Citrix SD-WAN Orchestrator for On-premises 11.1

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Release Notes for Citrix SD-WAN Orchestrator for On-premises 11.1 Release

July 9, 2021

This release notes document describes the enhancements and changes, fixed and known issues that exist for the Citrix SD-WAN Orchestrator for On-premises release 11.1.

Notes

This release notes document does not include security related fixes. For a list of security related fixes and advisories, see the Citrix security bulletin.

What's New

The enhancements and changes that are available in release 11.1.

Citrix SD-WAN 11.4.0a Release

Citrix SD-WAN 11.4.0a release is supported in Citrix SD-WAN Orchestrator for On-premises.

[SDW-19785]

Citrix SD-WAN 11.3.2 Release

Citrix SD-WAN 11.3.2 release is supported in Citrix SD-WAN Orchestrator for On-premises.

[SDW-19038]

Route summarization

Citrix SD-WAN Orchestrator for On-premises introduces an enhancement to the route summarization functionality. With this enhancement, you can add summary routes without specifying the gateway IP address.

[SDW-19404]

ECMP load balancing

Equal Cost Multi-Path (ECMP) groups allow you to group multiple routes, with the same cost, destination, and service type. ECMP load balancing ensures:

- Distribution of traffic over multiple equal-cost connections.
- Optimal usage of available bandwidth.
- Dynamic transfer of traffic to other ECMP member route, if a route becomes unreachable.
- ECMP groups can be formed over Virtual Paths and Intranet services.

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[SDW-17452]

Storage management (Preview)

Citrix SD-WAN Orchestrator for On-premises supports migrating the configuration and data from one disk to another. You can perform disk migration either to increase the disk space or for disaster recovery.

- **Add a new disk**: You can add a new disk with a storage size at least twice as that of the current data consumed by Citrix SD-WAN Orchestrator for On-premises.
- **Disaster recovery**: In the event of a disaster, you can attach the disk containing the Citrix SD-WAN Orchestrator for On-premises configuration and data to a new instance of Citrix SD-WAN Orchestrator for On-premises virtual machine.

[SDW-16404]

Cloud brokered zero-touch deployment (Preview)

Cloud brokered zero-touch deployment is an automated process that involves Citrix SD-WAN Orchestrator for On-premises as a broker to establish connectivity between Citrix SD-WAN Orchestrator for On-premises and the Citrix SD-WAN appliances.

[SDW-11614]

Transit node enhancements

Enabling hub-and-spoke communication as part of global settings allows all the sites to use the control nodes as transit nodes, by default, for site-to-site communication. Site-specific preferences for virtual overlay transit nodes allow you to override the global virtual overlay transit node settings for all the sites in your network. You can also choose a non-control node as the primary transit node for a site.

[SDW-12443]

IPv6 data plane support

Citrix SD-WAN Orchestrator for On-premises supports IPv6 addresses for the following Citrix SD-WAN appliance configurations with Citrix SD-WAN software version 11.3.1 or above:

- DNS server
- Flows
- Firewall connections
- IP groups
- Regions
- DHCP client
- IP rules and Application rules
- Network address translation
- GRE service

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- Interfaces
- Internet service
- Neighbor discovery protocol
- Prefix delegation group
- IPsec service
- HA settings
- IP routes
- In-band management
- DNS settings
- DHCP server, DHCP relay, and DHCP options set

[SDW-19194]

Fixed Issues

The issues that are addressed in release 11.1.

SD-WAN appliance versions lower than 11.2.0 cannot connect to Citrix SD-WAN Orchestrator for On-premises versions lower than 11.1. Citrix SD-WAN Orchestrator for On-premises 11.1 is the recommended version if users want to connect their SD-WAN appliances running a software version lower than 11.2.0.

[SDW-20220]

When there is a failure in upgrading a customer's account to production, the UI does not display the failure message.

[SDW-19574]

Upgrade to production fails in Citrix SD-WAN Orchestrator for On-premises, for prepaid customers having only perpetual licenses.

[SDW-19558]

Assigning perpetual licenses to sites fails in Citrix SD-WAN Orchestrator for On-premises.

[SDW-19556]

When there is a failure in assigning licenses, the UI does not display the failure message under **Administration** > **Licensing**.

[SDW-19238]

Even though the customer administrator does not have access to delete the remote authentication servers, the UI displays the delete icon. However, when the customer administrator tries to perform the delete operation, the following error is displayed:

```
User is not authorized to perform this operation.
```

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[SDW-18945]

From the provider level **Administration** > **Announcements** page, if you choose a customer from the top menu bar, a blank page with **Network Administration** as the heading is displayed.

[SDW-18944]

After importing valid production entitlements, the **Upgrade to production** option is made available under **Licensing** even before assigning the license to the appliance.

[SDW-18721]

Known Issues

The issues that exist in release 11.1.

Cloud brokered ZTD feature has a dependency on SD-WAN Orchestrator service, for it to work. This will be addressed in an upcoming SD-WAN Orchestrator service release. However, customers need not upgrade their Citrix SD-WAN Orchestrator for On-premises.

[SDW-20307]

When Citrix SD-WAN Orchestrator for On-premises is upgraded to the 11.1 version, the audit logs collected during the previous releases display **sdwan-onprem-sp** as the user and the log payloads toggle button is enabled on the UI. These logs are cleared after 92 days.

[SDW-20305]

SD-WAN cloud ZTD configuration fails to work for HA Sites if the cloud ZTD is already configured on a primary site.

Workaround:

1. Delete the primary site cloud ZTD configuration by navigating to **Administration** > **ZTD Settings** > **Cloud Brokered ZTD**.
2. Reconfigure the cloud ZTD site for both primary and secondary sites at the same time.

[SDW-20208]

Licensing feature is not supported in the provider managed setup of Citrix SD-WAN Orchestrator for On-premises. Providers can continue with the trial licenses. A grace period of 60 days is provided.

[SDW-18831]

When an appliance loses connectivity to Citrix SD-WAN Orchestrator for On-premises for more than 20 minutes and goes into the re-registration phase, it sends an incorrect serial number in the registration request.

Workaround: Reboot the appliance.

[SDW-18781]

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In a provider managed setup, the announcements added by the provider administrators are not getting displayed to customers at their login.

[SDW-18491]

Citrix SD-WAN Orchestrator for On-premises displays the status as **Not Connected** although the SD-WAN appliance is connected to Citrix SD-WAN Orchestrator for On-premises.

Workaround: Navigate to **Configuration** > **Network Config Home** and verify the connectivity status of the appliance on the Citrix SD-WAN Orchestrator for On-premises UI.

[SDW-18280]

When the database backup of an appliance is restored on another appliance having the same release of Citrix SD-WAN Orchestrator for On-premises, the user details are not restored. On the restored appliance, if you create a user with the same user name as in the backed-up database, the following error is displayed:

```
User has a role already assigned
```

Workaround: Create a user with a different user name that did not exist on the backed-up database.

[SDW-15984]

Citrix SD-WAN Orchestrator for On-premises running VMware ESXi 13 fails to reboot and goes into a bad state.

Workaround: Use VMware ESXi version 9.

[SDWANHELP-2182]

Release Notes for Citrix SD-WAN Orchestrator for On-premises 10.3 Release

July 12, 2021

This release notes document describes the enhancements and changes, fixed and known issues that exist for the Citrix SD-WAN Orchestrator for On-premises release 10.3.

Notes

This release notes document does not include security related fixes. For a list of security related fixes and advisories, see the Citrix security bulletin.

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What's New

The enhancements and changes that are available in release 10.3.

Configuration and Management

Dynamic Routing

From Citrix SD-WAN 11.3.1 release onwards, you can configure one router ID for the entire protocol and also one router ID per routing domain. With this enhancement, you can enable stable dynamic routing across multiple instances with different router IDs converging in a stable manner.

[SDW-17097]

Retry staging

Retry staging option is now available to reinitiate staging at the sites where the staging process has failed.

[SDW-16538]

Custom application

The **Enable Reporting** check box is newly added for the IP Protocol-based custom applications. Now you can also view the IP protocol and domain name-based custom application-defined traffic under the **Reports > Usage** page. The custom application option is also added as a type under the **Application quality configuration** page.

[SDW-10862]

Miscellaneous

Fallback configuration

Fallback configuration ensures that the appliance remains connected to the zero-touch deployment service if there is a link failure, configuration mismatch, or software mismatch. Fallback configuration is enabled by default on the appliances that have a default configuration profile. If the fallback configuration is disabled at a site, you can enable it through Citrix SD-WAN Orchestrator for On-premises.

[SDW-13978]

Flows

You can now use the Appliance settings **Flows** section to perform the following action:

- Enable/disable Citrix Virtual WAN service
- Restart dynamic routing
- Enable/disable virtual paths
- Enable/disable WAN links

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[SDW-13977]

Network Admin and Security Admin roles (Preview)

Citrix SD-WAN Orchestrator for On-premises supports the following roles:

- **Provide-Network-Admin**: An administrator who can only view and edit the network related information.
- **Provider-Security-Admin**: An administrator who can only view and edit the security related information.
- **Customer-Network-Admin**: A customer administrator who can only view and edit network related information.
- **Customer-Security-Admin**: A customer administrator who can only view and edit security related information.

[SDW-13845]

Appliance Settings

You can now configure date and time, at the site level, through Citrix SD-WAN Orchestrator for On-premises. You can either configure the date and time manually or through an NTP server and also set the time zone.

[SDW-13321]

Provider level support

Citrix SD-WAN Orchestrator for On-premises supports multitenancy. With the multitenancy feature, multiple customer accounts can be managed using a single Citrix SD-WAN Orchestrator for On-premises instance. You can have one of the following types of setups.

- **Provider managed setup**: Customers consume a managed Citrix SD-WAN Orchestrator for On-premises service from Citrix partners using the multitenancy feature.
- **Customer managed setup**: Customers manage their Citrix SD-WAN Orchestrator for On-premises as a self-managed service for their enterprise.

As part of provider managed setup support, the following capabilities are introduced:

- **Roles**: The following provider level roles are added:
  - Provider-Master-Admin-All
  - Provider-Master-Admin-Tenant
  - Provider-Master-ReadOnly-All
- **Dashboard**: A new UI page is added that provides a birds eye view of all the SD-WAN customers managed by a provider.
- **Connectivity with SD-WAN appliances**: In a provider managed setup, only providers have the ability to enable authentication type and regenerate the Citrix SD-WAN Orchestrator for On-premises certificate. Customers have the ability to upload the appliance certificate.

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- **Site profile templates and WAN link templates**: The templates enable the creation of **site profiles** and **WAN link profiles** at a customer level.
- **Publish software**: Citrix SD-WAN Orchestrator for On-premises allows provider administrators to download Citrix SD-WAN appliance software version required for all the appliances in your network. Providers can publish the downloaded software version. The published software is downloaded and stored in Citrix SD-WAN Orchestrator for On-premises. Customer administrators can deploy the published software to all the appliances managed by Citrix SD-WAN Orchestrator for On-premises.
- **Administration**: Provider administrators can configure management IP, DNS, NTP servers, and remote authentication servers.
- **Announcements**: Providers can use the **Announcements** option to send out announcements or notifications to their customers.
- **Reports**: The **Provider Reports** provide visibility into alerts, usage trends, and inventory aggregated across all the customers managed by a Provider.

[SDW-12589]

Zero Touch Deployment - Batch Sites

You can now import a CSV file to add multiple sites simultaneously for Zero Touch Deployment. A sample downloadable template is available in the UI, download it and provide all the site details.

[SDW-12249]

Platform and systems

Site Reports: WAN Link Metering

The **WAN Link Metering** reports provide details about the metered WAN link usage. You can view the reports to get insights into the data consumption of the metered WAN links.

[SDW-8892]

Known Issues

The issues that exist in release 10.3.

Configuration and Management

For In-band HA, the GUI does not have an option to select the direction of the Destination Rule with Service Type as Any resulting in failure of outbound rules. The error message [EC818] At Site sitename: service type ‘any’ may not be used when direction is outbound.

[SDW-16968]

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Miscellaneous

Even though the customer administrator does not have access to delete the remote authentication servers, the GUI displays the delete icon. However, when tried to perform the delete operation, the following error is displayed:

```
User is not authorized to perform this operation
```

[SDW-18945]

From the provider level **Administration > Announcements** page, if you choose a customer from the top menu bar, a blank page with **Network Administration** as the heading is displayed.

[SDW-18944]

You cannot restore the database backup taken in a provider managed setup on a customer managed setup. Similarly, you cannot restore the database backup taken in a customer managed setup on a provider managed setup.

[SDW-18904]

When the customer-security-admin role having read-only access to the site configuration tries to edit the configuration, instead of displaying unauthorized access, a red banner with an error message is displayed.

[SDW-18840]

Licensing feature is not supported in the provider managed setup of Citrix SD-WAN Orchestrator for On-premises. Providers can continue with the trial licenses. A grace period of 60 days will be provided.

[SDW-18831]

When an appliance loses connectivity to Citrix SD-WAN Orchestrator for On-premises for more than 20 minutes and goes into the re-registration phase, it sends an incorrect serial number in the registration request.

Workaround: Reboot the appliance.

[SDW-18781]

After importing valid production entitlements, **Upgrade to production** option is made available under Licensing even before assigning the license to the appliance.

Workaround: Click **Upgrade to Production** only after the license is assigned to the appliance.

[SDW-18721]

Network Address Translation (NAT) is not supported between Citrix SD-WAN Orchestrator for On-premises and the appliance.

[SDW-18703]

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In a provider managed setup, the announcements added by the provider administrators are not getting displayed to customers at their login.

[SDW-18491]

The CLI allows users to create a password out of the allowed 8–128 length range but the GUI login fails if the password length is out of the allowed range.

Workaround: On logging into the GUI, the user is forced to change the length of the password to the allowed range.

[SDW-16068]

When a user tries to log in, a red banner might display at the top of the page for a fraction of a second before displaying the login page.

[SDW-16024]

When the database backup of an appliance is restored on another appliance having the same release of Citrix SD-WAN Orchestrator for On-premises, the user details are not restored. On the restored appliance, if you create a user with the same user name as in the backed-up database, the following error is displayed:

```
User has a role already assigned
```

Workaround: Create a user with a different user name that did not exist on the backed-up database.

[SDW-15984]

Release Notes for Citrix SD-WAN Orchestrator for On-premises 9.6 Release

July 12, 2021

This release notes document describes the enhancements and changes, fixed and known issues that exist for the Citrix SD-WAN Orchestrator for On-premises release 9.6.

> **Note**
>
> This release notes document does not include security related fixes. For a list of security related fixes and advisories, see the Citrix security bulletin.

What's New

The enhancements and changes that are available in release 9.6.

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Configuration and Management

Dynamic Routing

From Citrix SD-WAN 11.3.1 release onwards, you can configure one router ID for the entire protocol and also one router ID per routing domain. With this enhancement, you can enable stable dynamic routing across multiple instances with different router IDs converging in a stable manner.

[SDW-17097]

Miscellaneous

HTTPS Certificate

HTTPS Certificate is required for establishing secure management HTTPS connection to Citrix SD-WAN Orchestrator for On-premises. You can use the default certificate available on the Citrix SD-WAN Orchestrator for On-premises GUI or upload a custom HTTPS certificate generated from any other framework such as OpenSSL. Custom HTTPS certificate allows you to have control over the security and the other subject parameters related to the certificate.

[SDW-16359]

Interfaces

From Citrix SD-WAN 11.3.1 release onwards, you can enable or disable a virtual interface using the **Enabled** check box.

[SDW-15993]

Fixed Issues

The issues that are addressed in release 9.6.

Configuration and Management

For Citrix SD-WAN 6100 SE appliance, the UI does not display **LAG** page under **Configuration > Advanced Settings**.

[SDWANHELP-1895]

Miscellaneous

Citrix SD-WAN Orchestrator for On-premises GUI prompts the users to log in every one hour even when the GUI is in continuous use and not left idle.

[SDWANHELP-1902]

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When you create a site by cloning an existing site **Deploy Config/Software > Verify Config** fails.

[SDW-16103]

Known Issues

The issues that exist in release 9.6.

Miscellaneous

If you open Citrix SD-WAN Orchestrator for On-premises GUI in a new tab while authentication token refresh is in progress, all existing sessions in the browser get logged out.

[SDW-17719]

If the disk is resized to more than 1.8 TB, resizing of the disk does not happen.

[SDW-16404]

The CLI allows users to create a password out of the allowed 8–128 length range. However, the GUI login fails if the password length is out of the allowed range.

Workaround: On logging into the GUI, the user is forced to change the length of the password to the allowed range.

[SDW-16068]

When a user tries to log in, a red banner might display at the top of the page for a fraction of a second before displaying the login page.

[SDW-16024]

When the database backup of an appliance is restored on another appliance having the same release of Citrix SD-WAN Orchestrator for On-premises, the user details are not restored. On the restored appliance, if you create a user with the same user name as in the backed-up database, the following error is displayed:

```
User has a role already assigned
```

Workaround: Create a user with a different user name that did not exist on the backed-up database.

[SDW-15984]

Release Notes for Citrix SD-WAN Orchestrator for On-premises 1.0 Release

July 12, 2021

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Citrix SD-WAN Orchestrator for On-premises is a self-hosted, management service available as separate instance for each customer. It provides a single-pane of glass management platform that enables you to configure, monitor, and analyze all the SD-WAN appliances on your SD-WAN network.

Citrix SD-WAN Orchestrator for On-premises is recommended for customers with strong regulatory requirements around data sovereignty and data privacy.

