS) traffic towards the device. Default: 1m

Table 79: Fields on the Template Settings Page for SRX4100 and SRX4200 Device Templates *(continued)*

Field Name	Description
Burst-size limit for DNS traffic towards the device	Enter the burst-size limit, in bytes, for (DNS) traffic towards the device. Default: 15k
Log Rotation Settings	
Max size (MB) for log files	Enter the maximum size of the log file, in megabytes (MB). Default: 10
Max number of log files	Enter the maximum number of log files. Default: 10
Feature Level Access Settings	
Allow TACACS access	Click the toggle button to enable TACACS communication. By default, TACACS communication is disabled.
Allow SNMP access	Click the toggle button to enable SNMP communication. By default, SNMP communication is disabled.
Customer Parameters	
AUTO_INSTALL_LICENSE_TO_DEVICE	Click the toggle button to enable automatic installation of the license file on the CPE device when the ZTP workflow ends. Default: Disabled
AUTO_INSTALL_DEFAULT_TRUSTED_CERTS_TO_DEVICE	Click the toggle button to disable automatic installation of default trusted certificates on the CPE device when the ZTP workflow ends. Default: Enabled
ZTP_ENABLED	Specify whether to enable ZTP for the device.
ENC_ROOT_PASSWORD	Specify the Junos OS-encrypted root password to be set on the CPE device.

Table 79: Fields on the Template Settings Page for SRX4100 and SRX4200 Device Templates *(continued)*

Field Name	Description
ACTIVATION_CODE_ENABLED	Click the toggle button to enable the tenant to use an activation code to activate the CPE device. Default: Disabled
CLUSTER_OFFSET	Enter the cluster slot number for designated secondary node.
AUTO_DEPLOY_STAGE2_CONFIG	Click the toggle button to enable automatic deployment of stage-2 configuration when the ZTP workflow ends. Default: Disabled
OOB_OAM_PORT	Enter the port number for out-of-band Operation, Administration, and Maintenance (OAM) traffic. This port is used in deployments where OAM and data traffic are on separate physical ports. **NOTE:** This option is supported only on SRX Series Services Gateways. Default: fxp0
MAX_DVPN_TUNNELS_ON_SITE	Enter the maximum number of site to site dynamic mesh tunnels that can be created at a site, exceeding which the site to site tunnels are not created any more and traffic goes through the hub.
MIN_DVPN_TUNNELS_TO_START_DEACTIVATE	Enter the minimum number of site-to-site dynamic mesh tunnels that must be present at a site to start deactivating the inactive site-to-site tunnels.

Table 79: Fields on the Template Settings Page for SRX4100 and SRX4200 Device Templates *(continued)*

Field Name	Description
WAN_PORT_NAMES	Specify the mapping of the physical or logical port names used for WAN side connectivity. You specify logical port names if you want to configure more than one WAN link on the same physical interface. The WAN links are connected from the same physical interface to the Provider Edge (PE) nodes through logical sub-interfaces with VLAN separation. WAN_0 WAN_1 WAN_2 WAN_3
WAN_MEMBER_PORT_NAMES	In case of dual CPE devices, specify the mapping of the physical or logical port names used for WAN side connectivity. You specify logical port names if you want to configure more than one WAN link on the same physical interface. The WAN links are connected from the same physical interface to the Provider Edge (PE) nodes through logical sub-interfaces with VLAN separation. WAN_0 WAN_1 WAN_2 WAN_3

Table 79: Fields on the Template Settings Page for SRX4100 and SRX4200 Device Templates *(continued)*

Field Name	Description
LAN_PORT_NAMES	Enter the name of the physical interfaces for the ports that are used to connect to LAN side devices. LAN_0— xe-0/0/0 LAN_1— xe-0/0/1 LAN_2— xe-0/0/2 LAN_3— xe-0/0/3 LAN_4— xe-0/0/4 LAN_5— xe-0/0/5 LAN_6— xe-0/0/6 LAN_7— xe-0/0/7
LAN_MEMBER_PORT_NAMES	In case of dual-CPE devices, enter the name of the physical interfaces for the ports that are used to connect to LAN side switch.. LAN_0_0— xe-0/0/2 LAN_0_1— xe-0/0/3 LAN_0_2— xe-0/0/4 LAN_0_3— xe-0/0/5
Login Security Settings	
Idle timeout (minutes)	Enter the maximum time (in minutes) that a session can be idle before the user is logged out of the system.
Attempts before locking out	Enter the maximum number of unsuccessful login attempts allowed before the account is locked. Range: 3 to 10
Lockout period in minutes	Enter the number of minutes an account must remain locked after the maximum number of unsuccessful login attempts. Range: 1 to 43,200

Table 79: Fields on the Template Settings Page for SRX4100 and SRX4200 Device Templates *(continued)*

Field Name	Description
Backoff factor in seconds	Enter the length of delay (in seconds) after each failed login attempt. The length of delay increases by this value for each subsequent login attempt after the value specified in the backoff-threshold option. Range: 5 to 10
Backoff threshold	Enter the threshold for the number of failed login attempts before the user experiences a delay when attempting to reenter a password. Range: 1 to 3
Maximum time to enter password in seconds	Enter the maximum time allowed (in seconds) to enter a password to log in to the device after entering your username. Range: 20 to 300.
Maintenance user account	Enter the name of a maintenance user account to be created on the device. The maintenance user account is used by maintenance personnel for troubleshooting when required.
Announcement	Enter the system login announcement, which is displayed after a user successfully logs in to the device.
Message	Enter the system login message, which is displayed when a user logs into the device.
RESERVED_MEMBER_PORT_NAMES	Enter the port names of the two 1-Gigabit Ethernet/10-Gigabit Ethernet ports,(CTL (control port) and FAB (fabric port)) to be used for synchronizing data and maintaining state information in a chassis cluster setup. • PORT_0_0— xe-0/0/6 • PORT_0_1— xe-0/0/7

Table 79: Fields on the Template Settings Page for SRX4100 and SRX4200 Device Templates *(continued)*

Field Name	Description
RESERVED_SUBNETS	Enter the IP address of reserved subnets that is used for System logs. • NODE_0— 10.10.12.0/24 • NODE_1— 10.10.13.0/24

RELATED DOCUMENTATION

About the Device Template Page | **201**

Updating Stage-2 Configuration Template in a Device Template

Each device template has a set of configuration templates that can be used to deploy additional configuration on to the CPE device after it is activated. These templates are known as stage-2 configuration templates. You can add or remove stage-2 configuration templates from a device template.

> **NOTE:** By default, the CPE device configuration is not supported on the CPE device. If you need the CPE device configuration, then you must configure it through stage-2 configuration in the device templates.

To add a stage-2 configuration template:

1. Select **Resources > Templates > Device Template**.

   The Device Templates page appears.

2. Select a device template for which you want to add the stage-2 configuration and select **Edit Device Template > Stage-2 Config Templates**.

   The Stage-2 Configuration Templates page appears. Table 80 on page 228 lists the fields (and their descriptions) on the Stage-2 Configuration Templates page.

3. Click the add icon (+) and complete the configuration settings according to the guidelines provided in Table 81 on page 229.

4. Click **Save**.

   The new stage-2 configuration template is included in the device template.

Table 80: Fields on the Stage-2 Configuration Templates Page

Name	Description
Name	View the name of the stage-2 configuration template. Example: LAN side config
Component Name	View the name of the component through which the settings are configured. The components that are currently supported are: • JUNOS—Supported only on SRX Series Services Gateway. • Juniper Device Manager (JDM)—Supported on NFX250 device. JDM is a Linux container that manages software components. • Juniper Control Plane (JCP)—Supported on NFX250 device. JCP is the Junos VM running on the hypervisor. Administrators can use JCP to configure the network ports of the NFX250 device. JCP is used to configure the switching and routing function on the NFX250 device. • Gateway Router (GWR)—Supported on NFX250 device. vSRX as a gateway provides the same capabilities as Juniper Networks SRX Series Services Gateways in a virtual form factor, providing perimeter security, IPsec connectivity, and filtering for malicious traffic without sacrificing reliability, visibility, or policy control. This virtual security and routing appliance ensures reliability and high availability for each application. Example: JUNOS
Hide	Displays whether the template is hidden on Customer Portal. • true—Template is not visible on Customer Portal. • false—Template is visible on Customer Portal. Example: false
Copy input from	Displays the template from which you copied the settings.
Auto Deploy	Displays whether the stage-2 configuration is automatically pushed to the device during ZTP process.

Table 80: Fields on the Stage-2 Configuration Templates Page *(continued)*

Name	Description
Enable for	Displays whether the stage-2 configuration template is enabled for all tenants, no tenants, or specific tenants.

Table 81: Fields on the Add New Template Page

Name	Description
Template	Select the configuration template from the drop-down list. The configuration templates are designed in the Configuration Designer tool. Example: srx-basic-sdwan-cpe-config
Display Name	Specify the name of the template that you want to display on the configuration interface. Example: SDWAN Config
Component Name	Specify the component name through which the settings are configured. The components that are currently supported are: • JUNOS—Supported on SRX Series Services Gateway. • Juniper Device Manager (JDM)— Supported on NFX250 device. JDM is a Linux container that manages software components. • Juniper Control Plane (JCP)—Supported on NFX250 device. JCP is the Junos VM running on the hypervisor. Administrators can use JCP to configure the network ports of the NFX250 device. JCP is used to configure the switching and routing function on the NFX250 device. • Gateway Router (GWR)—Supported on NFX250 device. vSRX as a gateway provides the same capabilities as Juniper Networks SRX Series Services Gateways in a virtual form factor, providing perimeter security, IPsec connectivity, and filtering for malicious traffic without sacrificing reliability, visibility, or policy control. This virtual security and routing appliance ensures reliability and high availability for each application. Example: JUNOS
Hide	Specify whether you want to hide the configuration template on Customer Portal. You might want to choose to hide the template if you are reusing the template for multiple components. • hide—White dot on right with blue background. • show—White dot on left with gray background. Example: hide

Table 81: Fields on the Add New Template Page *(continued)*

Name	Description
Copy From Template	If you have chosen to hide the configuration template on the user interface, then specify the template from which you want to copy the settings. Example: srx-mis-lan-to-wan-config
Auto Deploy	Specify whether the stage-2 configuration must be automatically pushed to the device during ZTP process. The available options are • Same as global settings • Yes • No
Enabled for	You can enable the stage-2 configuration template for all tenants, specific tenants, an SP administrator or an OpCo administrator. **NOTE:** Only users with SP administrator or OpCo administrator role can enable stage-2 configuration templates. The available options are: • **All Tenants**—Select this option to enable stage-2 configuration template for all tenants. Both SP and OpCo administrators can view templates for all tenants by switching the scope to the specific tenant. By default, stage-2 configuration templates assigned to all tenants are automatically applied to any new tenant. • **No Tenants**—Select this option to enable stage-2 configuration template for an SP administrator or an OpCo administrator. An SP administrator can modify the stage-2 configuration template. An OpCo administrator cannot modify the stage-2 configuration template. However, an OpCo administrator can clone the stage-2 configuration template and then modify the template. • **Selective Tenants**—Select this option to enable stage-2 configuration template for specific tenants. A tenant administrator can view and manage stage-2 template for a specific tenant. When you select the **Selective Tenants** option, the **Tenants** section is displayed. Select one or more tenants. Click the greater-than icon (>) to move the selected tenant or tenants from the **Available** column to the **Selected** column. You can use the search icon on the top right of each column to search for tenant names. The default option is All Tenants.

To remove a stage-2 configuration template:

1. Select **Resources > Templates > Device Templates**.

   The Device Templates page appears.

2. Select the device template for which you want to remove the stage-2 configuration and then select **Edit Device Template > Stage-2 Config Templates**.

   The Stage-2 Config Templates page appears.

3. Select a configuration template and click the delete icon (X).

   A page requesting confirmation for the deletion appears.

4. Click **Yes** to confirm that you want to delete the stage-2 configuration template.

   The configuration template is deleted.

Configuring Stage-2 Initial Configuration in a Device Template

In general, the tenant administrators initiate stage-2 configuration through Customer Portal. However, in certain cases, the same stage-2 configuration needs to be deployed to CPE devices in all sites that are activated using a specific device template. In such cases, you can attach an initial configuration to a stage-2 configuration template of a device template. When a new CPE device in the site is activated using the device template, the initial configuration is automatically deployed to the CPE device.

The list of initial configurations that are supported are:

- Policies configuration
- LAN configuration
- SD-WAN configuration
- Routing configuration
- APN configuration

To update an initial configuration for stage-2 configuration template:

1. Select **Resources > Templates > Device Templates**.

   The Device Templates page appears.

2. Select the device template for which you want to configure the stage-2 configuration and then select **Edit Device Template > Stage-2 Initial Config**.

   The Stage-2 Initial Configuration page appears, listing the existing settings.

3. Complete the configuration settings according to the guidelines provided in Table 82 on page 232, Table 83 on page 233, and Table 84 on page 233 and Table 85 on page 234.

4. Click **Ok**.

Table 82: Fields for the VLAN Settings on the Stage-2 Initial Configuration Page

Field	Description
VLAN ID	Specify the identifier for the Layer 2 VLAN for the CPE device. Example: 230

Table 82: Fields for the VLAN Settings on the Stage-2 Initial Configuration Page *(continued)*

Field	Description
IRB IP Prefix	Specify the IP address, including the subnet prefix, and the integrated routing and bridging (IRB) interface on the CPE device. Example: 192.0.2.15/24
LAN Ports	Specify the LAN ports on the CPE device. Example: ge-0/0/0

Table 83: Fields for the LAN Settings on the Stage-2 Initial Configuration Page

Field	Description
LAN port	Specify the LAN ports on the CPE device. Example: ge-0/0/0
IP Address	Specify the IP address on the CPE device. Example: 192.0.2.255

Table 84: Fields for the SRX Basic SD-WAN Settings on the Stage-2 Initial Configuration Page

Field	Description
Manage App Group	Click to manage the application groups. The application group is predefined in the system for all SRX Series and vSRX configuration settings. The settings are preloaded and displayed on the portal. You can also create new application groups.
Manage App SLA Profile	Click to manage the application service-level agreements (SLA) profiles.
Rule Name	Specify the rule name. Example: critical-apps
Application/Groups	Specify the applications or application groups for the rule. Example: Oracle, SAP
Application SLA Profile	Specify the application SLA profile for the rule. Example: critical-apps

Table 85: Fields for the APN Configuration Settings on the Stage-2 Initial Configuration Page

Field	Description
Use default APN settings	Click the toggle button to change the default APN settings. • Enabled—Select this option to use the default APN setting that is shipped along with the CPE device. This is the default option. • Disabled—Select this option to configure the APN settings.
APN Settings	
APN Name	Enter the access point name (APN) of the gateway router.
SIM Change Required	Click the toggle button to change the SIM card. You change the SIM card either to use a different LTE service provider or to use a private APN with the current LTE service provider. • Enabled—Select this option to change the APN settings and to use a new SIM card. This is the default option. • Disabled—Select this option to change the APN settings without changing the SIM card.
Authentication Method	Select the authentication method for the APN configuration. • PAP— Select to use Password Authentication Protocol (PAP) authentication. This is the default option. • CHAP— Select to use Challenge Handshake Authentication Protocol (CHAP) authentication. • None—Select to indicate that there is no authentication method.
Authentication Information	
SIP User ID	Enter the Session Initiation Protocol (SIP) user ID for authentication.
SIP Password	Enter the SIP password for authentication.

RELATED DOCUMENTATION

About the Device Template Page | 201

Modifying a Device Template Description

The device template description provides a brief overview about the supported platform, tenant, site, deployment model, and additional features supported through the template.

To modify the description of the device template:

> **NOTE:** An OpCo Administrator cannot edit a default device template.

1. Select the device template that you want to modify, and click the edit icon.

   The Edit Device template page appears.

2. Enter a meaningful description for the device template. For example: NFX250 deployed as a CPE device with SD-WAN capability.

3. Click **Ok** to save the changes.

   The description that you updated is listed in the device template table.

RELATED DOCUMENTATION

About the Device Template Page | **201**

Deleting a Device Template

Before deleting a device template, ensure that the template is not associated with any tenant site or a CPE device.

> **NOTE:** An OpCo Administrator cannot delete a default device template.

To delete a device template file:

1. Select **Resources > Templates > Device Templates**.

   The Device Template page appears.

2. Select the device template that you want to delete and click **Delete**.

   A page requesting confirmation for the deletion appears.

3. Click **Yes** to confirm that you want to delete the device template.

   The device template is deleted.

RELATED DOCUMENTATION

About the Device Template Page | 201

About the Configuration Templates Page

IN THIS SECTION

Tasks You Can Perform | 236
Field Descriptions | 237

To access this page, click **Resources > Templates > Configuration Templates** in Administration Portal.

You can use the Configuration Templates page to view and manage configuration templates.

> **NOTE:** In CSO releases before Release 5.1.0, configuration templates are called stage-2 configuration templates.

Tasks You Can Perform

In Administration Portal, users with the SP (Service Provider) Administrator role (on-premises installation only) or OpCo (Operating Company) Administrator role can perform the following tasks from this page, while users with operator roles only have read capabilities.

- Clone a configuration template—"Edit, Clone, and Delete Configuration Templates" on page 239.
- Deploy a configuration template on one or more devices—See "Deploy Configuration Templates to Devices" on page 242.
- Preview and render a configuration template—See "Preview and Render Configuration Templates" on page 251.
- View the details a configuration template—Select a configuration template and click **More** > **Template Details** or mouse over the configuration template click the Detailed View icon. The Detail for *Template-Name* pane appears on the right side of the page. See Table 87 on page 238 for an explanation of the fields.
- Import a configuration template—See "Import Configuration Templates" on page 252.
- Export a configuration template—See "Export a Configuration Template" on page 254.
- Assign a configuration template to a device template—See "Assign Configuration Templates to Device Templates" on page 255.
- Add a configuration template—See "Add Configuration Templates" on page 258.
- Edit or delete configuration templates—See "Edit, Clone, and Delete Configuration Templates" on page 239.
- View the configuration deployed on one or more devices—See "View the Configuration Deployed on Devices" on page 267.
- Search for configuration templates by using keywords—Click the search icon and enter the search term in the text box and press Enter. The search results are displayed on the same page.
- Sort configuration templates—Click a column name to sort the configuration templates based on the column name.

  NOTE: Sorting and filtering is applicable only to some fields.

- Show or hide columns—Click the **Show Hide Columns** icon at the top right corner of the page and select the columns that you want displayed on the Configuration Templates page.

Field Descriptions

Table 86 on page 238 displays the description of the fields on the Configuration Templates page and Table 87 on page 238 displays the description of the fields on the Detail for *Template-Name* Pane.

Table 86: Fields on the Configuration Templates Page

Field	Description
Name	Name of the configuration template.
Family	Device family to which the configuration template belongs.
Deployed Devices	Number of devices on which the configuration template was deployed. If the configuration template is not yet deployed on any devices then a blank cell is displayed. Click the ***number-of-devices*** link to view the configuration (for that configuration template) deployed on devices. See "View the Configuration Deployed on Devices" on page 267
Description	Description of the configuration template.
Last Updated	Date and time on which the template was last updated.
Owner	Depending on who added the configuration template, displays the following: • **System**—If the template is predefined or added by the Service Provider administrator • ***OpCo-Name***—Name of the Operating Company (OpCo) if the template is added by an OpCo administrator.

Table 87: Fields on the Detail for <Template-Name> Pane

Field	Description
General tab	
Name	See Table 86 on page 238.
Description	See Table 86 on page 238.
Family	See Table 86 on page 238.
Format	Format used by the configuration template: • CLI • XML (Extensible Markup Language)
Details tab	**NOTE:** If you want to add a new configuration template based on an existing one, you can copy the three files from the Details tab, modify the files as needed, and use the Import Configuration Template page to import a new template.
Jinja Template	Displays the configuration in Jinja Template language syntax.

Table 87: Fields on the Detail for <Template-Name> Pane *(continued)*

Field	Description
Data Model	Displays the Yang data model (configuration schema).
View Def	Displays the View Def (GUI configuration).

RELATED DOCUMENTATION

Device Template Overview | 196

Edit, Clone, and Delete Configuration Templates

IN THIS SECTION

- Edit a Configuration Template | 240
- Clone a Configuration Template | 241
- Delete a Configuration Template | 242

In Administration Portal, users with the SP (Service Provider) Administrator role (on-premises installation only) or OpCo (Operating Company) Administrator role can modify the parameters of existing configuration templates, clone existing configuration templates, and delete configuration templates that are no longer being used.

> **NOTE:** In CSO releases before Release 5.1.0, configuration templates are called stage-2 configuration templates.

Edit a Configuration Template

Users with the SP Administrator role can edit predefined templates and templates that they created. Users with the OpCo role can edit only the templates that they added (created).

To edit a configuration template:

1. Select **Resources > Templates > Configuration Templates**.

   The Configuration Templates page appears.

2. Select the configuration template that you want to modify and click the edit (pencil) icon.

   The Edit Configuration Template page appears. The fields on this page are same as the fields that you configure in the Add Configuration Template workflow.

3. Modify the fields as needed.

   Refer to "Add Configuration Templates" on page 258 for an explanation of the fields.

   > **NOTE:** Fields marked with an asterisk (*) are mandatory.

4. Click **OK**.

   The modifications are saved and you are returned to the Configuration Templates page, where a confirmation message is displayed. If the configuration template was previously deployed on a device or assigned to a device template, then you must redeploy the configuration template for the changes to take effect.

Clone a Configuration Template

To clone a configuration template:

1. Select **Resources > Templates > Configuration Templates**.

   The Configuration Templates page appears.

2. Select the configuration template that you want to clone and click **Clone**.

   - If you select a configuration template that was added in CSO Release 5.3.0, the Clone Configuration Template page appears. Proceed to Step 3.
   - If you select a configuration template that was added in a release before CSO Release 5.3.0, an alert message appears asking you to confirm whether you want to edit the template to automatically upgrade the template to the current CSO release version. You must go through the Edit workflow to upgrade the version.

     a. On the Edit Configuration Template page that appears, proceed to the Summary tab and click **OK**.

        The template is automatically upgraded to CSO Release 5.3.0 and the Configuration Templates page appears.

     b. Select the template again and click **Clone**.

        The Clone Configuration Template page appears.

3. In the **Template Name** field, enter a unique template name that can only contain alphanumeric characters and hyphens up to a maximum of 64 characters.

4. Click **OK**.

   You are returned to the Configuration Templates page and a confirmation message appears at the top of the page indicating the status of the clone operation.

After a template is cloned successfully, you can modify the template if needed. See the preceding section for details.

Delete a Configuration Template

To delete a configuration template:

> **NOTE:**
> - You cannot delete predefined configuration templates.
> - You can delete a configuration template only if the following conditions hold good:
> - You added (created) the template.
> - The template is not assigned to a device template.
> - The template is not deployed on a device.

1. Select **Resources > Templates > Configuration Templates**.

   The Configuration Templates page appears.

2. Select the configuration template that you want to delete and click the **X** (delete) icon.

   You are asked to confirm the delete operation.

3. Click **Yes**.

   You are returned to the Configuration Templates page and a popup appears indicating whether the deletion was successful or not.

RELATED DOCUMENTATION

Preview and Render Configuration Templates | 251

Deploy Configuration Templates to Devices

IN THIS SECTION

Deploy from the Configuration Templates Page | 243
Deploy from the Tenant Devices Page | 247

In Administration Portal, users with the SP (Service Provider) Administrator role (on-premises installation only) or OpCo (Operating Company) Administrator role can deploy a configuration template directly on one or more devices that were previously activated. This enables you to deploy configuration templates added after a device was activated or to deploy additional configuration to devices.

You can deploy configuration templates to devices from the Configuration Templates or Tenant Devices pages.

> **NOTE:** In CSO releases before Release 5.1.0, configuration templates are called stage-2 configuration templates.

Deploy from the Configuration Templates Page

To deploy a configuration template to one or more devices:

1. Select **Resources > Templates > Configuration Templates**.

   The Configuration Templates page appears.

2. Select the configuration template that you want deploy and click **Deploy to Devices**.

   - If you select a configuration template that was added in CSO Release 5.3.0, the Deploy Template *Template-Name* To Devices page appears. Proceed to Step 3.
   - If you select a configuration template that was added in a release before CSO Release 5.3.0, an alert message appears asking you to confirm whether you want to edit the template to automatically upgrade the template to the current CSO release version. You must go through the Edit workflow to upgrade the version.

     a. On the Edit Configuration Template page that appears, proceed to the Summary tab and click **OK**.

        The template is automatically upgraded to CSO Release 5.3.0 and the Configuration Templates page appears.

     b. Select the template again and click **Deploy to Devices**.

        The Deploy Template *Template-Name* To Devices page appears.

3. Complete the configuration according to the guidelines provided in Table 88 on page 244.

NOTE: Fields marked with an asterisk (*) are mandatory.

4. Click **OK**.

   The settings that you entered are saved and you are returned to the Configuration Templates page. A confirmation message appears indicating that a job was created. For each device, a separate job is triggered to deploy the configuration.

   You can view the status of the jobs from the Jobs page (**Monitor > Jobs**).

Table 88: Deploy Template <Template-Name> To Devices Settings

Setting	Guideline
Select Devices	
Configuration Template	Displays the name of the configuration template that you are deploying; you cannot modify this field.
Component Name	This field is displayed only for NFX250 devices. Select the component of the NFX250 device on which to deploy the template: • JCP—Junos Control Plane • JDM—Junos Device Manager • GWR-Gateway Router

Table 88: Deploy Template <Template-Name> To Devices Settings *(continued)*

Setting	Guideline
Devices	You can specify the devices on which you want to deploy the configuration template in the following ways: • By adding the devices manually: 1. From the list of devices displayed, select one or more devices by clicking the check box next to each device name. **NOTE:** You can search for devices or filter the list of devices displayed. • By uploading a comma-separated values (CSV) file containing the device information: **NOTE:** You must ensure that the CSV file is in the format that CSO can read and that the number of device records is 200 or lower. You can download a sample file by clicking the **Download Sample CSV File** button. 1. Click **Upload CSV File**. The Upload CSV File page appears. 2. Click **Browse** to open the file selection dialog, select a file, and click **Open**. The name of the file that you selected is displayed in the CSV File field. 3. Click **OK**. You are returned to the previous page where the devices that you imported are selected and displayed in the table. Click **Next**. You are taken to the Configure Global Parameters or the Configure Device Parameters tab.
Configure Global Parameters	**NOTE:** This tab is displayed only if the configuration template contains parameters that are global in scope. Specify the global parameters that are common to all the devices that you selected in the preceding step. After you are done, click **Next**. You are taken to the Configure Device Parameters tab.
Configure Device Parameters	

Table 88: Deploy Template <Template-Name> To Devices Settings *(continued)*

Setting	Guideline
Devices	The devices that you selected in the preceding step are displayed in the Devices table, and the first device is selected by default. For each device, the device name, device family, operational status, and the configuration status are displayed. When you first arrive on this tab, the configuration status for each device is *Not configured*. The *Device-Name* Parameters pane on the right displays the input parameters (from the configuration template) that you can specify for each device. After you specify the values for one device, you can select a different device and enter the configuration values. • If the configuration template contains validations for the parameters, CSO validates the values you entered for the device and changes the configuration status to Valid and displays a green check mark (√). • If the configuration template does not contain any validations, CSO changes the configuration status to Valid and displays a green check mark (√). • If the values that you entered do not match the validation, the configuration status displays Invalid. **NOTE:** You can optionally delete a device by selecting the device and clicking the delete (trash can) icon. After you specify the input parameter values for all the devices and ensure that the configuration status of all devices is Valid, click **Next**. You are taken to the Summary tab.
Summary	
Devices	The devices that you selected in the preceding step are displayed in the Devices table, and the first device is selected by default. For each device, the device name, device family, and operational status are displayed. For each device, the *Device-Name* Configuration pane on the right displays the actual configuration that will be deployed on the device. After you review the configuration for all the devices, click **Next**. You are taken to the Deploy tab.
Deploy	

Table 88: Deploy Template <Template-Name> To Devices Settings *(continued)*

Setting	Guideline
Deployment Schedule	Specify whether the configuration should be deployed on devices immediately(**Deploy now**) or deployed later (**Deploy later**). If you choose to deploy the configuration later, you must enter the date (in MM/DD/YYYY format) and time (in HH:MM:SS 24-hour or AM/PM format) that you want the deployment to occur.

Deploy from the Tenant Devices Page

To deploy a configuration template to one or more tenant devices:

1. Select **Resources > Tenant Devices**.

   The Tenant Devices page appears.

2. Select one or more devices on which you want deploy and click **More > Deploy Configuration Template**.

   > **NOTE:** The devices that you select must belong to the same device family. If you select devices from different device families, CSO displays an error message.

   The Deploy Template to Device *Device-Name* page appears.

3. From the **Configuration Templates** table, select the configuration template that you want to deploy and click **Next**.

   The configuration templates displayed are filtered based on the device family of the devices that you selected.

   - If you select a configuration template that was added in CSO Release 5.3.0, proceed to Step 4.
   - If you select a configuration template that was added in a release before CSO Release 5.3.0, an alert message appears asking you to confirm whether you want to edit the template to automatically upgrade the template to the current CSO release version. You must go through the Edit workflow to upgrade the version.

     a. On the Edit Configuration Template page that appears, proceed to the Summary tab and click **OK**.

        The template is automatically upgraded to CSO Release 5.3.0 and the Tenant Devices page appears.

b. Select the device again and click **More > Deploy Configuration Template**.

The Deploy Template to Device *Device-Name* page appears.

4. The rest of the deploy workflow is the same as you encounter if you initiate the deployment from the Configuration Templates page. Complete the configuration according to the guidelines provided in Table 88 on page 244.

> **NOTE:** Fields marked with an asterisk (*) are mandatory.

5. Click **OK**.

The settings that you entered are saved and you are returned to the Tenant Devices page. A confirmation message appears indicating that a job was created. For each device, a separate job is triggered to deploy the configuration.

You can view the status of the jobs from the Jobs page (**Monitor > Jobs**).

RELATED DOCUMENTATION

Assign Configuration Templates to Device Templates | 255

Undeploy a Configuration Template from a Device

As an SP (Service Provider) administrator or OpCo (Operating Company) Administrator, you can undeploy a configuration template when you no longer need the configuration deployed on the device. Undeploying a configuration template removes the configuration pushed to the device when the configuration template was deployed.

To remove only the references to the configuration template, without removing the configuration pushed to the device, you must dissociate the configuration template. See "Dissociate a Configuration Template from a Device" on page 250 for details.

> **NOTE:** You can undeploy configuration templates only from devices with Management Status **Provisioned**. In addition, the configuration templates must have been previously deployed (Deployment Status **Deployed**) on the device.

To undeploy a configuration template:

1. Do one of the following:
   - To undeploy a configuration template from a tenant device, select **Resources > Tenant Devices**.

     The Tenant Devices page appears.
   - To undeploy a configuration template from a provider hub device, select **Resources > Provider Hub Devices**.

     The Provider Hub Devices page appears.
2. Click the ***Device-Name*** link for the device from which you want to undeploy the configuration template.

   The ***Device-Name*** page appears.

3. From the **Configuration Template** tab, select the configuration template that you want to undeploy and click **Undeploy**.
   - If you select a configuration template that was added in CSO Release 5.3.0, an alert message appears, asking you to confirm the undeploy operation. Proceed to Step 4.
   - If you select a configuration template that was added in a release before CSO Release 5.3.0, an alert message appears asking you to confirm whether you want to edit the template to automatically upgrade the template to CSO Release 5.3.0. You must go through the Edit workflow to upgrade the version.

     a. On the Edit Configuration Template page that appears, proceed to the Summary tab and click **OK**.

        The template is automatically upgraded to CSO Release 5.3.0 and the Configuration Templates page appears.

     b. Select the template again and click **Undeploy**.

        An alert message appears, asking you to confirm the undeploy operation.

4. Click **Yes**.

   A message indicating that the undeploy configuration template job was triggered is displayed.

You can click the link in the message to view the progress of the job or view the progress on the Jobs page:

- If the job completes successfully, a confirmation message appears, indicating that the configuration template was undeployed from the device.
- If the job fails, an error message appears. You can repeat the procedure to undeploy the configuration template.

RELATED DOCUMENTATION

Deploy Configuration Templates to Devices | 242
Dissociate a Configuration Template from a Device | 250

Dissociate a Configuration Template from a Device

As an SP (Service Provider) Administrator or OpCo (Operating Company) Administrator, you can dissociate a configuration template when you no longer want the template to be associated with your device. Dissociating a configuration template removes references to the configuration template from the device but does not remove the configuration pushed to the device.