The following are some of the key capabilities:

- **Authentication**: Supports local and RADIUS / TACACS+ authentication.
- **Centralized configuration**: Centralized configuration of SD-WAN networks, with guided workflows, visual aids, and profiles.
- **Zero touch provisioning**: Seamless bring up of the network and connections.
- **Application-centric policies**: Application based traffic steering, Quality of Service (QoS), and Firewall policies, configurable globally or per site.
- **Hierarchical summarization of health**: Ability to centrally monitor the health, usage, quality, and performance of a network as a whole, with the ability to drill down into individual sites and associated connections.
- **Troubleshooting**: Device & Audit Logs, Diagnostic utilities such as Ping, Traceroute, Packet Capture to troubleshoot network connectivity issues.

Prerequisites

- **Appliances**: A minimum of two appliances. Each SD-WAN appliance or virtual instance must have an IP address configured.
- **Citrix SD-WAN Orchestrator service account**: To use Citrix SD-WAN Orchestrator for On-premises, you must have an account in the Citrix SD-WAN Orchestrator service. For more information, see Onboarding Citrix SD-WAN Orchestrator service.

Citrix SD-WAN Orchestrator for On-premises 1.0.1

Fixed Issues

- **SDW-16456**: Any to any routing domain is not supported in Citrix SD-WAN Orchestrator for On-premises.
- **SDW-16063**: At the network level, the Wi-Fi summary reports are unavailable.
- **SDW-16054**: If a customer account is created outside of the US region on the Citrix SD-WAN Orchestrator service, then the API token obtained by the Identity and Management (IDAM) page from Citrix Cloud does not work. The customer's login to Citrix SD-WAN Orchestrator for On-premises fails with the following error message: "Invalid Customer ID, Client ID, or Client Secret".

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You can now select the **POP** in which your cloud account was on-boarded, on booting up the Citrix SD-WAN Orchestrator for On-premises for the first time.

Known issues

- **SDW-16068**: The CLI allows users to create a password out of the allowed 8–128 length range but the GUI login fails if the password length is out of the allowed range.
  - **Workaround**: On logging into the GUI, the user is forced to change the length of the password to the allowed range.
- **SDW-16024**: When a user logs in to the UI, a red banner might display at the top of the page for a fraction of a second before displaying the login page.
- **SDW-15984**: When the database backup of an appliance is restored on another appliance having the same release of Citrix SD-WAN Orchestrator for On-premises, the user details are not restored. On the restored appliance, if you create a user with the same user name as in the backed-up database, the following error is displayed:

  User has a role already assigned

  - **Workaround**: Create a user with a different user name that did not exist on the backed-up database.
- **SDW-16103**: When you create a site by cloning an existing site, **Deploy Config/Software > Verify Config** fails.
  - **Workaround**: Do not create a site by cloning an existing site.
- **SDW-16404**: If the disk is resized to more than 1.8 TB, resizing of the disk does not happen.

System requirements and installation

June 30, 2021

Before you install Citrix SD-WAN Orchestrator for On-premises on a Virtual Machine (VM), ensure that you must understand the hardware and software requirements and have met the prerequisites.

> **Note**
>
> The system requirements are common for both single-region network and multi-region network.

Hardware requirements

The following are the hardware requirements for Citrix SD-WAN Orchestrator for On-premises to store data of 1 month or statistics for two WAN links per site on an average:

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Number of sites	Processor	RAM	Storage
2000	256 vCPUs 3 GHz or higher	512 GB	2 TB
1000	128 vCPUs 3 GHz or higher	256 GB	1 TB
500	64 vCPUs 3 GHz or higher	128 GB	500 GB
256	32 vCPU 3 GHz or higher	64 GB	256 GB
128	8 vCPUs 3 GHz or higher	16 GB	256 GB

Software

Citrix SD-WAN Orchestrator for On-premises VPX can be configured on the following platforms:

Hypervisor

- VMware ESXi server, version 6.5.
- Citrix XenServer 6.5 or higher.

Browsers must have cookies enabled, and JavaScript installed and enabled.

Citrix SD-WAN Orchestrator for On-premises Web Interface is supported on the following browsers:

- Google Chrome 40.0+
- Microsoft Internet Explorer 11+
- Mozilla Firefox 41.0+

Prerequisites

Following are the prerequisites for installing and deploying Citrix SD-WAN Orchestrator for On-premises:

- The SD-WAN Master Control Node (MCN) and existing client nodes must be upgraded to the latest Citrix SD-WAN software version.
- It is recommended to have a DHCP server available and configured in the SD-WAN network.
- You must have the Citrix SD-WAN Orchestrator for On-premises installation files.

> **Note**
>
> You cannot customize or install any third party software on Citrix SD-WAN Orchestrator for On-

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> premises. However, you can modify the vCPU, memory, and storage settings.

Download Citrix SD-WAN Orchestrator for On-premises software

Download the Citrix SD-WAN Orchestrator for On-premises Management Console software installation files, for the required release and platform, from the Downloads page.

Citrix SD-WAN Orchestrator for On-premises installation files use the following naming convention:

- ctx-sdw-onprem-build.extension
- ctx-onprem-build.extension
- ctx-onprem-build.extension

Platform	Extension
Citrix XenServer	.xva
VMware ESXi	-vmware.ova

Installation and configuration checklist

This section provides a checklist of the information you need to complete your Citrix SD-WAN Orchestrator for On-premises installation and deployment.

Gather or determine the following information:

- The IP address of the ESXi server and XenServer that hosts the Citrix SD-WAN Orchestrator for On-premises Virtual Machine (VM).
- A unique name to assign to the Citrix SD-WAN Orchestrator for On-premises VM.
- The amount of memory to allocate for the Citrix SD-WAN Orchestrator for On-premises VM.
- The amount of disk capacity to allocate for the virtual disk for the VM.
- The Gateway IP Address the Citrix SD-WAN Orchestrator for On-premises use to communicate with external networks.
- The subnet mask for the network in which the Citrix SD-WAN Orchestrator for On-premises VM is installed.

Difference between SD-WAN Orchestrator for On-premises and Citrix SD-WAN Orchestrator service

August 13, 2021

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Features

Features	Citrix SD-WAN Orchestrator service	SD-WAN Orchestrator for On-premises
Advanced Edition Platform	Yes	No
Premium Edition Platform	Yes	No
Zscaler Service	Yes	No
Cloud Direct Service	Yes	No
Azure Virtual WAN Service	Yes	No
Citrix Secure Internet Access Service	Yes	No
Hosted Firewall	Yes	No
Application Routing on preset DPI apps and custom apps (FQDN or IP based)	Yes	Yes
Application Routing on apps that require dynamic signature updates (Like Office 365, Citrix Cloud, and newly supported apps).	Yes	No
Orchestrator - High Availability	Yes	No

Requirements

Requirements	Citrix SD-WAN Orchestrator service	SD-WAN Orchestrator for On-premises
SD-WAN Factory Image required	All (Factory Shipping release)	Citrix SD-WAN 10.2.7, 11.1.1, 11.2.0, 11.2.2, 11.3.0 and above.*
Appliance Deployed in the Network	All	Citrix SD-WAN 11.2.2, 11.3.0 and above.*
SD-WAN appliance internet connectivity	Required	Not Required
Firewall ports to be open	443	443, 22, ICMP

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Requirements	Citrix SD-WAN Orchestrator service	SD-WAN Orchestrator for On-premises
Licensing	Postpaid and Prepaid models	Prepaid model only

- The supported Citrix SD-WAN software version depends on the SD-WAN Orchestrator for On-premises software version.

Install and configure SD-WAN Orchestrator for On-premises on ESXi Server

July 9, 2021

Install the VMware vSphere client

Following are the basic instructions for downloading and installing the VMware vSphere client that you use to create and deploy the Citrix SD-WAN Orchestrator for On-premises Virtual Machine (VM).

To download and install the VMware vSphere Client, do the following:

1. Open a browser and navigate to the ESXi server that hosts your vSphere Client and Citrix SD-WAN Orchestrator for On-premises virtual machine instance. The VMware ESXi Welcome page appears.
2. Click the **Download vSphere Client** link to download the vSphere Client installation file.
3. Install the vSphere Client.

   Run the vSphere Client installer file that you downloaded, and accept each of the default options when prompted.
4. After the installation completes, start the vSphere Client program.

   The VMware vSphere Client login page appears, prompting you for the ESXi server login credentials.
5. Enter the ESXi server login credentials:
   - **IP address/Name**: Enter the IP Address or Fully Qualified Domain Name (FQDN) for the ESXi server that hosts your Citrix SD-WAN Orchestrator for On-premises virtual machine instance.
   - **User name**: Enter the server administrator account name. The default is root.
   - **Password**: Enter the password associated with this administrator account.

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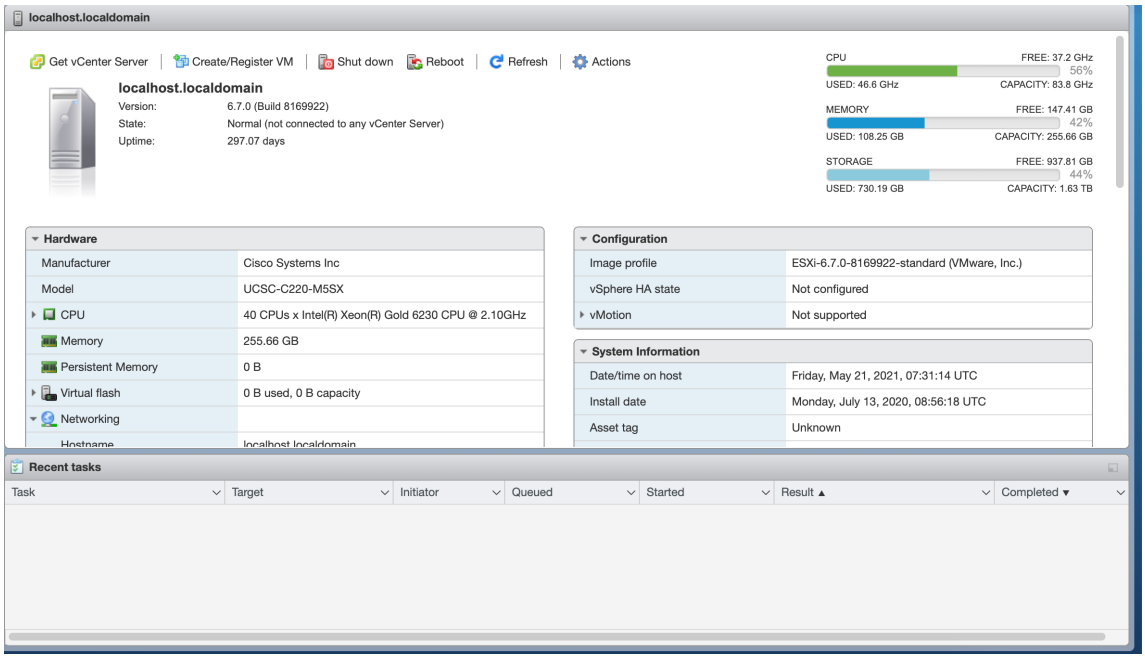
6. Click **Login**.
   The vSphere Client main page appears.



Creating the Citrix SD-WAN Orchestrator for On-premises virtual machine using the OVF template

After installing the VMware vSphere client, create the Citrix SD-WAN Orchestrator for On-premises virtual machine.

1. If you have not already done so, download the Citrix SD-WAN Orchestrator for On-premises OVF template file (.ova file) to the local PC.

   For more information, see System requirements and installation.

2. In the vSphere Client, click **Create/Register VM**, and then select **Deploy a virtual machine from an OVF or OVA file** from the list. Click **Next**.

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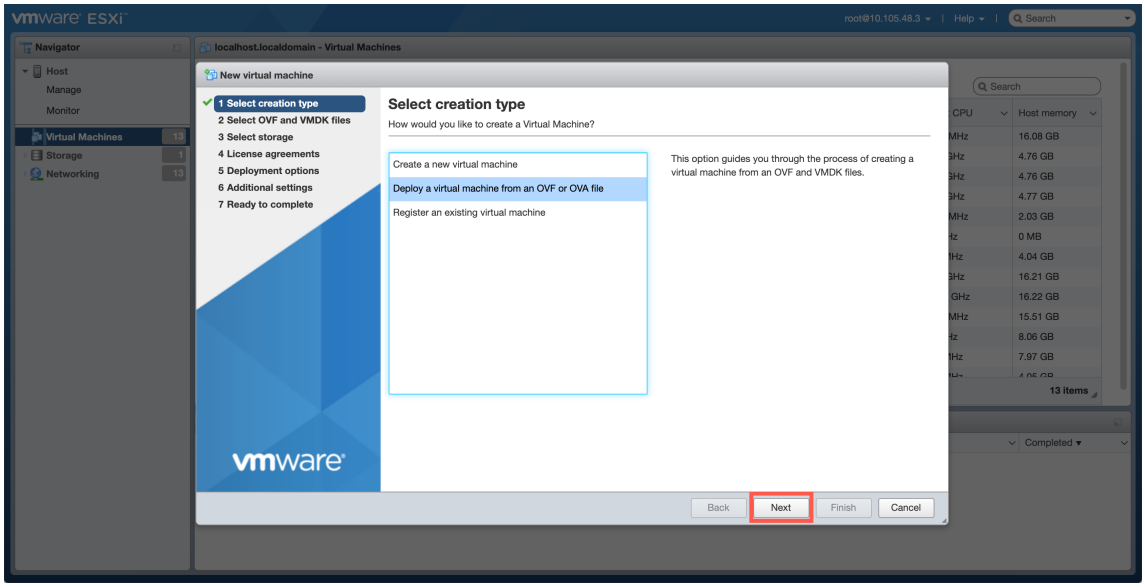
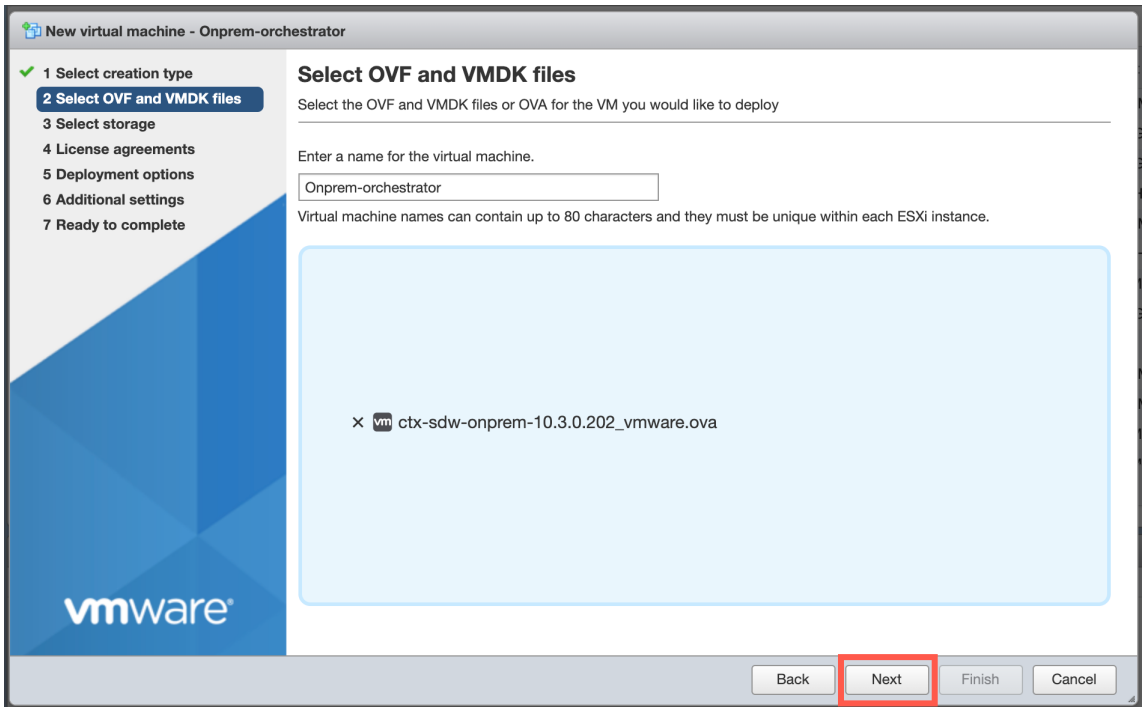


3. Enter a unique name for the new virtual machine.
4. Click inside the box and select the Citrix SD-WAN Orchestrator for On-premises OVF template (.ova file) that you want to install or you can drag and drop the file inside the box.
5. Click **Next**.



6. Click **Next**.

   The Storage page appears.