To remove the configuration pushed to the device, you must undeploy the configuration template. See "Undeploy a Configuration Template from a Device" on page 248 for details.

To dissociate a configuration template:

1. Do one of the following:

   - Select **Resources > Provider Hub Devices**.

     The Provider Hub Devices page appears.

   - Select **Resources > Tenant Devices**.

     The Tenant Devices page appears.

2. Click the ***Device-Name*** link for the device from which you want to dissociate the configuration template.

   The ***Device-Name*** page appears.

3. From the **Configuration Template** tab, select the configuration template that you want to dissociate from the device and click **Dissociate**.

   An alert message appears, asking you to confirm the dissociate operation.

4. Click **Yes**.

   If the dissociation is successful, a confirmation message appears, indicating that the references to the configuration template were removed from the device.

   If the dissociation fails, repeat the procedure to dissociate the configuration template.

Preview and Render Configuration Templates

In Administration Portal, users with the SP (Service Provider) Administrator role (on-premises installation only) or OpCo (Operating Company) Administrator role can use the Preview workflow to validate a configuration template by entering values for the configuration template and then render the template to view the configuration.

Although this is not mandatory, we recommend that you use this workflow to validate a configuration template before attaching it to a device template or deploying it on a device.

> **NOTE:** In CSO releases before Release 5.1.0, configuration templates are called stage-2 configuration templates.

To preview and render a configuration template:

1. Select **Resources > Templates > Configuration Templates**.

   The Configuration Templates page appears.

2. Select the configuration template that you want to check and click **Render Configuration**.
   - If you select a configuration template that was added in CSO Release 5.3.0, the Preview Configuration page appears displaying the parameters configured for the template. Proceed to Step 3.
   - If you select a configuration template that was added in a release before CSO Release 5.3.0, an alert message appears asking you to confirm whether you want to edit the template to automatically upgrade the template to the current CSO release version. You must go through the Edit workflow to upgrade the version.

     a. On the Edit Configuration Template page that appears, proceed to the Summary tab and click **OK**.

        The template is automatically upgraded to CSO Release 5.3.0 and the Configuration Templates page appears.

     b. Select the template again and click **Render Configuration**.

        The Preview Configuration page appears displaying the parameters configured for the template.

3. Specify values for the parameters as needed.

   > **NOTE:** Fields marked with an asterisk (*) are mandatory.

4. After you have entered the necessary parameters, click **Render**.

   The Rendered Config page appears displaying the configuration rendered based on the configuration template and the values that you specified.

5. Check if the configuration was rendered correctly.

   If the configuration was not rendered correctly, you can modify the configuration template as needed. See "Edit, Clone, and Delete Configuration Templates" on page 239.

6. Click **OK**.

   You are returned to the Preview Configuration Template page.

7. Click **Cancel** to exit the Preview Configuration Template page.

   You are returned to the Configuration Templates page. You can assign the configuration template to one or more device templates.

RELATED DOCUMENTATION

Assign Configuration Templates to Device Templates | 255

Import Configuration Templates

In Administration Portal, users with the SP (Service Provider) Administrator role (on-premises installation only) or OpCo (Operating Company) Administrator role can import a configuration template by specifying the parameters using a configuration template file (Jinja template language), Yang model file (schema for the configuration), and the Viewdef file (configuration of the UI).

> **NOTE:** In CSO releases before Release 5.1.0, configuration templates are called stage-2 configuration templates.

To import a configuration template:

1. Select **Resources > Templates > Configuration Templates**.

   The Configuration Templates page appears.

2. Select **More** > **Import**.

   The Import Configuration Template page appears.

3. Complete the configuration according to the guidelines provided in Table 89 on page 253.

   > **NOTE:** Fields marked with an asterisk (*) are mandatory.

4. Click **OK**.

   You are returned to the Configuration Templates page and a popup appears displaying the status of the import operation.

5. Click **OK** to close the popup.

   You are returned to the Configuration Templates page.

If the configuration template is imported successfully, you can validate the configuration template by using the Preview workflow and then assign the configuration template to a device template or deploy it on a device.

Table 89: Import Configuration Template Settings

Setting	Guideline
Template Name	Enter a unique name that can only contain alphanumeric characters and hyphens; 64-character maximum.
Description	Enter a description for the configuration template.
Output Config Format	Select the output configuration format for the template: • CLI (default) • XML
Device Family	Select the device family for which you are adding the template; for example, juniper-nfx.

Table 89: Import Configuration Template Settings *(continued)*

Setting	Guideline
Configuration Template File	Specify the file containing the configuration (in Jinja Template language syntax) by clicking the **Browse** button to navigate to the directory where the configuration template file is located and selecting the file.
Yang Model File	Specify the Yang data model (configuration schema) file by clicking the **Browse** button to navigate to the directory where the Yang model file is located and selecting the file.
Viewdef File	Specify the Viewdef file, which contains the configuration for the UI, by clicking the **Browse** button to navigate to the directory where the Viewdef file is located and selecting the file.

RELATED DOCUMENTATION

Preview and Render Configuration Templates | 251

Deploy Configuration Templates to Devices | 242

Assign Configuration Templates to Device Templates | 255

Export a Configuration Template

As an SP (Service Provider) Administrator or OpCo (Operating Company) Administrator, you can export a configuration template as a ZIP file if you want to reuse the template across multiple CSO instances. To reuse the template, you can import the template files into other CSO instances as is or modify the template files offline and then import them.

The ZIP file contains the configuration template file (Jinja template language), Yang model file (schema for the configuration), and the Viewdef file (configuration of the UI).

To export a configuration template:

1. Select **Resources > Templates > Configuration Templates**.

   The Configuration Templates page appears.

2. Select a configuration template from the list and click **More > Export**.

- If you select a configuration template that was added in CSO Release 5.3.0, the configuration template is automatically downloaded as a ZIP file to your local file system.
- If you select a configuration template that was added in a release before CSO Release 5.3.0, an alert message appears asking you to confirm whether you want to edit the template to automatically upgrade the template to the current CSO release version. You must go through the Edit workflow to upgrade the version.

  a. On the Edit Configuration Template page that appears, proceed to the Summary tab and click **OK**.

     The template is automatically upgraded to CSO Release 5.3.0 and the Configuration Templates page appears.

  b. Select the template again and click **Export**.

     The configuration template is automatically downloaded as a ZIP file to your local file system.

You can import the configuration template files as is or modify the files as needed and then import the files into other CSO instances.

RELATED DOCUMENTATION

About the Configuration Templates Page | 236

Import Configuration Templates | 252

Assign Configuration Templates to Device Templates

In Administration Portal, users with the SP (Service Provider) Administrator role (on-premises installation only) or OpCo (Operating Company) Administrator role can assign a configuration template to one or more device templates. Associating a configuration template with a device template enables you to deploy additional configuration on the device during ZTP and after the device is activated.

> **NOTE:** In CSO releases before Release 5.1.0, configuration templates are called stage-2 configuration templates.

To assign a configuration template to one or more device templates:

1. Select **Resources > Templates > Configuration Templates**.

   The Configuration Templates page appears.

2. Select the configuration template that you want to assign and select **More** > **Assign to Device Template**.

   The Assign Configuration Template to Device Templates page appears.

3. Complete the configuration according to the guidelines provided in Table 90 on page 256

   NOTE: Fields marked with an asterisk (*) are mandatory.

4. Click **OK**.

   You are returned to the Configuration Templates page and a popup appears indicating whether the assignment is successful or has failed. If the assignment failed, you can retry the assignment or contact Juniper Networks support.

   If the assignment is successful, you can navigate to the *Device-Name* page (where the configuration parameters are displayed) and enter values for the configuration and deploy the configuration on the device.

Table 90: Assign Configuration Template to Device Template Settings

Setting	Guideline
Template Settings	
Template	Displays the name of the configuration template that you are assigning; you cannot modify this field.
Display Name	Enter the name that you want displayed on the *Device-Name* page.

Table 90: Assign Configuration Template to Device Template Settings *(continued)*

Setting	Guideline
Component Name	For NFX250 devices, select the component name to which the configuration should be deployed. The components that are currently supported are: • Juniper Device Manager (JDM)—JDM is a Linux container that manages software components. • Juniper Control Plane (JCP)—JCP is the Junos VM running on the hypervisor. Administrators can use JCP to configure the network ports of the NFX250 device. JCP is used to configure the switching and routing function on the NFX250 device. • Gateway Router (GWR)—vSRX as a gateway provides the same capabilities as Juniper Networks SRX Series Services Gateways in a virtual form factor.
Auto Deploy	Specify whether the configuration should be deployed automatically on the device during the zero touch provisioning (ZTP) process. The options are: • **Yes**—Deploy the configuration automatically on the device during ZTP. • **No** (Default)—Don't deploy the configuration automatically on the device during ZTP. • **Same as global settings**—Use the same settings as the one configured in the device template.
Enable For	**NOTE:** This field is enabled only if you select Auto Deploy as No. Select whether the configuration template should be enabled for: • **All Tenants**, which means that the template is available for users with SP Administrator (on-premise installation only) or OpCo Administrator roles in Administration Portal and users with tenant administrator roles in Customer Portal. • **SP Admin**, which means that the template is available only for users with the SP Administrator role (on-premise installation only). • **OpCo Admin**, which means that the template is available only for users with the OpCo Administrator role. • **Specific Tenants**, which means that the configuration template is enabled only for specific tenants, which you can specify in the Tenants field.
Tenants	This field appears only if you specified that the configuration template should be available for specific tenants. Select one or more tenants and click the greater-than icon (>) to move the selected tenant or tenants from the Available column to the Selected column. You can use the search icon on the top right of each column to search for tenant names. Click **Next** to continue.
Device Templates	

Table 90: Assign Configuration Template to Device Template Settings *(continued)*

Setting	Guideline
Select Device Templates	The list of device templates to which you can assign the configuration template are displayed in a grid along with some information about the template. CSO displays only those device templates whose device family matches the device family of the configuration template. Select one or more device templates to which you want to assign the configuration template.

RELATED DOCUMENTATION

Deploy Configuration Templates to Devices | 242

Add Configuration Templates

In Administration Portal, users with the SP (Service Provider) Administrator role (on-premises installation only) or OpCo (Operating Company) Administrator role can add a configuration template by providing the device configuration using the Jinja template language syntax.

> **NOTE:** In CSO releases before Release 5.1.0, configuration templates are called stage-2 configuration templates.

- If a user with the SP Administrator role adds a template, the template is available to the OpCos, OpCo's tenants, and the SP Administrator's tenants.
- If a user with the OpCo Administrator role adds a template, the template is available only to the OpCo and the OpCo's tenants.

> **NOTE:**
> - Before you add the configuration template, ensure that you have the device configuration ready.
> - We recommend that you use a working device configuration to add the configuration template.

To add a configuration template:

1. Select **Resources > Templates > Configuration Templates**.

   The Configuration Templates page appears.

2. Click the **+** (add) icon.

   The Add Configuration Template page (wizard) appears.

   > **NOTE:** Fields marked with an asterisk (*) are mandatory.

3. Configure the fields on the Basic Information tab according to the guidelines provided in Table 91 on page 259.

   Click **Next** to go to the Templatize Config tab.

4. Add the configuration on the Templatize Config tab. Refer to Table 92 on page 260 for an explanation of the actions on this tab.

   Click **Next** to go to the Generated UI tab, where the UI for the parameters that you entered is generated and displayed.

5. Perform one or more actions on this tab, as explained in Table 93 on page 261.

6. Click **Save**.

   The configuration template is added and you are returned to the Configuration Templates page, where a confirmation message is displayed. You can assign the configuration template to device templates or deploy the template on devices.

Table 91: Basic Information Settings (Add Configuration Template Page)

Setting	Guideline
Template Name	Enter a unique name that can only contain alphanumeric characters and hyphens; 64-character maximum.
Description	Enter a description for the configuration template.
Output Config Format	Select the output configuration format for the template: • CLI (default) • XML

Table 91: Basic Information Settings (Add Configuration Template Page) *(continued)*

Setting	Guideline
Device Family	Select the device family for which you are adding the template; for example, juniper-nfx.
	Click **Next** to continue.

Table 92: Templatize Config Actions (Add Configuration Template Page)

Action	Description
View a sample configuration	You can view a sample configuration by clicking the **Sample Configuration** link near the top of the tab. The sample configuration appears in a new tab in your browser.
Add the device configuration	In the inline editor, copy and paste the device configuration ensuring that the syntax follows the Jinja Template language. CSO detects the template parameters corresponding to the configuration that you entered and displays them in the Parameters pane.
Advanced Mode	• When advanced mode is disabled, which is the default, CSO converts the configuration that you entered in Jinja Template language to a Junos OS configuration that uses Junos OS configuration groups. (Configuration groups make it easier to configure and maintain Junos OS configurations; see Understanding Junos OS Configuration Groups.) CSO also automatically includes the commands to delete the configuration groups in the configuration template. If you trigger an undeploy configuration template workflow, CSO uses these commands to delete the configuration. Therefore, to avoid conflict with the commands that CSO automatically includes, ensure that you do not manually include commands related to configuration groups (as part of the device configuration). • When advanced mode is enabled, CSO converts the configuration that you entered in Jinja Template language but does not use Junos OS configuration groups and does not include commands to delete the configuration. Therefore, if you plan to undeploy the configuration template later, you must ensure that you manually enter the commands to delete the configuration as part of the device configuration so that CSO can use these commands to delete the configuration.
[Detected Parameters]	Check that the parameters detected match the configuration that you added to the template: • If the parameters detected do not match, check the Jinja syntax that you used for the template configuration and make any changes needed in the inline editor. • If the parameters detected match the configuration that you added to the template, click **Next** to continue. CSO validates the Jinja template syntax and displays an error message if there are any errors.

Table 93: Generated UI Actions (Add Configuration Template Page)

Action	Description
Reorder the UI	Drag and drop individual fields, grids, or sections to change the order in which the parameters appear on the UI.
Modify the settings for a field, section, or grid	To modify the settings for a field, section, or grid: 1. Click the settings (gear) icon next to the field, section, or grid. The Form Settings pane appears on the right side of the page, displaying the Basic Settings and Advanced Settings tabs. 2. Modify the fields on these tabs, as needed. See Table 94 on page 261 for an explanation of the fields on these tabs. 3. Click **Save Settings** for each field to save your changes. The modifications that you made are displayed on the UI.
Reset the generated UI	Click **Undo all Edits** to discard the changes that you made and undo the changes made on the UI.
Preview configuration	Previewing the configuration enables you to check the configuration template that you added. To preview a configuration template: 1. Click **Preview Configuration**. The Preview Configuration page appears, displaying the configuration that was rendered based on the values that you entered. 2. Check if the configuration was rendered correctly. • If the configuration was not rendered correctly, click the close (**X**) icon to go back and make modifications as needed. • If the configuration was rendered correctly, click **OK**. You are returned to the Generated UI page.

Table 94: Form Settings (Add Configuration Template Page)

Setting	Guideline
Basic Settings Tab	Fields populated in this tab are based on the input type that you select.

Table 94: Form Settings (Add Configuration Template Page) *(continued)*

Setting	Guideline
Input Type	Select the input type for the parameter in the configuration template: • TEXT (default): If the input value for the parameter is a string of characters. • NUMBER: If the input value for the parameter is a number. • EMAIL: If the input value for the parameter is an e-mail address. • IP_V4: If the input value for the parameter is an IPv4 address. • IP_V4_PREFIX: If the input value for the parameter is an IPv4 prefix. • IP_V6: If the input value for the parameter is an IPv6 address. • IP_V6_PREFIX: If the input value for the parameter is an IPv6 prefix. • TOGGLE_BUTTON FOR BOOLEAN: If the input value for the parameter is a boolean value (true or false). • DROPDOWN: If the input value for the parameter is selected from a list. • PASSWORD: If the input value for the parameter is a password. The value that you enter is masked (default). (Optional) Click the **Show Password** (eye) icon to unmask the password. • CONFIRM PASSWORD: If the input value for the parameter is to confirm the password. If you select this option, a Confirm Password field appears on the UI. The value that you enter is masked (default). (Optional) Click the **Show Password** (eye) icon to unmask the password.
Label	Enter the label that you want displayed (on the UI) for the parameter.
Default Value	Specify a default value for the parameter.
Validate	For Text input type, select one or more validation criteria against which the input value will be checked. If the value that you entered for the parameter on the UI does not meet the selected validation criteria, an error message appears.
Description	Enter an explanation for the parameter, which will appear when you hover over the Help (?) icon for the parameter; the maximum length allowed is 256 characters.
Global Scope	Click the toggle button to make the parameter common across all devices to which the configuration template is being deployed to. If you disable the toggle button, which is default, the parameter must be specified for each device.

Table 94: Form Settings (Add Configuration Template Page) *(continued)*

Setting	Guideline
Hidden	Click the toggle button to hide the parameter on the UI when you preview and deploy the template. Typically, this option is used to hide a parameter and display it in the template only when an event is triggered. By default, the toggle button is disabled, which means that the parameter is displayed.
Required	Click the toggle button to make the parameter mandatory; parameters that are mandatory are marked with an asterisk (*) on the UI.
Max	For parameters that are numbers, enter the maximum value (up to 16 digits) for the input.
Min	For parameters that are numbers, enter the minimum value (up to 16 digits) for the input.
Visibility for Disabled	For Boolean parameters, select one or more parameters that must appear on the UI when the toggle button is disabled (boolean value is FALSE).
Visibility for Enabled	For Boolean parameters, select one or more parameters that must appear on the UI when the toggle button is enabled (boolean value is TRUE).

Table 94: Form Settings (Add Configuration Template Page) *(continued)*

Resource Type	For Dropdown input type, select the type of resource from which you want to retrieve data:
	• Static Resource—Resources in the list on the UI are mapped to the values that you specify.
	  ◦ To add a static resource:
	  1. Click the **+** (add) icon.
	  Cells appear in the List Values table.
	  2. Click inside the cells to specify values for the Label (name for the option in the list), Value (value for the option in the list), and Visibility (conditional visibility based on the option selected from the list) fields.
	  3. click **✓** (check mark) to save your changes.
	  The values that you specified are displayed in the List Values table.
	  ◦ To edit a static resource, select the resource and click the edit (pencil) icon.
	  ◦ To delete a static resource, select the resource and click the **X** (delete) icon.
	• Dynamic Resource—Resources in the list on the UI are mapped to the predefined services in CSO.
	  Click the *Resource Management* link to view add, edit, and delete dynamic resources. The Manage Resources page appears displaying the existing resources.
	  ◦ To add a dynamic resource:
	  1. Click the **+** (add) icon.
	  The Add Resource page appears.
	  2. Complete the configuration according to the guidelines specified in Table 95 on page 265. Fields marked with an asterisk (*) are mandatory.
	  3. Click **OK** to save the resource.
	  You are returned to the Manage Resources page, where the resource that you added appears.
	  4. Click **OK**.
	  You are returned to the Add Configuration Template page. The resource or resources that you added are available in the **Resource** list on the Form Settings pane.
	  ◦ To edit a dynamic resource, select the resource and click the edit (pencil) icon.
	  ◦ To delete a dynamic resource, select the resource and click the **X** (delete) icon.

Table 94: Form Settings (Add Configuration Template Page) *(continued)*

Key	For data in a table, select a column from the dropdown list that is to be used as a key. The column that you select is marked as unique (**Unique Key**), indicating that the entries in this column must be unique. Keys are unique identifiers used in defining entries (in a table) in the Yang data hierarchy. They help distinguish entries in a column.
Advanced Settings Tab	
Regexp	Enter a regular expression (regex pattern) to validate the input value. A regular expression defines a search pattern that is used to match characters in a string. For example, the regular expression [A-Z] matches the input with the characters A through Z. If the input consists of characters other than A through Z, an error message (as specified in the Invalid Message field) appears.
Invalid Message	Enter an error message that you want displayed on the UI when the input value does not match the specified regular expression.
Remote Validation	Enter a JavaScript function to validate the input value.
Event List	
Event Name	Select an event from the list based on which the parameter is conditionally displayed.
Event Handler	Enter a JavaScript function that specifies the actions that the event handler takes in response to an event.

Table 95: Fields on the Add Resource Page

Field	Guideline
Data Source	
Name	Enter a unique name for the resource.
Source Type	Select the source from which you want to retrieve data: • Service based, which uses predefined services to retrieve data. • URL based, which uses a URL of the API to retrieve data.

Table 95: Fields on the Add Resource Page *(continued)*

Field	Guideline
Service	For service-based source type, select a predefined service from which you want to retrieve data.
Entity	For service-based source type, select an entity for which you want to retrieve data.
URL	For URL-based source type, enter the URL of the API to be used for the request.
Method	For the URL-based source type, select the type of HTTPS method (GET or POST) to be used for the resource.
POST Body	For POST method, enter the format of the payload (in JavaScript Object Notation [JSON] format) of the API method, which is sent to the server.
Mock Result	Specify a mock result (in JSON format) if the API request is unable to retrieve data.
Result Mapping	
Result Mapping	Select the type of processing to be done on the output of the remote request: • Script—Use this option if you want to use a script (in JSON format) to process the output. • Mapping—Use this option if you want to map the output using a base path.
Mapping Script	To process the output by using a script, enter a mapping script in JSON format.
Select Path	To process the output by using a base path, enter the base path (JSONPath expression) of the variable in the output from which you want to extract the data; for example, interface.
Label Field	Select whether you want the names, UUIDs, or management status (for the selected entity) displayed as options in the list on the UI.
Value Field	Select a value (such as names, management status, and so on) that you want to associate with the labels (options) in the list on the UI. When you select an option from the list and save the configuration template, CSO processes its associated value (in the backend).

Table 95: Fields on the Add Resource Page *(continued)*

Field	Guideline
Extra Fields	Specify the additional values that you want to associate with the labels (options) in the list on the UI. When you select an option from the list on the UI, its associated additional value can be used to trigger an event, when a condition is met, by using a JavaScript function. You specify the JavaScript function in the Event Handler field. For example, let's say that the list contains device UUIDs (universally unique IDs) and that you specify device type as an additional value. You can enter a JavaScript function in the Event Handler field to display a parameter (such as the Virtual Chassis toggle button) on the UI only when the device is an EX Series switch. So, the Virtual Chassis toggle button is displayed only if you select an EX Series switch from the list.

RELATED DOCUMENTATION

Preview and Render Configuration Templates | 251

View the Configuration Deployed on Devices

In Administration Portal, for any configuration template, users with administrator or operator roles can view the configuration deployed on one or more devices.

> **NOTE:** In CSO releases before Release 5.1.0, configuration templates are called stage-2 configuration templates.

To view the configuration deployed on one or more devices:

1. Select **Resources > Templates > Configuration Templates**.

   The Configuration Templates page appears.

2. Navigate to the Devices column of the configuration template for which you want to view the deployed configuration, and click the **Number-of-devices** link.

   The Device Configuration page appears.

   Table 96 on page 268 explains the fields on this page.

3. After you have viewed the deployed configurations, click **OK**.

   You are returned to the Configuration Templates page.

Table 96: Device Configuration Page Fields

Setting	Guideline

Devices	The devices on which the configuration was deployed are displayed in a table. For each device, the following fields are displayed:
	• Device Name
	• Device Family
	• Operational Status, indicating whether the device is up or down.
	• Deployment Status:
	  ◦ CREATED, indicating that the deployment hasn't started.
	  ◦ DEPLOYED, indicating that the configuration was successfully deployed.
	  ◦ DEPLOYING, indicating that the deployment of the configuration is in progress.
	  ◦ DEPLOY_FAILED, indicating that the deployment of the configuration failed.
	• Deployment Date, indicating the date and time on which the deployment was triggered.
	• Job—Click the **View logs** link for a device to view the deployment history for that device. The Deployment History page appears displaying the number of jobs in progress, number of successful jobs, and number of failed jobs in addition to a table listing some details of the job. You can drill down further by clicking the **Regional Log** and **Log** links.

Device-Name Configuration	Select a device by clicking the check box corresponding to the row: • For each device on which the configuration deployed successfully, this pane displays the configuration that is deployed on the device. • For each device on which the configuration deployment is in progress, DEPLOYING is displayed.

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APN Overview

The access point name (APN) is the name of the gateway between an OpCo's network and the Internet. The APN connects the CPE device to the Packet Data Network (PDN) such as Internet through the Packet Data Network Gateway (P-GW). A CPE device can access multiple APNs, which consists of domain names and its associated parameters. All CPE devices are shipped with default APN settings.

In the Long Term Evolution (LTE) architecture for the Evolved Packet Core (EPC), the APN determines the P-GW that the CPE device must use. The APN also defines the tunnel connecting the CPE device to a PDN such as the Internet. Each PDN that the user has subscribed to has an APN and an associated P-GW, often called a "PDN subscription context." An example for a context is the default APN, connecting to a PDN such as the Internet unless the user activates another APN.

The CPE device is shipped to the tenant site with the default APN settings. The APN is applicable for sites with an LTE WAN link. CSO supports LTE WAN link on SRX320, SRX340, SRX345, NFX250 and NFX150 CPE devices only.

On NFX250 device, the LTE WAN link is supported through a USB dongle. The USB dongle is plugged into the USB port of the CPE device. The LTE-VM that is pre-installed on the NFX250 device has thousands of APN settings to enable the LTE modem to work with several OpCos all over the world. The NFX150 device is also pre-configured with default APN settings.

In both the devices, the initial LTE connection is established with default APN settings. As long as an LTE connection is established with the default APN settings, the LTE WAN link is used to reach CSO and complete the device activation process. Once the CPE device is activated at the tenant site, the tenant can choose to change the SIM card on the device to use a different LTE service provider. This requires new APN settings to be applied to the CPE device. Also in some cases the APN settings may need to be changed even when there is no SIM change required; this is to choose a private APN with the current LTE service provider. The tenant administrator can change the APN settings for specific tenant by logging into the Administration Portal.

NOTE: The LTE WAN links on NFX250 devices works only with the Vodafone K5160 dongle.

Benefits of APN Configuration

When CPE devices are shipped to different regions around the world, APN configuration feature allows the administrators to change the default APN settings to support local network as opposed to remote network and consequently avoid the roaming charges.

Configuring APN Settings on CPE Devices

IN THIS SECTION

- Configuring APN Settings with SIM Change on CPE Devices | 270
- Configuring APN Settings without SIM Change on CPE Devices | 272

You can configure Access Point Name (APN) settings on the following devices, with or without SIM change. You can change the APN settings either to use a private APN with the current LTE service provider or to use a different LTE service provider.

> **NOTE:** You can only insert a SIM card in the SIM1 slot of the LTE Mini-Physical Interface Module (Mini-PIM).

Following is the list of devices on which you can configure APN settings:

- NFX Series—NFX150 and NFX250 CPE devices
- SRX Series—SRX320, SRX340, and SRX345 CPE devices

Configuring APN Settings with SIM Change on CPE Devices

To configure APN settings with SIM change:

1. Log in to Administration Portal.

2. Select **Resources > Templates > Device Templates**.

   The Device Templates page appears.

3. Select a device template and click **Edit Device Template > Stage-2 Initial Configuration**.

   The Stage-2 Initial Configuration page appears.

4. Click **APN Configuration** tab and change the APN settings according to the guidelines provided in Table 97 on page 271.

5. Click **OK**.

   The new settings are applied after one minute.

6. Remove the USB dongle from the CPE device, change the SIM card, and re-insert the USB dongle.

   The system checks for the new APN settings every minute.

   - If the applied APN setting is compatible with the new SIM card—The LTE WAN link and its tunnels goes down after one minute and remain down till the new SIM card is inserted. The LTE dongle LED indicates that the connection is down during this period. Maximum one minute after the new SIM is inserted, the LTE dongle LED indicates connection Up. The LTE WAN link and its tunnels comes up automatically.
   - If the applied APN setting is not compatible with the new SIM—The LTE WAN link and its tunnels goes down after one minute and remains down even after the new SIM card is inserted. The LTE dongle LED indicates that the connection is down even after the new SIM is inserted.

7. To revert back to the old SIM, remove the USB dongle, replace the current SIM with the previous SIM, and re-insert the dongle.

   The system checks for the new APN settings every minute. Maximum one minute after the old SIM is inserted, the LTE dongle LED indicates that the connection is up (using the old SIM and old APN). The LTE WAN link and its tunnels comes up automatically

Table 97: Fields for the APN Configuration Settings on the Stage-2 Initial Configuration Page

Field	Description
Use default APN settings	Click the toggle button to enable (default) or disable the default APN settings. • If you enable this option, the default APN settings that are shipped along with the CPE device are used for configuring the APN. • If you disable this option, you must configure the APN settings manually.
APN Settings	
APN Name	Enter the access point name (APN) of the gateway router. The name can contain alphanumeric characters and special characters.
SIM Change Required	Click the toggle button to enable or disable changing the SIM card: **NOTE:** You can change the SIM card either to use a different LTE service provider or to use a private APN with the current LTE service provider. • (Default) Enable this option to change the APN settings and to use a new SIM card. • Disable this option to change the APN settings without changing the SIM card.

Table 97: Fields for the APN Configuration Settings on the Stage-2 Initial Configuration Page *(continued)*

Field	Description
Authentication Method	Select the authentication method for the APN configuration: • (Default) PAP—Select this option to use Password Authentication Protocol (PAP) as the authentication method. • CHAP—Select this option to use Challenge Handshake Authentication Protocol (CHAP) authentication as the authentication method. • None—Select this option if you do not want to use any authentication method.
Authentication Information	
SIP User ID	Enter the Session Initiation Protocol (SIP) user ID for authentication if you have selected the APN authentication method as either **PAP** or **CHAP**.
SIP Password	Enter the SIP password for authentication if you have selected the APN authentication method as either **PAP** or **CHAP**.

Configuring APN Settings without SIM Change on CPE Devices

To configure APN settings without SIM change:

1. Log in to Administration Portal.

2. Select **Resources > Templates > Device Templates**.

   The Device Template page appears.

3. Select a device template and click **Edit Device Template > Stage-2 Initial Configuration**.

   The Stage-2 Initial Configuration page appears.

4. Click **APN Configuration** tab and change the APN settings according to the guidelines provided in Table 97 on page 271.

5. Click **OK**.

   The new settings will be applied after one minute.

   - If the applied APN settings are valid, then in CSO, the LTE WAN link and its associated tunnels will go down momentarily and then gets re-established automatically.

- If the applied APN settings are invalid, then after one minute, the LTE dongle LED will indicate connection down. In CSO, the LTE WAN link and its associated tunnels will go down. After two minutes, the LTE dongle LED will indicate connection Up (using old APN). In CSO, the LTE WAN link and its tunnels will come up automatically

Device Images Overview

An image management system provides full lifecycle management of images for all network devices, including CPE device and virtualized network function (VNF) images. A *device image* is a software installation package for the CPE device or an image for a virtual application that runs on the device. For example, for a NFX Series device platform, you require an NFX software image and a software image for the vSRX application that provides security functions and routing on the device. You install a VNF image on a CPE device.

> **NOTE:** In CSO Release 5.0.0, the software images are uploaded and managed by the Juniper Networks team that manages the cloud installation. If you need a device image or VNF that is not listed among the supported images, contact your Juniper Networks representative.

You can deploy device images or VNF images on a single device or simultaneously on multiple devices of the same family. CPE device images include software images for the NFX and SRX Series.

You can stage the image on a device, verify the checksum, and deploy the staged image using the **Deploy** option from the Images page. You can also schedule the staging, deployment, and validation of a device image.

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About the Device Images Page | 274

About the Device Images Page

To access this page, click **Resources > Images**.

You can use the Images page to view uploaded device images for physical and virtual devices. From the Images page, you can stage, deploy, or stage and deploy an image onto a single device or simultaneously onto multiple devices of the same family. For more information, see "Device Images Overview" on page 273.

Tasks You Can Perform

You can perform the following tasks from this page:

- Stage device images. See "Staging an Image" on page 276
- Deploy device images. See "Deploying Device Images to Devices" on page 278.
- View details about a device image. Click the details icon that appears when you hover over the name of an image or click **More > Details**.
- Show or hide columns that contain information about the device image—Click the **Show Hide columns** icon in the top right corner of the page and select columns that you want to view on the page.
- Search an object for a device image—Click the Search icon in the top right corner of the page to search for a device image.
- View the history of image upgrade. Click **Image Upgrade History > Upgrade History** at the top right corner of a page. See Table 99 on page 275.

Field Descriptions

Table 98 on page 274 shows the fields on the Device Images page.

Table 98: Fields on the Images Page

Field	Description
Image Name	Displays the name of the device image. Example: juniper_srx_v1.tgz
Type	Displays the type of the device image. Example: VNF Image

Table 98: Fields on the Images Page *(continued)*

Field	Description
Version	Displays the version number of the device image. Example: 1.1
Vendor	Displays the vendor name of the device. Example: Juniper
Size	Displays the size of the device image. Example: 14 KB

Table 99 on page 275 shows fields on the Upgrade History page.