7. Accept the default storage resource by clicking **Next**.

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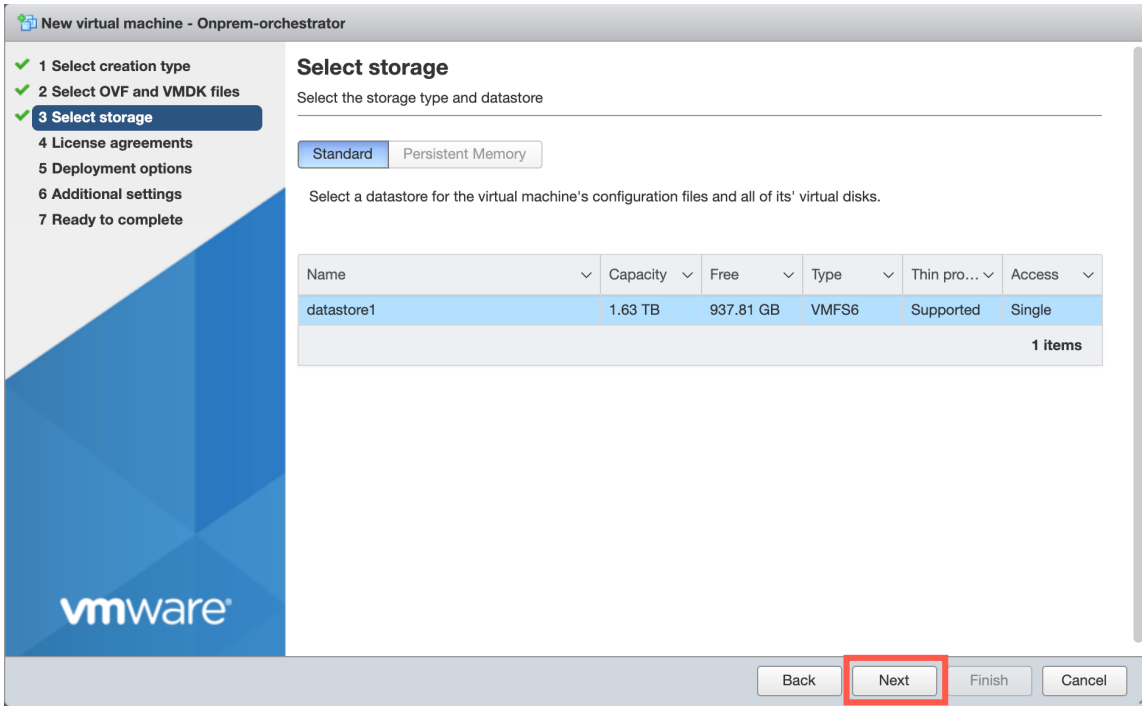
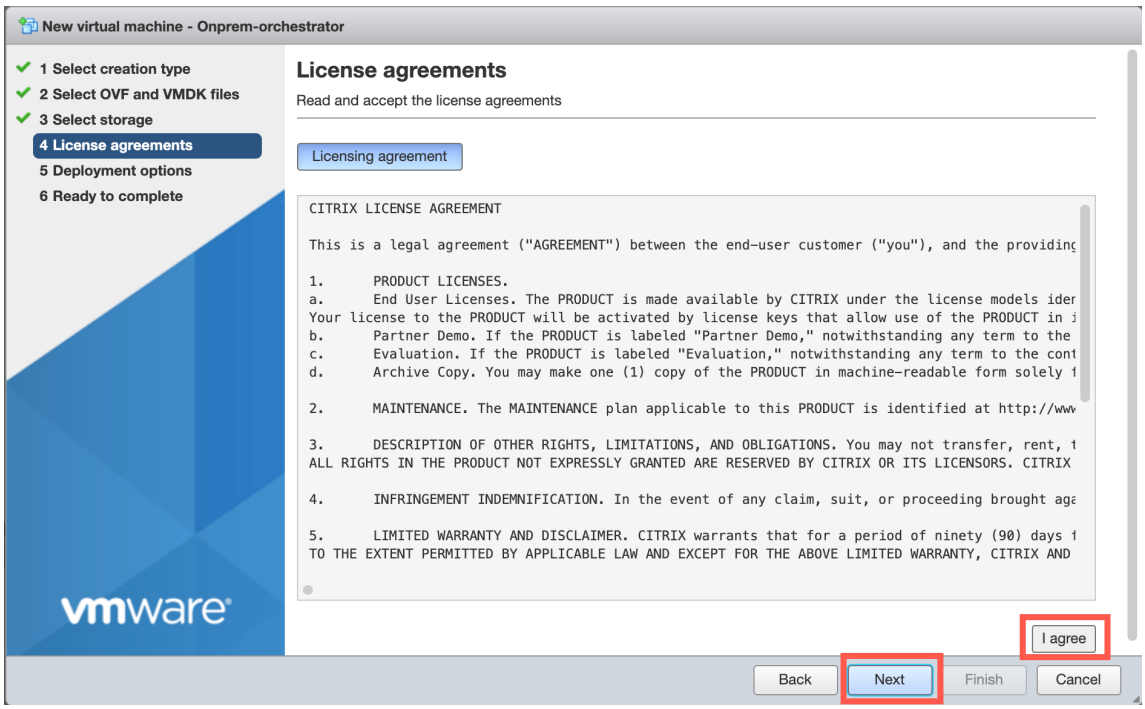


8. On the End User License Agreement page, click **I Agree**, and click **Next**.



9. On the Deployment option page, select the VM Network from the drop-down list and accept the default settings for other fields. Click **Next**.

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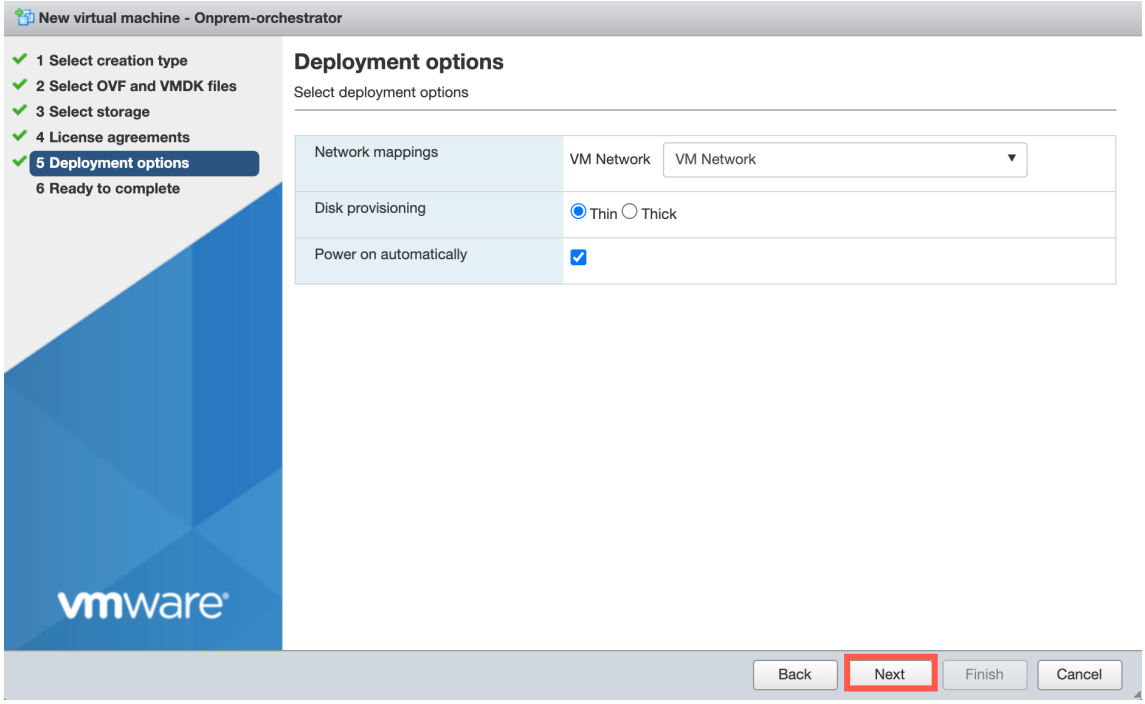
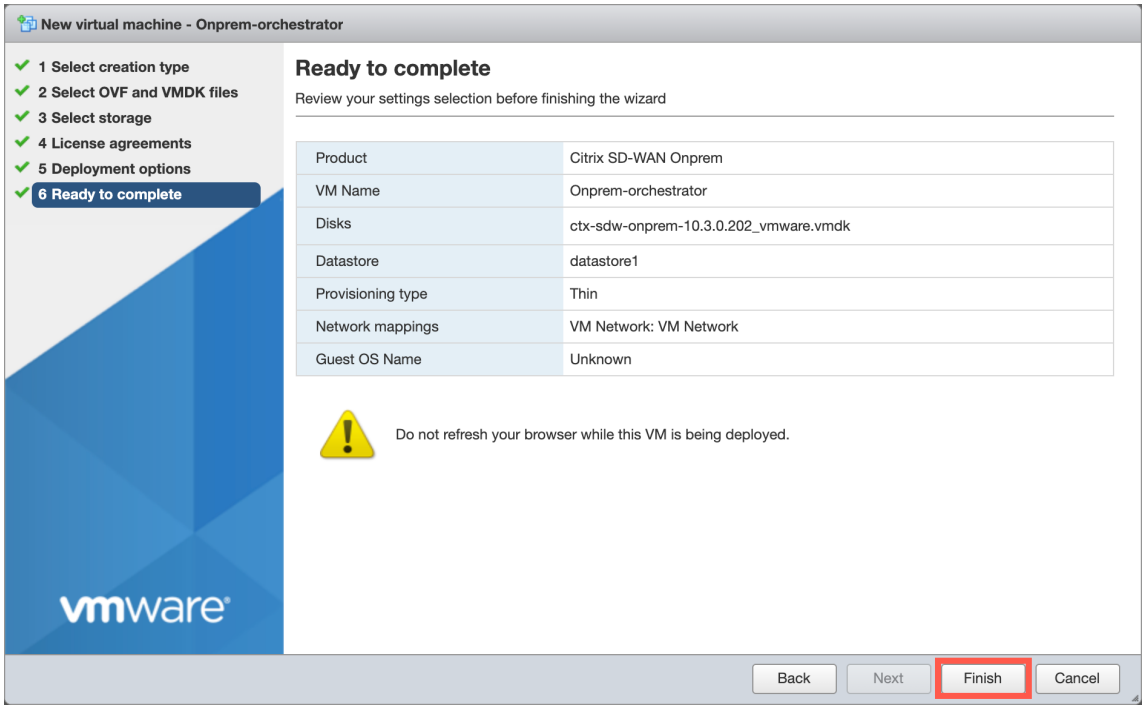


10. On the Ready to Complete page, click **Finish** to create the virtual machine.

> **Note**
>
> Decompressing the disk image onto the server can take several minutes.



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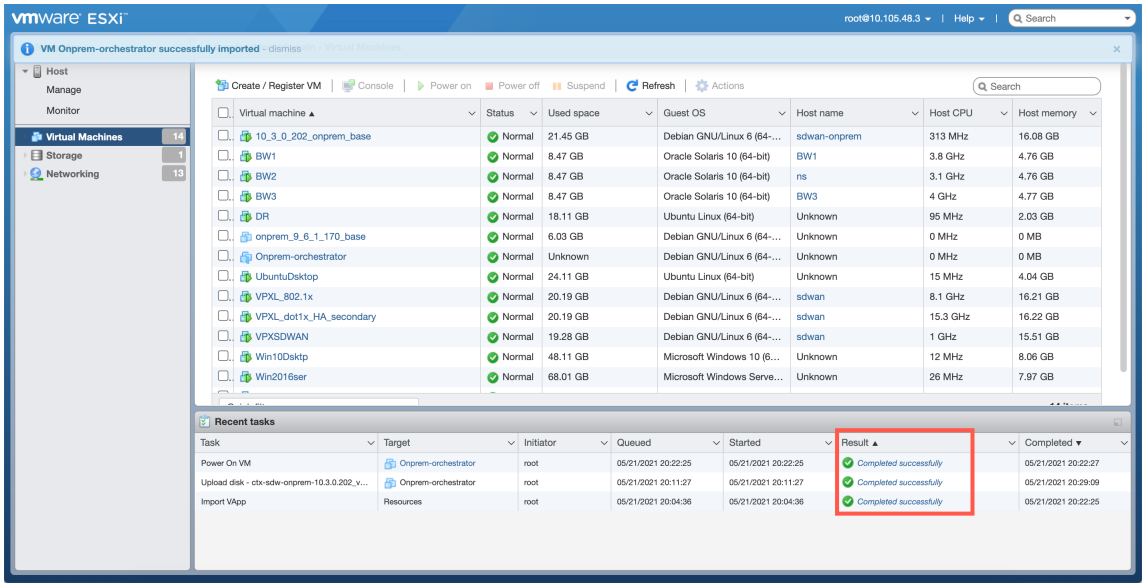
View and record the management IP address on the ESXi server

The management IP address is the IP address of the Citrix SD-WAN Orchestrator for On-premises virtual machine, use this IP address to log into the Citrix SD-WAN Orchestrator for On-premises Web UI.

To display the management IP address, do the following:

1. On the vSphere client Inventory page, select the new Citrix SD-WAN Orchestrator for On-premises virtual machine.
2. On the Citrix SD-WAN Orchestrator for On-premises page, under Recent Tasks, wait for the result to show completed.



3. Select the **Console** tab, and then click anywhere inside the console area to enter console mode.

> **Note**
>
> To release console control of your cursor, press the `<Ctrl>` and `<Alt>` keys simultaneously.

4. Press **Enter** to display the console login prompt.

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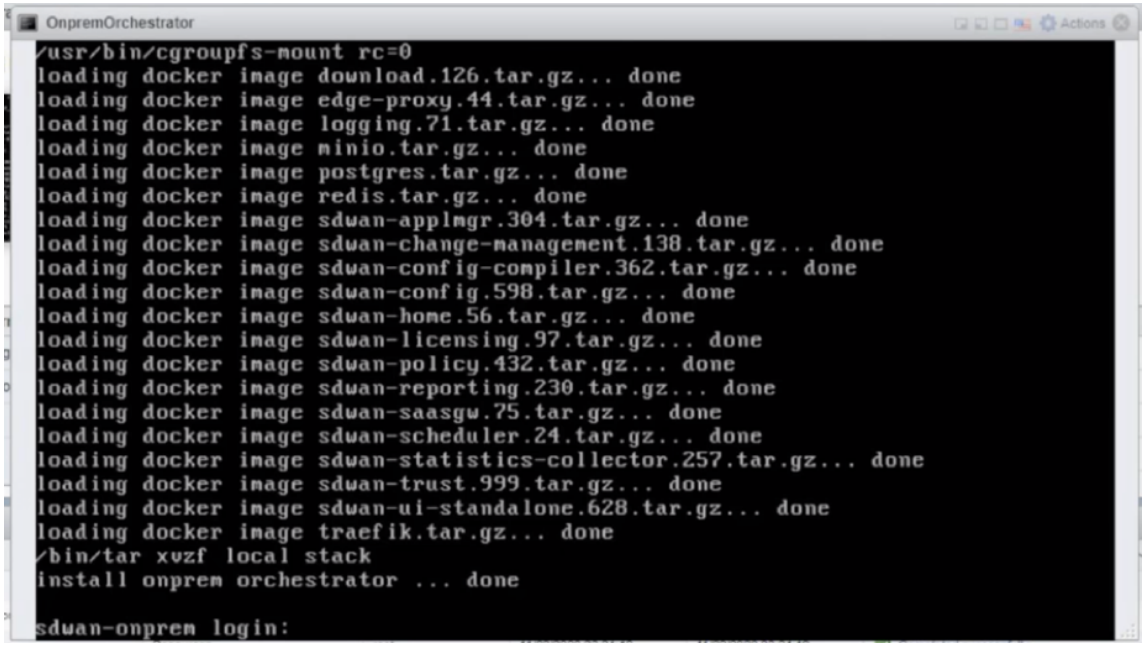
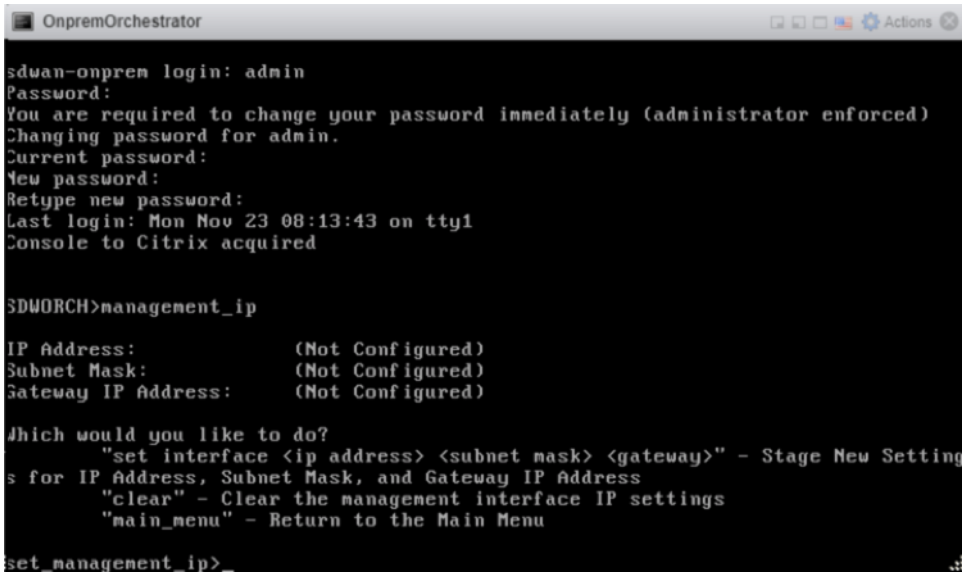


5. Log into the virtual machine console.

   The default login credentials for the new Citrix SD-WAN Orchestrator for On-premises virtual machine are as follows:

   - **Login**: admin
   - **Password**: password

   > **Note**
   >
   > It is mandatory to change the default admin user account password on a first time logon. This change is enforced using both CLI and UI.



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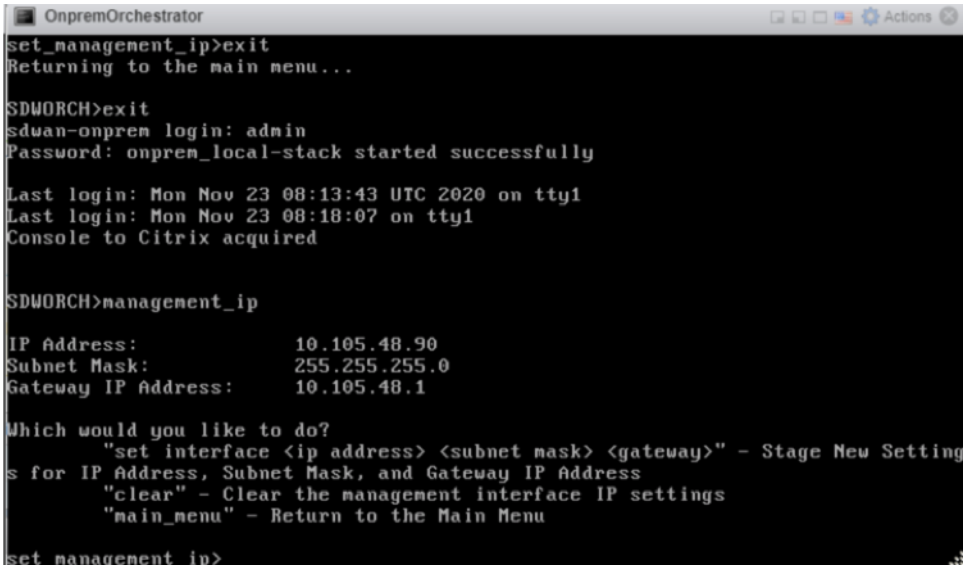
6. Record the Citrix SD-WAN Orchestrator for On-premises virtual machine's management IP address, which is shown as the Host IP address in a welcome message that appears when you log on.



> **Note**
>
> The DHCP server must be present and available in the SD-WAN network, or this step cannot be completed.

If the DHCP server is not configured in the SD-WAN network, you have to manually enter a static IP address.

To configure a static IP address as the management IP address:

1. When the virtual machine is started, click the **Console** tab.
2. Log into the virtual machine. The default login credentials for the new Citrix SD-WAN Orchestrator for On-premises virtual machine are as follows:
   - **Login**: admin
   - **Password**: password
3. In the console enter the CLI command `management_ip`.
4. Enter the command `set interface <ipaddress> <subnetmask> <gateway>`, to configure management IP.
5. Are you sure you want to change your Management Interface IP settings?

   You may lose connectivity to the appliance. <y/n>?

   Press "y" to change the IP and access the new management IP configured after nearly 6–7 minutes.

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Install and configure SD-WAN Orchestrator for On-premises on XenServer

January 20, 2021

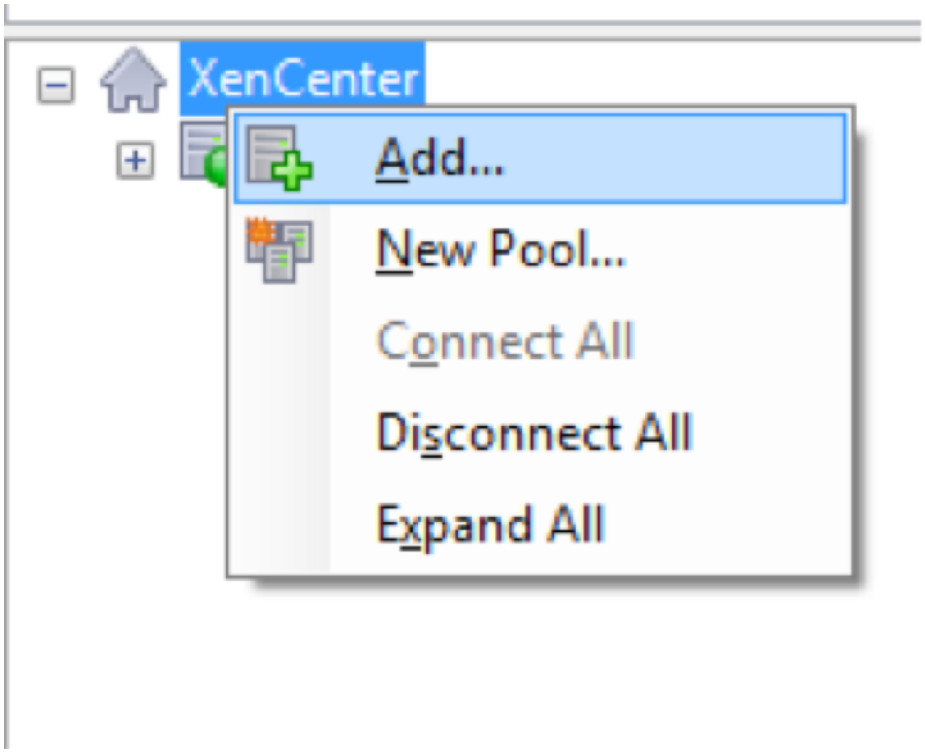
Before installing the Citrix SD-WAN Orchestrator for On-premises virtual machine on a XenServer server, gather the necessary information as described in Installation and configuration checklist.

Install the XenServer server

To install the Citrix XenServer server on which you deploy the Citrix SD-WAN Orchestrator for On-premises virtual machine, you must have XenCenter installed on your computer. If you have not already done so, download and install XenCenter.

To install a XenServer server:

1. Open the XenCenter application on your computer.
2. In the left tree pane, right-click on **XenCenter** and select **Add**.



3. In the **Add New Server** window, enter the required information in the following fields:
   - **Server**: Enter the IP Address or Fully Qualified Domain Name (FQDN) of the XenServer server that hosts your Citrix SD-WAN Orchestrator for On-premises virtual machine instance.

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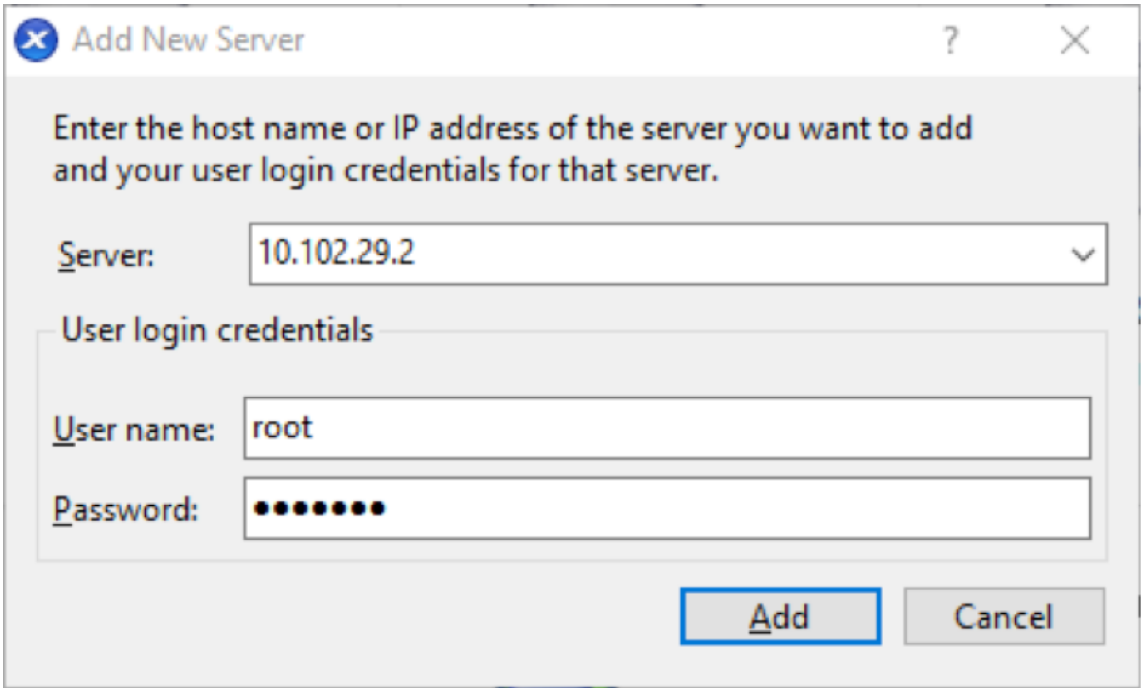
- **User name**: Enter the server administrator account name. The default is root.
- **Password**: Enter the password associated with this administrator account.



4. Click **Add**.

The new server's IP address appears in the left pane.

Create the Citrix SD-WAN Orchestrator for On-premises virtual machine using the XVA file

The Citrix SD-WAN Orchestrator for On-premises virtual machine software is distributed as an XVA file. If you have not already done so, download the .xva file. For more information, see System requirements and installation.

To create the Citrix SD-WAN Orchestrator for On-premises virtual machine:

1. In XenCenter, right-click **XenServer** and click **Import**.

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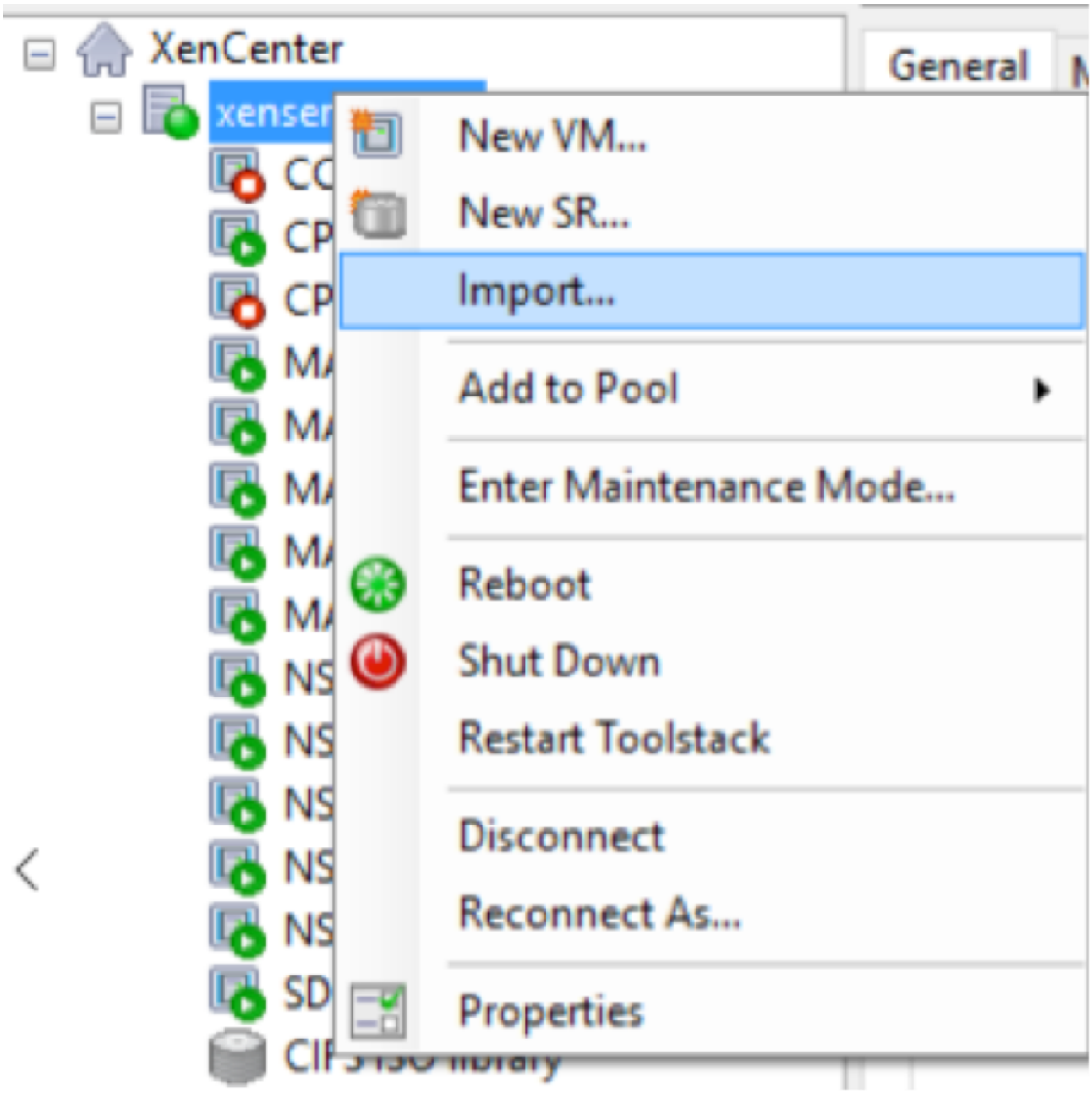

2. Browse to the downloaded .xva file, select it, and click **Next**.

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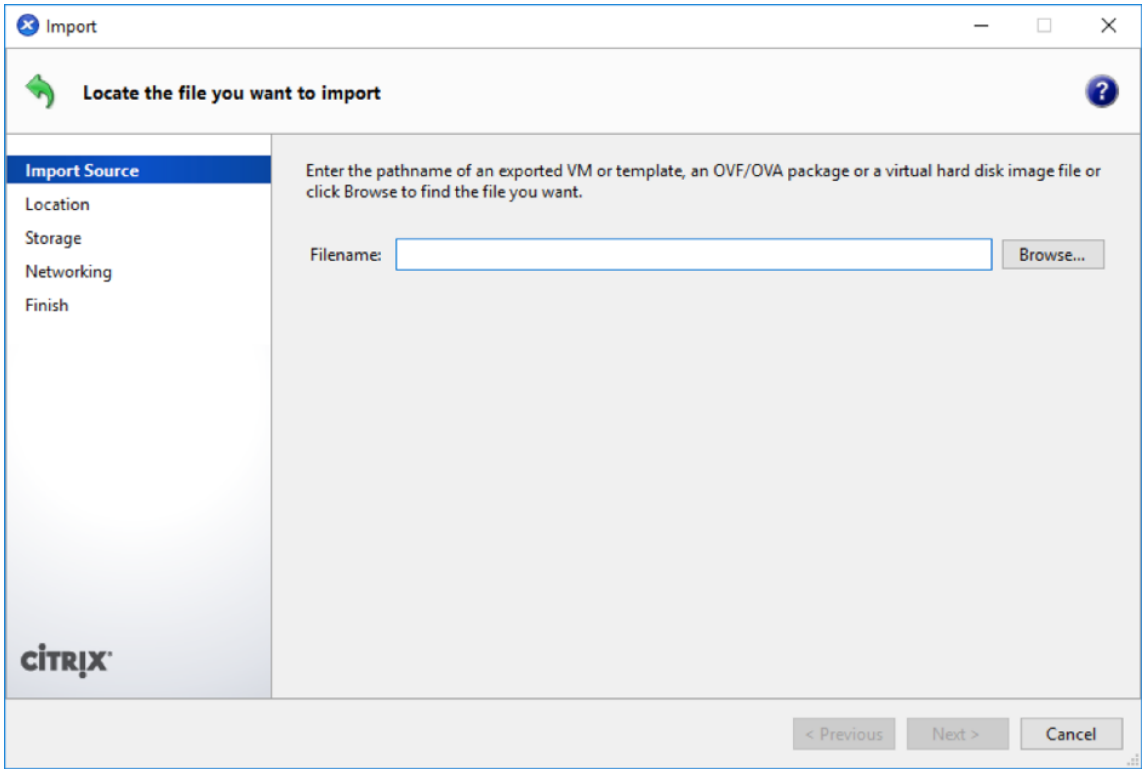
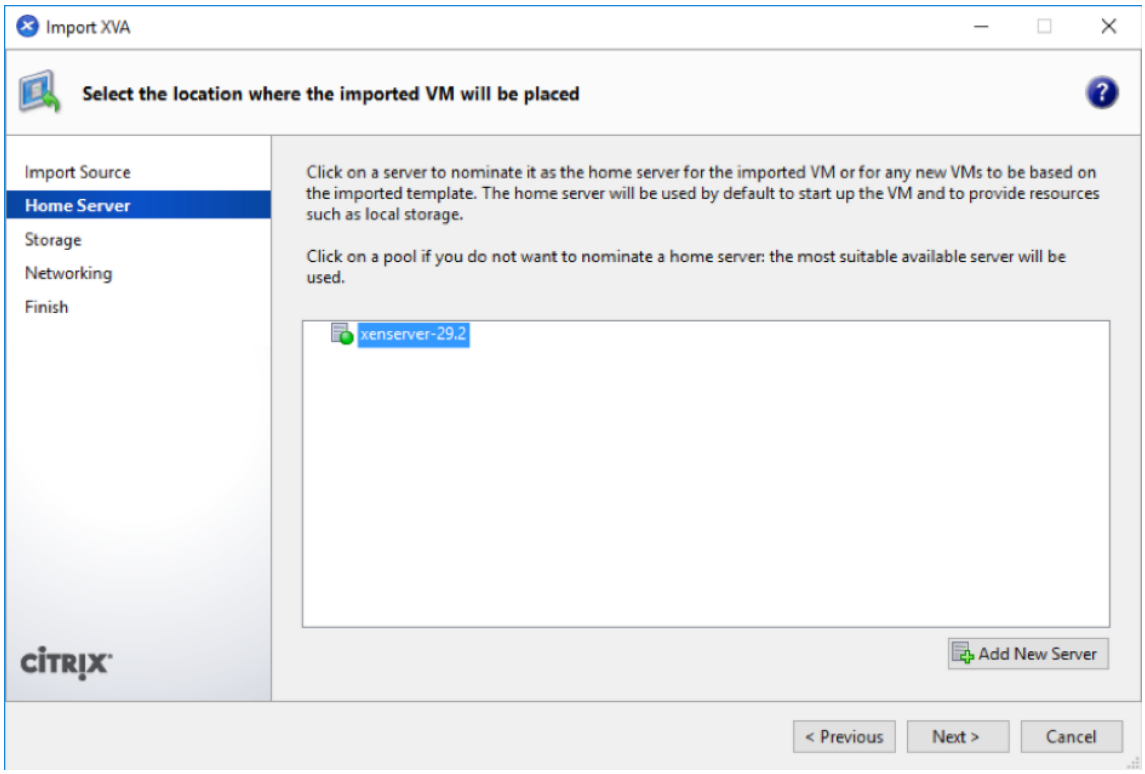


3. Select a previously created XenServer server as the location to which to import the virtual machine, and click **Next**.