Table 99: Fields on the Upgrade History Page

Field	Description
In progress	Displays the number of image upgrade tasks that are in progress.
Success	Displays the number of image upgrade tasks that are successful.
Failure	Displays the number of image upgrade tasks that have failed.
Name	Displays the name of the task.
Start Date	Displays the start date and time of the task.
End Date	Displays the end date and time of the task.
Status	Displays the status of the task to know whether the task succeeded or failed.
Log	Displays the import logs. Click a log to access more detailed information about the upgrade images.

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Deploying Device Images to Devices | 278

Staging an Image

From the **Resource > Images** page, you can select an image and click the **Stage** button to stage the image onto one or more physical or virtual devices or Virtual Network Functions (VNF). You can stage an image onto a single device or multiple devices on a per-site basis or across all sites of a tenant.

From the **Stage Image: Select Devices** page, you can choose to stage an image, and also to either run the staging immediately or at a scheduled time.

The **Stage** option is especially useful if you are using a low-bandwidth connection. On low-bandwidth connections, manually staging an image prior to deploying the image helps prevent the image deployment from timing out because of a slow connection. On high-bandwidth connections, you can choose to stage the image along with the image deployment.

To deploy a device image onto devices:

1. Select **Resource > Images**.

   The **Images** page appears.

2. Select the device image to be staged on the device and click the **Stage** button.

   The **Stage Image: Select Devices** page appears and a list of compatible devices (CPE and VNF) for the selected image is retrieved and displayed with their associated information in the page. See Table 100 on page 276 for the details of the device.

   > **NOTE:** The **Deploy** button is enabled only for device images.

3. Select one or more devices onto which the device image needs to be staged and schedule a date and time for image staging.

Table 100: Fields on the Deploy Image: Select Devices Page

Field	Description
Device Name	Displays the name of the device configured in the point of presence (POP) or site. Example: sunny-NFX-250
Tenant	Displays the name of the tenant. Example: tenant-blue

Table 100: Fields on the Deploy Image: Select Devices Page *(continued)*

Field	Description
Site Name	Displays the name of the tenant site. Example: site-blue-white
Location	Displays the name of the location. Example: San Jose, CA
WAN Links	Displays the number of WAN links. Example: 3
POP Name	Displays the name of the POP. Example: pop_blue
Management Status	Displays the management status of the devices deployed in the cloud. • EXPECTED—Regional server has activation details for the device, but the device has not yet established a connection with the server. • ACTIVE—Device has downloaded images, but is not yet configured. • PROVISIONED—IPsec tunnel on the NFX250, SRX, or vSRX device is operational. • PROVISION_FAILED—Device failed if the vSRX was not instantiated properly.
Model	Displays the name of the device model. Example: NFX250
Active Services	Displays the number of services that are activated for the device. Example: 3
Stage Expiry Time	Specify the maximum number of seconds CSO must wait for an image staging to be complete. If staging is not complete in the specified time, the operation times out. You can use this setting to configure a longer timeout for image staging over low-bandwidth connections. The default is 7200 seconds.
Choose Staging Time	
Run now	Select this option if you want to stage the image onto the device immediately.
Schedule at a later time	Select this option to schedule the image staging for a later date and time, and specify the date and time when you want the image to be staged.

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Deploying Device Images to Devices

From the **Resource > Images** page, you can select an image and click the **Deploy** button to deploy the image onto one or more physical or virtual devices or Virtual Network Functions (VNF). You can deploy an image onto a single device or multiple devices on a per-site basis or across all sites of a tenant.

From the **Deploy Image: Select Devices** page, you can choose to stage an image and deploy it, and also to either run the deploy immediately or at a scheduled time.

To deploy a device image onto devices:

1. Select **Resource > Images**.

   The **Images** page appears.

2. Select the device image to be deployed on the device and click the **Deploy** button.

   The **Deploy Image: Select Devices** page appears and a list of compatible devices (CPE and VNF) for the selected image is retrieved and displayed with their associated information in the page. See Table 100 on page 276 for the details of the device.

   NOTE: The **Deploy** button is enabled only for device images.

3. Select one or more devices onto which the device image needs to be deployed and schedule a date and time for image deployment.

Table 101: Fields on the Deploy Image: Select Devices Page

Field	Description
Device Name	Displays the name of the device configured in the point of presence (POP) or site. Example: sunny-NFX-250
Tenant	Displays the name of the tenant. Example: tenant-blue

Table 101: Fields on the Deploy Image: Select Devices Page *(continued)*

Field	Description
Site Name	Displays the name of the tenant site. Example: site-blue-white
Location	Displays the name of the location. Example: San Jose, CA
WAN Links	Displays the number of WAN links. Example: 3
POP Name	Displays the name of the POP. Example: pop_blue
Management Status	Displays the management status of the devices deployed in the cloud. • EXPECTED—Regional server has activation details for the device, but the device has not yet established a connection with the server. • ACTIVE—Device has downloaded images, but is not yet configured. • PROVISIONED—IPsec tunnel on the NFX250, SRX, or vSRX device is operational. • PROVISION_FAILED—Device failed if the vSRX was not instantiated properly.
Model	Displays the name of the device model. Example: NFX250
Active Services	Displays the number of services that are activated for the device. Example: 3
Stage Image	Indicates whether the Stage Image option is enabled or not. The **Stage Image** option is enabled by default and ensures that the image is staged to the device before image deployment is attempted. Click the toggle button to disable staging of the image onto the device. **NOTE:** We recommend that on low-bandwidth connections you disable the **Stage Image** option to prevent the deploy from timing out because of the delay in staging the image. On such connections, use the **Stage** option on the **Images** page to manually stage the image before you deploy the image. If you disable the **Stage Image** option without manually staging the image onto the device, the deploy operation fails.

Table 101: Fields on the Deploy Image: Select Devices Page *(continued)*

Field	Description
Stage Expiry Time	Specify the maximum number of seconds CSO must wait for an image staging to be complete. If staging is not complete in the specified time, the operation times out. You can use this setting to configure a longer timeout for image staging over low-bandwidth connections. The default is 7200 seconds.
Choose Deployment Type	
Run now	Select this option if you want to deploy the image to the device immediately.
Schedule at a later time	Select this option to schedule the image deployment for a later date and time, and specify the date and time when you want the image to be deployed.

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Uploading a Device Image

On the Images page, you can upload image files for CPE and VNF devices. You can also add some metadata about the device image file that you upload to the device.

> **NOTE:** The image being uploaded must use the same image name as the published image. Image upgrade might fail if the image name and details are changed.

To upload a device image for the device:

1. Click **Resources > Images.**

   The Images page appears.

2. Click the add icon (+).

   The Upload Image page appears.

3. Enter the required details in the fields on the Upload Image page. See the field descriptions in Table 102 on page 281.

4. Click **Upload**. If you want to discard the upload device image process, click **Abort** instead.

   : The Upload Image page displays the progress of the image upload.

5. Click **OK** to save the changes.

   You are returned to the Images page.

Table 102: Fields on the Upload Device Image Page

Field	Description
Name	Specify the filename for the device image that you are uploading. Example: juniper_nfx_250_v1_img.tgz You must use the following filename format for device images of VNFs as listed below: • Riverbed—**riverbed-img** • vSRX—**vsrx-vmdisk-15.1.qcow2** • NFX—**juniper_nfx_1.5_img.tgz**
Image Type	Specify the type of device image. • **Device Image**—Software image for the physical device (CPE). • **VNF Image**—Software image for the virtual device (VNF). • **VNF Script**—Provision script for the VNF image. • **EMS Plugin Package**—EMS plugin package to support a new device family. • **Device Extension Package**—Extension software package that can be installed on the device. • **Boot Config Image**—Boot configuration ISO image that can be used to boot up the VNF or virtual device. • **Telemetry Agent Package**—Installable package containing telemetry agent to run on a device. For example, NFX. Yes • **VNFM Plugin Package**—Installable package containing VNF Manager (VNFM) plugin specific to a certain set of VNFs.
Description	Enter a description of the device image.

Table 102: Fields on the Upload Device Image Page *(continued)*

Field	Description
File Location	Click **Browse** to navigate to the file location in your local system and select an image file to upload.
Vendor	Specify the vendor name of the device. Example: Juniper Networks.
Family	Specify the name of the device family. Example: NFX
Supported Platform	Specify the platform supported by the device image. Example: NFX250
Major Version Number	Specify the major version of the device image. Example: 12
Minor Version Number	Specify the minor version of the device image. Example: 1
Build Number	Specify the build name of the device image. Example: X53-D102.2

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Deleting Device Images

You can delete one or more device images from the Images page.

To delete a device image:

1. Select **Resources > Images**.

The Images page appears with a list of device images.

2. Select the device image that you want to delete and then click the X icon.

   The Confirm Delete page appears.

3. Click **Yes** to confirm.

   The device image is deleted.

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Network Services Overview

A *network service* is a final product offered to end users with a full description of its functionality and specified performance.

Administrative users deploy network services between two locations in a virtual network, so that traffic traveling in a specific direction on that link is subject to action from that service. The term *network service* is defined in the ETSI Network Functions Virtualization (NFV) standard.

A network service consists of a *service chain* of one or more linked network functions, which are provided by specific virtualized network functions (VNFs), with a defined direction for traffic flow and defined ingress and egress points. The term service chain refers to the structure of a network service, and although not defined in the ETSI NFV standard, this term is regularly used in NFV and software-defined networking (SDN).

A network service designer creates network services in Network Service Designer. When the designer publishes the service to the network service catalog from Network Service Designer, administrators can see the network service in Administration Portal.

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About the Network Services Page

To access this page, click **Configuration > Network Services**.

You can use the Services page to view the complete list of network services that service designers have published to the network service catalog from Network Service Designer and to view information about the services. For an introduction to network services, see "Network Services Overview" on page 283.

Tasks You Can Perform

You can perform the following tasks from this page:

- Quickly view important data about services and about instances of those services deployed at customers' sites in the widgets that appear at the top of the page. See Table 103 on page 284.
- View full information about a service and about instances of a service at customer sites. Click the name of a service in the list. See "About the Service Instances Page" on page 288.

Field Descriptions

Table 103 on page 284 shows the descriptions of the widgets that appear at the top of the Services page.

Table 103: Widgets on the Services Page

Widget	Description
Top Network Services Used	View the numbers of instances of the three services that are most used by tenants in the network. This view might help you to identify trends for network services, especially when you introduce a new service.
Services with Critical Alerts	View the top three network services that are receiving maximum number of critical alerts in the network.
Top Services by POP CPU Usage	View the top three network services that are using the largest percentage of CPU from the assigned cores in the network.

Table 104 on page 285 shows the descriptions of the fields on the Network Services page.

Table 104: Fields on the Network Services Page

Field	Description
Name	View the name of the network service. Click the name to view full information about a service.
Tenants	View the number of tenants and the names of the tenants that have access to this nnetwork service. • View the name of the first tenant that used the network service (left of the table cell). • View the additional number of tenants using this network service (right of the table cell). • Hover over the additional number of tenants to view a complete list of all the tenants using this network service.
Sites	View the total number of sites at which the network service is deployed for the tenant.
Instances	View the total number of occurrences of the network service that administrative users have activated for the tenant.
Last Update	View the date on which the network service designer last modified the service.

Table 105 on page 285 shows the descriptions of the fields on the Detail for *Service-Name* page.

Table 105: Fields on the Service Detail Page

Field	Description
General Information	
Type	View the category of service.
Configuration	View the settings that the network service designer or you have configured for this service.
Version	View the version number of the network service.
State	View the status of the network service. Example: Published
Performance Goals	View performance of the network service which include bandwidth, number of sessions, and latency.

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About the Service Instances Page | 288

About the Service Overview Page

To access this page, click **Configuration > Network Services > *Service Name* > Overview**.

You can use the Service Overview page to view information about a service that the service designer has published to the network service catalog from Network Service Designer.

Tasks You Can Perform

You can perform the following tasks from this page:

- View administrative details about the service. See *General Information* in Table 106 on page 286.
- View resources required for the service and its performance specification. See *Service Requirements* and *Service Performance* in Table 106 on page 286.
- View the service chain, with its constituent VNFs. See *Service Configuration* in Table 106 on page 286.

Field Descriptions

Table 106 on page 286 provides guidelines on using the fields on the Service Overview page.

Table 106: Fields on the Service Overview Page

Field	Description
General Information	
Description	View a summary about the service's capabilities. The network service designer provides this summary.

Table 106: Fields on the Service Overview Page *(continued)*

Field	Description
State	View the state of the network service: • Discontinued—Service is no longer available for customers. • Published—Service designer has published service to network catalog, and it is available for customers.
Tenants	View the number of tenants using this service.
Service Requirements	
CPU	View the number of CPUs that the service needs (cores).
Memory	View the amount of RAM that the service needs in gigabytes (GB).
Service Performance	
Sessions	View the number of sessions concurrently supported by one instance of the service.
Bandwidth	View the data rate for the service in megabytes per second (Mbps) or gigabytes per second (Gbps).
Latency	View the time a packet takes to traverse the service in milliseconds (ms) or nanoseconds (ns).
License cost	Specify the license cost for the network service in USD.
Service Configuration (graphic of the service chain)	
I	View the ingress point—the point at which packets enter the service.
E	View the egress point—the point at which packets exit the service.
One or more VNFs	Click to view settings for the VNF. The service designer can configure the VNF settings in Network Service Designer and the administrative user can configure the VNF settings in Customer Portal. **BEST PRACTICE:** The network service designer configures settings for the virtual machine (VM) in which the virtualized network function (VNF) resides and the administrative user configures settings for the service, such as policies. The service designer can also configure a few example settings for the service. These example settings should be generic and not network-specific.

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About the Service Instances Page

To access this page, click **Configuration > Network Services** > *Service Name* > **Instances**

You can use the Service Instances page to view information about occurrences of the service at specific customer sites.

Tasks You Can Perform

You can perform the following tasks from this page:

- View details about a service instance. Click the details icon that appears when you hover over the name of a service. See Table 108 on page 289.
- Enable or disable a network service or virtualized network function (VNF) recovery. Select a service instance and click **Enable Auto Healing** to enable automatic recovery of a network service. By default, automatic recovery of a network service or VNFs is enabled.

Field Descriptions

Table 107 on page 288 shows the descriptions of the fields on the Service Instances page.

Table 107: Fields on the Service Instances Page

Field	Description
Name	View the name of the occurrence of a service at a specific tenant site.
Tenant	View the name of the tenant.
Status	View the state of the service at the customer site: • Created—Administrative user for the tenant has enabled this service instance, which is active. • Blank—Administrative user for the tenant has disabled this service instance.

Table 107: Fields on the Service Instances Page *(continued)*

Field	Description
Site	View the name of the site at which service occurrence is available.
POP	View the POP in which the site is located.
Functions	View network functions that the service offers; for example, Network Address Translation (NAT) or firewall.

Table 108 on page 289 shows the descriptions of the fields on the Detail for *Service-Instance-Name* page.

Table 108: Fields on the Service Instance Details Page

Field	Description
General	
Description	View information about this service instance. This information is generated from data in Customer Portal.

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Allocating a Service to Tenants

NOTE: Only a service provider administrator can allocate services to tenants.

For a tenant to have access to a service, you must assign the service to the tenant. You can assign a service to multiple tenants simultaneously; however, you can assign only one service at a time.

To assign a service to tenants:

1. Select **Configuration > Network Services**.

   The Network Services page appears.

2. Select the service that you want to assign to the tenants.

3. Click **Allocate Services**.

   The Tenants: Select Tenant(s) to allocate the Service page appears.

4. Select the tenants to which you want to assign the service.

5. Click **OK** to save the changes.

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Removing a Service from Tenants

> **NOTE:** Only a service provider administrator can remove services allocated to tenants.

You can remove a service from one or more tenants simultaneously. You can only remove one service at a time, however.

To remove a service from tenants:

1. Click **Configuration > Network Services**.

   The Network Services page appears.

2. Select the service that you want to remove from the tenants.

3. Click **Detach Services**.

   The Detach Service from Tenants page appears.

4. Select the tenants from which you want to remove the service.

5. Click **Ok**.

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7

CHAPTER

Managing Signatures

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Signature Database Overview

The signature database that Juniper provides contains application and intrusion prevention system (IPS) signatures:

- Application signatures are definitions of predefined attacks and applications, and can be used to identify applications for tracking firewall policies and quality-of-service (QoS) prioritization.
- IPS signatures are definitions of predefined attack object and attack object groups that you can use in IDP policies to match traffic against known attacks.

Contrail Service Orchestration (CSO) enables users with the Service Provider (SP) administrator role to download the signature database. When you trigger a download, a job is created and the job might take some time to complete. You can track the progress of this job on the Jobs page.

After the signature download operation is complete, predefined signatures (application and IPS) and IPS profiles are available in CSO. You cannot modify predefined signatures or IPS profiles.

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Downloading a Signature Database | 295

About the Signature Database Page

To access this page, select **Administration** > **Signature Database**.

Use the Signature Database page to download the signature database, which contains intrusion prevention system (IPS) and application signatures. The signature database contains definitions of attacks and application, which are used in defining IPS profile rules and application firewall rules. These attack objects and groups are designed to detect known attack patterns and protocol anomalies within the network traffic.

Tasks You Can Perform

You can perform the following tasks from this page:

> **NOTE:** In Administration Portal, only users with the Service Provider (SP) Administrator role can download the signature database.

- Download the signature database—See "Downloading a Signature Database" on page 295.
- Show or hide columns—Click the **Show Hide Columns** icon at the top right corner of the page and select the columns that you want displayed on the Signature Database page.

Field Descriptions

Table 109 on page 294 describes the fields on this page.

Table 109: Fields on the Signature Database Page

Field	Description
Active Database	
Database Version	Version of signature database.
Publish Date	Date and time (YYYY-MM-DD HH:MM:SS 24-hour format) when the signature database was published.
Update Job	Job ID of the last successful download signatures job. Click the hyperlinked job ID to go to the Jobs page where you can view the details of the job.
Installed Device Count	Number of devices on which the signature database was successfully installed.
Detectors	Version numbers of the detector engines associated with the signature database. Click the *detector-versions* link to view the detector details. The Detector Details for *Signature-Database-Version* page appears displaying (in a table) the platform, OS version, and version of the detectors for the signature database. Click **Close** to return to the Signature Database page.

Table 109: Fields on the Signature Database Page *(continued)*

Field	Description
Latest List of Signatures	The available signature databases are listed in a table. You can search the list of signature databases by using the search option.
Database Version	Version of the signature database.
Publish Date	Date and time (YYYY-MM-DD HH:MM:SS 24-hour format) when the signature database was published.
Update Summary	Displays the summary of changes from the previous version of the signature database; for example, 6 new signatures, 1 updated signature, 1 renamed signature. Click the hyperlinked text to view the details of the updates. The Signature Update Details for Database *Version* page appears displaying (in a grid) the list of signatures updated and action (add, update, rename), the type, and the name for each signature. Click **Close** to return to the Signature Database page.
Detectors	Version numbers of the detector engines associated with the signature database. Click the *detector-versions* link to view the detector details. The Detector Details for *Signature-Database-Version* page appears displaying (in a table) the platform, OS version, and version of the detectors for the signature database. Click **Close** to return to the Signature Database page.
Action	Click the **Full Download** link to download the complete signature database; the download might take a while to complete. **NOTE:** This field is displayed only for users with the SP administrator role.

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Downloading a Signature Database

Users with the Service Provider (SP) Administrator role can use the Signature Download Settings page to specify the URL from which the signature database must be downloaded and trigger the download of the

signature database. When you trigger a download, a job is created; and this job might take some time to complete. You can track the progress of the signature download job on the Jobs page.

To download the signature database:

1. Select **Administration > Signature Database**.

   The Signature Database page appears.

2. Click **Signature Download Settings**.

   The **Signature Download Settings** page appears.

3. Enter the download settings according to the guidelines provided in Table 110 on page 296.

4. Click **OK** to save the changes:

   - If you specified that the signature database should be downloaded immediately, a Job Tasks page appears displaying information about the signature download job. Click **OK** to close this page and return to the Signature Database page.
   - If you scheduled the signature download for later, a job is created and you are returned to the Signature Database page. A confirmation message (with the job ID) is displayed at the top of the page.

Table 110: Fields on the Signature Download Settings Page

Field	Description
Download URL	Specifies the location of the Juniper hosted server from which the signature database is downloaded to the CSO server. The default download URL is https://signatures.juniper.net/. To download signatures from this location, Internet connectivity must be available from CSO. If Internet connectivity from CSO is not available, you can download the signatures from a local source such as your laptop or any other web server connected through the intranet to CSO. To do this, enter the location from which you want to download the signatures in the **Download URL** field. For more information, see "Download Locations for Signature Database" on page 297.
Signature Version	**NOTE:** This field is enabled only when you change the download URL from https://signatures.juniper.net/. Enter the numeric value of the signature database version. The value must only contain numbers and not have any special characters or negative values.

Table 110: Fields on the Signature Download Settings Page *(continued)*

Field	Description

Type	You can chose to download the signature database immediately or schedule the download for later.
	• Select **Run now** to automatically download the signature database immediately.
	• Select **Schedule at a later time** to download the signature database later and specify the date and time, as follows:
	  ◦ Click on the calendar icon to choose the date for the download.
	  ◦ Enter the time for the download. You can choose the 12 hour (AM or PM) or 24 hour format to specify the time by selecting the option from the drop-down list provided beside the time field.
	NOTE: The time-zone is picked-up based on the time-zone specified when CSO is installed.

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Download Locations for Signature Database

In order to perform offline download of signature database or package, you must first download the signature database to a folder location on any webserver. You need to start a local webserver to host the signature database or package.

The following are the folder locations to which you must download the signature package or database for different servers:

- **Python server**—You can use the **python -m SimpleHTTPServer 8000** command to start an HTTP server on port 8000. You need to log in as the root user and then execute the command at the root directory of the server. You must download the signature package to the folder location **/space/2/*version*/**. Therefore, the URL of the downloaded signature package is ***IP address*: *portnumber* /space/2/*version*/*latest-space-update.zip***.

  For example, **10.213.18.101:8000/space/2/2981/*latest-space-update*.zip**

- **Apache server**—In Mac OS, you must download the signature package, *latest-space-update*.zip, to the folder location **/Library/WebServer/Documents/space/2/version/**.

- **Other servers**—For other servers, download the signature package, *latest-space-update*.zip, in the folder location **location /space/2/*version*/**.

RELATED DOCUMENTATION

Signature Database Overview

Application Signatures Overview

Juniper Networks regularly updates the predefined application signature database, making it available to subscribers on the Juniper Networks website. This database includes signature definitions of known application objects that can be used to identify applications for tracking, firewall policies, and quality-of-service prioritization.

Use the **Application Signatures** page to get an overall, high-level view of your application signature settings. You can filter and sort this information to get a better understanding of what you want to configure.

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Adding Application Signature Groups | **310**

Editing, Cloning, and Deleting Application Signature Groups | **311**

About the Application Signatures Page

To access the **Application Signatures** page, select **Configuration** > **Shared Objects** > **Application Signatures**.

Use this page to view application signatures and application signature groups that are already downloaded and to create, modify, clone, and delete custom application signatures and custom application signature groups. This page displays the name, object type, category and subcategory, risk associated with, and characteristics of the signature. You can create custom application signatures and custom application signature groups with a set of similar signatures for consistent reuse when defining policies.

Tasks You Can Perform

You can perform the following tasks from this page:

- Create an application signature. See "Adding Application Signatures" on page 302.
- Modify, clone, or delete an application signature. See "Editing, Cloning, and Deleting Application Signatures" on page 308.
- Create an application signature group. See *Adding Application Signature Groups*.
- Modify, clone, or delete an application signature group. See *Editing, Cloning, and Deleting Application Signature Groups*.
- View the configured parameters of an application signature or application signature group— Hover over the application signature or group name and click the Detailed View icon or click **More > Detailed View**.

  The Detailed View page appears, displaying the same values that you specified for each parameter in the selected application or application signature group.
- Show or hide columns displayed on the page—Click the **Show Hide columns** icon in the top right corner of the table and select the columns that you want to view on the page.
- Search for a specific application signature or application signature group—Click the Search icon in the top right corner of the table and enter the search text in the text box, and press **Enter**. The search results are displayed on the same page.
- Filter the application signature information based on the selected criteria—Select the filter icon at the top right corner of the table to apply a filter. For example, you can filter information based on the object type (application signature or application signature group) or risk level (Low, Moderate, and so on).

  Click **Clear All** to remove the applied filter.

Field Descriptions

Table 111 on page 300 describes the fields on the **Application Signatures** page.

Table 111: Fields on the Application Signatures Page

Field	Description
Name	Name of the application signature or application signature group.
Object Type	Signature type—either application signature or application signature group.
Category	UTM category of the application signature. For example, the value of **Category** can be Messaging, Web, Infrastructure, Remote-Access, Multimedia, and so on.
Subcategory	UTM subcategory of the application signature. For example, the value of **Subcategory** can be Wiki, File-Sharing, Multimedia, Social-Networking, News, and so on.
Risk	Level of risk associated with the application signature. For example, the value of **Risk** can be low, moderate, high, critical, unsafe, and so on.
Characteristic	One or more characteristics of the application signature. For example, supports file transfer, loss of productivity, and so on.
Predefined or Custom	A list of predefined application signatures and application signature groups, and a list of custom application and custom application signature groups that you created.
Cacheable	Indicates whether the information related to an application signature is cacheable (True) or non-cacheable (False).

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Understanding Custom Application Signatures

Application identification supports user-defined custom application signatures to detect applications as they pass through the device. Custom application signatures are unique to your environment and are not part of the predefined application package. You use this custom application signature in SD-WAN policies and firewall policies to steer, and block traffic when a threat is detected.

Custom application signatures are required to:

- Control traffic particular to an environment.
- Bring visibility to unknown or unclassified applications.
- Identify Layer 7 applications or temporary applications, and to achieve further granularity of known applications.
- Perform QoS for your specific application.

CSO supports the following custom application signatures:

- ICMP-Based Mapping—The Internet Control Message Protocol (ICMP) mapping technique maps standard ICMP message types and optional codes to a unique application name. This mapping technique lets you differentiate between various types of ICMP messages.
- IP Address-Based Mapping—Layer 3 and Layer 4 address mapping defines an application by the IP address and optional port range of the traffic.

  To ensure adequate security, use address mapping when the configuration of your private network predicts application traffic to or from trusted servers. Address mapping provides efficiency and accuracy in handling traffic from a known application.

  With Layer 3 and Layer 4 address-based custom applications, you can match the IP address and port range to destination IP address and port range. When IP address and port range are configured, they must match the destination tuples (IP address and port range) of the packet.

  For example, consider a Session Initiation Protocol (SIP) server that initiates sessions from its known port 5060. Because all traffic from this IP address and port is generated by only the SIP application, the SIP application can be mapped to an IP address of the server and port 5060 for application identification. In this way, all traffic with this IP address and port is identified as SIP application traffic.
- IP Protocol-Based Mapping—Standard IP protocol numbers can map an application to IP traffic. As with address mapping, to ensure adequate security, use IP protocol mapping only in your private network for trusted servers.
- Layer 7-Based Signatures—Layer 7 custom signatures define an application running over TCP or UDP or Layer 7 applications. Layer 7-based custom application signatures are required for the identification of multiple applications running on the same Layer 7 protocols. For example, applications such as Facebook and Yahoo Messenger can run over HTTP, but there is a need to identify them as two different applications

running on the same Layer 7 protocol. The custom signature is cacheable for Layer 7 signatures only. You can create multiple signatures and each signature can contain multiple members (maximum 15 members).

Layer 7-based custom application signatures detect applications based on the patterns in HTTP contexts. However, some HTTP sessions are encrypted in SSL, also called Transport Layer Security (TLS). Application identification can extract the server name information or the server certification from the TLS or SSL sessions. It can also detect patterns in TCP or UDP payload in Layer 7 applications.

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Adding Application Signatures

You can add custom application signatures for applications that are not part of the Juniper Networks predefined application database. When you add custom application signatures, make sure that your application signatures are unique, by providing a unique and relevant name.

You can add custom application signatures by specifying a name, protocol, port number where the application runs, and match criteria.

To create a custom application signature:

1. Select **Configuration > Shared Objects > Application Signatures**.
2. Click **Create > Signature**.
3. Complete the configuration according to the guidelines provided in Table 112 on page 303.
4. Click **OK** to save the changes. If you want to discard your changes, click **Cancel** instead.

A new application signature with your configurations is created. You use this application signature while creating SD-WAN policy and firewall policy intents.

Table 112 on page 303 provides guidelines on using the fields on the **Create Application Signature** page.

Table 112: Fields on the Create Application Signature Page

Field	Description
Name	Enter a unique name that is a string of alphanumeric characters, colons, periods, dashes, and underscores. No spaces are allowed and the maximum length is 63 characters.
Description	Enter a description for the application signature.
Signature Order and Priority	
Order	Enter the order for the custom application signature. A lower order value has higher priority. This option is used when multiple custom application signatures of the same type match the same traffic. However, you cannot use this option to prioritize among different type of applications such as TCP stream-based applications against TCP port-based applications or IP address-based applications against port-based applications. Range is 1-50000.
Priority	Specify the application signature priority (high or low) over other application signatures.
Signature Classification	
Category	Enter the category of the application signature. For example, Messaging, Web, Infrastructure, Remote-Access, Multimedia, and so on.
Sub Category	Enter the subcategory of the application signature. For example, Wiki, File-Sharing, Multimedia, Social-Networking, News, and so on.
Risk	Select the level of risk associated with the application signature. For example, low, moderate, high, critical, unsafe, and so on.
Characteristics	Enter one or more characteristics of the application signature. For example, supports file transfer, loss of productivity, and so on.
Application Criteria	Enable one or more application matching criteria: • ICMP Mapping • IP Protocol Mapping • Address Mapping • L7 Signature

Table 112: Fields on the Create Application Signature Page *(continued)*

Field	Description
ICMP Mapping	Click the toggle button to specify the Internet Control Message Protocol (ICMP) value for an application while configuring custom application signatures for application identification. The ICMP mapping technique maps standard ICMP message types and optional codes to a unique application name. The ICMP code and type provide additional specification, for packet matching in an application definition.
ICMP Type	Enter an ICMP value for the application. The ICMP mapping technique maps standard ICMP message types and optional codes to a unique application name. Range is 0-254.
ICMP Code	Enter an ICMP code for the application. The field provides further information (such as RFCs) about the ICMP type field. Range is 0-254.
IP Protocol Mapping	Click the toggle button to specify the IP protocol value for an application. This parameter is used to identify an application based on it's IP protocol value and is intended only for IP traffic. To ensure adequate security, use IP protocol mapping only in your private network for trusted servers.
IP Protocol	Enter an IP Protocol number for the application. Standard IP protocol numbers map an application to IP traffic. To ensure adequate security, use IP protocol mapping only in your private network for trusted servers. Range is 0-254. You can find a complete list of industry standard protocol numbers at the IANA website. **NOTE:** You cannot use IP protocol numbers 1(ICMP), 6(TCP) and 17(UDP) for custom application signature creation. Instead, we recommend you to use L7 signature policies for these protocols.

Table 112: Fields on the Create Application Signature Page *(continued)*

Field	Description
Address Mapping	Click the toggle button to specify address mapping information. Layer 3 and Layer 4 address mapping defines an application by matching the destination IP address or port range (optional) of the traffic. Use the address mapping option to configure custom applications signatures when the configuration of your private network predicts application traffic to or from trusted servers. Address mapping provides efficiency and accuracy while handling traffic from a known application. For more information, see Table 113 on page 305. **NOTE:** • You must specify either IP address or TCP/UDP port range for address mapping. • If both IP address and TCP/UDP ports are configured, both should match destination tuples (IP address and port range) of the packet.
L7 Signature	Click the toggle button to specify the Layer 7-based custom application signatures that are required to identify the multiple applications running on the same L7 protocols. Configure a custom signature based on L7 applications. You create Layer 7-based custom application signatures for the identification of multiple applications running on the same L7 protocols. For example, applications such as Facebook and Yahoo Messenger can both run over HTTP, but there is a need to identify them as two different applications running on the same Layer 7 protocol. For more information, see Table 114 on page 306.
Cacheable	Click the toggle button to enable caching of application identification results on the device. Enable this option to **True** only when L7 signatures are configured alone in a custom signature. This option is not supported for address-based, IP protocol-based, and ICMP-based custom application signatures.