4. Select a storage repository where the virtual disk for the new virtual machine is stored, and click

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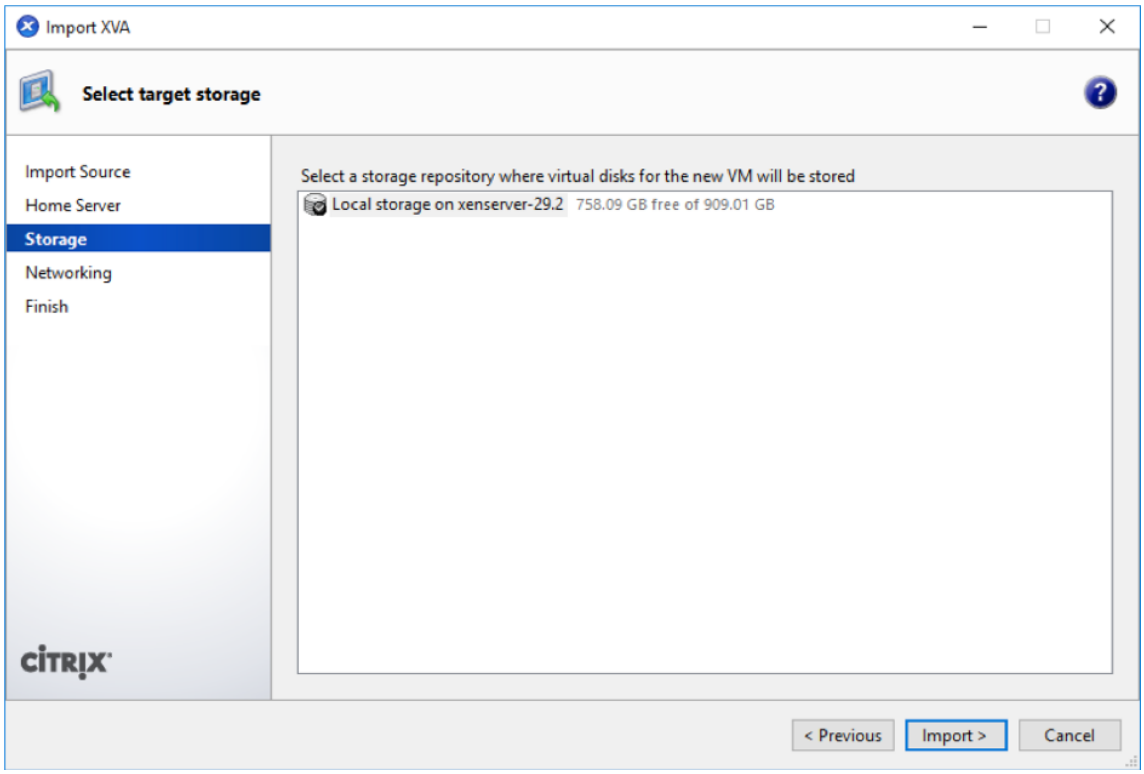
Import.

For now, you can accept the default storage resource. Or you can configure the datastore.



The imported Citrix SD-WAN Orchestrator for On-premises virtual machine appears in the left pane.

5. Select a network to which to connect the virtual machine, and click **Next**.

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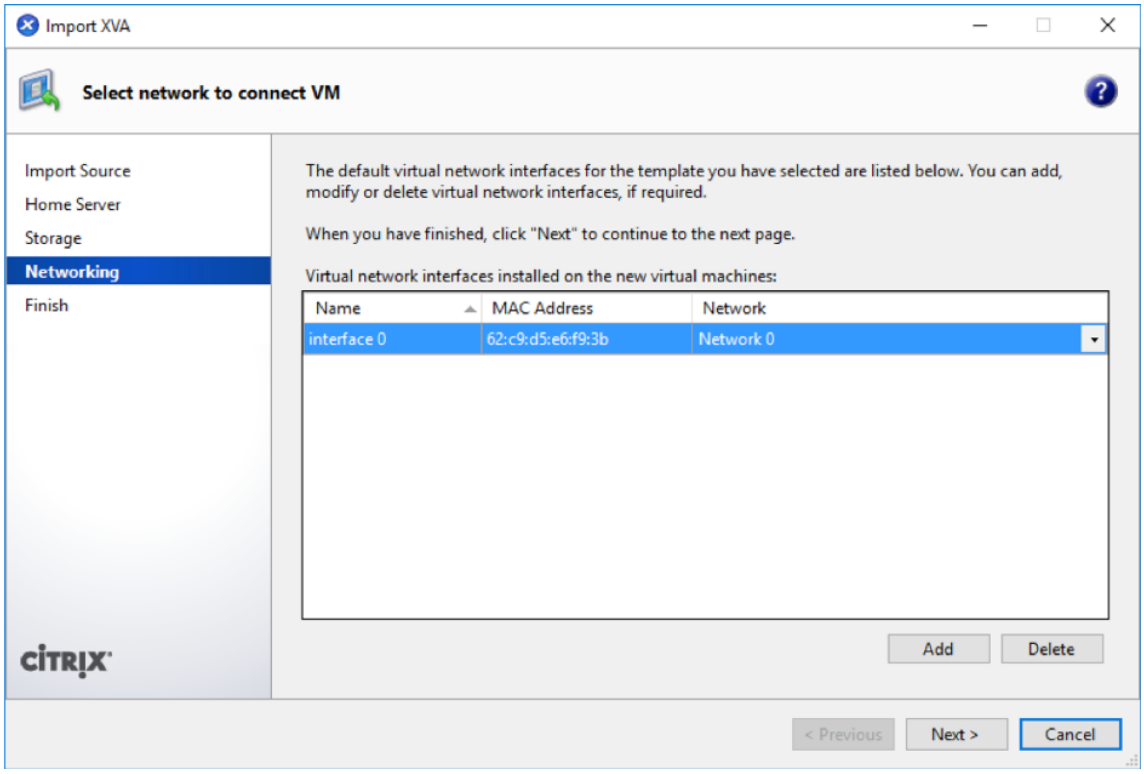

6. Click **Finish**.

View and record the management IP address on XenServer

The management IP address is the IP address of the Citrix SD-WAN Orchestrator for On-premises virtual machine, use this IP address to log into the Citrix SD-WAN Orchestrator for On-premises Web UI.

> **Note**
>
> The DHCP server must be present and available in the SD-WAN network.

To display the management IP Address:

1. In the XenCenter interface, in the left pane, right-click the new Citrix SD-WAN Orchestrator for On-premises virtual machine and select **Start**.
2. When the virtual machine is started, click the **Console** tab.

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```
sdwan-onprem login: admin
Password:
You are required to change your password immediately (administrator enforced)
Changing password for admin.
Current password:
New password:
Retype new password:
Last login: Wed Nov 25 09:13:56 on tty1
Console to Citrix acquired


SDWORCH>management_ip

IP Address:             10.105.59.125
Subnet Mask:            255.255.255.0
Gateway IP Address:     10.105.59.1

Which would you like to do?
        "set interface <ip address> <subnet mask> <gateway>" - Stage New Setting
s for IP Address, Subnet Mask, and Gateway IP Address
        "clear" - Clear the management interface IP settings
        "main_menu" - Return to the Main Menu

set_management_ip>_
```

3. Make a note of the management IP address.

   > **Note**
   >
   > The DHCP server must be present and available in the SD-WAN network, or this step cannot be completed.

4. Log into the virtual machine. The default login credentials for the new Citrix SD-WAN Orchestrator for On-premises virtual machine are as follows:

   Login: admin

   Password: password

   > **Note**
   >
   > It is mandatory to change the default admin user account password on a first time logon. This change is enforced using both CLI and UI.

   If the DHCP server is not configured in the Citrix SD-WAN network, you have to manually enter a static IP address.

To configure a static IP address as the management IP address:

1. When the virtual machine is started, click the Console tab.
2. Log into the virtual machine. The default login credentials for the new Citrix SD-WAN Orchestrator for On-premises virtual machine are as follows:

   Login: admin

   Password: password

3. In the console enter the CLI command `management_ip`.

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4. Enter the command `set interface <ipaddress> <subnetmask> <gateway>`, to configure management IP.
5. Are you sure you want to change your Management Interface IP settings?

   You may lose connectivity to the appliance. <y/n>?

   Press “y” to change the IP and access the management IP configured after nearly 6–7 minutes.

Onboarding SD-WAN Orchestrator for On-premises

May 17, 2021

Here is an overview of the Citrix SD-WAN Orchestrator for On-premises onboarding process:

- Onboarding provider and tenants: Our customers can consume a managed SD-WAN service from Citrix partners, enabled by the multitenant Citrix SD-WAN Orchestrator service.
- Onboarding “Do It Yourself” (DIY) Enterprises: Citrix SD-WAN Orchestrator service is also available as a self-managed service for enterprises.

Onboarding provider and tenants

This section describes the onboarding process for Citrix partners and their tenants.
Here is a summary of the onboarding process:

1. A prospective partner sign up as a Citrix Partner.
2. Citrix Partner registers as a Citrix SD-WAN Reseller.

Partner signs up for a Citrix partnership program

A prospective partner would need to sign up for the Citrix Service Provider Program (CSP) - CSP sign-up.
A partner can also sign up for the Citrix SD-WAN Managed Service Provider Program, which has been specially crafted for Citrix SD-WAN partners - SD-WAN MSP Sign Up.

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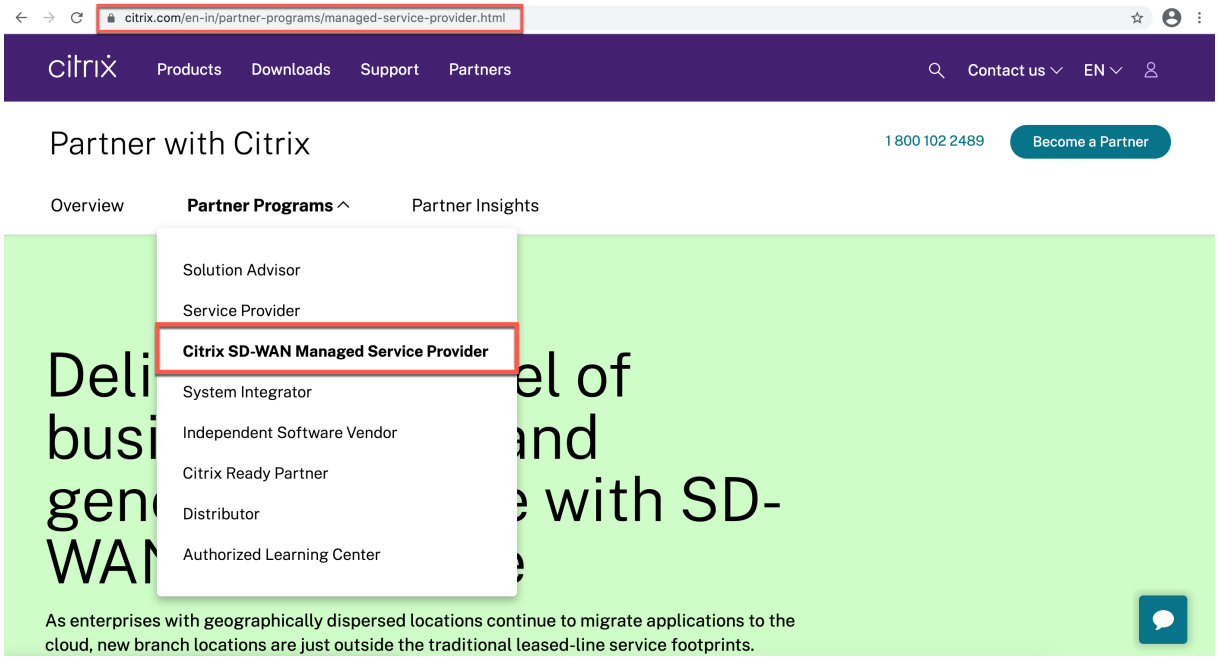
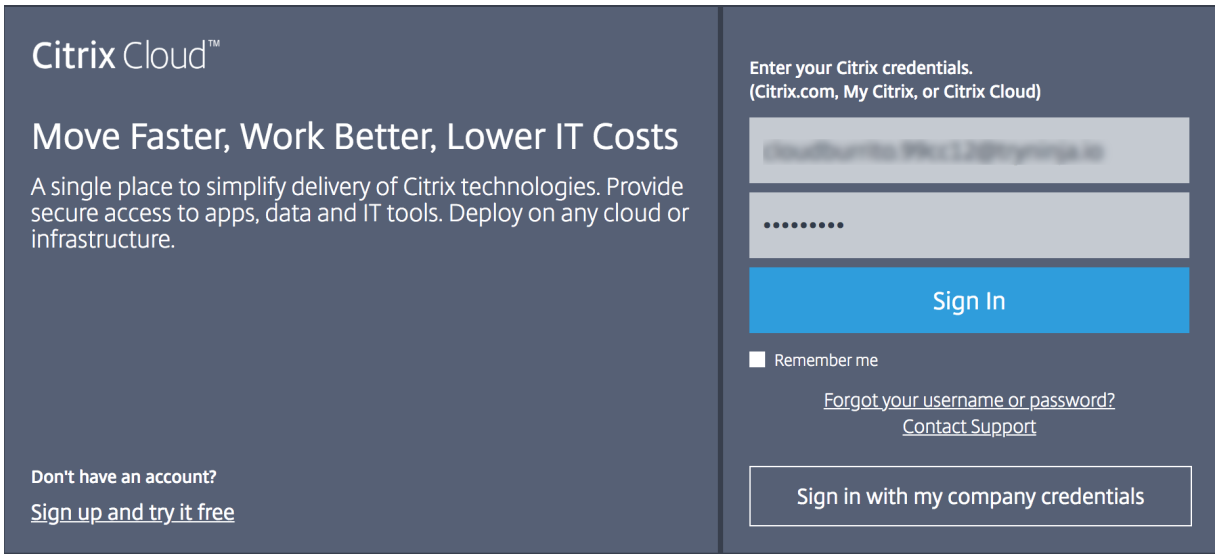


A Citrix Cloud (CC) account is created for the partner as part of the registration process. For more information, see Signing Up for Citrix Cloud.

Partner registers as a Citrix SD-WAN reseller

Partner logs into the Citrix Cloud account.



A menu of all the available services offered on Citrix Cloud is displayed on the home page. The **Citrix SD-WAN Orchestrator service** tile can be found in the **Available Services** section. The partner clicks **Resell SD-WAN** on the tile to register themselves as a Citrix SD-WAN reseller or service provider.

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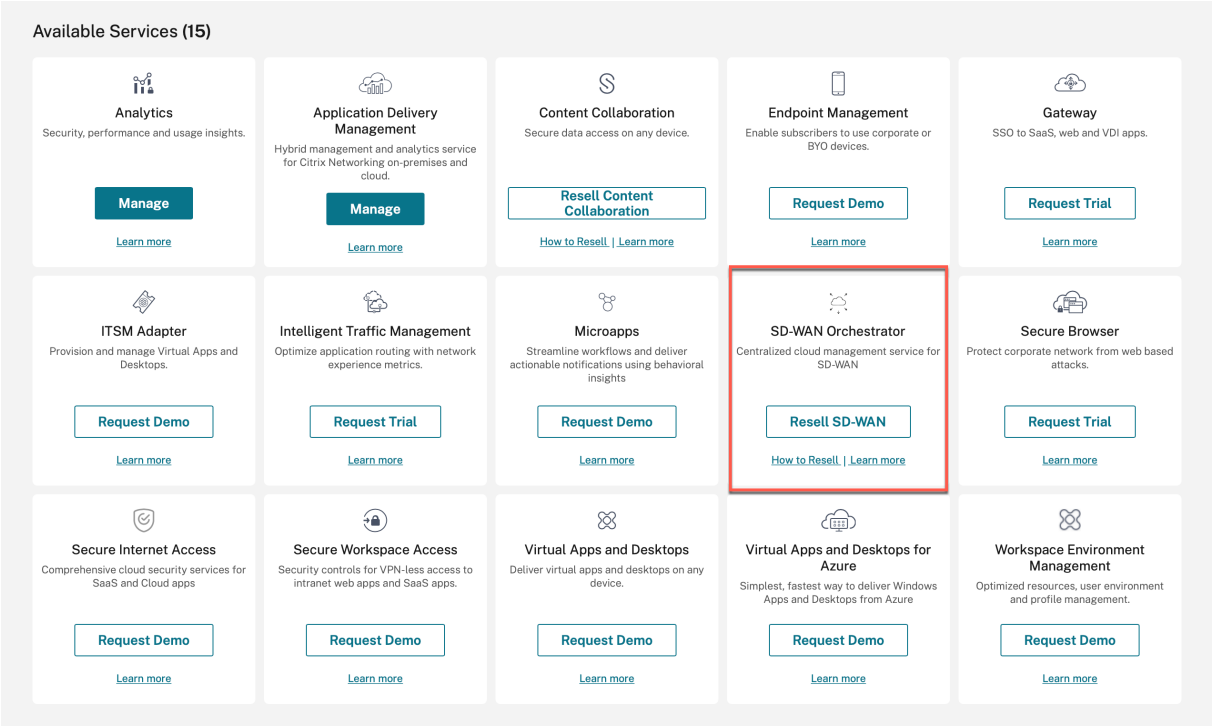

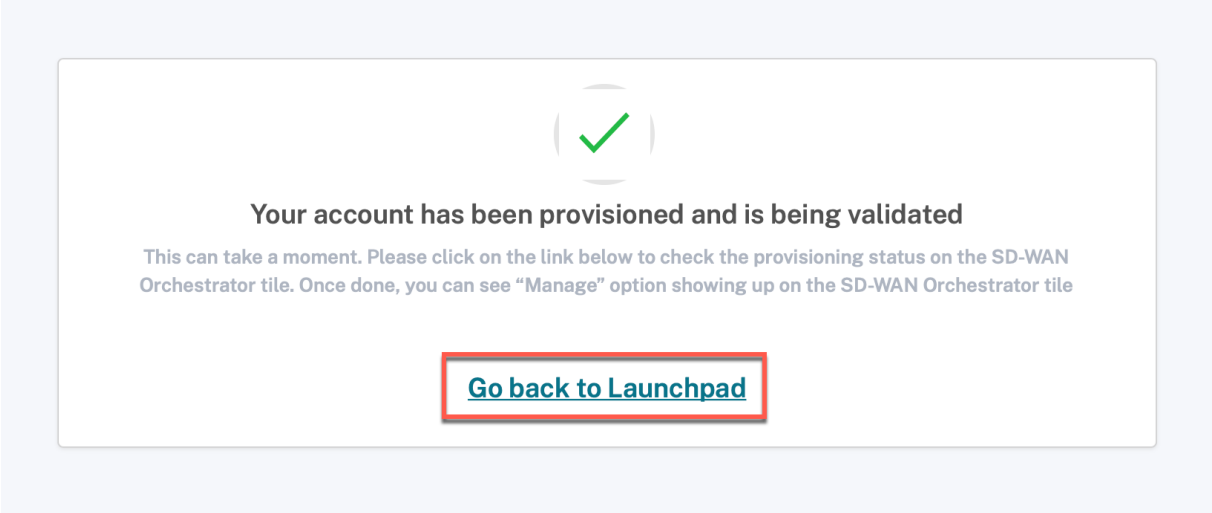

The **Citrix SD-WAN Orchestrator service** tile now shows up under **My Services**.

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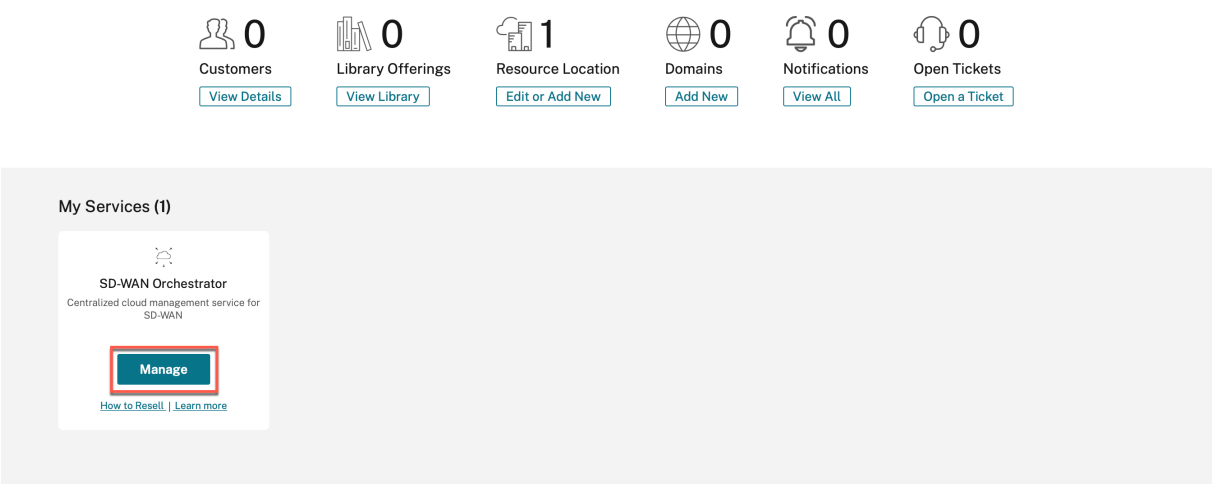
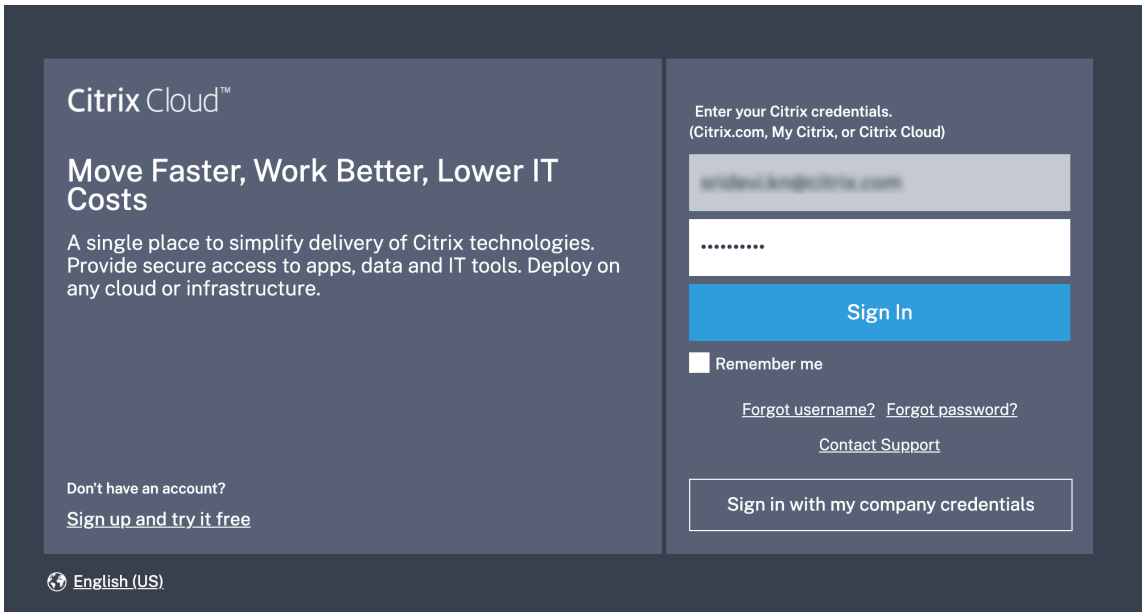


Onboarding DIY Enterprise Customers

This section describes the process to onboard DIY enterprise customers and the procedure to invite administrators to manage their SD-WAN network.

Onboarding DIY customers

1. Customer logs into Citrix Cloud account.



A menu of all the available services offered on Citrix Cloud is displayed on the home page. The **Citrix SD-WAN Orchestrator service** tile can be found in the **Available Services** section.

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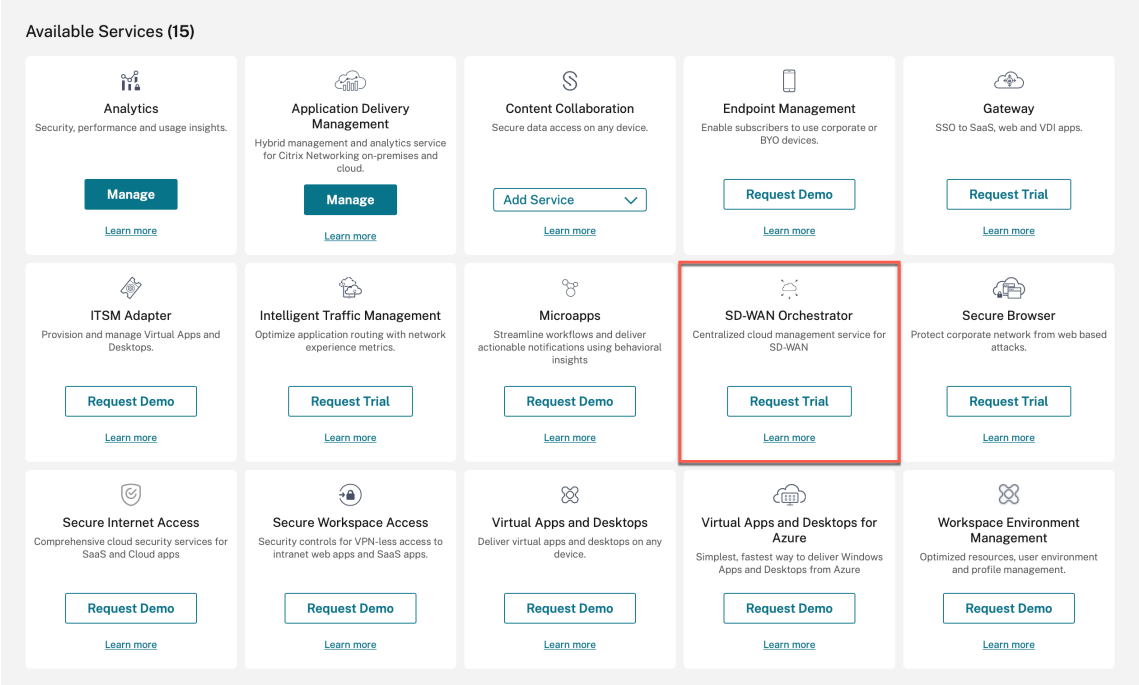
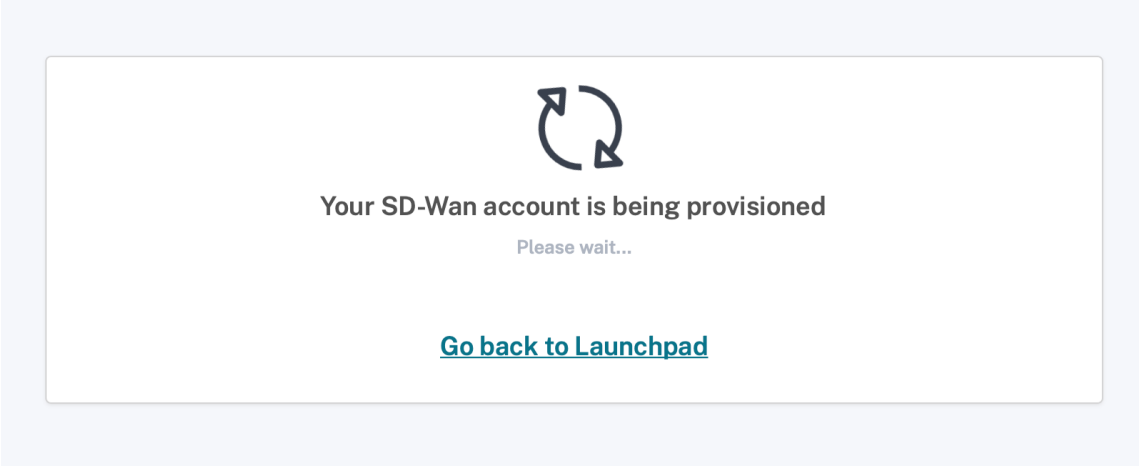
> **Note**
>
> Ensure that you sign up for Citrix Cloud using only one official account. The company name and email-id used must be associated with only one Citrix Cloud account.

2. The customer clicks **Request Trial**.



The customer's SD-WAN account gets provisioned.



3. The **Citrix SD-WAN Orchestrator service** tile now shows up under **My Services**.

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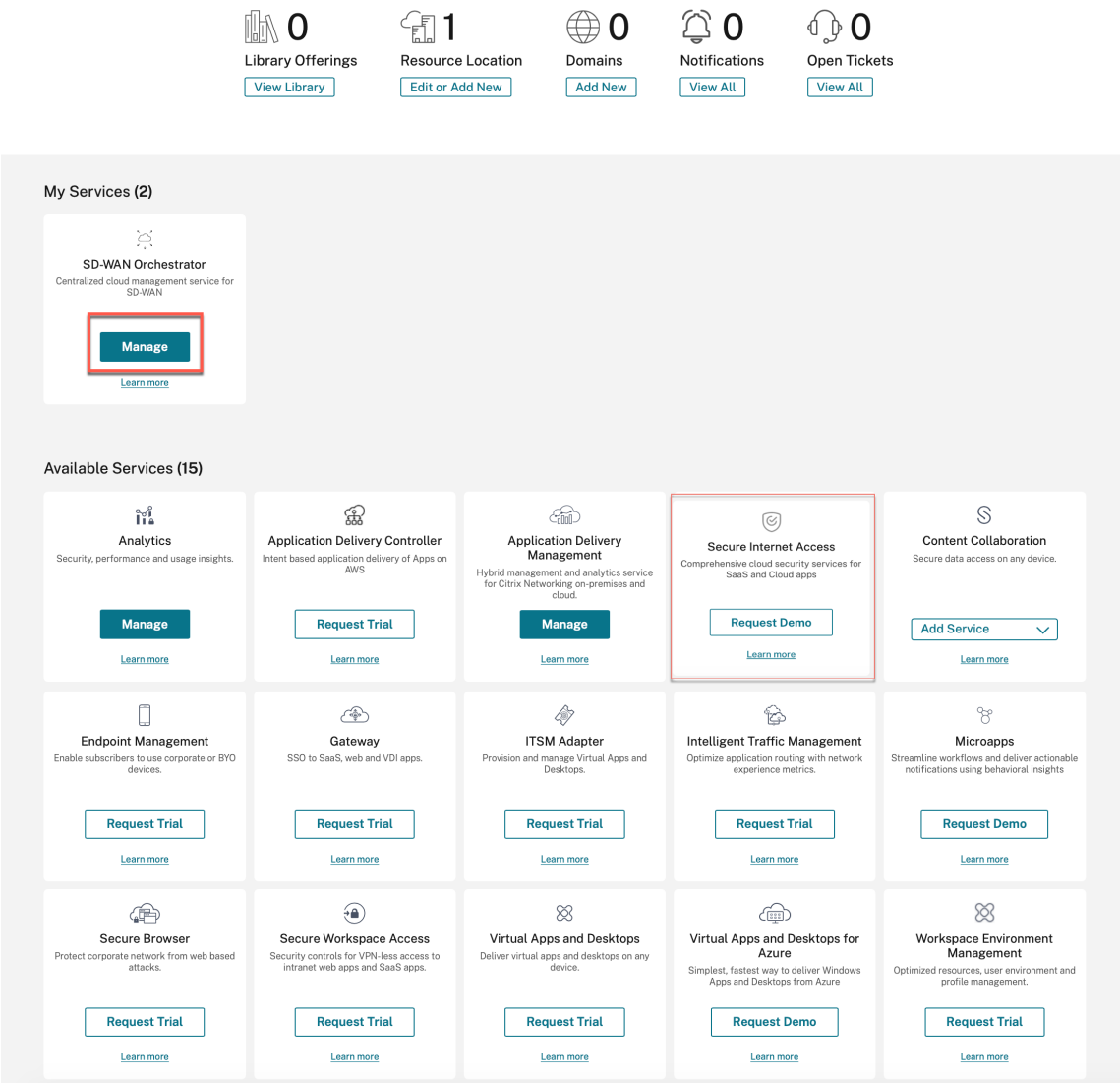