Table 113: Fields on the Add IP Address Mapping Page

Field	Description
Name	Enter a unique string of alphanumeric characters, colons, periods, dashes, and underscores. No spaces are allowed; maximum length is 63 characters.
IP Address	Enter the destination IPv4 or IPv6 address of the application.
CIDR	Enter a CIDR value for the IP Address that you assign to the application. Range for IPv4 address is 1-32. Range for IPv6 address is 1-128.

Table 113: Fields on the Add IP Address Mapping Page *(continued)*

Field	Description
TCP Port range	(Optional) Enter space-separated list of ports or port ranges to match a TCP destination port for Layer 3 and Layer 4 address-based custom applications. The range is 0-65535. Example: 80-82 443.
UDP port range	(Optional) Enter space-separated list of ports or port ranges ranges to match an UDP destination port for Layer 3 and Layer 4 address-based custom applications. The range is 0-65535. Example: 160-162 260.

Table 114: Fields on the Add Signature Page

Field	Description
Over Protocol	Displays the signature to match the application protocol. Example: HTTP.
Signature Name	Enter a unique name that is a string of alphanumeric characters, colons, periods, dashes, and underscores. No spaces are allowed and the maximum length is 63 characters.
Port Range	Enter the port range for the application. Range is 0-65535 Example: 80-82,443
Add Members	Click the plus icon (+) to add the member details.
Member No.	Enter the member name for a custom application signature. Custom signatures can contain multiple members that define attributes for an application. (The supported member name range is m01—m15.)

Table 114: Fields on the Add Signature Page *(continued)*

Field	Description

Context	Select the service-specific context.
	• For L7 Signatures over HTTP, select any of the following context:
	  ◦ http-get-url-parsed-param-parsed
	  ◦ http-header-content-type
	  ◦ http-header-cookie
	  ◦ http-header-host
	  ◦ http-header-user-agent
	  ◦ http-post-url-parsed-param-parsed
	  ◦ http-post-variable-parsed
	  ◦ http-url-parsed
	  ◦ http-url-parsed-param-parsed
	• For L7 Signatures over SSL, select the service-specific context as **ssl-server-name**.
	• For L7 Signatures over TCP, select the service-specific context as **stream**.
	• For L7 Signatures over UDP, select the service-specific context as **stream**.
	For possible combinations of context and direction for L7 application creation, refer context (Application Identification).

Direction	Select the direction of the packet flow to which the signature must be matched. • any—The direction of packet flow can either be from client-side to server-side or from server-side to client-side. • client-to-server—The direction of packet flow is from client-side to server-side. • server-to-client—The direction of packet flow is from server-side to client-side.
Pattern	Enter the deterministic finite automaton (DFA) pattern matched on the context. The DFA pattern specifies the pattern to be matched for the signature. Maximum length is 128.

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Adding Path-Based Steering Profiles | 351

Editing, Cloning, and Deleting Application Signatures

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- Editing Application Signatures | 308
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You can edit, clone, and delete application signatures from the **Application Signatures** page.

Editing Application Signatures

To modify the parameters configured for a cloned user-created (custom) application signature:

1. Select **Configuration > Shared Objects > Application Signatures**.

   The **Application Signatures** page appears.

2. Select the application signature that you want to edit, and then click on the edit icon (pencil), on the top right corner of the table, or right-click and select **Edit Application Signature**.

   The **Edit Application Signature** page appears, showing the same options as those displayed when you create a new application signature.

3. Modify the parameters according to the guidelines provided in "Adding Application Signatures" on page 302.

4. Click **Save** to save the changes. If you want to discard your changes, click **Cancel** instead.

The modified application signature appears on the **Application Signatures** page.

Cloning Application Signatures

You can clone a custom application signature when you want to reuse an existing application signature, but with a few minor changes. This way, you can save time recreating the application signature from scratch.

To clone a custom application signature:

1. Select **Configuration > Shared Objects > Application Signatures**.

   The **Application Signatures** page appears.

2. Select the application signature that you want to clone, and then select **More > Clone**, or right-click the application signature and then select **Clone**.

   The **Clone** page appears with editable fields.

3. Modify the fields as required. Refer to the guidelines provided in "Adding Application Signatures" on page 302

4. Click **OK** to save the changes. If you want to discard your changes, click **Cancel** instead.

The cloned application signature is displayed on the **Application Signatures** page.

Deleting Application Signatures

To delete a cloned user-created (custom) application signature:

1. Select **Configuration > Shared Objects > Application Signatures**.

   The **Application Signatures** page appears.

2. Select the application signature you want to delete and then click the delete icon.

   An alert message appearsto verify that you want to delete the selected application signature.

3. Click **Yes** to delete the selected application signature. If you do not want to delete, click **Cancel** instead.

The deleted application signature is removed from the Application Signatures page.

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Adding Application Signature Groups

Application identification supports custom application signatures to detect applications as they pass through the device. When you create custom signature groups, make sure that your signature groups are unique, by providing a unique and relevant name.

To create an application signature group:

1. Select **Configure > Shared Objects > Application Signatures**.
2. Click **Create > Signature Group**.
3. Complete the configuration according to the guidelines provided in Table 115 on page 310.
4. Click **OK** to save the changes. If you want to discard your changes, click **Cancel** instead.

A new application signature group with your configurations is created. You can use this application signature group in firewall, NAT, and SD-WAN policies.

Table 115 on page 310 provides guidelines on using the fields on the **Create Application Signature Group** page.

Table 115: Fields on the Create Application Signature Group Page

Field	Description
Name	Enter a unique name that is a string of alphanumeric characters, colons, periods, dashes, and underscores. No spaces are allowed and the maximum length is 63 characters.
Description	Enter a description for the application signature group.
Group Members	Click the add icon (+) to add signatures to your application group. On the **Add Application Signatures** page, select the check boxes next to the signatures you want to add to the group and click **OK**.

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Editing, Cloning, and Deleting Application Signature Groups

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- Editing Application Signature Groups | 311
- Cloning Application Signature Groups | 312
- Deleting Application Signature Groups | 312

You can edit, clone, and delete application signature groups from the **Application Signatures** page.

Editing Application Signature Groups

To modify the parameters configured for an application signature group:

1. Select **Configuration > Shared Objects > Application Signatures**.

   The **Application Signatures** page appears.

2. Select the application signature group that you want to edit, and then select **More > Edit**, or click on the edit icon (pencil symbol), on the top right corner of the table, or right-click and select **Edit**.

   The **Edit** page appears, showing the same options as those displayed when you create a new application signature group.

3. Modify the parameters according to the guidelines provided in "Adding Application Signature Groups" on page 310.

4. Click **Save** to save the changes. If you want to discard your changes, click **Cancel** instead.

The modified application signature group appears in the **Application Signatures** page.

Cloning Application Signature Groups

You can clone an application signature group when you want to reuse an existing application signature group, but with a few minor changes. This way, you can save time recreating the application signature group from the start.

To clone an application signature group:

1. Select **Configuration > Shared Objects > Application Signatures**.

   The **Application Signatures** page appears.

2. Right-click the application signature group that you want to clone and then select **Clone**, or select **More > Clone**.

   The **Clone** page appears with editable fields.

3. Click **OK** to save the changes. If you want to discard your changes, click **Cancel** instead.

The cloned application signature group is displayed on the **Application Signatures** page.

Deleting Application Signature Groups

To delete an application signature group:

1. Select **Configuration > Shared Objects > Application Signatures**.

   The **Application Signatures** page appears.

2. Select the application signature group you want to delete and then click the delete icon **(X)** .

   An alert message appears, verifying that you want to delete the selected item.

3. Click **Yes** to delete the selected application signature group. If you do not want to delete, click **Cancel** instead.

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8

CHAPTER

Managing Profiles

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Application Quality of Experience Overview

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Contrail Service Orchestration (CSO) supports Application Quality of Experience (AppQoE) that enables you to effectively prioritize, segregate, and route business-critical application traffic without compromising performance or availability.

AppQoE utilizes the capabilities of two application security services:

- Application identification (AppID) to identify specific applications in your network.
- Advanced policy-based routing (APBR) to specify a path for the application traffic.

AppQoE-enabled devices perform service- level agreement (SLA) measurements across the available WAN links, and then dynamically map the application traffic to the path that best serves the application's SLA requirement.

> **NOTE:** AppQoE is applicable only for SD-WAN sites.

AppQoE is supported on the following devices in both hub-and-spoke and full mesh topologies:

- vSRX instances
- SRX300 series
- SRX550M
- SRX1500
- SRX4100
- SRX4200

You can configure an AppQoE between two SRX Series device endpoints (book-ended) when both the devices run the same version of Junos OS.

CSO pushes the SLA parameters, path selection parameters and related configuration to the device and the device monitors the links for SLA violation. If there is a violation, the device switches the link and generates **APPQOE_(APP)_SLA_METRIC_VIOLATION** and **APPQOE_BEST_PATH_SELECTED** system

log messages. The device also aggregates and averages the SLA metrics, and generates periodic **APPQOE_APP_PASSIVE_SLA_METRIC_REPORT** system log messages.

AppQoE measures the application performance across multiple links by collecting real-time data by continuously the monitoring application traffic and identifying any network or device issues by sending active and passive probes. To monitor the SLA compliance of the link on which the application traffic is sent, the Customer Premises Equipment (CPE) device sends inline probes (called passive probes) along with the application traffic. Additionally, to identify the best available link for an application if the active link fails to meet the SLA criteria, the CPE constantly monitors and collects the SLA compliance data for the other available links by sending probes (called active probes) over the links. The active probes are sent based on the probe parameters that you configure in the application traffic type profile.

The CPE device switches links at the application level, which means that only the traffic corresponding to the application that reported the SLA violation is moved to a link that meets the specified SLA. Traffic for the remaining applications remain on the same link until those applications report an SLA violation.

You can configure traffic type profiles to specify the class of service (CoS) and probe parameters for each traffic type. When you add a steering profile (SLA-based or path-based), you specify the SLA parameters and SLA sampling criteria, and link the steering profile with a traffic type profile. The steering profile is then linked to an SD-WAN policy intent and the SD-WAN policy is deployed to enable AppQoE.

You can view the SLA performance details of all tenants from the Tenant SLA Performance (**Monitor > Tenant SLA Performance**) page. For more information on the AppQoE workflow, see "Configure and Monitor Application Quality of Experience" on page 318.

Benefits of Application Quality of Experience

- Enables cost-effective QoE by real-time monitoring of application traffic, which provides a consistent and predictable level of service.
- Improves the user experience at the application level by ensuring that the application data is sent over the most SLA-compliant link.

RELATED DOCUMENTATION

Application Quality of Experience

Configure and Monitor Application Quality of Experience

Application Quality of Experience (AppQoE) improves the user experience by constantly monitoring the class of service (CoS) parameters and service-level agreement (SLA) compliance of the available WAN links, ensuring that the application data is sent over the most SLA-compliant link. For more information, see "Application Quality of Experience Overview" on page 316.

As an SP administrator user, to configure and monitor AppQoE in Administration Portal:

1. Review the "default traffic type profiles" on page 319 and enable the required profiles. You can also "modify the default profiles" on page 328 or "add new profiles" on page 324.

   > **NOTE:** This step is applicable only for on-premise version of Contrail Service Orchestration (CSO).

2. Add a tenant with SD-WAN service. For more information, see "Adding a Single Tenant" on page 72.

3. Add an SLA-based steering profile or a path-based steering profile and associate an application traffic type profile with the added steering profile. For more information, see "Adding SLA-Based Steering Profiles" on page 339 or "Adding Path-Based Steering Profiles" on page 351.

4. Change the scope to the tenant you added previously.

5. Add an SD-WAN policy intent that references to the steering profile you added previously. For more information, see *Creating SD-WAN Policy Intents* in the *Customer Portal User Guide*.

   > **NOTE:** Before you deploy an SD-WAN policy, ensure that you have added one or more SD-WAN sites. For more information, see *About the Sites page* in *Customer Portal User Guide*.

6. Deploy the SD-WAN policy intent on one or more SD-WAN sites to deploy AppQoE. For more information, see *Deploying Policies* in *Customer Portal User Guide*.

7. View the SLA performance details of all the sites in the tenant on the Application SLA Performance page (**Monitor > Application SLA Performance**). For more information, see *About the SLA Performance of a Single Tenant Page* in *Customer Portal User Guide*.

> **NOTE:** As an SP administrator user, you can view the SLA performance details of all tenants on the Tenants SLA Performance page (**Monitor > Tenants SLA Performance**). For more information, see "Monitoring Application-Level SLA Performance for real time-optimized SD-WAN" on page 444.

RELATED DOCUMENTATION

About the Application Traffic Type Profiles Page | 319
About the SLA-Based Steering Profiles Page | 335

About the Application Traffic Type Profiles Page

IN THIS SECTION

Tasks You Can Perform | 320
Field Descriptions | 320

To access this page from Administration Portal, select **Configuration** > **Application Traffic Type Profiles**.

You can use the **Application Traffic Type Profiles** page to:

- configure class-of-service parameters for various traffic types based on your specific business requirements.
- assign a priority and service-level criteria to the traffic types.

Application traffic type profiles are used in path-based steering, SLA-based steering, and breakout profiles.

Contrail Service Orchestration (CSO) provides predefined application traffic type profiles. For more information, see "Predefined Application Traffic Type Profiles" on page 322.

Tasks You Can Perform

You can perform the following tasks from this page:

- View details of the application traffic type profiles. To view more details about each profile, click the details icon that appears when you hover over the name of the application traffic type profile. Alternatively, select the application traffic type profile and click **More** > **Detail**.

  The **Details for <Application-Traffic-Type-Profile>** pane appears on the right side of the page.
- Add an application traffic type profile. See "Add Traffic Type Profiles" on page 324.
- Edit or delete an application traffic type profile. See "Editing and Deleting Traffic Type Profiles" on page 328.
- Show or hide columns that contain information about the application traffic type profiles. Click the **Show/Hide columns** icon in the top right corner of the page and select columns that you want to view on the page.
- Search for application traffic type profiles using keywords. Click the search icon. Enter partial text or full text of the keyword in the search bar and press Enter. The search results are displayed.

Field Descriptions

Table 116 on page 320 describes the fields on the Application Traffic Type Profiles page and Details for <Application-Traffic-Type-Profile> Pane.

Table 116: Fields on Application Traffic Type Profiles Page and Details for <Application-Traffic-Type-Profile> Pane

Field	Description	Displayed In
Name	Name of the application traffic type profile.	Application Traffic Type Profiles Page
Priority	Priority level of the application traffic type profile (arranged in decreasing order of priority): • S-High (Strict high) • M-High (Medium high) • High • M-Low (Medium low) • Low	Application Traffic Type Profiles Page Details for <Application-Traffic-Type-Profile> Pane

Table 116: Fields on Application Traffic Type Profiles Page and Details for <Application-Traffic-Type-Profile> Pane *(continued)*

Field	Description	Displayed In
Status	Status (enabled or disabled) of the application traffic type profile.	Application Traffic Type Profiles Page Details for <Application-Traffic-Type-Profile> Pane
Probe Parameters	Displays the probe parameters configured for the application traffic type profile: • Data Size: Size (in bytes) of the data packet. • Probe Interval: Interval (in seconds) between the time that two probes are sent. • Probe Count: Number of probes to be evaluated to assess service-level agreement (SLA) compliance of the link. • Burst Size: Maximum number of probes that can be sent at a time.	Application Traffic Type Profiles Page Details for <Application-Traffic-Type-Profile> Pane
DSCP Value	Differentiated Services Code Point (DSCP) value assigned to the application traffic type profile. DSCP values define the forwarding properties of the packet within the Differentiated Services framework.	Application Traffic Type Profiles Page Details for <Application-Traffic-Type-Profile> Pane
Bandwidth	Minimum and maximum bandwidth allocation (as percentage of the total available bandwidth) for the application traffic type profile.	Application Traffic Type Profiles Page Details for <Application-Traffic-Type-Profile> Pane
Buffer	Buffer allocation (in percentage) for the application traffic type profile.	Application Traffic Type Profiles Page Details for <Application-Traffic-Type-Profile> Pane
Created by	Name of the user who created the application traffic type profile.	Application Traffic Type Profiles Page

RELATED DOCUMENTATION

About the SLA-Based Steering Profiles Page

About the Path-Based Steering Profiles Page

Predefined Application Traffic Type Profiles

Table 117 on page 322 lists the predefined application traffic type profiles provided by Contrail Service Orchestration (CSO) and the default parameters for each profile.

Table 117: Predefined Application Traffic Type Profiles and Parameters

Traffic Type	Priority	Buffer Allocation	Bandwidth Allocation	Probe Parameters		DSCP Value
High Priority Video	Low	20%	Minimum: 20% Maximum: 25%	Data size (bytes)	64	af31
				Probe interval (seconds)	30	
				Probe count	10	
				Burst size	1	
Premium-Internet	Low	10%	Minimum: 12% Maximum:15%	Data size (bytes)	64	af12
				Probe interval (seconds)	20	
				Probe count	10	
				Burst size	2	
Internet	Low	5%	Minimum: 15% Maximum: 20%	Data size (bytes)	64	af11
				Probe interval (seconds)	10	
				Probe count	5	
				Burst size	1	

Table 117: Predefined Application Traffic Type Profiles and Parameters *(continued)*

Traffic Type	Priority	Buffer Allocation	Bandwidth Allocation	Probe Parameters		DSCP Value
Hosted-AV	Low	10%	Minimum: 16% Maximum: 20%	Data size (bytes)	64	af32
				Probe interval (seconds)	10	
				Probe count	100	
				Burst size	10	
Voice-Video	Low	5%	Minimum: 20% Maximum: 20%	Data size (bytes)	64	af41
				Probe interval (seconds)	10	
				Probe count	100	
				Burst size	10	

NOTE:

- By default, Voice-Video, Internet, and Premium-Internet application traffic type profiles are enabled on the on-premise and cloud versions of CSO. In the cloud version of CSO, the Juniper team can enable additional profiles, add new profiles, and edit or delete the existing profiles on a need-basis. In the on-premise version of CSO, the Service Provider (SP) administrator user can enable additional profiles, create new profiles, edit or delete the existing application traffic type profiles.
- You can enable a maximum of six application traffic type profiles at a time.
- The total buffer allocation of the enabled traffic type profiles cannot exceed 100%.

RELATED DOCUMENTATION

About the SLA-Based Steering Profiles Page

Add Traffic Type Profiles

You can use traffic type profiles to configure class-of-service parameters for various types of traffic. Traffic type profiles enable you to configure class-of-service parameters based on your specific business requirements, and assign priority and service level criteria for traffic types. You can link an application traffic type profile with an application SLA profile, which can be linked to an SD-WAN policy intent.

> **NOTE:** The Add Traffic Type Profiles operation can be performed by users with an SP Administrator role.

To add an application traffic type profile:

1. Select **Configuration** > **SD-WAN** > **Application Traffic Type Profiles**.

   The **Application Traffic Type Profiles** page appears.

2. Click the Add (**+**) icon.

   The **Create New Traffic Type Profile** page appears.

3. Configure the traffic type profile parameters as per the guidelines provide in Table 118 on page 324.

   > **NOTE:** Fields marked with an asterisk (*) are mandatory.

4. Click **OK**.

   A confirmation message appears indicating the job is created for adding a traffic type profile. You can view the status of the job from the Jobs page (Monitor > Jobs).

   After the job is complete, the traffic type profiles that you configured appear on the Application Traffic Type Profiles page.

   Table 118: Fields on the Create Traffic Type Profiles page

Field	Description
General	

Table 118: Fields on the Create Traffic Type Profiles page *(continued)*

Field	Description
Name	Enter a unique name that can contain alphanumeric characters and hyphens (-); the maximum length is 15 characters.
Priority	Select the priority value that you want to assign to the traffic type profile. The following list is arranged in the decreasing order of priority, where the first item indicates the highest priority and the fifth item, the lowest priority. 1. **S-High**, which denotes strict high or the highest priority. 2. **M-High**, which denotes medium high. 3. **High** 4. **M-Low**, which denotes medium low. 5. **Low** When network congestion occurs, traffic type profiles with higher priority take precedence over the ones with lower priority. **NOTE:** You can enable only one profile with S-High and one profile with High priority at any given time
Status	Click the toggle button to enable the traffic type profile. By, default, the traffic type profile is disabled. You can enable a maximum of six traffic profiles at a time. You can assign only those traffic type profiles that are marked as enabled to application SLA profiles. **NOTE:** If more than six traffic type profiles are enabled when you initiate the deployment of an SD-WAN policy, the policy deployment fails.
Quality of Service	
Probe Parameters	The following are the parameters for probes that are sent on links other than the active links: • Data Size • Probe Interval • Probe Count • Burst Size Probe results are used to verify the SLA compliance of links and to identify the best available link to which traffic can be routed if the active link fails to meet SLA.

Table 118: Fields on the Create Traffic Type Profiles page *(continued)*

Field	Description
Copy probe parameters from	You can select an existing traffic type profile from the **Copy probe parameters from** list to copy the probe parameters from that profile, and, if required, modify the values.
Data Size	Specify the size of the data packets, in bytes, to be used for active probes. Range: 4 through 256.
Probe Interval	Specify the interval, in seconds, between two probes. Range: 1 through 10.
Probe Count	Specify the number of probes within a test packe. Range: 10 through 1000.
Burst Size	Specify the maximum number of probes that can be sent in one go. The burst size must be less than or equal to the probe count. Range: 10 through 100.
Bandwidth	

Table 118: Fields on the Create Traffic Type Profiles page *(continued)*

Field	Description
DSCP Value	Choose the Differentiated Services Code Point (DSCP) value that you want to assign to the traffic type profile. DSCP values define the forwarding properties of the packet within the Differentiated Services framework. You can assign an Expedited Forwarding (ef), an Assured Forwarding (af), the Best Effort (be), or a Class Selector (CS) value. Class Selector value provides backward compatibility with IP Precedence. You can choose one of the following DSCP values: **NOTE:** For a traffic profile you assign only one type of DSCP value. . • ef • af11 • af21 • af22 • af23 • af31 • af32 • af33 • af41 • af42 • af43 • be • cs1 • cs2 • cs3 • cs4 • cs5 • nc2/cs7
Minimum Bandwidth	(Optional) Move the slider button to choose the minimum bandwidth, as percentage of the total available bandwidth, that you want to allocate to the traffic type profile. The minimum bandwidth value denotes the guaranteed bandwidth allocation for the traffic type.
Maximum Bandwidth	(Optional) Move the slider button to choose the maximum bandwidth, as percentage of the total available bandwidth, that you want to allocate to the traffic type profile. The bandwidth allocation for a traffic type never exceeds the maximum bandwidth configured for the traffic type.
Buffer	

Table 118: Fields on the Create Traffic Type Profiles page *(continued)*

Field	Description
Allocation	Move the slider button to choose the bandwidth buffer that you want to allocate to the traffic type profile. Buffer allocation enables interfaces to queue and transmit traffic when there are large bursts of traffic and thus reduces the packet loss when network congestions occur. You can specify the buffer allocation as a percentage of the total available delay buffer. **NOTE:** The total buffer allocation of all the traffic type profiles that are in enabled state cannot exceed 100%.

RELATED DOCUMENTATION

About the Application Traffic Type Profiles Page | 319
Editing and Deleting Traffic Type Profiles | 328

Edit and Delete Application Traffic Type Profiles

IN THIS SECTION

- Edit Application Traffic Type Profiles | 329
- Delete Application Traffic Type Profiles | 329

Users with the Service Provider (SP) Administrator role (on-premises installation only) can modify the parameters of existing application traffic type profiles and delete application traffic type profiles that are no longer being used.

Edit Application Traffic Type Profiles

To edit an application traffic type profile:

1. Select **Configuration** > **Application Traffic Type Profiles**.

   The **Application Traffic Type Profiles** page appears.

2. Select the application traffic type profile that you want to modify and click the **Edit** icon.

   The **Edit Traffic Type Profile** page appears displaying the same fields that are presented when you add an application traffic type profile.

3. Modify the fields as required.

   Refer to "Add Traffic Type Profiles" on page 324 for an explanation of the fields.

   > **NOTE:** You cannot modify the name of the application traffic type profile.

4. Click **OK** to save the changes.

   The modifications are saved and you are returned to the Application Traffic Type Profiles page, where a confirmation message appears.

   If you edit a traffic type profile that is associated with a steering or breakout profile and the traffic type profile is used in an SD-WAN policy intent that was previously deployed, you must redeploy the SD-WAN policy for the changes to take effect.

Delete Application Traffic Type Profiles

You can delete an application traffic type profile only if both the following conditions hold good:

- The traffic type profile is disabled.

  To delete a traffic type profile that's enabled, edit the profile and disable it, and then trigger the deletion.

- The traffic profile is not associated with a steering or breakout profile.

  To delete a traffic type profile that's associated with a steering or breakout profile, do one of the following:

  - Edit the traffic type profile to remove the steering or breakout profile, disable the traffic type profile, and then trigger the deletion.

- Delete the associated steering or breakout profile, disable the traffic type profile, and then trigger the deletion.

To delete an application traffic type profile:

1. Select **Configuration** > **Application Traffic Type Profiles**.

   The **Application Traffic Type Profiles** page appears.

2. Select the application traffic type profile that you want to delete and click the **Delete** icon.

   The **Confirm Delete** page appears asking you to confirm the delete operation.

3. Click **Yes**.

   You are returned to the **Application Traffic Type Profiles** page.

   If the selected application traffic type profile is disabled and is not associated with a steering or breakout profile, the application traffic type profile is deleted and a confirmation message appears.

SEE ALSO

About the SLA-Based Steering Profiles Page

About the Path-Based Steering Profiles Page | **348**

About the Breakout Profiles Page | **355**

SLA Profiles and SD-WAN Policies Overview

IN THIS SECTION

- Traffic-Based Steering Profiles | **331**
- SD-WAN Policies | **333**

Contrail Service Orchestration (CSO) enables you to add traffic-based steering profiles and map them to software-defined WAN (SD-WAN) policies for traffic management.

Traffic-Based Steering Profiles

Traffic-based steering profiles are created for applications or groups of applications for all tenants. Traffic-based steering profiles are categorized as follows:

- SLA-Based Steering Profiles—An SLA-based steering profile consists of a set of configurable constraints such as SLA configuration, SLA threshold, SLA parameters, path selection criteria, Class of Service, and upstream and downstream data rates.
- Path-Based Steering Profiles—A path-based steering profile consists of a set of configurable constraints such as path preference, traffic type profiles, and upstream and downstream data rates.
- Breakout Profiles—A breakout profile consists of set of configurable constraints such as type of breakout, traffic type profiles, path preference, and upstream and downstream data rates. A cloud breakout profile is added by Contrail Service Orchestration (CSO) by default.

. Table 119 on page 331, Table 120 on page 332 and Table 121 on page 332 lists the categories of configurable constraints that are defined in an SLA-based profile, path-based profile and breakout profiles..

Table 119: SLA-Based Profile Categories

Category	Description

SLA profile parameters	You can define one or more than one of the following SLA profile parameters:
	• SLA Configuration—Whether to use recommended or custom values for the SLA threshold and SLA parameters.
	• SLA Threshold—Whether to use, liberal, baseline, or conservative settings for the threshold.
	• SLA parameters:
	  ◦ Packet loss—Percentage of data packets dropped by the network to manage congestion.
	  ◦ RTT—Target round-trip time (RTT) for the SLA profile.
	  ◦ Jitter—Difference between the maximum and minimum round-trip times (in ms) of a packet of data.

Path preference and failover	Paths are the WAN links to be used for the SLA profile. You can select MPLS, Internet, or any link as the preferred path. MPLS is more latency-sensitive than Internet. You can trigger the path failover criteria when any of the SLA parameters is violated.or when all the SLA parameters are violated.
Class of service	Class of service (CoS) provides different levels of service assurances to various forms of traffic. CoS enables you to divide traffic into classes and offer an assured service level for each class. The classes of service listed in increasing order of priority and sensitivity to latency are best effort, voice, interactive video, streaming audio or video, control, and business essential. The default CoS is voice.

Table 119: SLA-Based Profile Categories *(continued)*

Category	Description
Rate limiters	Rate limiters are defined for traffic shaping and efficient bandwidth utilization. You can define the following rate limiters: • Maximum upstream and downstream rates—The maximum upstream and downstream rate for all applications associated with the SLA profile. • Maximum upstream and downstream burst sizes—The maximum size of a steady stream of traffic sent at average rates that exceed the upstream and downstream rate limits for short periods.

Table 120: Path-Based Profile Categories

Category	Description
Path preference	Paths are the WAN links to be used for the SLA profile. You can select an MPLS or Internet link as the preferred path. MPLS is more latency-sensitive than Internet.
Class of service	Class of service (CoS) provides different levels of service assurances to various forms of traffic. CoS enables you to divide traffic into classes and offer an assured service level for each class. The classes of service listed in increasing order of priority and sensitivity to latency are best effort, voice, interactive video, streaming audio or video, control, and business essential. The default CoS is voice.
Rate limiters	Rate limiters are defined for traffic shaping and efficient bandwidth utilization. You can define the following rate limiters: • Maximum upstream and downstream rates—The maximum upstream and downstream rate for all applications associated with the SLA profile. • Maximum upstream and downstream burst sizes—The maximum size of a steady stream of traffic sent at average rates that exceed the upstream and downstream rate limits for short periods.

Table 121: Breakout Profile Categories

Category	Description
Type	The type of breakout profile that you want to add: • **Local Breakout (Underlay)**—Select this option if you want traffic to break out locally (on the underlay) from the site. • **Backhaul**—Select this option if you want traffic to break out through a hub or a enterprise hub (if configured). • **Local Breakout (Cloud)**—Select to break out traffic through a cloud-based security platform. Currently, Zscaler is the only cloud-based security platform supported.

Table 121: Breakout Profile Categories *(continued)*

Category	Description
Traffic Type Profile	The traffic type profile to apply class of service parameters to the breakout traffic. You can select only a traffic type profile that is enabled.
Preferred Path	The preferred path (MPLS, Internet, or Any) to be used for breaking out the traffic. If a WAN link type that matches the preferred path is enabled for breakout, then that WAN link type is used for breakout traffic. If you specify that any path can be used, then there is no preference and all breakout-enabled links are used in a load-balancing mode.
Rate Limiting	Rate limiting of breakout traffic for cacheable applications. By default, rate limiting is disabled. If you enable rate limiting, you must specify the upstream and downstream parameters, and the loss priority.
Upstream Rate	The maximum upstream rate (in Kbps) for all cacheable applications associated with the breakout profile.
Upstream Burst Size	The maximum size (in bytes) of a steady stream of traffic sent at average rates that exceed the upstream rate limit for short periods.
Downstream Rate	The maximum downstream rate (in Kbps) for all cacheable applications associated with the breakout profile.
Downstream Burst Size	The maximum size (in bytes) of a steady stream of traffic sent at average rates that exceed the downstream rate limit for short periods.
Loss Priority	Loss priority based on which packets are dropped or retained when network congestion occurs. Packet drops are most likely when the loss priority is High and least likely when the loss priority is Low.

SD-WAN Policies

Applications are classified into the following categories:

- Cacheable applications, which refer to applications or application groups that are stored in the application cache when they are recognized by the device. After they are stored in the application cache, subsequent sessions are routed directly through the correct WAN link.

- Non-cacheable applications, which refer to applications or application groups that are not stored in the application cache and all sessions are first routed through the default path, and then routed to the correct WAN link based on the SD-WAN policy.

Policy intents consist of the following parameters:

- **Source**—A source endpoint that you can choose from a list of sites, site groups, and departments or a combination of all of these. The SD-WAN policy intent is applied to the selected source endpoint.
- **Destination**—A destination endpoint that you can choose from a list of applications and predefined or custom application groups. You can select a maximum of 32 applications or application groups as destination endpoints. The SD-WAN policy intent is applied to the selected destination endpoint.
- **Traffic Steering Profile**—Depending on whether you want to apply the policy intent to site-to-site traffic or breakout traffic, you can associate the traffic steering profile with the policy intent. The following options are available:
  - SLA-based steering profile— Applicable for site-to-site traffic
  - Path-based steering profile— Applicable for site-to-site traffic
  - Breakout profile—Applicable for breakout traffic (local, central, or cloud).
- **Intent name**—A unique name for the SD-WAN policy intent.

SD-WAN supports advanced policy-based routing (APBR). APBR enables you to dynamically define the routing behavior of the SD-WAN network based on applications. Dynamic application-based routing makes it possible to define policies and to switch WAN links on the fly based on the application's defined SLA parameters. The APBR mechanism classifies sessions based on applications and application signatures and uses policy intents to identify the best possible route for the application. When the best possible route does not meet the application's defined SLA requirements, the SD-WAN network finds the next best possible route to meet SLA requirements.

For example, consider an application in a site. If you want the application group to use custom throughput, latency, or jitter, you can create an SLA profile with these custom values. You can then create an intent and configure the intent with the application and apply the custom SLA profile. When the intent is deployed, CSO determines the best suited WAN link to route traffic based in the application. If the WAN link fails to meet SLA requirements in runtime, the SD-WAN network switches WAN links to the next best suited path.

On the basis of the configured traffic-based steering profile constraints, you can categorize SD-WAN policies into three types:

- **Path-based steering policy**—If only the path preference is defined and none of the SLA parameters are defined in the SLA profile, then the policy is called a path-based steering policy. In path-based steering profile, you can define the path (MPLS or Internet) that must be used for a given traffic type profile, You cannot configure SLA parameters or path failover criteria for a path-based steering profile. The traffic type profile must be in enabled state in order to be used in any profile.

- **SLA-based steering policy**—If one or more SLA parameters in the SLA profile are defined, then the policy is called an SLA-based steering policy. In an SLA-based steering profile, each profile is associated with a traffic type profile and tracks the SLA parameters such as packet loss, Jitter and RTT. The traffic type profile must be in enabled state in order to be used in any profile. Based on your requirements, you can choose the recommended SLA threshold or enter custom SLA threshold for the traffic type profile. You can even set the path preference (Any, MPLS, or Internet) to switch traffic from one WAN interface to another based on the path failover criteria.

  When an intent is deployed on a site, if the WAN link chosen by the SD-WAN network does not meet the SLA requirements and the network performance deteriorates, then the site switches WAN links to meet the SLA requirements. The link switching is recorded as an SD-WAN event and displayed in the SD-WAN Events page in the customer portal and the *Tenant_name* SLA Performance pages in the administration and customer portals.

- **Breakout policy**—If local breakout, central breakout, or cloud breakout parameters are defined, then the policy is called a breakout policy.

RELATED DOCUMENTATION

Adding SLA-Based Steering Profiles | 339

Adding Path-Based Steering Profiles | 351

About the SLA-Based Steering Profiles Page

To access this page, select **Configuration > SLA-Based Steering Profiles** in the Administration Portal.

In an SLA-based steering profile, each profile is associated with a traffic type profile and tracks the SLA parameters such as packet loss, Jitter and RTT. The traffic type profile must be in enabled state in order to be used in any profile. Based on your requirements, you can choose the recommended SLA threshold or enter custom SLA threshold for the traffic type profile. You can even set the path preference (Any, MPLS, or Internet) to switch traffic from one WAN interface to another based on the path failover criteria.

You can use the SLA-Based Steering Profiles page to view information about service-level agreement (SLA)-based steering profiles for all tenants.

Tasks You Can Perform

You can perform the following tasks from this page:

- View details of SLA-based steering profiles for all tenants.
- Add an SLA-based steering profile for all tenants. See "Adding SLA-Based Steering Profiles" on page 339.
- Edit or delete an SLA-based steering profile. See "Editing and Deleting SLA-Based Steering Profiles" on page 346.
- Show or hide columns that contain information about SLA-based steering profiles—Click the **Show Hide columns** icon in the top right corner of the page and select columns that you want to view on the page.
- Search for SLA-based steering profiles using keywords. Click the search icon. Enter partial text or full text of the keyword in the search bar and press Enter. The search results are displayed.

Field Descriptions

Table 122 on page 336 shows the descriptions of the fields on the SLA-Based Steering Profiles page.

Table 122: Fields on the SLA-Based Steering Profiles Page

Field	Description	Displayed On
Name	Name of the SLA-based steering profile.	SLA-Based Steering Profiles page (SLA Profiles List tab) Detail for *SLA-Profile-Name* pane
Priority	Priority of the SLA-based steering profile. A value zero (0) indicates lower priority and one (1) indicates highest priority.	Detail for *SLA-Profile-Name* pane
Traffic Type Profile	Indicates the traffic type profile associated with the SLA-based steering profile. • VOICE-VIDEO • HIGH_PRIORITY_VIDEO • HOSTED_AV • PREMIUM_INTERNET • INTERNET	SLA-Based Steering Profiles page (SLA Profiles List tab) Detail for *SLA-Profile-Name* pane
Packet Loss (%)	Target packet loss for the SLA profile.	SLA-Based Steering Profiles page (SLA Profiles List tab) Detail for *SLA-Profile-Name* pane

Table 122: Fields on the SLA-Based Steering Profiles Page *(continued)*

Field	Description	Displayed On
Jitter (ms)	Target jitter for the SLA profile.	SLA-Based Steering Profiles page (SLA Profiles List tab) Detail for *SLA-Profile-Name* pane
RTT	Target round-trip time (RTT) for the SLA profile.	SLA-Based Steering Profiles page (SLA Profiles List tab) Detail for *SLA-Profile-Name* pane
SLA Probe Match	Indicates whether the profile requires the SLA probe to match all SLA criteria (All) or not (Any) .	Detail for *SLA-Profile-Name* pane
Created By	Name of the user who created the SLA-based steering profile.	SLA-Based Steering Profiles page (SLA Profiles List tab)
Path Preference	The preferred path for the SLA profile. The available options are: • MPLS • Internet • Any (default)	Detail for *SLA-Profile-Name* pane
Session-sampling %	Indicates the matching percentage of sessions for which you want to run the passive probes.	Detail for *SLA-Profile-Name* pane
SLA Violation Counts	Indicates the number of SLA violations after which you want CSO to switch paths.	Detail for *SLA-Profile-Name* pane
Sampling Period	The sampling period, in milliseconds, for which the SLA violations are counted.	Detail for *SLA-Profile-Name* pane
Switch Cool-off Period	The waiting period, in milliseconds, only after which you want the link switch to happen if an active link comes back online. This parameter helps prevent frequent switching of traffic between active and backup links.	Detail for *SLA-Profile-Name* pane
Path Failover Criteria	Indicates the path failover criteria for link switching. Path failover occurs when any (Any)of the SLA parameters is violated or when all (All) the SLA parameters are violated.	Detail for *SLA-Profile-Name* pane

Table 122: Fields on the SLA-Based Steering Profiles Page *(continued)*

Field	Description	Displayed On
Maximum Upstream Rate	The maximum upstream rate (in Kbps) for all applications associated with the SLA-based steering profile.	Detail for *SLA-Profile-Name* pane
Maximum Upstream Burst Size	The maximum upstream burst size (in bytes).	Detail for *SLA-Profile-Name* pane
Maximum Downstream Rate	The maximum downstream rate (in Kbps) for all applications associated with the SLA-based-steering profile.	Detail for *SLA-Profile-Name* pane
Maximum Downstream Burst Size	The maximum downstream burst size (in bytes).	Detail for *SLA-Profile-Name* pane

RELATED DOCUMENTATION

SLA Profiles and SD-WAN Policies Overview | 330

Adding SLA-Based Steering Profiles

You can use the Add SLA Profile page to add a new service-level agreement (SLA)-based steering profile, specify the traffic type profile, SLA configuration, SLA threshold, SLA parameters, path selection criteria, and rate limiting parameters for the profile. Table 123 on page 340 lists the SLA-based steering profiles that are tuned for specific application categories and traffic types.

Table 123: Predefined SLA-Based Steering Profiles

SLA-Based Steering Profiles	Traffic Type	Application Group	Applications Supported
CSO-AV	VOICE-VIDEO	CSO_Collaboration_AV	Skype for Business Zoom Video GotoMeeting Jive Jabber Citrix Online WebEx Zoho Meeting Google Hangout Adobe Connect

Table 123: Predefined SLA-Based Steering Profiles *(continued)*

SLA-Based Steering Profiles	Traffic Type	Application Group	Applications Supported
CSO-Productivity	PREMIUM-INTERNET	CSO_Productivity	ERP: Salesforce, Oracle, SAP Office365 (including SharePoint) Zendesk HRPayroll Zoho Office Suite Slack Square Concur Adobe Quickbooks Freshbooks Workday Project Management-MS PJ Basecamp Asana
CSO-Security	INTERNET	CSO_Security	Symantec McAfee Sophos Zonealarm Lookout

Table 123: Predefined SLA-Based Steering Profiles *(continued)*

SLA-Based Steering Profiles	Traffic Type	Application Group	Applications Supported
CSO-Email	PREMIUM-INTERNET	CSO_Collaboration_Email	MS Exchange IMAP POP3 Gmail OWA Yahoo
CSO-FileShare	INTERNET	CSO_File_Share	Box Dropbox Gsuite OneDrive Skype for Business-File Transfer Zoho Share

To add an SLA-based steering profile:

1. Select **Configuration > SLA Based Steering Profiles**.

   The SLA-Based Steering Profiles page appears.

2. Click the add icon (+).

   The Add SLA Profile page appears.

3. Enter the SLA profile information according to the guidelines provided in Table 124 on page 343.

   NOTE: Fields marked with an asterisk (*) are mandatory.

4. Click **OK** to add the SLA profile.

   The SLA-Based Steering Profiles page appears with the new SLA profile information. You are returned to the SLA-Based Steering Profiles page and a confirmation message indicating that the SLA-based

steering profile was added is displayed. The page refreshes to display the SLA-based steering profile that you added.

Alternatively, if you want to discard your updates, click **Cancel** instead.

> **NOTE:** After you add an SLA-based steering profile, you must add an SD-WAN policy intent that references the SLA-based steering profile in order to enable site-to-site traffic.

Table 124: Fields on the Add SLA Profile page

Field	Guidelines
General	
Name	Enter a unique string that can contain alphanumeric characters and hyphens (-); the maximum length is 15 characters.
Traffic Type Profile	Choose a traffic type profile to apply the class-of-service configuration and priority to the SLA profile. You can select a traffic type profile only when it is in the **Enabled** state.
SLA Configuration	Choose one of the following options: • **Use Recommended**: To use the default SLA threshold and SLA parameters for the SLA-based steering profile. • **Enter Custom**: To specify customized values for SLA configuration and SLA parameters for the SLA-based steering profiles.
SLA Threshold	Choose one of the following options: • **Liberal**—To use a relaxed SLA threshold. • **Baseline**—To use the default SLA threshold. • **Conservative**—To use a strict SLA threshold.
SLA Parameters	
Packet Loss	Enter the target packet loss (in %) for the SLA-based steering profile. Packet loss is the percentage of data packets dropped by the network to manage congestion.
RTT	Enter the target round-trip time (RTT) for the SLA-based steering profile.
Jitter	Enter the target jitter (in ms) for the SLA-based steering profile. Jitter is the difference between the maximum and minimum round-trip times of a packet of data.

Table 124: Fields on the Add SLA Profile page ***(continued)***

Field	Guidelines
Path Selection Criteria	
Path Preference	Select the preferred WAN link type to associate with the SLA profile. The options are Any, MPLS, and Internet. Any is the default value. Select the preferred path (MPLS, Internet, or Any) to be used for site-to-site traffic. If a WAN link type that matches the preferred path is enabled for site-to-site traffic, then that WAN link type is used for site-to-site traffic. If you specify that any path can be used, then there is no preference and all site-to-site-traffic-enabled links are used in a load-balancing mode.
Path Failover Criteria	Specify the failover criteria to determine how links are switched when the active links fail to meet the SLA criteria. In such cases, the traffic is routed to links that meet SLA criteria. Choose one of the following options: • **Does not meet one or more SLA parameters**—This triggers the path failover if any of the SLA parameters is violated. • **Does not meet all SLA parameters**—This triggers the path failover only when all the SLA parameters are violated.
Advanced Configuration-	
Rate Limiting	
Maximum Upstream Rate	Enter the maximum upstream rate (in Kbps) for all applications associated with the SLA profile. Range: 64 through 10,485,760 Kbps
Maximum Upstream Burst Size	Enter the maximum upstream burst size (in bytes). Range: 1 through 1,342,177,280 bytes
Maximum Downstream Rate	Enter the maximum downstream rate (in Kbps) for all applications associated with the SLA profile. Range: 64 through 10,485,760 Kbps
Maximum Downstream Burst Size	Enter the maximum downstream burst size (in bytes). Range: 1 through 1,342,177,280

Table 124: Fields on the Add SLA Profile page ***(continued)***

Field	Guidelines
Loss Priority	Select a loss priority based on which packets can be dropped or retained when network congestion occurs. The chances of a packet getting dropped is the highest when the loss priority is set to **High**. Other available values are **Medium High**, **Medium Low**, and **Low**.
Real Time Optimized Mode Setting **NOTE:** The following fields are applicable only for sites configured with the real-time-optimized SD-WAN mode.	
SLA Sampling	
Session-sampling %	Enter the matching percentage of sessions for which you want to run the passive probes.
SLA-violation-count	Enter the number of SLA violations after which you want CSO to switch paths. The range is 1 through 32.
Sampling-period	Enter the sampling period, in seconds, for which the SLA violations are counted. The range is 2 through 60.
Switch-cool-off-period	Enter the waiting period, in seconds, only after which you want the link switch to happen if an active link comes back online. This parameter helps prevent frequent switching of traffic between active and backup links. The range is 5 through 300.

RELATED DOCUMENTATION

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About the SLA-Based Steering Profiles Page | **335**

Editing and Deleting SLA-Based Steering Profiles | **346**

Editing and Deleting SLA-Based Steering Profiles

IN THIS SECTION

- Editing an SLA-Based Steering Profile | 346
- Deleting SLA-Based Steering Profiles | 347

You can use the SLA-Based Steering Profiles page to edit and delete SLA profiles.

> **NOTE:** Only SP administrator can edit the SLA-Based steering profiles that are automatically created by Contrail Service Orchestration (CSO).

Editing an SLA-Based Steering Profile

To edit an SLA-based steering profile:

> **NOTE:** If you edit an SLA-based steering profile that is used in an SD-WAN policy intent, then that SD-WAN policy is marked for redeployment.

1. Select **Configuration > SLA-Based Steering Profiles**.

   The SLA-Based Steering Profiles page appears.

2. Select the SLA-based steering profile that you want to edit, and click the Edit (pencil)icon .

   The Edit SLA Profile page appears displaying the same fields that are presented when you add a SLA-based steering profile. For more information, see "Adding SLA-Based Steering Profiles" on page 339.

3. Modify the fields as needed.

> **NOTE:** You cannot edit the SLA-based steering profile name.

4. Click **OK**.

   You are returned to the SLA-Based Steering Profiles page. The modifications that you made are saved and a confirmation message is displayed.

Deleting SLA-Based Steering Profiles

You can delete the SLA-based steering profile if they are no longer needed. To delete one or more SLA-based steering profile:

> **NOTE:** You cannot delete an SLA-based steering profile if it is referenced by one or more SD-WAN policy intents.

1. Select **Configuration > SLA-Based Steering Profiles**.

   The SLA-Based Steering Profiles page appears.

2. Select the SLA-based steering profiles that you want to delete and click the delete (trash can) icon .

   A popup dialog appears asking you to confirm the deletion.

3. Click **Yes**.

   You are returned to the SLA-Based Steering Profiles page. The selected SLA-based steering profile is deleted and a confirmation message is displayed.

RELATED DOCUMENTATION

SLA Profiles and SD-WAN Policies Overview | 330
About the SLA-Based Steering Profiles Page | 335
Adding SLA-Based Steering Profiles | 339

About the Path-Based Steering Profiles Page

To access this page, select **Configuration > Path-Based Steering Profiles** in the Administration Portal.

In path-based steering profile, you can define the path (MPLS or Internet) that must be used for a given traffic type profile. You cannot configure SLA parameters or path failover criteria for a path-based steering profile. The traffic type profile must be in enabled state in order to be used in any profile.

You can use the Path-Based Steering Profiles page to view information about the path-based steering profiles for all tenants.

Tasks You Can Perform

You can perform the following tasks from this page:

- View details of path-based steering profiles for all tenants.
- Add path-based steering profiles for all tenants. See "Adding Path-Based Steering Profiles" on page 351.
- Edit or delete a path-based steering profiles. See "Editing and Deleting Path-Based Steering Profiles" on page 353.
- Show or hide columns that contain information about path-based steering profiles—Click the **Show Hide columns** icon in the top right corner of the page and select columns that you want to view on the page.
- Search for path-based steering profiles using keywords. Click the search icon. Enter partial text or full text of the keyword in the search bar and press Enter. The search results are displayed.

Field Descriptions

Table 125 on page 348 shows the descriptions of the fields on the Path-Based Steering Profiles page.

Table 125: Fields on the Path-Based Steering Profiles Page

Field	Description	Displayed on
Name	Name of the path-based-steering profile.	Path-Based Steering Profiles Page (Path Profiles List tab) Detail for *Path-Profile-Name* pane

Table 125: Fields on the Path-Based Steering Profiles Page *(continued)*

Field	Description	Displayed on
Traffic Type Profile	Indicates the traffic type profile associated with the path-based-steering profile. • VOICE-VIDEO • HIGH_PRIORITY_VIDEO • HOSTED_AV • PREMIUM_INTERNET • INTERNET	Path-Based Steering Profiles Page (Path Profiles List tab) Detail for *Path-Profile-Name* pane
Path Preference	The preferred path for the SLA profile. The available options are: • MPLS • Internet	Path-Based Steering Profiles Page (Path Profiles List tab) Detail for *Path-Profile-Name* pane
Created by	The name of the user who created the path profile.	Path-Based Steering Profiles Page (Path Profiles List tab)
Priority	Priority of the path-based steering profile. A value zero (0) indicates lower priority and one (1) indicates highest priority.	Detail for *Path-Profile-Name* pane
Packet Loss	Target packet loss for the SLA profile.	Detail for *Path-Profile-Name* pane
RTT	Target round-trip time (RTT) for the SLA profile.	Detail for *Path-Profile-Name* pane
Jitter	Target jitter for the SLA profile.	Detail for *Path-Profile-Name* pane
SLA Probe Match	Indicates whether the profile requires the SLA probe to match all SLA criteria (All) or not (Any) .	Detail for *Path-Profile-Name* pane
Session-sampling %	Indicates the matching percentage of sessions for which you want to run the passive probes.	Detail for *Path-Profile-Name* pane
SLA Violation Counts	Indicates the number of SLA violations after which you want CSO to switch paths.	Detail for *Path-Profile-Name* pane
Sampling Period	The sampling period, in milliseconds, for which the path-based steering profile violations are counted.	Detail for *Path-Profile-Name* pane

Table 125: Fields on the Path-Based Steering Profiles Page *(continued)*

Field	Description	Displayed on
Switch Cool-off Period	The waiting period, in milliseconds, only after which you want the link switch to happen if an active link comes back online. This parameter helps prevent frequent switching of traffic between active and backup links.	Detail for *Path-Profile-Name* pane
Path Failover Criteria	Indicates the path failover criteria for link switching. Path failover occurs when any (Any)of the path-based steering profile parameters is violated or when all (All) the path-based steering profile parameters are violated.	Detail for *Path-Profile-Name* pane
Maximum Upstream Rate	The maximum upstream rate (in Kbps) for all applications associated with the path-based steering profile.	Detail for *Path-Profile-Name* pane
Maximum Upstream Burst Size	The maximum upstream burst size (in bytes).	Detail for *Path-Profile-Name* pane
Maximum Downstream Rate	The maximum downstream rate (in Kbps) for all applications associated with the path-based-steering profile.	Detail for *Path-Profile-Name* pane
Maximum Downstream Burst Size	The maximum downstream burst size (in bytes).	Detail for *Path-Profile-Name* pane

RELATED DOCUMENTATION

SLA Profiles and SD-WAN Policies Overview | 330

Adding Path-Based Steering Profiles

You can use the Add Path Profile page to add a new path-based steering profile, and specify the traffic type profile, path preference, and advanced configuration for the profile.

To add a path-based steering profile:

1. Select **Configuration > Path-Based Steering Profiles**.

   The Path-Based Steering Profiles page appears.

2. Click the add (**+**) icon.

   The Add Path Profile page appears.

3. Enter the path-based steering profile information according to the guidelines provided in Table 126 on page 351.

   > **NOTE:** Fields marked with an asterisk (*) are mandatory.

4. Click **OK** .

   You are returned to the Path-Based Steering Profiles page and a confirmation message indicating that the path-based steering profile was added is displayed. The page refreshes to display the path-based steering profile that you added.

   > **NOTE:** After you add a path-based steering profile, you must add an SD-WAN policy intent that references the path-based steering profile in order to enable site-to-site traffic.

Table 126: Fields on the Add Path Profile page

Field	Guidelines
Name	Enter a unique string that can contain alphanumeric characters and hyphens (-); the maximum length is 15 characters.
Traffic Type Profile	Choose a traffic type profile to apply the class-of-service configuration and priority to the SLA profile. You can select a traffic type profile only when it is in the **Enabled** state.

Table 126: Fields on the Add Path Profile page *(continued)*

Field	Guidelines
Path Preference	Select the preferred WAN link type to associate with the SLA profile. The options are MPLS, and Internet.
Advanced Configuration	
Maximum Upstream Rate	Enter the maximum upstream rate (in Kbps) for all applications associated with the SLA profile. Range: 64 through 10,485,760 Kbps
Maximum Upstream Burst Size	Enter the maximum burst size (in bytes). Range: 1 through 1,342,177,280 bytes
Maximum Downstream Rate	Enter the maximum downstream rate (in Kbps) for all applications associated with the SLA profile. Range: 64 through 10,485,760 Kbps
Maximum Downstream Burst Size	Enter the maximum burst size (in bytes). Range: 1 through 1,342,177,280 bytes
Loss Priority	Select a loss priority based on which packets can be dropped or retained when network congestion occurs. The chances of a packet getting dropped is the highest when the loss priority is set to **High**. Other available values are **Medium High**, **Medium Low**, and **Low**.

RELATED DOCUMENTATION

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About the Path-Based Steering Profiles Page | 348

Editing and Deleting Path-Based Steering Profiles | 353

Editing and Deleting Path-Based Steering Profiles

IN THIS SECTION

- Editing a Path-Based Steering Profile | 353
- Deleting a Path-Based Steering Profile | 354

You can use the Path-Based Steering Profiles page to edit and delete path-based steering profiles.

Editing a Path-Based Steering Profile

To edit a path-based steering profile:

> **NOTE:** If you edit a path-based steering profile that is used in an SD-WAN policy intent, then that SD-WAN policy is marked for redeployment.

1. Select **Configuration > Path-Based Steering Profiles**.

   The Path-Based Steering Profiles page appears.

2. On the Path Profiles tab, select the path-based steering profile that you want to edit.

3. Click the edit (pencil) icon.

   The Edit Path Profile page appears displaying the same fields that are presented when you add a path-based steering profile. For more information, see "Adding Path-Based Steering Profiles" on page 351.

4. Modify the fields as needed.

   > **NOTE:** You cannot edit the path profile name.

5. Click **OK**.

You are returned to the Path-Based Steering Profiles page. The modifications that you made are saved and a confirmation message is displayed..

Deleting a Path-Based Steering Profile

You can delete path-based steering profiles if they are no longer needed. To delete one or more path-based steering profiles:

> **NOTE:** You cannot delete a path-based steering profile if it is referenced by one or more SD-WAN policy intents.

1. Select **Configuration > Path-Based Steering Profiles**.

   The Path-Based Steering Profiles page appears.

2. On the Path Profiles List tab, select the path profiles that you want to delete.

3. Click the delete (trash can) icon.

   A popup dialog appears asking you to confirm the deletion.

4. Click **Yes**.

   You are returned to the Path-Based Steering Profiles page. The selected path-based steering profiles are deleted and a confirmation message is displayed.

RELATED DOCUMENTATION

SLA Profiles and SD-WAN Policies Overview | 330
About the Path-Based Steering Profiles Page | 348
Adding Path-Based Steering Profiles | 351

About the Breakout Profiles Page

IN THIS SECTION

- Tasks You Can Perform | 355
- Breakout Profiles Field Descriptions | 356

To access this page, click **Configuration > SD-WAN Breakout Profiles**.

You can use the Breakout Profiles page to view existing breakout profiles, add local, backhaul, and cloud breakout profiles, edit breakout profiles, and delete breakout profiles. You can also add settings for cloud breakout, edit cloud breakout settings, assign the settings to one or more sites, detach the settings from one or more sites, and delete the settings.

The breakout profiles are displayed on the Breakout Profiles tab and the cloud breakout settings are displayed on the Cloud Breakout Settings tab.

Tasks You Can Perform

You can perform the following tasks from this page:

- View existing breakout profiles—See Table 127 on page 356 for a description of the fields.
- View the details of a breakout profile—On the Breakout Profiles tab, select a breakout profile and from the More menu, select **Detail View**. The Detail for *Breakout-Profile-Name* pane appears on the right-hand side of the page. See Table 127 on page 356 for a description of the fields on this pane.
- Add a breakout profile—See "Editing and Deleting Breakout Profiles" on page 359.
- Edit and delete a breakout profile—See "Adding Breakout Profiles" on page 357.

Breakout Profiles Field Descriptions

Table 127: Breakout Profiles Field Descriptions

Field	Description	Displayed On
Name	Name of the breakout profile.	Breakout Profiles page (Breakout Profiles tab) Detail for *Breakout-Profile-Name* pane
Type	Indicates whether the breakout profile is for local breakout (underlay) or backhaul (central breakout) or cloud breakout.	Breakout Profiles page (Breakout Profiles tab) Detail for *Breakout-Profile-Name* pane
Description	Description of the breakout profile.	Breakout Profiles page (Breakout Profiles tab)
Path Preference	Indicates the preferred path to be used for breakout traffic: • MPLS • Internet • Any, which indicates no preference.	Breakout Profiles page (Breakout Profiles tab)
Added by	Username of the user who added the breakout profile.	Breakout Profiles page (Breakout Profiles tab)
FqName	Internal name of the breakout profile.	Breakout Profiles page (Breakout Profiles tab)
Rate Limiting	Indicates whether rate limiting is enabled or disabled for the breakout profile.	Detail for *Breakout-Profile-Name* pane
Downstream Rate	Indicates the maximum downstream rate (in Kbps) for all cacheable applications associated with the breakout profile.	Detail for *Breakout-Profile-Name* pane
Downstream Burst Size	Indicates the maximum downstream burst size (in bytes) for all cacheable applications associated with the breakout profile.	Detail for *Breakout-Profile-Name* pane
Upstream Rate	Indicates the maximum upstream rate (in Kbps) for all cacheable applications associated with the breakout profile.	Detail for *Breakout-Profile-Name* pane

Table 127: Breakout Profiles Field Descriptions *(continued)*

Field	Description	Displayed On
Upstream Burst Size	Indicates the maximum upstream burst size (in bytes) for all cacheable applications associated with the breakout profile.	Detail for *Breakout-Profile-Name* pane
Loss Priority	Indicates the loss priority associated with the breakout profile. The loss priority determines which packets are dropped or retained when network congestion occurs.	Detail for *Breakout-Profile-Name* pane

RELATED DOCUMENTATION

Adding Breakout Profiles

You use the Add Breakout Profile page to add a local breakout (underlay), backhaul, or a cloud breakout profile. A cloud breakout profile is added by Contrail Service Orchestration (CSO) by default.

To add a breakout profile:

1. Select **Configuration > SD-WAN Breakout Profiles**.

   The Breakout Profiles page appears.

2. On the **Breakout Profiles** tab, click the add icon (**+**).

   The Add Breakout Profile page appears.

3. Complete the configuration according to the guidelines provided in Table 128 on page 358.

   NOTE: Fields marked with an asterisk (*) are mandatory.

4. Click **OK**.

   You are returned to the Breakout Profiles page (Breakout Profiles tab) and a confirmation message indicating that the breakout profile was added is displayed. The page refreshes to display the breakout profile that you added.

NOTE: After you add a breakout profile, you must add an SD-WAN policy intent that references the breakout profile in order to enable breakout traffic.

Table 128: Fields on the Add Breakout Profile Page

Field	Description
Type	Select the type of breakout profile that you want to add: • **Local Breakout (Underlay)**—Select this option if you want traffic to break out locally (on the underlay) from the site. • **Backhaul**—Select this option if you want traffic to break out through a hub or a enterprise hub (if configured). • **Local Breakout (Cloud)**—Select to break out traffic through a cloud-based security platform. Currently, Zscaler is the only cloud-based security platform supported.
Name	Enter a unique name for the breakout profile. You can use alphanumeric characters and hyphens (-); the maximum length is 15 characters.
Description	Enter a description for the breakout profile.
Traffic Type Profile	Select a traffic type profile to apply class of service parameters to the breakout traffic. You can select only a traffic type profile that is enabled.
Preferred Path	Select the preferred path (MPLS, Internet, or Any) to be used for breaking out the traffic. If a WAN link type that matches the preferred path is enabled for breakout, then that WAN link type is used for breakout traffic. If you specify that any path can be used, then there is no preference and all breakout-enabled links are used in a load-balancing mode.
Advanced Configuration	
Rate Limiting	Click the toggle button to enable rate limiting of breakout traffic for cacheable applications. By default, rate limiting is disabled. If you enable rate limiting, you must specify the upstream and downstream parameters, and the loss priority.
Upstream Rate	Specify the maximum upstream rate (in Kbps) for all cacheable applications associated with the breakout profile.

Table 128: Fields on the Add Breakout Profile Page *(continued)*

Field	Description
Upstream Burst Size	Specify the maximum size (in bytes) of a steady stream of traffic sent at average rates that exceed the upstream rate limit for short periods.
Downstream Rate	Specify the maximum downstream rate (in Kbps) for all cacheable applications associated with the breakout profile.
Downstream Burst Size	Specify the maximum size (in bytes) of a steady stream of traffic sent at average rates that exceed the downstream rate limit for short periods.
Loss Priority	Select a loss priority based on which packets are dropped or retained when network congestion occurs. Packet drops are most likely when the loss priority is High and least likely when the loss priority is Low.

RELATED DOCUMENTATION

Editing and Deleting Breakout Profiles

IN THIS SECTION

- Editing Breakout Profiles | 360
- Deleting Breakout Profiles | 360

On the Breakout Profiles page, you can edit breakout profiles and delete breakout profiles that are not used in SD-WAN policy intents.

Editing Breakout Profiles

To edit a breakout profile:

> **NOTE:** If you edit a breakout policy that is used in an SD-WAN policy intent, then that SD-WAN policy is marked for redeployment.

1. Select **Configuration > SD-WAN > Breakout Profiles**.

   The Breakout Profiles page appears.

2. On the **Breakout Profiles** tab, select the breakout profile that you want to edit.

3. Click the edit (pencil) icon.

   The Edit Breakout Profile page appears displaying the same fields that are presented when you add a breakout profile. For more information, see *Adding Breakout Profiles*.

4. Modify the fields as needed.

   > **NOTE:** You can modify only some fields when you are editing a breakout profile

5. Click **OK**.

   You are returned to the Breakout Profiles page. The modifications that you made are saved and a confirmation message is displayed.

Deleting Breakout Profiles

To delete a breakout profile that is not used in an SD-WAN policy intent:

1. Select **Configuration > SD-WAN > Breakout Profiles**.

   The Breakout Profiles page appears.

2. On the **Breakout Profiles** tab, select the breakout profile that you want to delete.

3. Click the delete (trash can) icon.

A popup dialog appears asking you to confirm the deletion.

4. Click **Yes**.

   You are returned to the Breakout Profiles page. The selected breakout profile is deleted and a confirmation message is displayed.

RELATED DOCUMENTATION

9

CHAPTER

Managing Licenses

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Uploading a Device License File | **364**

Editing and Deleting Device Licenses | **365**

Pushing a License to Devices | **367**

About the CSO Licenses Page | **368**

Add a CSO License | **370**

Edit and Delete CSO Licenses | **373**

Assign CSO Licenses, and Update or Unassign CSO License Assignments | **375**

About the Device License Files Page

To access this page, click **Administration > Licenses> Device Licenses**.

You can use the Device License Files page to upload licenses for devices and virtual network services from your local file system. Each device license file should contain only one license key. A license key is required to enable various features including virtual network services such as application-based routing, application monitoring, and vSRX security features.

Tasks You Can Perform

You can perform the following tasks from this page:

- Add device license files. See "Uploading a Device License File" on page 364.
- Edit and delete device license entries. See "Editing and Deleting Device Licenses" on page 365.
- Push licenses to devices. See "Pushing a License to Devices" on page 367.
- View details of a device license. Click the details icon that appears when you mouse over the row for each license file or click **More > Details**.
- Show or hide columns about the device license files—Click the **Show Hide columns** icon in the top right corner of the page and select columns that you want to view on the page.
- Sort the device license files.
- Search an object about the device license files—Click the Search icon in the top right corner of the page. You can enter partial text or full text of the keyword in the text box and press **Enter**. The search results are displayed on the same page.