Citrix SD-WAN Orchestrator for On-premises log-in

July 9, 2021

This article describes how a customer can first time log in to the Citrix SD-WAN Orchestrator for On-premises.

Following are the prerequisites that you need to have before login to the Citrix SD-WAN Orchestrator for On-premises:

- You must have a Citrix Cloud Account. For more information, see Customer accesses SD-WAN Orchestrator.

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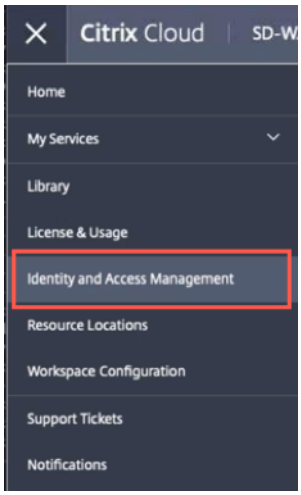
- To use Citrix SD-WAN Orchestrator for On-premises, you must have an account in the Citrix SD-WAN Orchestrator service. For more information, see Onboarding Citrix SD-WAN Orchestrator service.
- Create an administrator with custom privileges.
- Create a client from the API Access page to get the customer ID, ID, and Secret detail. These details are needed during the Citrix SD-WAN Orchestrator for On-premises log in

> **Note**
>
> Without the Cloud login, you cannot proceed to the local login.

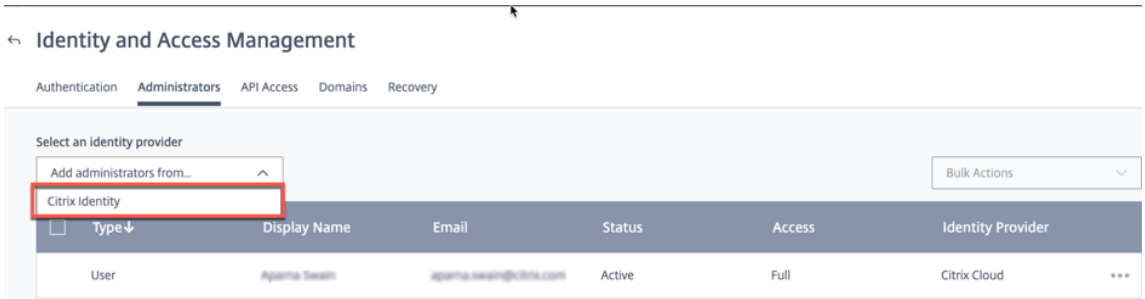
Create Administrator

A provider or an enterprise customer can invite an administrator to manage their SD-WAN network. Perform the following steps to invite an administrator:

1. Log in to the Citrix Cloud and navigate to **Identity and Access Management**.



2. Go to **Administrators** page and select **Citrix Identity** from the identity provider drop-down list.



3. Enter the new administrator email id and click **Invite**.

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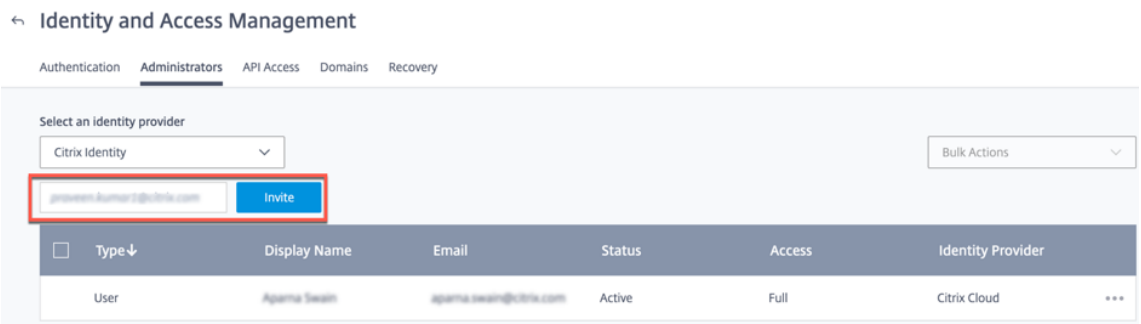

4. You can choose either **Full access** or **Custom access**. It is recommended to set the custom access for the administrator managing only SD-WAN services. When the **Custom access** radio button is selected, you must also select the **Secure Client** check box from the **General Management** section and **SD-WAN** check box.

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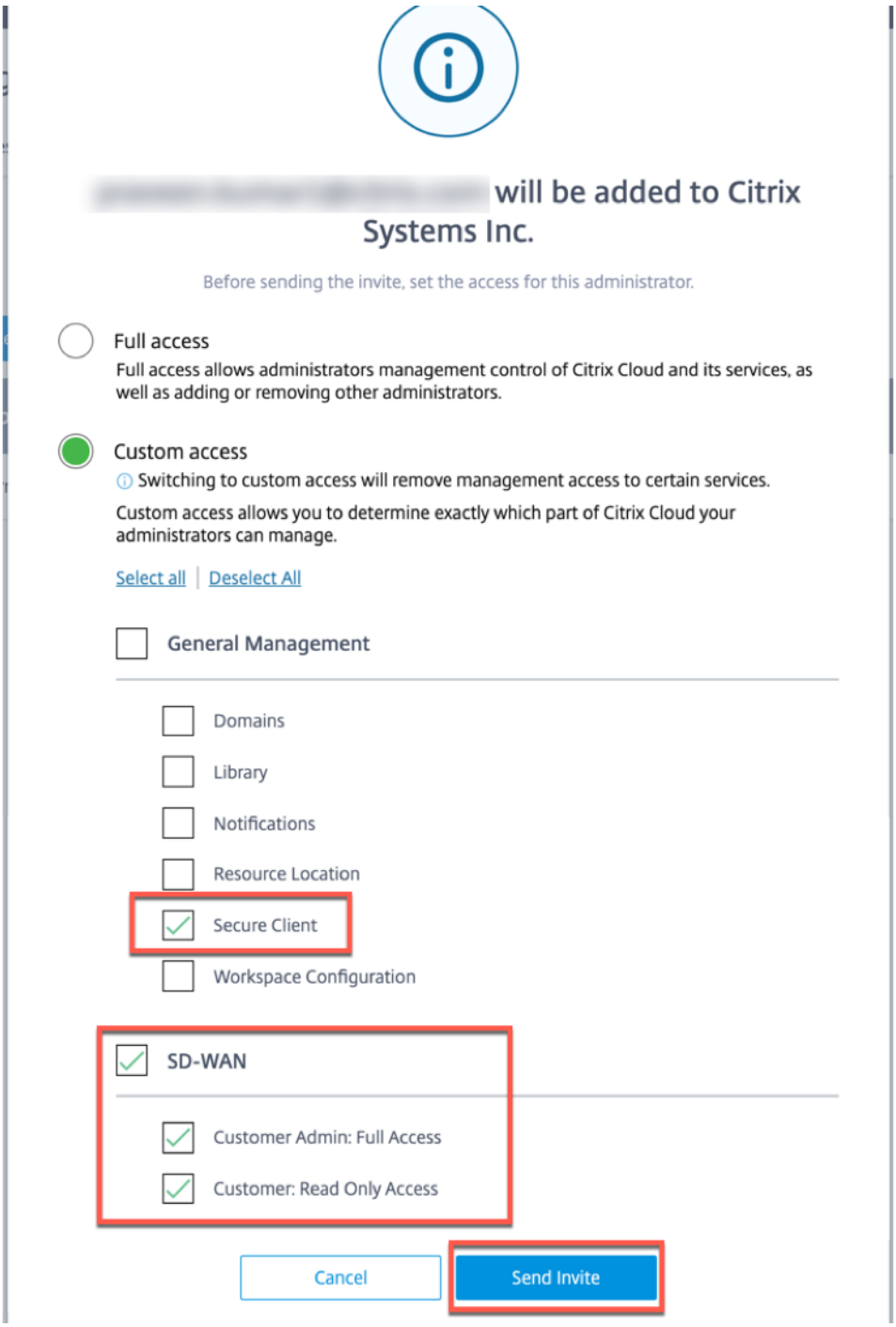

5. Click **Send Invite**.

Once you created the administrator account, login through the administrator account to generate the **API** keys.

> **Note**
>
> If you already have a custom administrator role, then you can use it to create the API token.

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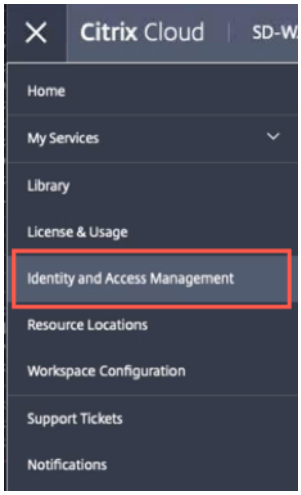
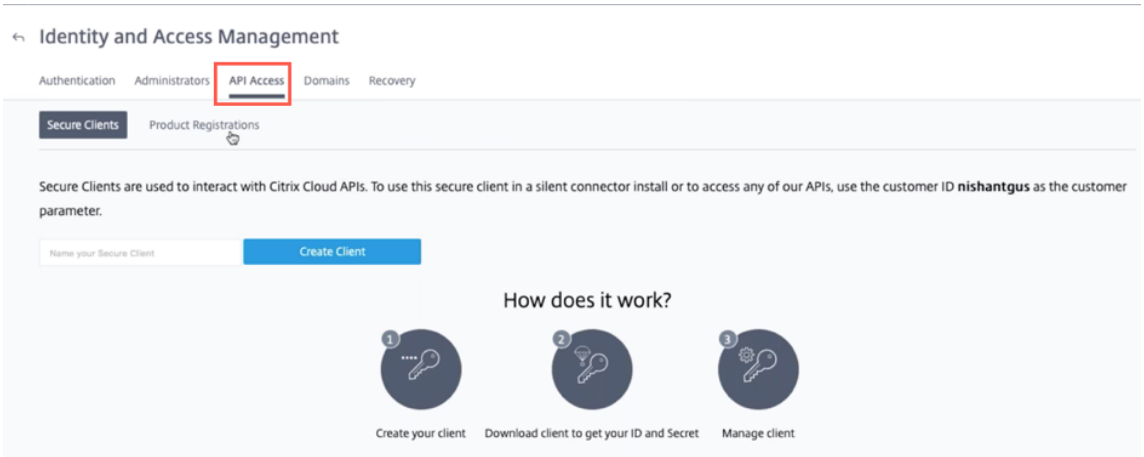
Generate API token

Perform the following steps to log in to Citrix SD-WAN Orchestrator for On-premises.

1. Log in to the Citrix Cloud and navigate to **Identity and Access Management**.



2. Go to **API Access** page.



3. Create a client. Note down the **Customer ID** that you need later to login to Citrix SD-WAN Orchestrator for On-premises.

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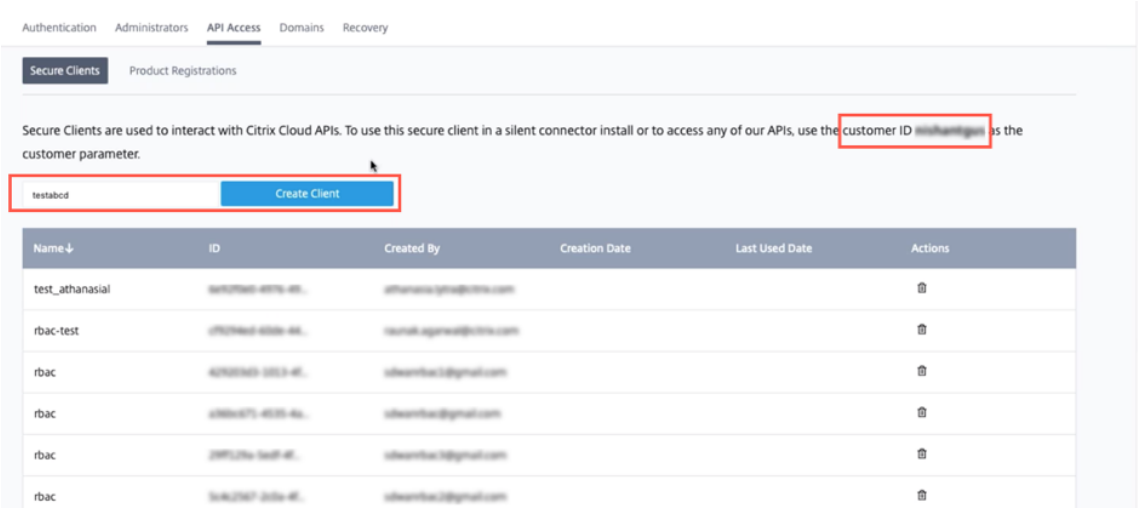
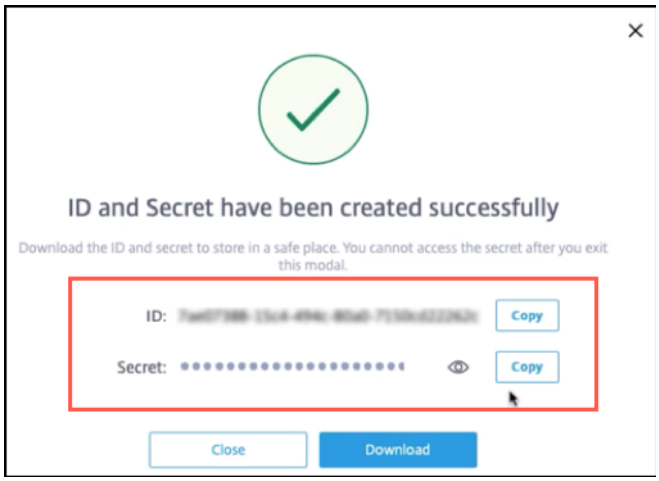


4. On click of **Create Client**, it provides you the **ID** and a **Secret key** that you can copy and save, or download.



5. Go to your Citrix Hypervisor (XenServer/VMware) and boot up Citrix SD-WAN Orchestrator for On-premises.

6. Once the Citrix SD-WAN Orchestrator for On-premises is booted up, provide the default user name (admin) and Password (password).

> **Note**
>
> It is mandatory to change the default admin user account password on a first time logon. This change is enforced using both CLI and UI.

7. If the DHCP server is not configured in the SD-WAN network, you have to manually enter a static IP address. To configure a static IP address as the management IP address:

   - In the console, enter the CLI command `management_ip`.
   - Enter the command `set interface <ipaddress> <subnetmask> <gateway>`.

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> **Note**
>
> - The management IP address is the IP address of the Citrix SD-WAN Orchestrator for On-premises virtual machine, use this IP address to log into the Citrix SD-WAN Orchestrator for On-premises Web UI.
> - The management interface can be configured via the two methods – CLI and DHCP.

8. Once the Citrix SD-WAN Orchestrator for On-premises is booted up, by default it is configured with DNS servers 9.9.9.9 and 149.112.112.112 as primary and secondary respectively. If necessary, you can change the DNS server IP address using the following commands:
   - In the console, enter the CLI command `set_dns`.
   - Enter the command `set primary <ipaddress>` and then enter `y` to confirm the change.
   - Enter the command `set secondary <ipaddress>` and enter `y` to confirm the change.