Field Descriptions

Table 129 on page 363 describes the fields on the License Files page.

Table 129: Fields on the License Files Page

Field	Description
File Name	Displays the filename of the license. Example: license_Image_v1.txt

Table 129: Fields on the License Files Page *(continued)*

Field	Description
Description	Displays the description of the license. Example: License file for application routing.
Tenant	Displays the name of the tenant if the license is associated with a tenant. Example: Tenant 1
Uploaded By	Displays the administrator who uploaded the license. Example: test_admin
Uploaded	Displays the date and time when the license was uploaded. Example: Jun 5, 2018, 12:41:08 PM
Devices	Displays the number of devices to which the license is pushed. Click the number to view the devices to which the license is pushed.

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Editing and Deleting Device Licenses | 365
Pushing a License to Devices | 367

Uploading a Device License File

To upload a device license file:

1. Click **Administration > Licenses > Device Licenses**.

   The Device License Files page appears.

2. Click the plus icon (+).

   The Add Device Licenses page appears.

3. In the Device License File field, specify the location of the license file that you want to upload. Alternatively, you can click Browse to navigate to the file location and select the file.

   NOTE: Each license file should contain only one license key.

4. (Optional) From the Tenants list, select the tenant to which you want to associate the license file.

   If you associate a license with a tenant, you can apply that license only to devices that belong to that tenant. If a tenant has licenses associated with the tenant, when a device is activated during ZTP, a matching license from the licenses associated with the tenant is downloaded to the device.

   You can apply a license that is not associated with a tenant to any device of any of the tenants. During ZTP, when a device is activated for a tenant that does not have any license associated with it, a matching license from the licenses that are not associated with any tenant is downloaded to the device.

5. In the Description field, enter a description for the license that you want to upload.

6. Click **OK** to upload the license.

   You are returned to the Device License Files page.

RELATED DOCUMENTATION

About the Device License Files Page | 363
Device Images Overview | 273

Editing and Deleting Device Licenses

IN THIS SECTION

Editing a Device License Entry | 366
Deleting a Device License | 366

The following sections describe the procedure for editing and deleting uploaded device licenses:

Editing a Device License Entry

You can edit a device license entry to modify the description for the license file.

1. Click **Administration > Licenses > Device Licenses**.

   The Device License Files page appears.

2. Select the device license for which you want to modify the description and click the Edit icon.

   The Update Device License page appears.

3. Update the description.

4. Click **OK** to save the changes. To discard the changes, click **Cancel**.

   If you click **Cancel**, a confirmation message appears. Click **Yes** to confirm that you want to cancel the update.

Deleting a Device License

To delete a device license:

1. Click **Administration > Licenses > Device Licenses**.

   The Device License Files page appears.

2. Select the device license that you want to delete and click the delete icon.

3. In the confirmation message, click **Yes** to delete the device license.

   To cancel the delete operation, click **No**.

Pushing a License to Devices

You can push licenses on to devices from the Licenses page of the Administration portal. If a license is associated with a tenant, you can push that license only to devices associated with that tenant. However, if no tenant is associated with a license, you can apply the license to any device that belongs to any tenant.

When a license is applied to a device, the license information is added to the device object. When the same license is pushed to the device again, the a device-level error message is created. Similarly, if a pushed license does not match a device, the device generates an error message.

To push a license to a device:

1. Click **Administration > Licenses > Device Licenses**.

   The License Files page appears.

2. Select the license that you want to push to a device.

   The **Push License** button is enabled.

3. Click the **Push License** button.

   The Push License page appears.

4. From the Tenants list, select the tenant associated with the site and devices to which you want to apply the license.

   > **NOTE:** If the license has already been associated with a tenant, you cannot select a different tenant. You can apply the license only to the sites and devices associated with the tenant.

   Sites and devices associated with the selected tenant appear.

5. Select the sites and devices to which you want to apply the license and click **Push Licenses**.

   CSO applies the license to the selected devices.

RELATED DOCUMENTATION

About the Device License Files Page | 363

Editing and Deleting Device Licenses | 365

About the CSO Licenses Page

To access this page, click **Administration > Licenses > CSO Licenses**.

You use the CSO Licenses page in Administration Portal to manage CSO licenses.

Tasks You Can Perform

You can perform the following tasks from this page:

> **NOTE:** The tasks that you can perform depends on your role, so some tasks are available only with users with a specific role, which is indicated below.

- Group CSO licenses by sales order or SKUs:
  - Click **Group By** and select **Sales Order** to group CSO licenses by sales orders. By default, CSO licenses are grouped by sales order.
  - Click **Group By** and select **SKU** to group CSO licenses by SKUs.
- (SP Administrator user only) Add CSO licenses for a tenant or an operating company (OpCo)—See "Add a CSO License" on page 370.
- (SP Administrator user only) Edit a license—See "Edit and Delete CSO Licenses" on page 373.
- (SP Administrator user only) Delete a license—See "Edit and Delete CSO Licenses" on page 373.
- (OpCo Administrator user only) Assign CSO licenses to one or more tenants—See "Assign CSO Licenses, and Update or Unassign CSO License Assignments" on page 375.
- (OpCo Administrator only) Update or unassign CSO license assignments—See "Assign CSO Licenses, and Update or Unassign CSO License Assignments" on page 375.
- (OpCo Administrator user only) View the tenants previously assigned to a CSO license—Click *assigned-number* corresponding to a CSO license. The View Assigned page appears displaying the tenants and quantity assigned to each tenant.
- Search for CSO licenses by using keywords—Click the search icon and enter the search term in the text box and press Enter. The search results are displayed on the same page.

  You can search using license SKU, sales order, type, tier, or device class.
- Sort CSO licenses—Click a column name to sort based on the column name.

> **NOTE:** Sorting is applicable only to some fields.

- Show or hide columns—Click the **Show Hide Columns** icon at the top right corner of the page and select the columns that you want displayed on the CSO Licenses page.

Field Descriptions

Table 130 on page 369 describes the fields on the CSO Licenses page.

Table 130: Fields on the CSO Licenses page

Field	Description
License SKU	Displays the license SKU name; for example, S-CSO-C-S1-A-3.
OpCo/Tenant	Displays the operating company or a tenant to which the license SKU is applicable.
Sales Order	Sales order number; for example, 15563238.
Type	Displays whether the license is for an on-premise installation or for a cloud-hosted CSO installation.
Tier	Support tier associated with the license (standard or advanced).
Device Class	Class of the Juniper device associated with the license; for example, B-class.
SSRN	Software support reference number (SSRN), which is necessary to identify your purchase order when you contact Juniper Networks for support.
Start Date	Date (in MMM DD , YYYY format) from which the license is valid; for example, Aug 29, 2019.
End Date	Date (in MMM DD , YYYY format) up to which the license is valid. CSO calculates the end date based on the validity of the license SKU.

Table 130: Fields on the CSO Licenses page *(continued)*

Field	Description
Device Quantity	For a license assigned to an OpCo, displays the total number of devices that the OpCo Administrator can assign for the license. For a license assigned to a tenant, displays the total number of devices that the tenant can add.
Available	For a license assigned to an OpCo, displays the available number of devices (that the tenant can add) that the OpCo Administrator can assign to tenants.
Assigned	**NOTE:** This field is applicable only for licenses assigned to an OpCo. Number of devices (that the tenant can add) that are already assigned to one or more tenants: • An OpCo Administrator can click *assigned-number* to view the tenants and quantity assigned for each tenant. The View Assigned page appears displaying the tenants and quantity assigned to each tenant. • If the CSO license is not assigned to any tenants, an OpCo Administrator can click **Assign** to assign the license to one or more tenants. See "Assign CSO Licenses, and Update or Unassign CSO License Assignments" on page 375.

RELATED DOCUMENTATION

About the Device License Files Page | 363

Add a CSO License

To maintain a record of CSO licenses purchased by tenants or operating companies (OpCos), a user with the SP Administrator role can add the CSO license for a tenant or an OpCo from the CSO Licenses page.

To add a CSO license:

1. In Administration Portal, select **Administration** > **Licenses** > **CSO Licenses**.

   The CSO Licenses page appears.

2. Click the add (+) icon.

   The Add CSO License page appears.

3. Complete the configuration according to the guidelines in Table 131 on page 371.

   NOTE: Fields marked with an asterisk (*) are mandatory.

4. Click **OK**.

   You are returned to the CSO Licenses page. A job is triggered to add the license and a confirmation message appears at the top of the page. After the job completes successfully, a confirmation message appears and the page refreshes to display the newly added license SKUs.

Table 131: Fields on the Add CSO License page

Setting	Guideline
Add License	Select whether you are adding the license for a tenant or for an operating company.
Tenant	If you are adding the license for a tenant, select the name of the tenant from the drop-down list.
Operating Company	If you are adding the license for an OpCo, select the name of the OpCo from the drop-down list.
Sales Order	Specify the sales order number; For example, 15563238.
SSRN	Specify the software support reference number (SSRN). This information is necessary to identify your sales order if you contact Juniper Networks for support.
Start Date	Specify the start date (in MM/DD/YYYY format) from which the license is effective.

Table 131: Fields on the Add CSO License page *(continued)*

Setting	Guideline

License SKUs	To add one or more license SKUs:
	1. Click the add (+) icon.
	A row appears inline in the License SKU List grid.
	2. In the **License SKU** field, enter the SKU name.
	The SKU format is as follows:
	S-CSO-*Release-Type-License-Type-Device-Class-License-Period*, where:
	• S, which indicates that the SKU is for software.
	• CSO, which indicates that the SKU is for CSO.
	• *Release-Type*, which indicates whether the SKU is for a cloud release (C) or an on-premise release (P).
	• *License-Type*, which indicates whether the license is standard (S1) or advanced (A1)
	• *Device-Class*
	  ◦ A denotes SRX300, SRX320, SRX340, SRX345, vSRX (2 vCPUs), NFX150 devices
	  ◦ B denotes NFX250 (2 vCPUs), SRX550 High Memory Services Gateway (SRX550M), SRX1500, vSRX (5 vCPUs) devices.
	  ◦ C denotes NFX250 (8 vCPUs), SRX4100, SRX4200, vSRX (9 or 17 vCPUs) devices.
	  ◦ D denotes EX2300, EX3400, and EX4300 switches
	• *License-Period*, which indicates the term for the CSO license (1, 3, or 5 years).
	3. In the **Device Quantity** field, enter the maximum number of on-premise spoke sites that a tenant is authorized to create. You must enter a non-zero number to proceed.
	4. Click **√** (check mark) to save your changes.
	The license SKU is saved and displayed in the grid.
	5. (Optional) Repeat the preceding steps if you want to add more license SKUs.
	You can modify a license SKU by selecting the corresponding row and clicking the edit (pencil) icon.

RELATED DOCUMENTATION

About the CSO Licenses Page | 368

Edit and Delete CSO Licenses

IN THIS SECTION

Edit a CSO License | 373
Delete a CSO License | 374

In Administration Portal, users with the SP Administrator role can edit or delete CSO licenses.

Edit a CSO License

To edit a CSO license:

1. In Administration Portal, select **Administration** > **Licenses** > **CSO Licenses**.

   The CSO Licenses page appears.

2. Select the license that you want to edit and click the edit (pencil) icon.

   The Edit CSO License page appears.

3. Modify the license according to the guidelines in Table 132 on page 374.

   NOTE: Fields marked with an asterisk (*) are mandatory.

4. Click **OK**.

   You are returned to the CSO Licenses page. A job is triggered to update the license and a confirmation message appears at the top of the page. After the job completes successfully, a confirmation message appears and the page refreshes to display the modified information.

Table 132: Fields on the Edit CSO License page

Setting	Guideline
Tenant/OpCo	Displays the tenant or OpCo to which the license is applicable. You cannot modify this field.
Sales Order	Displays the sales order number associated with the license SKU. You cannot modify this field.
SSRN	Displays the software support reference number (SSRN) associated with the license SKU. If you modify the SSRN, the modified SSRN is applicable to all license SKUs associated with the sales order.
Start Date	Displays the start date (in MM/DD/YYYY format) from which the license is effective. If you modify the start date, the modified start date is applicable to all license SKUs associated with the sales order.
SKU Name	Displays the license SKU name. You cannot modify this field.
Assigned	Displays the quantity that is already assigned to tenants. You cannot modify this field.
Quantity	Displays the quantity that is available to be assigned tenants.

Delete a CSO License

In Administration Portal, users with the SP Administrator role can delete CSO licenses.

To delete a CSO license:

1. In Administration Portal, select **Administration** > **Licenses** > **CSO License**:

   The CSO Licenses page appears.

2. Select the license that you want to delete and click the delete (trash can) icon.

   A popup dialog appears asking you to confirm the deletion.

3. Click **Yes** to confirm the delete operation.

   You are returned to the CSO Licenses page. A job is triggered to delete the license and a confirmation message appears at the top of the page. After the job completes successfully, a confirmation message appears at the top of the page.

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About the CSO Licenses Page | 368

Assign CSO Licenses, and Update or Unassign CSO License Assignments

IN THIS SECTION

Assign CSO Licenses to Tenants | 375
Update or Unassign CSO License Assignments | 377

Users with the Operating Company (OpCo) Administrator role can:

- Assign a CSO license to one or more tenants.
- Update the assignment of a CSO license that was previously assigned to one or more tenants.
- Unassign a CSO license that was previously assigned to a tenant.

Assign CSO Licenses to Tenants

To assign a CSO license that is not yet assigned to a tenant:

1. Select **Administration** > **Licenses** > **CSO Licenses**.

   The CSO Licenses page appears.

2. Click the **Assign** link corresponding to the license that you want to assign (in the Assigned column).

   The Assign CSO License page appears.

3. Configure the fields according to the guidelines provided in Table 133 on page 376.

4. Click **Assign**.

   CSO validates the quantities that you assigned against the total quantity for the license:

- If the sum of assigned quantities is greater than the total quantity, an error message is displayed. You must then modify the assigned quantities to proceed.
- If the sum of assigned quantities is less than or equal to the total quantity, a job is triggered. You are returned to the CSO Licenses page and a confirmation message is displayed on the top of the page. After the job completes successfully, the CSO Licenses page displays the updated information in the Available and Assigned columns.

Table 133: Fields on the Assign CSO License page

Field	Description
License Information	Displays the following information for the license: • Sales Order • License SKU • Start Date
License Assignment	
Device Quantity	Displays the total quantity that can be assigned to tenants.
Available	Displays the available quantity that can be allocated to tenants.
Tenants List	To assign the license to one or more tenants: 1. Click the **+** icon. A row is added in the grid and selected. 2. In the **Tenant** column, select the tenant to which you want to assign the license. 3. In the **Device Quantity** column, enter the quantity that you want to assign to the tenant. 4. Click **√** (check mark) to save your changes. 5. (Optional) Click the pencil icon to modify the tenant name or the quantity and click **√** (check mark) to save your changes. 6. (Optional) Repeat the steps if you want to assign the license to additional tenants.

Update or Unassign CSO License Assignments

For a CSO license that is already assigned to one or more tenants, to update or unassign the license assignment:

1. Select **Administration** > **Licenses** > **CSO Licenses**.

   The CSO Licenses page appears.

2. Select the license for which you want to update or unassign the license assignment and click the **Update Assignment** button.

   The Assign CSO License page appears.

3. From the list of tenants displayed in the grid, select the tenant (row) and do one of the following:

   - To update the license assignment:

     a. Click the edit (pencil) icon.

     b. In the **Device Quantity** column, modify the device quantity.

     c. Click **√** (check mark) to save your changes.

        The modification that you made is displayed in the grid.

   - To unassign the license assignment:

     a. Click the delete (trash can) icon.

        A popup appears asking you to confirm the unassign operation.

     b. Click **Yes**.

        The license is unassigned from the tenant that you selected and the tenant is removed from the grid.

4. (Optional) If the available quantity is non-zero, you can assign the license to additional tenants. See Table 133 on page 376 for more information.

5. Click **Assign**.

   CSO validates the modifications against the total device quantity for the license:

   - If the sum of assigned quantities is greater than the total quantity, an error message is displayed. You must then modify the assigned quantities to proceed.

- If the sum of assigned quantities is less than or equal to the total quantity, a job is triggered and you are returned to the CSO Licenses page. A confirmation message is displayed on the top of the page.

  After the job completes successfully, the CSO Licenses page displays the updated information in the Available and Assigned columns.

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10

CHAPTER

Managing Users and Roles

Role-Based Access Control Overview | **380**

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Add User-Defined Roles for Service Provider, OpCo, and Tenant Users | **393**

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Role-Based Access Control Overview

Contrail Service Orchestration supports the authentication and authorization of users. Service Provider, OpCo, and tenant users access the pages within the unified Administration Portal and Customer Portal based on their role and access permissions.

In addition to predefined roles, CSO enables you to add object-based custom roles. You can create custom roles and assign access privileges (read, create, update, delete, and other actions) to each role.

Table 134 on page 380 shows predefined Service Provider, OpCo, and tenant roles and their access privileges.

Table 134: Roles and Access Privileges

Role	Role Scope	Access Privileges
SP Admin	Service Provider	Users with the SP Admin role have full access to the Administration Portal UI or API capabilities. They can use the UI or APIs to add one or more users with SP Admin, SP Operator, and custom roles. They can onboard tenants, and add the first tenant user during the tenant onboarding process. They can also add tenant administrators or operators by switching the scope to a specific tenant. **NOTE:** When the SP administrator creates one or more operating companies under the service provider, the service provider is called a global service provider and the SP administrator is called the global SP administrator.
SP Operator	Service Provider	Users with the SP Operator role have read-only access to the Administration Portal UI and APIs.
Tenant Admin	Tenant	Users with the Tenant Admin role have full access to the Customer Portal UI and APIs. They can add one or more users with the Tenant Administrator or Tenant Operator roles.
Tenant Operator	Tenant	Users with the Tenant Operator role have read-only access to the Customer Portal UI and APIs.
OpCo Admin	Operating Company	Users with the OpCo Admin role have full access to the OpCo's Administration Portal UI and API capabilities. They can use the UI or APIs to add one or more users with OpCo Admin, OpCo Operator, and custom roles. They can onboard tenants, and add the first tenant user during the OpCo's tenant onboarding process. They can also add tenant administrators or operators by switching the scope to a specific tenant.

Table 134: Roles and Access Privileges *(continued)*

Role	Role Scope	Access Privileges
OpCo Operator	Operating Company	Users with the OpCo Operator role have read-only access to the OpCo's Customer Portal UI and APIs.

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Authentication Methods Overview | 56

About the Users Page in Administration Portal

To access the Users page, select **Administration** > **Users** in the Administration Portal.

Use this page to manage users in the Service Provider and Operating Company (OpCo) scopes.

For information about service provider and OpCo user roles and access permissions, see "Role-Based Access Control Overview" on page 380.

The information listed on the Users page changes depending on the authentication method configured:

- **Local** —The Users page lists all local users that you can add, edit, and delete.
- **Authentication and Authorization with SSO Server**—The Users page is not displayed because users are externally managed in the single sign-on (SSO) server.

Tasks You Can Perform

You can perform the following tasks from this page:

- Add a service provider user, or an OpCo user. See "Add Service Provider and OpCo Users" on page 383.
- Edit and delete a service provider user or an OpCo user. See "Edit and Delete Service Provider Users and OpCo Users" on page 386.

> **NOTE:** You can edit or delete the information for a tenant user or an OpCo tenant user from the Customer Portal.

- View details of users in the Service Provider and OpCo scopes. See Table 135 on page 382.
- Show or hide columns displayed on the page—Click the **Show Hide columns** icon in the top right corner of the table and select the columns that you want to view on the page.
- Reset password for a user. See "Resetting the Password for Service Provider, OpCo, and Tenant Users" on page 387.
- Search for a user—Click the Search icon in the top right corner of the table and enter the search text in the text box, and press Enter. The search results are displayed on the same page.

Field Descriptions

Table 135 on page 382 displays the fields on the Users page in the Service Provider and OpCo scopes.

Table 135: Fields on the Users Page

Field	Description
Username	Username of the user. Example: *xyz@example.com*
First Name	First name of the user.
Last Name	Last name of the user.
Status	Indicates whether the user can log in to CSO (enabled) or cannot log in to CSO (disabled).
Role	Depending on the scope selected, indicates the roles assigned to the service provider user or the OpCo user. By default, this column lists only one role assigned to the user. When a user is assigned more than one role, a ***+<integer>***icon (for example: +2) appears to the right of the role. The integer indicates the number of additional roles assigned to the user. Click on the integer to view the additional roles.
Last Login	Date and time (in MM/DD/YYYY HH:MM formats) when the user last logged into the Administration portal. Example: 07/22/2017 20:07 Date and time are not displayed when the user has not logged in to the Administration Portal.

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Role-Based Access Control Overview | 380

Add Service Provider and OpCo Users

Use the Add User page or Add OpCo User page in the Administration portal to add service provider or Operating Company (OpCo) users respectively. After you add a user, the user receives an e-mail with the initial login credentials.

In the service provider scope, you can create a user and assign the following roles or a combination of roles to the user:

- Service provider roles
- Service provider and OpCo roles.
- Service provider and tenant roles. If a user is assigned both service provider and tenant roles, then the user is a service provider user. The user can view all tenants and access tenant objects based on the access privileges assigned in the tenant roles.
- Service provider, OpCo, and tenant roles. If a user is assigned service provider, OpCo, and tenant roles, then the user is a service provider user. The user can view all tenants and OpCos, and access tenant and OpCo objects, based on the access privileges assigned in the tenant and OpCo roles.

> **NOTE:** Users with the SP Operator role have read-only access to Administration Portal, Customer Portal and APIs and they cannot add new users.

In the OpCo scope, you can create a user and assign the following roles or combination of roles to the user:

- OpCo roles
- OpCo and OpCo tenant roles

To add a service provider user or an OpCo user:

1. Click **Administration > Users**.

   The Users page appears.

2. Click the add icon (+) or click the **Add User** button. The Add User button appears when there are no users configured in the scope you have logged in.

In the Service Provider scope, the Add User page appears. In the OpCo scope, the Add OpCo User page appears.

3. Complete the configuration as described in Table 136 on page 384.

4. Click **OK** to save the changes or click **Cancel** to discard the changes.

   If you click OK, a confirmation message indicating that the user account is created appears and the user account is listed on the Users page.

   To enhance the security related to your login credentials, an automatically generated password is sent to the e-mail address that you have specified for the user. You are prompted to change the password after you log in with the automatically generated password. For more information about changing the password on first login, see "Changing the Password on First Login" on page 39.

Table 136: Fields on the Add User and Add OpCo User Pages

Field	Description
First Name	Enter the first name as a string of alphanumeric characters, some special characters [underscore (_) and period(.)] and spaces. The maximum length allowed is 32 characters.
Last Name	Enter the last name as a string of alphanumeric characters, some special characters [underscore (_) and period(.)] and spaces. The maximum length allowed is 32 characters.
Username (Email)	Enter a valid e-mail address in the *user@domain* format.
Status	Click the toggle button to enable or disable the user. By default, the status is enabled. A user can log in to CSO only when the status is enabled.

Table 136: Fields on the Add User and Add OpCo User Pages *(continued)*

Field	Description
Role	In the Service Provider scope, specify whether you want to assign specific roles to the user or make the user a Global Administrator: • **Select specific roles**—Select this option to assign specific roles to the user in the SP, OpCo, and tenant scopes, and assign one or more roles in the different scopes. To assign roles: 1. Click the scope in which you want to assign one or more roles to the user. The available roles are listed under the **Available** column. 2. Select one or more roles that you want to assign to the user and click the right-arrow icon to move the selected roles from the **Available** column to the **Selected** column. You can use the search icon on the top right of each column to search for role names. • **Make Global Administrator**—Select this option to make the user a Global Administrator. As a Global Administrator, the user has permissions to perform all administration tasks in the SP, OpCo, and tenant scopes. In the OpCo scope, you can only assign OpCo and OpCo tenant roles to a user. To assign roles: 1. Click the scope in which you want to assign one or more roles to the user. The available roles are listed under the **Available** column. 2. Select one or more roles that you want to assign to the user and click the right-arrow icon to move the selected roles from the **Available** column to the **Selected** column. You can use the search icon on the top right of each column to search for role names. To know more about the predefined roles for service provider, OpCo and tenant users, see "Role-Based Access Control Overview" on page 380.

RELATED DOCUMENTATION

Roles Overview | 388

Edit and Delete Service Provider Users and OpCo Users

IN THIS SECTION

- Edit Service Provider and OpCo Users | 386
- Delete Service Provider and OpCo Users | 387

You can edit the information about a service provider or an Operating Company (OpCo) user, and also delete users from Contrail Service Orchestration (CSO).

> **NOTE:** To edit and delete users, you should be assigned a role, such as an SP Admin or OpCo Admin, that allows you to edit and delete users.

Edit Service Provider and OpCo Users

To modify the information about a service provider user or an OpCo user:

1. Select **Administration > Users**.

   The Users page appears.

2. Select the user that you want to modify, and click the edit icon.

   In the Service Provider scope, the Edit User page appears. In the OpCo scope, the Edit OpCo User page appears.

3. Modify the parameters by following the guidelines provided in Table 136 on page 384.

   > **NOTE:** You cannot modify the **Username (E-mail)** field.

4. Click **OK** to save the changes or click **Cancel** to discard the changes.

If you click OK, a confirmation message indicating that the user information is successfully updated appears on top of the Users page.

Delete Service Provider and OpCo Users

To delete one or more service provider users or OpCo users:

1. Select **Administration > Users**.

   The Users page appears.

2. Select the users that you want to delete and click the delete icon.

   An alert message appears, asking you to confirm the delete operation.

3. Click **Yes** to delete the selected users or **No** to cancel the deletion.

   If you click **Yes**, a confirmation message indicating that the user account is deleted from CSO appears on top of the Users page.

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Roles Overview | 388

Resetting the Password for Service Provider, OpCo, and Tenant Users

•

As an SP administrator or OpCo administrator, you can reset the password for OpCo and tenant users. Also, users with the Update permission for user objects can reset the password for service provider, OpCo, and tenant users.

You must reset the password when a user's account is locked. A user's account is locked when the user enters password incorrectly for five times successively.

To reset the password:

1. Select **Administration > Users** in Administration Portal.

The Users page appears, displaying a list of service provider, OpCo, and tenant users.

2. Select the username for which you want to reset the password, and then select **More > Reset Password**.

   An alert message appears, asking you to confirm the reset password operation.

3. Click **Yes** to confirm the reset password operation.

   A confirmation message appears, indicating that the password is successfully reset, and CSO sends an e-mail with a link to reset the password to the e-mail address associated with the user ID for which you are resetting the password.

   > **NOTE:** The link is active only for 24 hours.

The user can set a new password by accessing the mail from CSO and use the new password to log in to CSO.

RELATED DOCUMENTATION

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Roles Overview

IN THIS SECTION

- Types of Roles | 389
- Role Scopes | 389
- Access Privileges | 390
- Relationship Between Users, Roles, and Access Privileges | 391
- Benefits of Roles in CSO | 391

A role is a function assigned to a user that defines the tasks that the user can perform within CSO. Each user can be assigned one or more roles depending on the tasks that the user is expected to perform.

User roles enable you to classify users based on the privileges to perform tasks on CSO objects. Roles assigned to a user determine the tasks and actions that the user can perform.

This topic contains the following sections:

Types of Roles

There are two types of roles: predefined roles and custom roles.

- **Predefined roles**—System-defined roles with a set of predefined access privileges assigned to a user to perform tasks within the CSO application. Predefined roles are created in the system during CSO installation. For more information about predefined roles, see "Role-Based Access Control Overview" on page 380.
- **Custom roles**—Object-based user-defined roles with a set of access privileges assigned to a user to perform tasks within the CSO application. Objects include menu and submenu items (for example, Resources, Devices, Images, and POPs) in the CSO application, from which you can create, edit, clone, and delete objects.

  Custom roles can be created by:

  - An SP administrator, OpCo administrator, or a tenant administrator.
  - A service provider user with the Create Role privilege. This user can create custom roles for service provider, tenant, and OpCo users.
  - A tenant user with the Create Role privilege. This user can create custom roles for tenant users.
  - An OpCo user with the Create Role privilege. This user can create custom roles for both OpCo and tenant users.

You can create custom roles and assign access privileges to each role by using the Roles page (**Administration > Roles**).

You can assign one or more roles to a user when you create or edit a user account. Each role can have one or more access privileges.

Role Scopes

A role scope defines the capabilities of the user under a scope (service provider, OpCo, and tenant).

- A service provider administrator can assign service provider, OPCo, and tenant roles to service provider, OpCo, and tenant users.
- An OpCo administrator can assign OpCo and tenant roles to OpCo users and tenant roles to tenant users.
- A tenant administrator can assign tenant roles only to tenant users.

A role can have the following scopes:

- **Service provider**—Represents a provider that offers services to other service providers and customers. A service provider could be a global service provider that provides services to its operating companies in different geographical locations. The operating companies act as service providers and provide services to their tenants. An SP administrator with access privileges can view and access resources across operating companies.
- **Tenant**—Represents a customer that can view, configure, and manage tenant sites through Customer Portal.
- **Operating company**—An operating company (OpCo) is a service provider that manages its tenants and provides services to them. Tenants managed by one OpCo are isolated from tenants of another OpCo. An OpCo can manage all activities related to its own tenants. For more information, see "Operating Companies Overview" on page 104.

Access Privileges

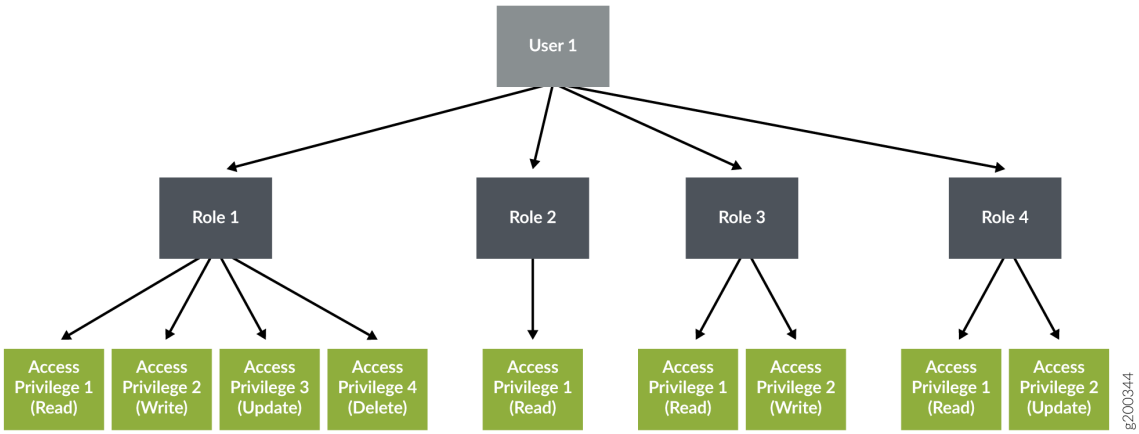
The following access privileges and actions can be assigned to a user role to access objects (Dashboard, Device Templates, Tenants, and so on) in CSO. For example, a user can be given only read, create, update privileges to device objects and only the delete privilege to security alerts objects.

- Read
- Create
- Update
- Delete
- Other actions (for example, for the device templates object, other actions such as cloning and editing the device template are supported).

Relationship Between Users, Roles, and Access Privileges

Figure 10 on page 391 shows the relationship between users, user roles, and access privileges. A user can have one or more roles and each role can have one or more access privileges.

Figure 10: Relationship Between a User, Roles, and Access Privileges



Benefits of Roles in CSO

- Provide a well-defined separation of responsibility and visibility.
- Provide granular-level access control on CSO objects within each navigation menu. Roles enable you to control which system users can access CSO objects based on certain business and operational needs.

RELATED DOCUMENTATION

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About the Roles Page | 392

Edit, Clone, and Delete User-Defined Roles for Service Provider, OpCo, and Tenant Users | 395

About the Roles Page

To access this page, select **Administration > Roles** in Administration Portal.

You can use the Roles page to view a list of predefined (system-defined) and custom (user-defined) roles that can be assigned to SP administrator, OpCo and tenant users. You can create, edit, or delete custom roles and clone both custom and predefined roles.

Tasks You Can Perform

You can perform the following tasks from this page:

- Create a custom role. See "Add User-Defined Roles for Service Provider, OpCo, and Tenant Users" on page 393.
- Edit, clone, or delete a role. See "Edit, Clone, and Delete User-Defined Roles for Service Provider, OpCo, and Tenant Users" on page 395.

Field Descriptions

Table 137 on page 392 describes the fields on the Roles page.

Table 137: Fields on the Roles Page

Field	Description
Role Name	Displays the name of the role.
Role Scope	Displays the role scope, such as OpCo, or tenant.
Role Type	Displays whether the role is a predefined role or a custom role.
Created By	Displays the username of the user that created the role.

RELATED DOCUMENTATION

Add User-Defined Roles for Service Provider, OpCo, and Tenant Users | 393

Edit, Clone, and Delete User-Defined Roles for Service Provider, OpCo, and Tenant Users | 395

Add User-Defined Roles for Service Provider, OpCo, and Tenant Users

Use the Add Role page to create custom (user-defined) roles and assign access privileges (read, create, update, delete, and other actions) to service provider, OpCo, and tenant user roles.

A user with the Create Role privilege can create custom roles for service provider, OpCo, and tenant users.

To create a custom role:

1. Select **Administration > Roles** in Administration Portal.

   The Roles page appears.

2. Click the add icon (+) to create a new role.

   The Add Role page appears.

3. Complete the configuration according to the guidelines provided in Table 138 on page 393.

4. Click **OK**.

   A new role is created and listed on the Roles page.

> **NOTE:** The tenant list in the top banner of CSO is not displayed if the Service Provider or OpCo user that is logged in to CSO does not have tenant roles assigned.

Table 138: Fields on the Add Role Page

Field	Description
Role Name	Enter a unique role name. The name can contain alphanumeric characters, underscore, period, and space.
Description	Enter a description for the role.

Table 138: Fields on the Add Role Page *(continued)*

Field	Description
Role scope	Select the scope of the role. You can assign the role to a service provider, OpCo, or tenant user. There are three scopes for user roles: • Service Provider—Select this option to assign the role to service provider users. If you select the role scope as Service Provider, then the Privileges section displays the objects of the Administration Portal • **Tenant**—Select this option to assign the role to tenant users. If you select the role scope as Tenant, then the **Privileges** section displays the objects of the Customer Portal. • **OpCo**—Select this option to assign the role to OpCo users. If you select the role scope as OpCo, then the **Privileges** section displays the objects of the OpCo.
Access Privileges	**All Objects**—Displays the objects of Administration Portal and Customer Portal based on the scope of the role that you selected. You must select the check box against each object and then select the type of privileges (read, write, update, delete, and other actions) that you want to assign the user for the selected object. You can select one or more access privileges to assign to the user role. **NOTE:** You must assign at least one access privilege to a role. If you select the first-level objects, the submenu items that belong to the main object and the corresponding access privileges are also selected. The following access privileges can be assigned to a user role: • **Read**—Enables the user to read existing objects. • **Create**—Enables the user to create new objects. • **Update**—Enables the user to modify existing objects. • **Delete**—Enables the user to delete existing objects. You can also assign other actions to user roles. The other actions include retry, schedule update, schedule delete, activate, reboot, push license, clone, edit template, deploy, and upgrade history.

RELATED DOCUMENTATION

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Edit, Clone, and Delete User-Defined Roles for Service Provider, OpCo, and Tenant Users | 395

Edit, Clone, and Delete User-Defined Roles for Service Provider, OpCo, and Tenant Users

IN THIS SECTION

- Edit Roles | 395
- Clone Roles | 396
- Delete Roles | 397

You can edit and delete custom (user-defined) roles of service provider, OpCo, and tenant users from the Roles page. You can also clone both predefined and custom roles.

> **NOTE:** You cannot edit or delete predefined roles.

This topic has the following sections:

Edit Roles

To modify the parameters configured for a role:

1. Select **Administration > Roles**.

   The Roles page appears, displaying the details of the available roles.

2. Select the role that you want to edit and click the edit icon (pencil) to modify the attributes.

   The Edit Role page appears. The fields on the Edit Role page are available for editing.

   > **NOTE:** You cannot modify the role name and role scope.

3. Modify the role description and privileges as needed.

4. Click **OK** to save the changes.

   A confirmation message appears, indicating the status of the edit operation.

Clone Roles

You can clone a role (both custom and predefined) when you want to quickly create a copy of an existing role and modify its access privileges.

1. Select **Administration > Roles**.

   The Roles page appears, displaying the details of the available roles.

2. Select the role that you want to clone and then click the **Clone** button at the top-right corner of the page.

   The Clone Role: *Role-Name* page appears.

3. Specify an appropriate name for the clone role.

4. Click **OK** to save your changes.

   A confirmation message appears, indicating the status of the clone operation.

   The name of the clone role is displayed on the Roles page.

5. Select the new clone role and click the edit icon (pencil) to modify the parameters.

   The Edit Role page appears.

6. Select the objects, and modify the access privileges of the role, as needed.

   NOTE: You cannot modify the role name and role scope.

7. Click **OK** to save your changes.

   A confirmation message appears, indicating the status of the edit operation.

Delete Roles

To delete a role:

1. Select **Administration > Roles**.

   The Roles page appears, displaying the details of the available roles.

2. Select the role that you want to delete and then click the delete icon (X).

   An alert message appears, asking you to confirm the delete operation.

3. Click **Yes** to delete the selected role.

   A confirmation message appears, indicating the status of the delete operation.

RELATED DOCUMENTATION

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Add User-Defined Roles for Service Provider, OpCo, and Tenant Users | **393**

Access Privileges for Role Scopes (Operating Company and Tenant)

This topic describes the access privileges for the Operating Company (OpCo) and tenant role scopes. For more information about roles and role scopes, see "Roles Overview" on page 388.

Table 139 on page 398 shows the access privileges for operating company scope.

Table 140 on page 400 shows the access privileges for tenant scope.

Table 139: Access Privileges for Operating Company Scope

Role Scope	Menu Name	Actions	Other Actions
Operating company (OpCo)	SP Geo Map	Read	-
	Tenants SLA Performance	Read	-
	Alerts	Read and Delete	-
	Alarms	Read and Delete	-
	SD-WAN Alerts Definitions	Read	-
	Security Alert Definitions	Read	-
	Jobs	Read	Retry Schedule Update Schedule Delete
	POPs	Read	-
	Provider Hub Devices	Read	-
	Tenant Devices	Read	Configure Stage-2
	Device Templates	Read, Create, Update, and Delete	Clone Edit Template
	Images	Read	Upgrade History Deploy Stage
	SLA Based Steering Profiles	Read, Create, Update, and Delete	-
	Path Based Steering Profiles	Read, Create, Update, and Delete	-

Table 139: Access Privileges for Operating Company Scope *(continued)*

Role Scope	Menu Name	Actions	Other Actions
	Application Traffic Type Profiles	Read	-
	Network Services	Read	Detach Allocate
	Tenants	Read, Create, Update, and Delete	-
	Users	Read, Create, Update, and Delete	-
	Roles	Read, Create, Update, and Delete	-
	Audit Logs	Read	Purge
	Authentication	Read, Create, Update, and Delete	-
	Device Licenses	Read, Create, Update, and Delete	Push
	CSO Licenses	Read, Create, and Update	-
	Dynamic Mesh	Read and Update	
	Signature Database	Read	-
	SMTP	Read and Update	-
	Terms of Use	Read and Update	
	Email Templates	Read and Update	-
	Getting Started	Read	-
	What's New	Read	-
	Help Center	Read	-
	FAQ	Read	-
	Release Notes	Read	-
	About	Read	-

Table 140: Access Privileges for Tenant Scope

Role Scope	Menu Name	Actions	Other Actions
Tenant	Tenant GeoMap	Read	-
	Link Switch Events	Read	-
	Jobs	Read	Retry Schedule Update Schedule Delete
	SD-WAN Alert Definitions	Read	-
	Security Alert Definitions	Read, Create, Update, and Delete	-
	Alerts	Read and Delete	Jump to Event Viewer
	Alarms	Read and Delete	-
	Security Events	Read	Manage Filter Create Alert Create Report
	Application Visibility	Read	-
	Threats Map (Live)	Read	-
	Application SLA Performance	Read	-
	Devices	Read	

Table 140: Access Privileges for Tenant Scope *(continued)*

Role Scope	Menu Name	Actions	Other Actions
			Activate Traceroute Ping Push License Reboot RMA Discover APs Configure Stage2
	Device Configuration	Read and Update	-
	Images	Read	Upgrade History Stage Deploy
	Deployments	Read	Deploy Schedule
	Network Services	Read, Update, and Delete	Start Disable
	SD-WAN Policy	Read and Update	Deploy
	Tenant SLA Based Steering Profiles	Read, Create, Update, and Delete	-
	Tenant Path Based Steering Profiles	Read, Create, Update, and Delete	-
	Cloud Breakout Profiles	Read, Create, Update, and Delete	Assign Sites
	Firewall Policy	Read, Create, Update, and Delete	Deploy
	SSL Policy	Read, Create, Update, and Delete	Deploy

Table 140: Access Privileges for Tenant Scope *(continued)*

Role Scope	Menu Name	Actions	Other Actions
	NAT	Read, Create, Update, and Delete	Deploy
	UTM	Read, Create, Update, and Delete	-
	Schedule	Read, Create, Update, and Delete	-
	Address	Read, Create, Update, and Delete	-
	Department	Read, Create, and Delete	-
	Service	Read, Create, Update, and Delete	-
	Application Signature	Read, Create, Update, and Delete	Clone
	Site Management	Read, Create, and Delete	Configure Upgrade
	Site Groups	Read, Create, Update, and Delete	-
	Site LAN Segment	Read, Create, and Delete	Deploy Deploy History Re-assign
	Mesh Tags	Read, Create, and Delete	-
	Report Definitions - Security	Read, Create, Update, and Delete	Run Preview Send Clone
	Report Definitions - SD-WAN	Read, Create, Update, and Delete	Run Preview Send Clone
		Read and Delete	-

Table 140: Access Privileges for Tenant Scope *(continued)*

Role Scope	Menu Name	Actions	Other Actions
	Generated Reports -Security		
	Generated Reports SD-WAN	Read and Delete	-
	Users	Read, Create, Update, and Delete	-
	Roles	Read, Create, Update, and Delete	-
	Audit Logs	Read	Purge
	Device Licenses	Read, Create, Update, and Delete	Push License
	CSO Licenses	Read	-
	Tenant Setting	Read, Create, and Update	-
	Tenant Signature Database	Read	Install
	Certificates	Read, Create, Update, and Delete	-
	VPN Authentication	Read	Renew CRL
	Identity Management	Read and Update	-
	Wi-Fi Settings	Read and Update	-
	Getting Started	Read	-
	What's New	Read	-
	Help Center	Read	-
	FAQ	Read	-
	Release Notes	Read	-
	About	Read	-

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11

CHAPTER

Managing Jobs

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Editing and Deleting Scheduled Jobs | **409**

Retrying a Failed Job on Devices | **411**

About the Jobs Page

To access this page, click **Monitor > Jobs**.

A job is an action that is performed on any object that is managed by CSO, such as a device, tenant, site, or user. You can monitor the status of jobs that have run or are scheduled to run in CSO. You can run the job immediately or schedule it for a later date and time. You can view the status of the job whether it is completed or failed. You can retry tssm.ztp type jobs that are failed.

Use this page to view the list of all jobs and the jobs that are scheduled to be executed. You can view general information about the jobs and the overall progress and status of the jobs. You can also edit and delete scheduled jobs.

Tasks You Can Perform

You can perform the following tasks from this page:

- View details about a job. See "Viewing Job Details" on page 408.
- Retry a job. See "Retrying a Failed Job on Devices" on page 411.
- Edit and delete schedule jobs. See "Editing and Deleting Scheduled Jobs" on page 409.

Field Descriptions

Table 141 on page 406 provides guidelines on using the fields on the Jobs page.

Table 141: Fields on the Jobs Page

Field	Description
Job Name	View the name of the job. CSO automatically generates the job name. Example: MSEC_DOWNLOAD_IPS/APPLICATION_SIGNATURES_08_Jul_17_124229_024
Status	View the status of the job to know whether the job succeeded, failed, or in progress. Example: Success
Owner	View the name of the owner who created the job. Example: cspadmin

Table 141: Fields on the Jobs Page *(continued)*

Field	Description
Number of Tasks	View the number of tasks associated with the job. Example: 2 For example, the tasks **site.ucpe-32** and **customer.sdwan** are associated with this job.
Job ID	When a job is initiated from a object in CSO, CSO assigns a unique ID to that job, which serves to identify the job (along with the job type) on the Jobs page. The following is a list of some of the job types supported in CSO: • Import POP • Configure Sites • Download Signature • Create Sites • Onboard Tenant • Create OpCo • Remove Site
Start Date	View the start date and time of a task associated with the job.
End State	View the end date and time of a task associated with the job.

Field Descriptions

Table 142 on page 407 provides guidelines on using the fields on the Scheduled Jobs page.

Table 142: Fields on the Scheduled Jobs Page

Field	Description
Schedule ID	View the unique ID of the scheduled job. The value is generated by the database when a new schedule record is inserted into the database. Example: 48
Name	View the unique name of the scheduled job. Example: Tenant Delete_csp.tssm_remove_site_e340354716ae43859fad5ba15669eee2

Table 142: Fields on the Scheduled Jobs Page *(continued)*

Field	Description
Status	View the status of the last triggered job. The default status is scheduled.
Record Type	View the job type. Example: tssm onboard tenant
Owner	View the name of the owner who scheduled the job. Example: cspadmin
Next Run Time	View the time when the job is scheduled to run next.

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Retrying a Failed Job on Devices | 411

Viewing Job Details

You can use the Detail for *Job-Name* page to view all the parameters of a job. This page has the following two tabs:

- **Details**—Displays the overall progress of the job and lists general information about the job (for example, the Job ID, Request ID, Created By, and so on). For more information about the field description on this page, see *About the Jobs Page*.
- **Tasks**—Displays the number of tasks associated with the job. A green check mark (success) or a red cross mark (failed) is displayed next to each task indicating the status of the task. You can click the Detailed View icon to view the summary of the task.

To view details of a job:

- Right-click the job name that you want to see the detailed view for and select **Detail View**.
- Select the job and click **More > Detail View**.

- Alternatively, hover over the job name and click the Detailed View icon that appears before it.

The Detail for *Job-Name* page appears, showing the details of the job and the number of tasks associated with the job. See *About the Jobs Page* for a description of each fields on this page.

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Editing and Deleting Scheduled Jobs

IN THIS SECTION

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Deleting Scheduled Jobs | 410

You can edit or delete scheduled jobs.

Editing Scheduled Jobs

You can modify the date and time of deployment of scheduled jobs.

To modify a scheduled job:

1. Select **Monitor > Jobs > Scheduled Jobs**.

   The Jobs page displays all scheduled jobs.

2. Select the job that you want to reschedule the deployment, and click the edit icon.

   The Edit Schedule page appears. This page displays the option that you have selected initially.

3. Modify the deployment type.

   To execute the job immediately, select the **Run now** option.

To reschedule the job for a later date and time, select the **Schedule at a later time** option and select the date and time of deployment.

4. Click **Save** to save the changes.

   A success message is displayed indicating that the scheduled job is modified.

Deleting Scheduled Jobs

You can delete one or more scheduled jobs.

To delete a scheduled job:

1. Select **Monitor > Jobs> Scheduled Jobs**.

   The Jobs page displays all scheduled jobs.

2. Select the job that you want to delete and then click the delete icon (X). You can select one or more jobs

   The Confirm Delete page appears.

3. Click **Yes** to confirm.

   A success message is displayed indicating that the scheduled job is deleted.

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Retrying a Failed Job on Devices

As a service provider user or OpCo user with the Job Retry capability, you can retry a failed job instead of redoing the tasks involved in the job, to save time.

> **NOTE:** Before you retry a failed job, identify the reason for the failure and then fix it, before retrying the job.
>
> For example, if the bootstrap process failed because the device could not establish an outbound SSH connection, you must fix the problem and ensure that the outbound SSH connection is established before you retry the bootstrap job.

You can retry only the following jobs that did not complete successfully on your devices:

- ZTP jobs
- Bootstrap jobs

To retry a job that was not successful:

1. Select **Monitor > Jobs**.

   The Jobs page appears.

2. Select the failed job that you want to retry.

3. Click the **Retry Job** button on the top-right corner of the page.

   A retry job is created and executed.

   If the job is successful, a confirmation message appears and the job status changes to **Success** on the Jobs page.

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12

CHAPTER

Managing Audit Logs

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Audit Logs Overview

An audit log is a record of a sequence of activities that have affected a specific operation or procedure. Audit logs are useful for tracing events and for maintaining historical data.

Audit logs contain information about tasks initiated by using the Contrail Service Orchestration (CSO) GUI or APIs. In addition to providing information about the resources that were accessed, audit log entries usually include details about user-initiated tasks, such as the name, role, and IP address of the user who initiated a task, the status of the task, and date and time of execution.

> **NOTE:** Device-driven tasks (that is, tasks not initiated by the user) are not recorded in audit logs.

Administrators can use audit logs to review events. For example, administrators can identify the user accounts associated with an event, determine the chronological sequence of events. For audit log entries that have an associated job, you can click the hyperlinked job ID to go to the Jobs page, where you can view the details of the job.

RELATED DOCUMENTATION

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Exporting Audit Logs | **417**

Purging Audit Logs (After Archiving or Without Archiving) | **419**

About the Audit Logs Page

To access this page, select **Administration** > **Audit Logs**.

Use the Audit Logs page to view the tasks that you have initiated either by using the Contrail Service Orchestration (CSO) GUI or APIs. You can also export audit logs as a comma-separated values (CSV) file and purge audit logs after archiving them or without archiving them.

Tasks You Can Perform

You can perform the following tasks from this page:

- View the details of various user-initiated tasks by selecting **More** > **Details**. You can also mouse over the audit log and click on the **Detailed View** icon. See "Viewing the Details of an Audit Log" on page 415.
- Export audit logs as a CSV file—See "Exporting Audit Logs" on page 417.
- Purge audit logs—See "Purging Audit Logs (After Archiving or Without Archiving)" on page 419.
- Search for audit logs by using keywords—Click the search icon and enter the search term in the text box and press Enter. The search results are displayed on the same page.
- Sort and filter audit logs:

  NOTE: Sorting and filtering is applicable only to some fields.

  - Click a column name to sort the audit logs based on the column name.
  - Click the filter icon and select whether you want to show or hide column filters or apply a quick filter. For example, you can use audit log filtering to track user accounts that were added on a specific date, track configuration changes across a particular type of device, view services that were provisioned on specific devices, monitor user login and logout activities over time, and so on.
- Show or hide columns—Click the **Show Hide Columns** icon at the top right corner of the page and select the columns that you want displayed on the Audit Logs page.

Table 143 on page 414 provides description of the fields on the Audit Logs page.

Table 143: Fields on the Audit Logs Page

Field	Description
Username	Displays the username of the user who initiated the task.
User IP	Displays the IP address of the client from which the user initiated the task. For tasks that do not have an associated user IP address, this field is blank.
Object Name	Displays the name of the object on which the task was initiated. An object can be a tenant, site, device, device image, template, and so on.
Task	Displays the name of the task that triggered the audit log. For example, tenant.create, device.create, site.configure, site.provision, tenant.update, and so on.
Description	Displays details about the task.

Table 143: Fields on the Audit Logs Page *(continued)*

Field	Description
Status	Displays the status of the task that triggered the audit log: • Success—Job or task was completed successfully. • Failure—Job or task failed and was terminated. • Job Scheduled—Job is scheduled but has not yet started. • Recurring Job Scheduled—Recurring job is scheduled.
End Time	Displays the date and time at which the execution of the task was completed. This timestamp is stored in UTC time in the database, but is mapped to the local time zone of the client computer.
Job ID	For tasks that have associated jobs, displays the ID of the job associated with the task. You can click the job ID to go to the Jobs page, where you can view the status of the job.

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Viewing the Details of an Audit Log

Use the Audit Log Details pane to view details of an audit log.

To view the details of an audit log:

1. Select **Administration** > **Audit Logs**.

   The Audit Logs page appears displaying the audit logs.

2. Select the audit log for which you want to view details and click **More** > **Details**. Alternatively, mouse over the audit log, and click on the **Detailed View** icon.

   The Audit Log Details pane appears on the right side of the Audit Logs page. Table 144 on page 416 provides descriptions of fields on the Audit Log Details pane.

3. Click the close icon (X) to close the Audit Log Details pane.

You are returned to the Audit Logs page.

Table 144: Fields on the Audit Log Details Pane

Field	Description
Details	
User	
Username	Displays the user who initiated the task.
User IP	Displays the IP address of the client from which the user initiated the task. For tasks that do not have an associated user IP address, this field is blank.
Task	
Task	Displays the name of the task that triggered the audit log. For example, tenant.create, device.create, site.configure, site.provision, tenant.update, and so on.
Status	Displays the status of the task that triggered the audit log: • Success—Job or task was completed successfully. • Failure—Job or task failed and was terminated. • Job Scheduled—Job is scheduled but has not yet started. • Recurring Job Scheduled—Recurring job is scheduled.
Description	Displays details about the task.
Affected Objects	
Object Name	Displays the name of the affected object on which the task was initiated. An affected object can be a tenant, site, device, device image, template, and so on.. Click the hyperlinked object name to view details of the object: **NOTE:** If the object is deleted or if you do not have permissions to view it, an error message is displayed.
Object UUID	Displays the Universally Unique Identifier (UUID) of the affected object.
Log Info	
Audit Log ID	Displays the automatically-generated unique ID of the audit log associated with the task.

Table 144: Fields on the Audit Log Details Pane *(continued)*

Field	Description
Job ID	For tasks that have associated jobs, displays the ID of the job associated with the task. You can click the job ID to go to the Jobs page, where you can view the status of the job.
End Time	Displays the date and time at which the task completed execution. This timestamp is stored in UTC time in the database, but is mapped to the local time zone of the client computer.
Raw Audit Log	
Microservice	Displays the name of the microservice that initiated the task.
Raw Audit Log	Displays all the fields of the audit log that are stored in the database. The raw audit log typically contains additional details or parameters associated with the audit log.

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Exporting Audit Logs

You can export audit logs as comma-separated values (CSV) file that can be opened or edited using an application such as Microsoft Excel. You can view and analyze the exported audit logs, as needed.

To export the audit logs:

1. Select **Administration** > **Audit Logs**.

   The Audit Logs page appears displaying the audit logs.

2. Click **Export**.

   The Export Audit Logs page appears.

3. Specify the time period for which you want to export the audit logs according to the guidelines provided in Table 145 on page 418.

> **NOTE:** You can export audit logs for a maximum of 30 days prior to the current date and time. For example, if the current date is May 31, 2018, you can export the audit logs starting from May 1, 2018.

4. Click **OK** to export the audit logs.

   Depending on the settings of the browser that you are using, the CSV file containing the audit logs for the specified time period is either downloaded directly, or you are asked to open or save the file.

   You are returned to the Audit Logs page.

   After the file is downloaded, you can open the CSV file in an application such as Microsoft Excel and view and analyze the logs as required.

Table 145: Fields on the Export Audit Logs Page

Field	Description
Start Date and Time	Specify the date and time (in MM/DD/YYYY and HH:MM:SS 24-hour or AM/PM formats) from when the audit logs should be exported.
End Date and Time	Specify the date and time (in MM/DD/YYYY and HH:MM:SS 24-hour or AM/PM formats) up to when the audit logs should be exported.

RELATED DOCUMENTATION

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Viewing the Details of an Audit Log | 415

Purging Audit Logs (After Archiving or Without Archiving)

You can manage the volume of audit log data stored by purging log files from the CSO database without archiving them or by purging log files after archiving them. You can purge audit logs immediately or schedule the purging for a later date and schedule the purging on a recurring basis.

> **NOTE:** Audit logs related to a tenant are deleted automatically when the tenant is deleted from CSO.

To purge audit logs after archiving or without archiving them:

1. Select **Administration** > **Audit Logs**.

   The Audit Logs page appears displaying the audit logs.

2. Click **Purge**.

   The Purge Audit Logs page appears.

3. Complete the configuration according to the guidelines provided in Table 146 on page 419.

   > **NOTE:** Fields marked with an asterisk (*) are mandatory.

4. Click **OK**.

   You are returned to the Audit Logs page and one of the following operations occur:

   - If you triggered a purge of the audit logs without archiving, a job to purge the audit logs is created.
   - If you triggered a purge of the audit logs after archiving, a job is created to archive the audit logs and then purge the audit logs after archiving.

   After the audit logs are purged successfully, the Audit Logs page refreshes automatically and displays only the audit logs that were not purged.

Table 146: Purge Audit Logs Settings

Field	Description
Purge Options	

Table 146: Purge Audit Logs Settings *(continued)*

Field	Description
Purge Logs	Select one of the following options to purge audit logs: • Purge audit logs that were generated before a specified date and time—If you select this option, you must enter a date and time in the **Before** field. • Purge generated audit logs that are older than a specified number of days—If you select this option, you must specify the number of days in the **Older than** field.
Before	To purge audit logs before a specified date and time, enter the date (in MM/DD/YYYY format) and time (in HH:MM:SS 24-hour or AM/PM format) You specify the time in the local time zone of the client computer.
Older than	To purge generated audit logs older than a specified number of days, enter the number of days (from 1 through 90)
Archive Logs Before Purging	To archive audit logs *before* purging them, select this check box. By default, this check box is cleared, which means that audit logs are purged without archiving them. **CAUTION:** If you choose not to archive the audit logs before purging, the audit logs are deleted from the CSO database and cannot be recovered.
Archive Mode	Specify whether you want to archive the log files locally (**local**) or on a remote server (**remote**). If you archive the logs on a remote server, which is the default option, you must enter access and login details for the remote server. **NOTE:** • Archived log files are saved in a single file in compressed comma-separated values (CSV) format (extension .zip). • When you archive data locally, the archived log files are saved on the central microservices virtual machine (VM).
Username	Enter a valid username to access the remote server.
Password	Enter a valid password to access the remote server on which the audit logs will be archived.
Confirm Password	For confirmation, re-enter the password to access the remote server.
Remote Server IP Address	Enter the IPv4 address of the remote server; for example, 192.0.2.10.

Table 146: Purge Audit Logs Settings *(continued)*

Field	Description
Remote Server Path	Enter the directory path on the remote server on which to store the archived log files. The directory that you specify must already exist on the remote server.
Schedule Purge	
Type	Specify whether the audit logs should be purged immediately (**Run now**) or schedule the purge for later (**Schedule at a later time**). If you schedule the purge for later, enter the date (in MM/DD/YYYY format) and time (in HH:MM:SS 24-hour or AM/PM format) that you want the purge to occur. You specify the time in the local time zone of the client computer.
Recurrence	To specify whether the purge operation should occur on a recurring basis, select this check box. **NOTE:** This option is enabled only if you choose to archive and purge audit logs older than a specified number of days.
Repeat	Specify the periodicity of the recurrence. Currently, a weekly periodicity is the only option supported.
On	For purges that recur every week, specify one or more days on which you want the purge to recur.
Time	Enter the time (in HH:MM:SS 24-hour or AM/PM format) that you want the recurring purge to occur. By default, the purge recurs at 12.00 AM. You specify the time in the local time zone of the client computer.
Ends	Specify whether the recurring purge ends or not: • Select **Never** to continue (without an end date) the recurring purge operation at the specified recurrence interval. • Select **On** and enter the date (in MM/DD/YYYY format) and time (in HH:MM:SS 24-hour or AM/PM format) on which to stop the recurring purge operation. You specify the time in the local time zone of the client computer.

RELATED DOCUMENTATION

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About the Audit Logs Page | 413

13

CHAPTER

Monitoring

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About the Monitor Overview Page

To access this page, click **Monitor > Overview**.

You can use the Monitor Overview page to view information about the alarms and alerts for tenants, POPs, connections, and sites on a geographical map. The network operator views the alarms and alerts, and then takes the necessary actions to resolve the issues.

Tasks You Can Perform

You can perform the following tasks from this page:

- View POP details.
- View site details.
- View connections.
- View only the nodes with alerts.

Field Descriptions

Table 147 on page 425 shows the descriptions of the fields on the Monitor Overview page.

Table 147: Fields on the Monitor Overview Page

Field	Description
POPs	View the POP in which the site is located. Click the **POPs** drop-down list and select **POP Name**. Enter the name of the POP.
Sites	View the sites at which the service is deployed. Click the **Sites** drop-down list and enter the name of the site.
Connections	View the connections in the network. Click the **Connections** drop-down list and select **Show connections**.

Table 147: Fields on the Monitor Overview Page *(continued)*

Field	Description
Only the node with alerts	View the nodes with issues with the service. Click the drop-down list located next to the **Only the nodes with alerts** check box and select the type of alerts. • Critical—Issues that prevent the node from working and require action from the operator. The nodes with critical alerts are displayed in red. • Major—Issues that prevent the node from working at this time, but they do not require action from the operator. The nodes with major alerts are displayed in orange. • Minor—Issues that allow a node to continue working, but not optimally. The network operator may need to take action to resolve the issue. The nodes with minor alerts are displayed in yellow. **NOTE:** The nodes without any alerts are displayed in blue.

RELATED DOCUMENTATION

About the Alert Definitions/Notifications Page | 429

Creating SD-WAN Alert Definitions | 431

Alerts Overview

Alerts and notifications are used to notify administrators about significant events within the system. Notifications can also be sent through e-mail. You will be notified when a predefined network traffic condition is met. The alert trigger threshold is the number of network traffic events crossing a predefined threshold within a period of time.

Alerts and notifications provide options for:

- Defining alert criteria based on a set of predefined filters. You can use the filters defined in the advanced search to create an alert. You can also save filters and add them to security alert definitions.
- Generating an alert message and notifying you when alert criteria are met.
- Searching for specific alerts on the Generated Alerts page based on alert ID, description, or alert type.
- Supporting event-based alerts.

For example, If you are an administrator, you can define a condition such that if the number of firewall-deny events crosses a predefined threshold in a given time range for a specific device, you will receive an e-mail alert.

> **NOTE:** If a threshold is crossed and remains so for a long duration, new alerts are not generated. Alerts are generated again when the number of logs matching the alert criteria drops below the threshold and crosses the threshold again.

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About the Generated Alerts Page | 427
About the Alert Definitions/Notifications Page | 429

About the Generated Alerts Page

To access this page, click **Monitor > Alerts & Alarms > Alerts**.

Use this page to view the system event-based alerts in response to a configured alert definition. The generated alerts help you to identify problems that appear in your monitored network environment and displays both security and SD-WAN alerts. You can view statistics such as the number of critical and non-critical alerts.

Tasks You Can Perform

You can perform the following tasks from this page:

- Select the generated alert and then right-click or click **More > Detail View**. The Alert Detail page appears displaying all the details of the alert.
- Select the generated alert and then right-click or click **More > Clear All Selections**.

Field Descriptions

Table 148 on page 428 provides information about the fields on the Generated Alerts page.

Table 148: Fields on the Generated Alerts Page

Field	Description
Severity	View the severity of the alert.
Time	View the date and time when the alert was generated.
Site	View the name of the tenant site.
Source	View the source of the alert. The source identifies whether an alert is a security alert or an SD-WAN alert.
Description	View the description of the alert.
Alert Type	View the type of alert.
ID	View the alert ID. Alert ID is an unique identification for each alert. For example, b4a3c027-7157-4861-8e3c-c872721cff2d.
Service Instance	View the service instance associated with the alert.
Object Type	View the object type.
Alert Name	View the name of the alert.
Tenant	View the name of the tenant.

RELATED DOCUMENTATION

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Creating SD-WAN Alert Definitions | 431
Editing and Deleting SD-WAN Alert Definitions | 432

About the Alert Definitions/Notifications Page

To access this page, select **Monitor > Alarms & Alerts > Definitions/Notifications** in the Administration Portal.

Use the Alert Definitions page to manage alert definitions for SD-WAN, SD-LAN, and view alert definitions for security. An alert definition consists of data criterion for triggering alerts about issues in the SD-WAN environment. Alert definitions also define the necessary action required to resolve issues based on the severity of the alert. An alert is triggered when the event threshold exceeds the data criteria that is defined. You can create an alert definition to monitor your data in real time and identify issues and attacks before they impact your network.

You can also enable or disable SD-WAN/SD-LAN alarm notification.

Tasks You Can Perform

You can perform the following tasks from this page:

- View existing SD-WAN Alert Definitions in the SD-WAN tab. The SD-WAN alert definitions are loading by default when the Alert Definitions page is loaded. See Table 149 on page 430 for descriptions of the fields on the SD-WAN alert definitions pane.
- Create SD-WAN alert definitions. See "Creating SD-WAN Alert Definitions" on page 431.
- Edit or delete an existing SD-WAN alert definition. See "Editing and Deleting SD-WAN Alert Definitions" on page 432.
- View existing security alert definitions by clicking **Security**. See Table 150 on page 430 for descriptions of the fields on the Security alert definitions pane.
- Show or hide columns that contain information about SD-WAN and Security alert definitions—Click the **Show Hide columns** icon in the top right corner of the page and select columns that you want to view on the page.
- Search for alert definitions using keywords. Click the search icon. Enter partial text or full text of the keyword in the search bar and press Enter. The search results are displayed.

Field Descriptions

Table 149 on page 430 describes the fields on the SD-WAN alert definitions pane.

Table 149: Fields on the SD-WAN Alert Definitions Pane

Field	Description
Rule Priority	View the priority of the alert definition. A value of one (1) indicates highest priority.
Alert Description	View the description of the alert.
Filter	View the matching alert criteria to trigger the alert.
Action	View the action to be performed to resolve issues.
Context	View the additional configuration parameters that you can pass on to the rule action function.

Table 150 on page 430 provides guidelines on using the fields on the Security alert definitions pane.

Table 150: Fields on the Security Alert Definitions Pane

Field	Description
Alert Name	View the name of the alert.
Alert Description	View the description for the alert.
Filter	View filter values of the alert.
Recipients	View recipients' e-mail addresses where alert notifications are sent.
Status	View the status of the alert.
Alert Type	View the type of alert. Example: Event-based
Tenant	View the tenant who defined the alert.

RELATED DOCUMENTATION

Creating SD-WAN Alert Definitions | **431**.

Editing and Deleting SD-WAN Alert Definitions | **432**.

Creating SD-WAN Alert Definitions

You can use the Create SD-WAN Alert Definition page to create an alert definition for SD-WAN that consists of data criteria for triggering alerts about issues in the SD-WAN environment. In the alert definition, you can also define the necessary action that is required to resolve issues based on the severity of the alert.

To create an SD-WAN alert definition:

1. Click the add icon (+) on the **Monitor > Alarms & Alerts > Alert Definitions > SD-WAN** page in Administration Portal.

   The Create SD-WAN Alert Definition page appears.

2. Enter the alert definition configuration according to the guidelines provided in Table 151 on page 431.

3. Click **OK** to create the alert definition.

   Alternatively, if you want to discard your changes, click **Cancel** instead.

Table 151 on page 431 describes the fields on the Create SD-WAN Alert Definition page.

Table 151: Fields on the Create SD-WAN Alert Definition Page

Field	Guidelines
Alert Name	Enter the name of the alert definition. Enter a unique string of alphanumeric characters and some special characters (. -). No spaces are allowed, and the maximum length is 256 characters.
Alert Description	Enter a description for the alert definition; maximum length is 512 characters.
Priority	Enter the priority for the alert definition. A value of 1 indicates highest priority.
Filter	Select the matching severity criteria to trigger an alert. You can match severity, alert type, or object types. You can select one of the following options: • To match severity options, select **Match Severity Critical**, **Match Severity Not Critical**, **Match Severity Major**, **Match Severity Not Major**, **Match Severity Normal**, **Match Severity Not Normal**, or **Match Severity All**. The **Match Severity Critical** option is selected by default. • To match alert types, such as alerts related to the device host or the application services on the host, select **Match Alert Type Service** or **Match Alert Type Host**. • To match object types, such as a single uCPE device or a uCPE VNF, select **Match Object Type UCPE DEVICE** or **Match Object Type UCPE VNF** respectively.

Table 151: Fields on the Create SD-WAN Alert Definition Page *(continued)*

Field	Guidelines
Action	Select the action to be performed to resolve issues based on the severity of the alert. You can select one of the following actions: • **Alert Action Send to Rmq**—Send the alert object to an external RabbitMQ broker. This option is selected by default. If this option is selected, you can also enter additional RabbitMQ broker configuration parameters in the Context field. • **Alert Action Discard**—Discard the alert object. • **Alert Action Resolve Uuids**—Resolve UUIDs to a machine-readable format.

Context	Enter a set of additional configuration parameters for the external RabbitMQ broker. The configuration parameters include the RabbitMQ broker IP address, port number, the exchange name and type, and the username and password. The parameters must be entered in JSON format. The additional parameters are passed as arguments to the action function when the selected action is **Alert Action Send to Rmq**.
	Example:
	`{`
	`“broker_ip”: “192.0.2.0”,`
	`“broker_port”: “5672”,`
	`“exchange_name”: “external_alert_exchange”,`
	`“exchange_type”: “topic”,`
	`“user”: “user-name”,`
	`“password”: “password”`
	`}`

RELATED DOCUMENTATION

About the Alert Definitions/Notifications Page | 429
Editing and Deleting SD-WAN Alert Definitions | 432

Editing and Deleting SD-WAN Alert Definitions

You can edit and delete SD-WAN alert definitions from the SD-WAN Alert Definitions page.

Editing an SD-WAN Alert Definition

To modify an SD-WAN alert definition:

1. Select the check box for the alert definition that you want to modify, and click the edit icon on the **Monitor > Alarms & Alerts > Alert Definitions > SD-WAN** page in the Administration Portal.

   The Edit SD-WAN Alert Definition page appears.

2. Update the configuration as needed and according to the guidelines in "Creating SD-WAN Alert Definitions" on page 431.

3. Click **OK** to save your changes.

   The alert definition information that you updated appears on the SD-WAN Alert Definitions page.

   Alternatively, if you want to discard your changes, click **Cancel** instead.

Deleting SD-WAN Alert Definitions

If the alert definition is no longer needed, then you can delete the alert definition. To delete an SD-WAN alert definition:

1. Select one or more alert definitions that you want to delete and click the delete icon (**X**) on the **Monitor > Alarms & Alerts > Alert Definitions > SD-WAN** page in the Administration Portal.

   A page requesting confirmation for the deletion appears.

2. Click **Yes** to confirm that you want to delete the alert definition.

   The alert definition is deleted.

   Alternatively, if you want to cancel the delete operation, click **No** instead.

RELATED DOCUMENTATION

About the Alert Definitions/Notifications Page | 429

Creating SD-WAN Alert Definitions | 431

About the Alarms Page

To access this page, select **Monitor > Alerts & Alarms > Alarms** in the Administration Portal.

Use this page to view system generated alarms. Alarms alert you to conditions that might prevent the device from operating normally. System alarm conditions are preset based on fault monitoring and performance monitoring (FMPM) being performed on a device. For example, conditions such as hardware issues, drop in throughput and latency of data, temperature variations, and capacity optimization issues automatically trigger an alarm.

> **NOTE:** To generate alarms correctly, ensure that CSO and the devices are NTP enabled, and in sync. The time set on CSO must match with the time set on the devices.

The difference between alerts and alarms lies in the type of events that are being monitored. An alert is used to notify administrators about significant events within the system. For example, when a predefined network traffic condition is met. For more information about alerts, see "Alerts Overview" on page 426.

Tasks You Can Perform

You can perform the following tasks from this page:

- View alarm activity within a specific time range:
  - You can select the time range by clicking on the options provided—2 hours (2h), 4 hours (4h), 8 hours (8h), 16 hours (16h), 24 hours (24h), or 1 week (1w). By default, alarm activity is displayed for 1 week.
  - You can view alarm activity for a custom time range by clicking on **Custom** and providing the time range.
- View details about the alarm. See Table 152 on page 435 for more information.
- Select the generated alarm and then right-click or click **More > Detail View** to view the details of the alarm.

Field Descriptions

Table 152 on page 435 provides information about the fields on the Alarms page.

Table 152: Fields on the Alarms Page

Field	Description
Severity	View the severity of the alarm.
Time	View the date and time when the alarm was generated.
Tenant	View the name of the tenant.
Site	View the site for which the alarm was generated.
Source	View the source of the alarm.
Description	View the description of the alarm.
ID	View the alarm ID.
Link Name	View the name of the link that generated the alarm.
Service Instance	View the service instance associated with the alarm..
Object Type	View the type of alarm. Example: Event-based
POP	View the point of presence (POP) of the alarm.

RELATED DOCUMENTATION

About the Generated Alerts Page | 427

About the Alert Definitions/Notifications Page | 429

Multidepartment CPE Device Support

Multitenancy enables a single NFX Series device to be mapped to serve across multiple departments within a single tenant. Each department has its own Layer 3 VPN and all Layer 3 VPNs are carried over to the hub using a shared overlay. The traffic is segregated to each department. A single overlay of IPsec or generic routing encapsulation (GRE) tunnels is used to carry all department traffic from the site through MPLS-based traffic separation.

Multitenancy is a cost-effective approach where the cost of a device and its maintenance is shared among multiple departments across a tenant. With multitenant device support, a dedicated share of the device is allocated to each department, and the data is kept private from the other tenants that access the same device.

> **NOTE:** Only users with the Tenant Administrator role have access to the Customer Portal GUI.

The tenant administrator can perform the following tasks:

- Manage and monitor all policies and dashboards for all departments.
- Manage applications in the dashboard for each tenant.
- Create SD-WAN and security policies for each tenant and monitor the dashboard at the site level or at the department level.
- View or select SD-WAN or security services on the shared CPE device through the management portal.
- View the shared CPE device and its services and networks even though the WAN links might be shared by multiple departments.

The OpCo administrator can see all departments within the CPE device and activate the device.

RELATED DOCUMENTATION

About the SLA Performance of a Single Tenant Page | 440

Viewing the SLA Performance of a Site | 446

About the SLA Performance of All Tenants Page

To access this page, select **Monitor > Tenants SLA Performance** in the Administration Portal.

You can use the Tenants SLA Performance page to view the SLA performance of all tenants. This page displays the list of tenants with low, medium, and high SLA performance during a specified time range. By default, the data is shown for the previous one day. You can change the time range for which the data is displayed. Tenants with low and medium SLA performance are grouped together. The SLA performance classification is done based on the **Performance Threshold** value you set. You can customize the view by selecting the card or grid view.

Tasks You Can Perform

You can perform the following tasks from this page:

- Specify performance threshold values based on which tenants can be classified as tenants with low, medium, or high SLA performance.
- View the SLA performance of all tenants that have low or medium SLA performance in the specified time period.
- View the SLA performance of all tenants that have high SLA performance in the specified time period.
- Select grid or card view for tenant SLA performance.

  Select the **Card** view or the **Grid** view at the top right of the page to switch between views. By default, the card view is selected.
- You can customize the time range to view the SLA performance of all tenants.

  Select the time range for which you want to view SLA performance. You can choose from Previous 1 hour, Previous 1 day, Previous 1 week, Previous 1 month, and Custom. For custom time, you must enter from and to dates in MM/DD/YYYY format and the time in HH:MM:SS format. By default, Previous 1 day is selected.

Field Descriptions

Table 153 on page 438 describes the fields on the Tenants SLA Performance page.

Table 153: Fields on the Tenants SLA Performance Page

Field	Description
Time range	Select the time range for which you want to view the SLA performance. You can choose from Previous 1 hour, Previous 1 day, Previous 1 week, Previous 1 month, and Custom. For custom time, you must enter from and to dates in MM/DD/YYYY format and the time in HH:MM:SS format. By default, Previous 1 day is selected.
View	Select the view in which you want to display the SLA performance. You can choose between card and grid views. By default, card view is selected.
Performance Threshold	Specify the performance threshold, in percentage, based on which tenants can be classified as tenants with low, medium, or high SLA performance. To set the performance threshold, click **More** > **Performance Threshold**. From the **Performance Threshold** dialog box, move the slider button to set the low and high thresholds. Tenants that have a performance score below the low threshold are marked as having low SLA performance and tenants that exceed the high threshold are marked as having high SLA performance. Tenants that have a performance score between the low and high are considered as having medium SLA performance.
Tenants with Low and Medium Performance	View tenants that have low and medium SLA performance in the selected time period. The low and medium performance classification is done based on the performance threshold you specify. Click each tenant to view information about the SLA performance of the sites in the tenant. See "About the SLA Performance of a Single Tenant Page" on page 440.
Tenants with High Performance	View the tenants that have high SLA performance in the selected time range. Click each tenant to view information about the SLA performance of the sites in the tenant. See "About the SLA Performance of a Single Tenant Page" on page 440.

Table 154 on page 438 describes the fields in the card and grid views.

Table 154: Fields in the Card and Grid Views of Tenants SLA Performance Page

Field	View	Description
Name	Card and Grid	Name of the tenant.
Sites	Card and Grid	Number of sites associated with the tenant.

Table 154: Fields in the Card and Grid Views of Tenants SLA Performance Page *(continued)*

Field	View	Description
SLA Performance	Card and Grid	Displays the SLA performance score on a scale of 100. Scores that exceed the high performance threshold are displayed in green. Scores that are below the low performance threshold are displayed in red, and the medium scores that are between the low and high performance threshold are displayed in orange. For information about SLA performance score, see "Understanding SLA Performance Score for Applications, Links, Sites, and Tenants" on page 452.
Sites with Low Performance	Card and Grid	Number of sites with low SLA performance.
SLA Not Met Events	Grid	Number of events that failed to meet the SLA.
Total Sessions	Card and Grid	Total number of sessions during the specified period.
Session Switch Count	Grid	Number of instances when a session switch occurred because of non-compliance with SLA. Note that the session switch count may have a value higher than the total sessions if multiple SLA violations occur for all the sessions.
Total Tenant Traffic	Card and Grid	Total traffic across all sites and links for the specified tenant.
Transmitted Bytes	Card and Grid	Total outgoing traffic from the tenant.
Received Bytes	Card and Grid	Total incoming traffic to the tenant.

RELATED DOCUMENTATION

About the SLA Performance of a Single Tenant Page | **440**

Viewing the SLA Performance of a Site | **446**

Viewing the SLA Performance of an Application or Application Group | **450**

Adding SLA-Based Steering Profiles | **339**

Adding Path-Based Steering Profiles | **351**

About the SLA Performance of a Single Tenant Page

To access this page from the Administration Portal, select **Monitor** > **Tenant SLA Performance** and then, click the name of the tenant for which you want view the site-level SLA performance information. .

You can use the *Tenant-Name* SLA Performance page to view SLA performance of all sites in a tenant. This page displays the list of sites with low, medium, and high SLA performance during the specified time range. By default, the data is shown for the previous one day. You can change the time range for which the data is displayed. Sites with low and medium SLA performance are grouped together. The SLA performance classification is done based on the **Performance Threshold** value you set. You can customize the view by selecting card or grid views

Tasks You Can Perform

You can perform the following tasks from this page:

- Specify performance threshold values based on which sites can be classified as sites with low, medium, or high SLA performance.
- View the SLA performance of all sites that have low or medium SLA performance in the specified time period.
- View the SLA performance of all sites that have high SLA performance in the specified time period.
- View the SLA performance for all sites in a tenant in grid or card views.

  Select the **Card** view or the **Grid** view at the top right of the page. By default, the card view is selected.
- Customize the time range to view the SLA performance for all sites in a tenant.

  Select the time range for which you want to view SLA performance. You can choose from Previous 1 hour, Previous 1 day, Previous 1 week, Previous 1 month, and Custom. For custom time, you must enter from and to dates in MM/DD/YYYY format and the time in HH:MM:SS format. By default, Previous 1 day is selected.

Field Descriptions

Table 155 on page 441 describes the fields on the SLA Performance of a Single Tenant page.

Table 155: Fields on the SLA Performance of a Single Tenant Page

Field	Description
Time range	Select the time range for which you want to view the SLA performance. You can choose from Previous 1 hour, Previous 1 day, Previous 1 week, Previous 1 month, and Custom. For custom time, you must enter from and to dates in MM/DD/YYYY format and the time in HH:MM:SS format. By default, Previous 1 day is selected.
View	Select the view in which you want to display the SLA performance for all sites in the tenant. You can choose between card and grid views. By default, card view is selected.
Performance Threshold	Specify the performance threshold based on which sites can be classified as sites with low, medium, or high SLA performance. The performance threshold is specified in percentage terms. To set the performance threshold, click **More** > **Performance Threshold**. From the **Performance Threshold** dialog box, move the slider button to set the low and high thresholds. Site that have a performance score below the low threshold are marked as having low SLA performance and sites that exceed the high threshold are marked as having high SLA performance. Sites that have a performance score between the low and high are considered as having medium SLA performance.
Sites with Low and Medium Performance	View sites that have low and medium SLA performance in the selected time period. The low and medium performance classification is done based on the performance threshold you specify. Click each site to view information about application-level SLA performance. See "Application and Link Level SLA Performance" on page 442.
Sites with High Performance	View the sites that have high SLA performance in the selected time range. Click each site to view information about the application-level SLA performance. See "Application and Link Level SLA Performance" on page 442.

Table 156 on page 441 describes the fields in the card and grid views.

Table 156: Fields on the SLA Performance of a Single Tenant Page in Card and Grid Views

Field Name	Card or Grid View	Description
Site name	Card and Grid	Name of the tenant.

Table 156: Fields on the SLA Performance of a Single Tenant Page in Card and Grid Views *(continued)*

Field Name	Card or Grid View	Description
AppQoE Function	Card and Grid	Shows whether AppQoE is enabled or not. AppQoE is enabled only when the SD-WAN mode is set to Real time-Optimized.
SLA Performance	Card and Grid	Displays the SLA performance score on a scale of 100. Scores that exceed the high performance threshold are displayed in green. Scores that are below the low performance threshold are displayed in red, and the medium scores that are between the low and high performance threshold are displayed in orange. For information about SLA performance score, see "Understanding SLA Performance Score for Applications, Links, Sites, and Tenants" on page 452.
Total sessions	Card and Grid	Total number of sessions during the specified period.
Total Bytes	Card and Grid	Total traffic across all links for the specified tenant.
Transmitted Bytes	Card and Grid	Total outgoing traffic from the site.
Received Bytes	Card and Grid	Total incoming traffic to the site.

Application and Link Level SLA Performance

When AppQoE is enabled, you can view SLA performance of all applications in the site. You can also customize your view by selecting graph view or grid view. In the graph view, you can further select scatter plot or tree map views.

Table 157 on page 442 describes the fields on the SLA Performance of a Single Tenant page.

Table 157: Fields on the SLA Performance of a Single Tenant Page

Field	Description
Time range	Select the time range for which you want to view the SLA performance. You can choose from Previous 1 hour, Previous 1 day, Previous 1 week, Previous 1 month, and Custom. For custom time, you must enter from and to dates in MM/DD/YYYY format and the time in HH:MM:SS format. By default, Previous 1 day is selected.

Table 157: Fields on the SLA Performance of a Single Tenant Page *(continued)*

Field	Description
View	Select the view in which you want to display the SLA performance. You can choose between graph and grid views. By default, graph view is selected.
View App Names	Select this check box to view the names of the applications in the graph view.
Top 10 applications	Select this check box to see the top 10 applications.
Application SLA Performance	
Departments	Select All Departments to view application SLA data for all departments, or select one department to view application SLA data specific to that department. By default, All Departments is selected.
SLA Parameters	Choose one of the following SLA parameters based on which you want to view the application SLA performance data: • Throughput • Latency metric • Packet loss • Jitter metric By default, Throughput is selected. The data for the selected parameter is displayed in the y-axis in the scatter plot view.
Group by	Select whether you want to group the applications based on the SLA Profile or the Traffic Type. By default, the SLA Profile option is selected.
SLA Profile	If you selected **SLA Profile** for **Group by**, select the SLA Profile for which you want to view the SLA performance information. This option is available only if you selected **SLA Profile** for **Group by**.
Traffic Type	If you selected **Traffic Type** for **Group by**, select the **Traffic Type** for which you want to view the SLA performance information. This option is available only if you selected **Traffic Type** for **Group by**.
Graph	Select whether you want to view the SLA performance information for applications in the **Scatter Plot** view or in **Tree Graph** view. By default, **Scatter Plot** is selected.
Link SLA Performance	

Table 157: Fields on the SLA Performance of a Single Tenant Page *(continued)*

Field	Description
Traffic Type	Select the traffic type for which you want to view the link SLA performance. You can choose either **All Traffic Type** or one of the available traffic types.
Links	Select the links for which you want to view the SLA performance. You can choose either **All Links** or one of the available links.

RELATED DOCUMENTATION

About the SLA Performance of All Tenants Page | **437**

Viewing the SLA Performance of a Site | **446**

Viewing the SLA Performance of an Application or Application Group | **450**

Adding SLA-Based Steering Profiles | **339**

Adding Path-Based Steering Profiles | **351**

Monitoring Application-Level SLA Performance for real time-optimized SD-WAN

CSO uses the system log information from SRX devices to monitor application-level SLA performance and displays the relevant information on the **Monitor** > **Tenant SLA Performance** page of the Admin Portal and the **Monitor** > **Application SLA Performance** page of the Customer Portal.

In real time-optimized mode, CSO uses the class-of-service values and the probe results to assign each application, site, and tenant scores that indicate the SLA performance. For more information about the SLA performance scores, see "Understanding SLA Performance Score for Applications, Links, Sites, and Tenants" on page 452.

The following sections explain how you can view the SLA performance information at tenant level, site level, and application level:

1. Viewing SLA Performance of Tenants | **445**
2. Viewing SLA Performance of Sites | **445**

Viewing SLA Performance of Tenants

Service provider administrators and OpCo administrators can view the SLA performance of all the tenants from the **Monitor** > **Tenant SLA Performance** page.

To view the SLA performance of all tenants:

1. From the administration portal, click **Monitor** > **Tenant SLA Performance**.

   The "Tenant SLA Performance" on page 437 page appears.

2. Customize the view to your specific requirements.

   For customization options, see Table 153 on page 438

   The Tenants SLA Performance page displays the SLA performance information for all the tenants in the format and for the time range you specified. For each of the tenant, you can view the details as described in Table 154 on page 438

Viewing SLA Performance of Sites

Service provider administrators and OpCo administrators can view SLA performance information for all the sites associated with a tenant.

To view SLA performance information for the sites associated with a tenant:

1. From the administration portal, click **Monitor** > **Tenant SLA Performance**, and then click the name of the tenant for which you want view the site-level SLA performance information.

   The *Tenant Name* SLA Performance page appears. For more information, see "About the SLA Performance of a Single Tenant Page" on page 440.

2. Customize the view as required. For more information about the customization options, see Table 155 on page 441

   The *Tenant Name* SLA Performance page displays the information in the format and for the time range you specified. For each of the sites, you can view the information as explained in Table 156 on page 441.

3. Click the name of the site to view more details about application-level and link-level SLA performance. A new page appears with graphical representation of SLA performance information for the site as well as the applications and links available in the site.

   You can customize the view as described in Table 157 on page 442.

Viewing the SLA Performance of a Site

IN THIS SECTION

- SLA Not Met by SLA Profiles | 446
- Applications SLA Performance by Throughput | 447
- SLA Performance for ALL | 449

You can use the **Monitor > *Tenant-Name* SLA Performance > *Site-Name* SLA Performance** page in the Administration Portal to view SLA performance for all applications and application groups in a site. You can view the SLA performance for all applications and application groups in a site for a specified time range and in graph or grid views.

The ***Site-Name* SLA Performance** page is divided into the following three sections:

SLA Not Met by SLA Profiles

You can use the **SLA Not Met by SLA Profiles** section on the ***Site_name* SLA Performance** page to view the SLA profiles for which SLA requirements were not met and the time at which they were not met. The y-axis represents the SLA profiles and the x-axis represents the specified time range. The **SLA Not Met by SLA Profiles** section can be viewed and remains the same in both graph and grid views.

To view a graphical representation of SLA profiles for which SLA target values were not met:

1. Select the time range for which you want to view the SLA profiles for which SLA target values were not met. You can choose from Previous 1 hour, Previous 1 day, Previous 1 week, Previous 1 month, and Custom. For custom time, you must enter from and to dates in MM/DD/YYYY format and the time in HH:MM:SS format. By default, Previous 1 day is selected.

   The graphical representation of SLA profiles for which SLA target values were not met is displayed for the selected time range.

2. (Optional) You can use the sliders at the sides of the graph to further customize the time range.

   The graphical representation of SLA profiles for which SLA target values were not met is refreshed and displayed for the customized time range. The graphical representation of SLA performance data in the subsequent sections on the page is also refreshed and displayed for the customized time range.

Applications SLA Performance by Throughput

You can view average throughput performance of all applications and application groups in a site. You can also customize your view by selecting graph view or grid view. In the graph view, you can further select scatter plot or tree map views.

To view a graphical representation of average throughput performance of all applications and application groups in a site:

1. Select **Graph View** at the top right of the page. By default, Graph View is selected.

   A graphical representation of average throughput performance of all applications and application groups in a site against the target throughput is displayed in the **Scatter Plot** view. The y-axis represents the average throughput. 0% on the x-axis represents the target throughput (in %) defined in the SLA profiles, while the regions on the left and right of the target represent percentages below and above the target throughput, respectively.

   A carousel at the bottom of the section also displays the list of all applications and application groups with their SLA profiles, target throughput, and average throughput values.

2. Click **Legend** at the bottom right of the section to view the plotting legend.

   The items described in the **Legend** are:

   - A single application is represented by a blue circle.
   - An application group is represented by a blue square.
   - An application or application group whose target throughput value in the SLA profile was modified during runtime is represented by an uncolored circle or uncolored square, respectively.
   - The SLA profiles are represented by their priority numbers within the colored or uncolored circles and squares.

3. (Optional) You can use the sliders at the sides of the graph further to customize the time range.

   The carousel is refreshed for the customized time range.

4. Click the circles or squares to view more information about the application or application groups. See "Viewing the SLA Performance of an Application or Application Group" on page 450.

> **NOTE:** You can also select **Tree Map** at the top right of the section to view a list of all applications and application groups in a site and their average throughput values.
>
> A list of all applications and application groups in a site along with their associated SLA profiles and the average throughput values is displayed.

To view a tabular representation of average throughput performance of all applications and application groups in a site:

1. Select **Grid View** at the top right of the page.

   A list of all applications and application groups along with their SLA profiles, average throughput, and target throughput values is displayed in a tabular format.

   Table 158 on page 448 describes the fields on the Applications SLA Performance by Throughput grid view.

   Table 158: Fields on the Applications SLA Performance by Throughput Grid View

Field	Description
Name	View name of the application or application group.
SLA Profile	View the SLA profile associated with the application or application group.
Type	View the type—application or application group
Category	View the category of the application or application group. The value of category can be Messaging, Web, Infrastructure, Remote-Access, Multimedia, Video, and so on.
Sessions	View the number of sessions consumed by the application or application group.
Throughput Avg. Performance	View the average throughput performance value (in %) of the application or application group. The upward triangle on the left of the average throughput performance value indicates that the average throughput is higher than the target throughput configured in the SLA profile of the application or application group. The value (in %) denotes the percentage above the target throughput value. Similarly, the downward triangle on the left of the average throughput performance value indicates that the average throughput is lower than the target throughput configured in the SLA profile of the application or application group. The value (in %) denotes the percentage below the target throughput value.

2. (Optional) Click the details icon to the left of the application or application group name to view more details about the application or application group. See "Viewing the SLA Performance of an Application or Application Group" on page 450.

SLA Performance for ALL

View a graphical representation of the performance of the SLA parameters such as round-trip time (RTT), latency, packet loss, and jitter for the specified time range for MPLS and Internet WAN links for all SLA profiles. The y-axis represents the SLA parameters and the x-axis represents the specified time range. You can also view the respective target SLA parameters in the graphs.

> **NOTE:** The graphical representation of the performance of all SLA parameters for the WAN links is available only in the graph view.

To view a graphical representation of the performance of all SLA parameters for the WAN links:

- Select **All** at the top right of the section. By default, **All** is selected.

  A graphical representation of the performance of the SLA parameters such as RTT, latency, packet loss, and jitter for the specified time range for all WAN links is displayed.

- Select **wan_0**, **wan_1**, and so on at the top right of the section to view the performance of the SLA parameters for the MPLS and Internet WAN links. You can enable and configure **wan_0**, **wan_1**, and so on and map them to MPLS or Internet links when you create a site.

  The graphical representation of the performance of the SLA parameters such as RTT, latency, packet loss, and jitter for the specified time range is refreshed and only the performance for the selected WAN link is displayed.

- (Optional) Click **Legend** at the bottom right of the section to view the plotting legend for the horizontal dotted lines parallel to the x-axis in the graphs. The horizontal dotted lines represent the respective target SLA parameters of the SLA profiles.

> **NOTE:** RTT is represented as Delay on the "About the SLA-Based Steering Profiles Page" on page 335 and "About the Path-Based Steering Profiles Page" on page 348 page.

RELATED DOCUMENTATION

About the SLA Performance of All Tenants Page | **437**

About the SLA Performance of a Single Tenant Page | **440**

Viewing the SLA Performance of an Application or Application Group | **450**

Viewing the SLA Performance of an Application or Application Group

You can use the **Monitor > *Tenant-Name* SLA Performance > *Site-Name* SLA Performance** page in the Administration Portal to view the SLA performance of individual applications and application groups in a site. You can also view the SLA performance of the associated SLA profile for all SLA parameters.

To view SLA performance of an application or application groups:

- Click one of the circles or squares in the **Applications SLA Performance by Throughput** section on the ***Site-Name* SLA Performance** page.

  The page that appears displays SLA performance details of the application or application group.

Table 159 on page 450 describes the fields on the application or application group SLA Performance details page.

Table 159: Fields on the Application or Application Group Details Page

Field	Description
Category and Description	View the category of the application or application group. The category can be Messaging, Web, Infrastructure, Remote-Access, Multimedia, Video, and so on. You can also view a description of the application or application group.
SLA	View the name of the SLA profile associated with the application or application group.
Target	View the current target throughput defined in the SLA profile associated with the application or application group. If the target throughput was modified during runtime, the date and time when the throughput was modified and the previously defined throughput value are also displayed.
Avg. Performance	View the average throughout performance (in %) above or below the configured target throughput. The average throughput (in Mbps) is displayed within parentheses.
SLA Metrics by Throughput	View a graphical representation of the SLA metrics by throughput during the specified time range for that application or application group. The y-axis represents the throughput (in Mbps). The x-axis represents the specified time range. Hover over the graph to view the throughput value and time at any specified point. You can also view the sessions consumed by the WAN links for the application or application group for the specified time range.

Table 159: Fields on the Application or Application Group Details Page *(continued)*

Field	Description
Global SLA Profile Performance	View the performance for all the SLA parameters of the SLA profile associated with the application or application group. The SLA performance is represented by a color-coded donut chart. The section in blue in the donut chart indicates the percentage of time during which SLA requirements for the SLA profile were met. The section in red in the donut chart indicates the percentage of time during which SLA requirements for the SLA profile were not met. Click the red colored section of the donut chart to view more information about when SLA requirements for the SLA profile were not met. The **SLA Profile Performance** page appears. The SLA Profile Performance page displays the following fields: • SLA Profile—SLA profile associated with the application or application group • Target—Target throughput configured in the SLA profile • SLAs Not Met—Percentage of time SLA requirements were not met for the SLA profile • Sessions—Number of sessions consumed by the application or application group • Start Time—Time at which the WAN links associated with the application or application groups started to fail meeting the SLA requirements • End Time—Time at which SLA profile requirements started to be met again • Avg Val—Average throughput (in Mbps) when the SLA requirements started to fail • Duration—Total duration (in seconds) during which SLA requirements were not met • From—Source WAN link • To—Destination WAN link

RELATED DOCUMENTATION

About the SLA Performance of All Tenants Page | 437

About the SLA Performance of a Single Tenant Page | 440

Viewing the SLA Performance of a Site | 446

Understanding SLA Performance Score for Applications, Links, Sites, and Tenants

IN THIS SECTION

- Application Score | 452
- Site Score | 453
- Tenant Score | 453
- Link Score | 453

This topic explains the following SLA performance scores:

Application Score

CSO supports Application Quality of Experience (AppQoE) to improve the user experience at the application level. In real time-optimized SD-WAN networks, CSO monitors application traffic using passive probes, which are inline probes sent along with the application traffic. Based on various parameters collected from the passive probes, CSO assigns a score to each of the applications. Based on the sampling rate you specified as part of the traffic type profile, CSO sends passive probes to detect packet loss, jitter, and violations in RTT. If the probe detects any of these issues, a syslog is generated and a violation count is added for the session.

The following metrics are used to calculate the application score:

- Session Violation Count
- Sampling Percentage
- Total Session Count

NOTE: Application score is available only in real time-optimized SD-WAN networks.

Site Score

For AppQoE enabled (real time-optimized SD-WAN) networks, site score is calculated as an aggregate of individual parameters across all applications in the site. For information about application score calculation, see "Application Score" on page 452.

Tenant Score

Tenant score is calculated as the average value of site scores. For information about site score calculation, see "Site Score" on page 453.

Link Score

Link score is calculated based on the following SLA parameters collected using AppQoE active probes (in real time-optimized networks) or RPM probes:

- Latency
- Jitter
- Packet Loss

For VoIP traffic, the link score calculation also considers the R-Value and MOS.