```
SDWORCH>set_dns

Primary :               nameserver 9.9.9.9
Seconday :              nameserver 149.112.112.112

Which would you like to do?
        "set primary <ip address>" - Stage New Primary DNS IP Address
        "set secondary <ip address>" - Stage New Primary DNS IP Address
        "clear" - Clear all DNS IP Address
        "main_menu" - Return to the Main Menu

set_dns>set primary 8.8.8.8

Are you sure you want to change your Domain Name Server IP settings? <y/n>?
y

Primary :               nameserver 8.8.8.8
Seconday :              nameserver 149.112.112.112

Which would you like to do?
        "set primary <ip address>" - Stage New Primary DNS IP Address
        "set secondary <ip address>" - Stage New Primary DNS IP Address
        "clear" - Clear all DNS IP Address
        "main_menu" - Return to the Main Menu

set_dns>set secondary 9.9.9.9

Are you sure you want to change your Domain Name Server IP settings? <y/n>?
y

Primary :               nameserver 8.8.8.8
Seconday :              nameserver 9.9.9.9

Which would you like to do?
        "set primary <ip address>" - Stage New Primary DNS IP Address
        "set secondary <ip address>" - Stage New Primary DNS IP Address
        "clear" - Clear all DNS IP Address
        "main_menu" - Return to the Main Menu
```

9. Open a new browser using the management IP. The following screen appears:

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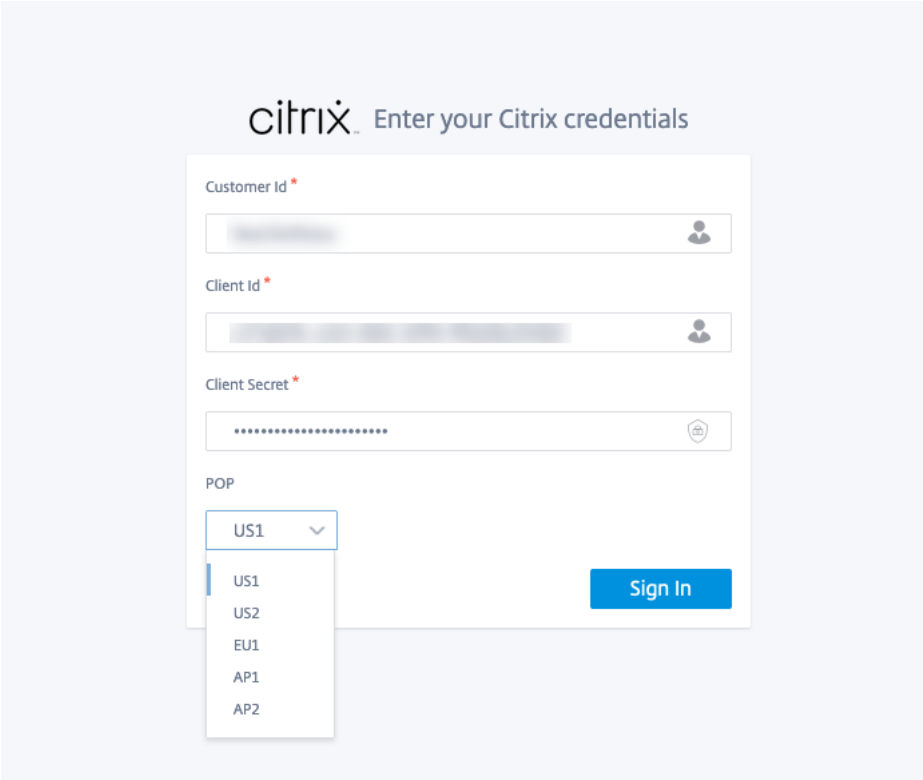
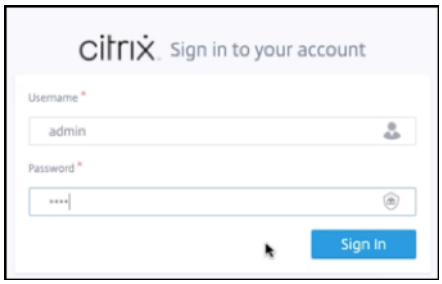


10. Provide the **Customer ID, Client ID,** and **Client Secret** that you saved or downloaded earlier while creating the client from the cloud Orchestrator. Select the POP in which your cloud account was on boarded. You cannot change the POP after a successful login.

    > **Note**
    >
    > This screen appears once in 15 days. For the subsequent log on/out, you see only the local login page.

11. Provide the default user name and password on the local login page.



You can see that the Citrix SD-WAN Orchestrator for On-premises Dashboard page appears.

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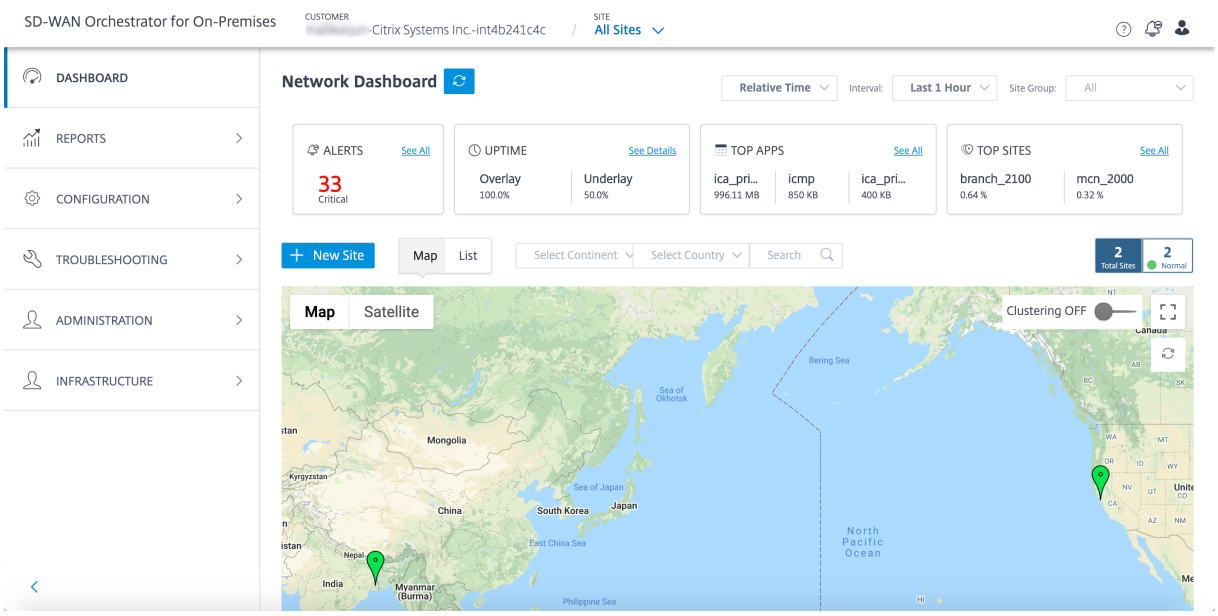

Citrix SD-WAN Orchestrator for On-premises licensing

July 9, 2021

Citrix SD-WAN Orchestrator for On-premises licensing is applicable for Do It Yourself (DIY) customers – Direct Enterprise Customers.

As a prerequisite for Citrix SD-WAN Orchestrator for On-premises licensing ensure that you are logged into the Citrix Cloud. For more information, see Citrix SD-WAN Orchestrator for On-premises login.

Citrix SD-WAN Orchestrator for On-premises deployment is available free of charge, but the customer needs to bear the cost of management server infrastructure and maintenance.

Trial Mode

The customer's Citrix SD-WAN Orchestrator for On-premises account is provisioned in trial mode. The trial mode continues for a default period of 60 days.

After the trial period expires, the customer's data paths are brought down. Additional changes cannot be deployed until valid licenses are uploaded. The customer's Citrix Cloud entitlement for Citrix SD-WAN Orchestrator for On-premises changes from Trial to Production when the first valid license is hosted on it. Based on the number and type of licenses uploaded, an equivalent number of sites can come up with the right bandwidth entitlements. A persistent message **Your Trial has expired. Upgrade to Production by retrieving at least one valid license entitlement on the Orchestrator to restore the network functionality and continue the usage.** is displayed for prepaid customers. For more information, see Retrieve and assign entitlements for prepaid billing model.

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Prepaid Billing Model

A prepaid billing model is provided for Citrix SD-WAN Orchestrator for On-premises customers. The following three types of prepaid billing models are available:

- **Prepaid annual subscription**: The prepaid subscription has a 1-year and a 3-year plan. The subscription expires on the expiry date. All the appliances in the customer network have a prepaid annual subscription. Maintenance licenses are included in the subscription package and provide the ability to upgrade appliances to newer software versions.
- **Prepaid perpetual**: With prepaid perpetual the licenses have no time limit, restricted duration, or expiration. However, the hardware maintenance license is available as a paid add-on and must be purchased separately. All the appliances in the customer network have a prepaid perpetual subscription.

To view the billing model in Citrix SD-WAN Orchestrator for On-premises, at the network level navigate to **Administration** > **Licensing** > **Select Billing Model**. The billing model is displayed as **Prepaid Annual and Perpetual**.

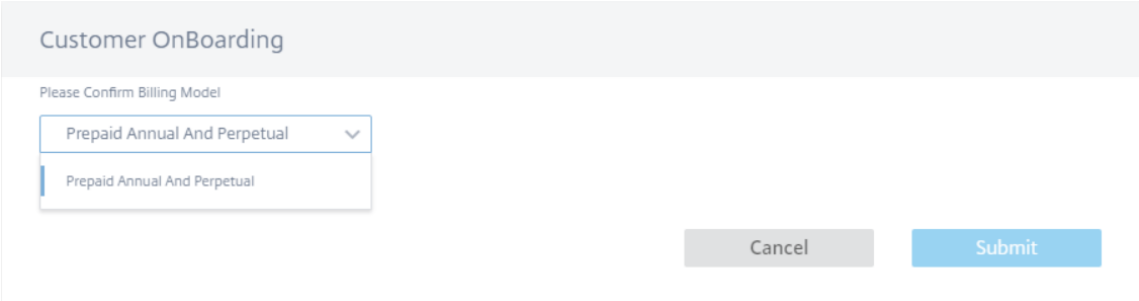
Upload the licenses to all the customer sites. For more information, see Retrieve and assign entitlements for prepaid billing model.

Retrieve and assign entitlements for prepaid billing model

You can retrieve the license entitlements using the Access Code provided by Citrix via email. Alternatively, the customer can also view the Access Code in the license management portal within Citrix Cloud. The customer can have either **Prepaid Perpetual**, or **Prepaid Annual Subscription** billing model in the network.

Prerequisite: Ensure that the Citrix SD-WAN Orchestrator for On-premises licenses are not allocated by logging into the license management portal. If the licenses are allocated, release/de-allocate the licenses before using the License Access Codes in the Citrix SD-WAN Orchestrator for On-premises product.

1. In the Citrix SD-WAN Orchestrator for On-premises UI navigate to **Administration** > **Licensing** and click **Select Billing Model**. Select a billing model and click **Submit**.



2. Click **Retrieve Licenses**.

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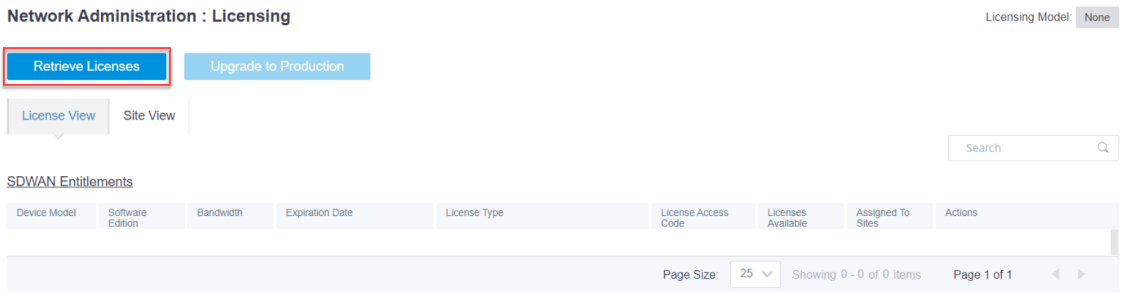
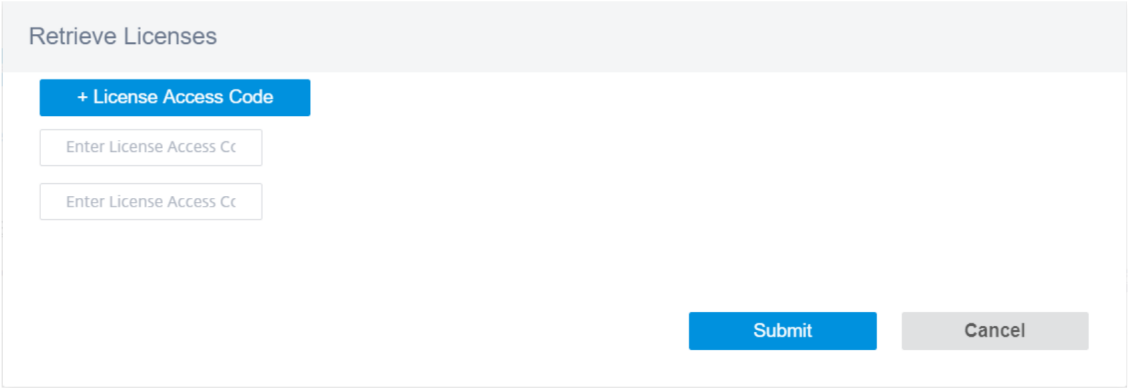
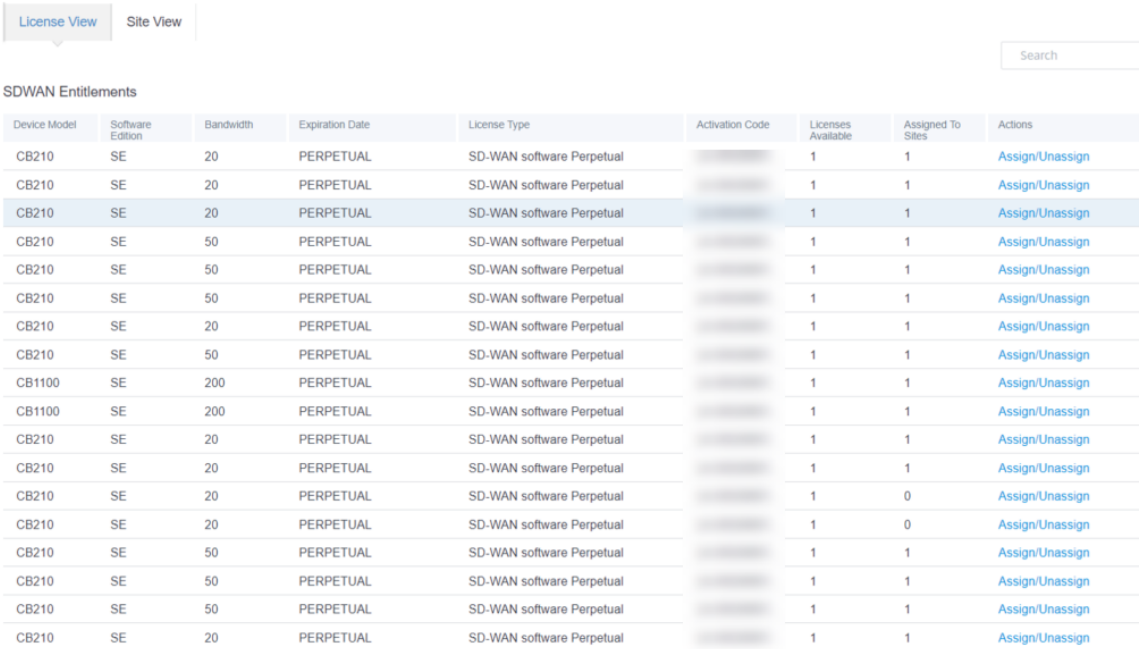


3. Click **+ License Access Code**, enter the required number of access codes to retrieve the entitlements and click **Submit**.



The Citrix SD-WAN Orchestrator for On-premises retrieves the entitlements and populates the license table.



Device Model	Software Edition	Bandwidth	Expiration Date	License Type	Activation Code	Licenses Available	Assigned To Sites	Actions
CB210	SE	20	PERPETUAL	SD-WAN software Perpetual		1	1	Assign/Unassign
CB210	SE	20	PERPETUAL	SD-WAN software Perpetual		1	1	Assign/Unassign
CB210	SE	20	PERPETUAL	SD-WAN software Perpetual		1	1	Assign/Unassign
CB210	SE	50	PERPETUAL	SD-WAN software Perpetual		1	1	Assign/Unassign
CB210	SE	50	PERPETUAL	SD-WAN software Perpetual		1	1	Assign/Unassign
CB210	SE	50	PERPETUAL	SD-WAN software Perpetual		1	1	Assign/Unassign
CB210	SE	20	PERPETUAL	SD-WAN software Perpetual		1	1	Assign/Unassign
CB210	SE	50	PERPETUAL	SD-WAN software Perpetual		1	1	Assign/Unassign
CB1100	SE	200	PERPETUAL	SD-WAN software Perpetual		1	1	Assign/Unassign
CB1100	SE	200	PERPETUAL	SD-WAN software Perpetual		1	1	Assign/Unassign
CB210	SE	20	PERPETUAL	SD-WAN software Perpetual		1	1	Assign/Unassign
CB210	SE	20	PERPETUAL	SD-WAN software Perpetual		1	1	Assign/Unassign
CB210	SE	20	PERPETUAL	SD-WAN software Perpetual		1	0	Assign/Unassign
CB210	SE	20	PERPETUAL	SD-WAN software Perpetual		1	0	Assign/Unassign
CB210	SE	50	PERPETUAL	SD-WAN software Perpetual		1	1	Assign/Unassign
CB210	SE	50	PERPETUAL	SD-WAN software Perpetual		1	1	Assign/Unassign
CB210	SE	50	PERPETUAL	SD-WAN software Perpetual		1	1	Assign/Unassign
CB210	SE	20	PERPETUAL	SD-WAN software Perpetual		1	1	Assign/Unassign

4. Click **Assign/Unassign** and select **All Unlicensed**. All the unlicensed sites with configured bandwidth equal to or less than the license bandwidth is displayed.

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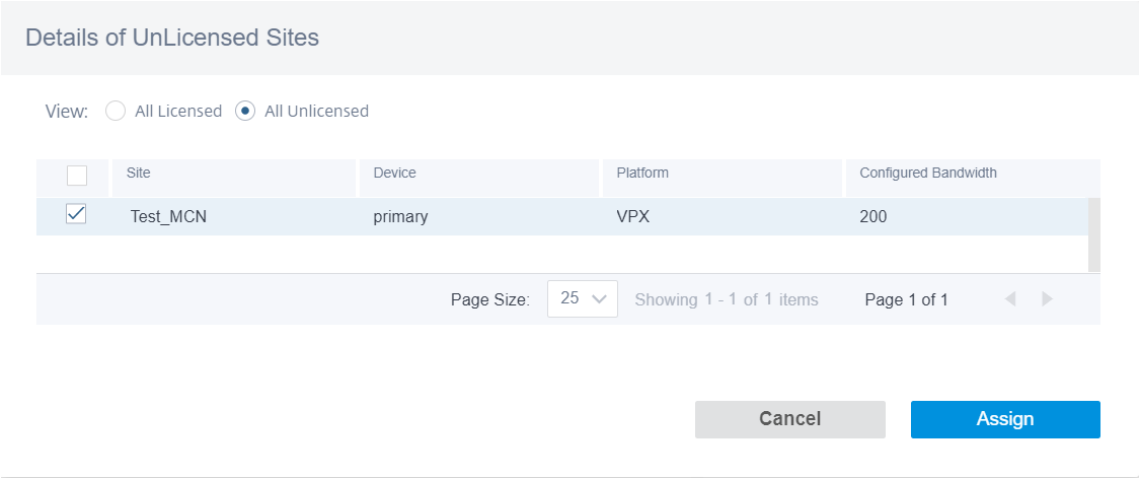
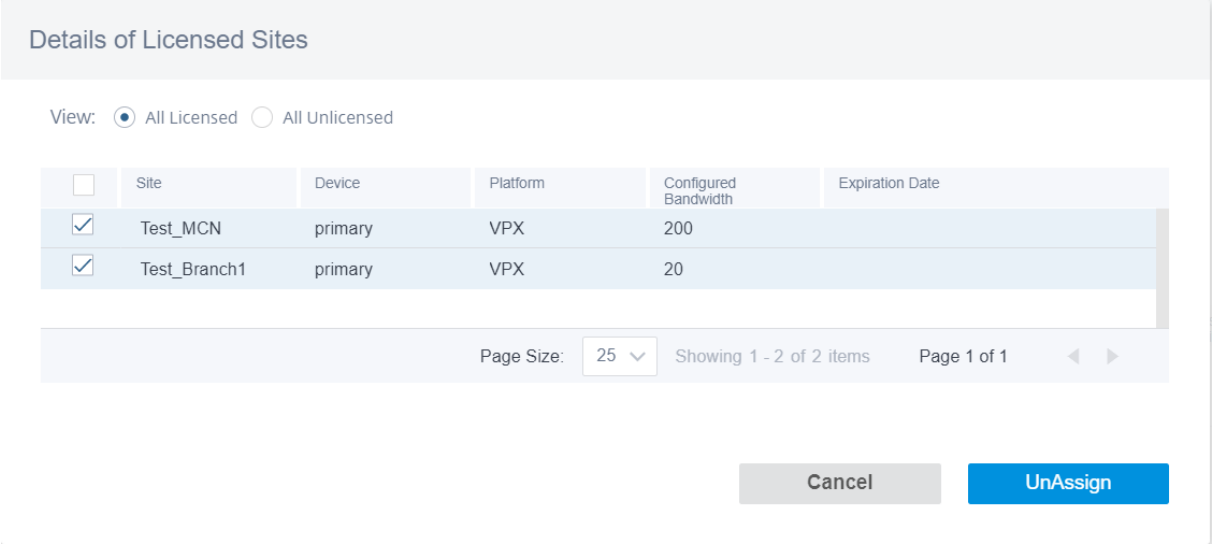


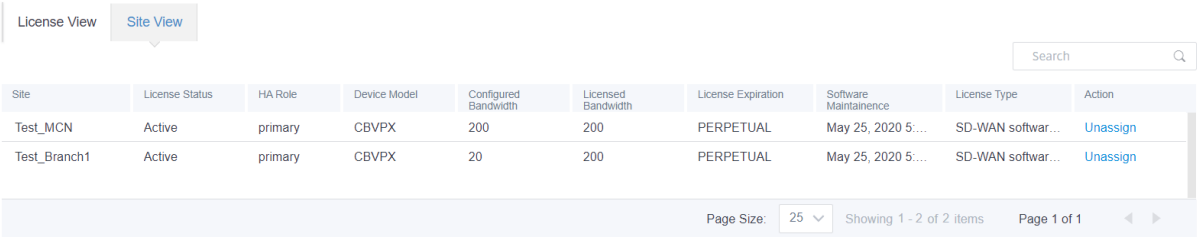
5. Select the sites, click **Assign** and then click **Upgrade to Production**.

In the **All Licensed** view, a list of licensed sites is displayed. You can choose to unassign the licenses and release it back to the pool.



Under **Site View**, the sites are automatically matched with licenses based on the configured bandwidth and license bandwidth, enabling you to allocate licenses quickly.

> **Note**
>
> To assign a license to the appliance, an appliance must have a verified serial number.



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License Expiry

When the license expires, a grace period of 30 days is granted. The partner/customer is expected to renew their licenses during this time. After the grace period expires, the customer's network data paths are brought down, and additional changes cannot be deployed until the licenses are renewed.

Connectivity with Citrix SD-WAN appliances

July 7, 2021

After configuring sites on Citrix SD-WAN Orchestrator for On-premises, establish connectivity between Citrix SD-WAN appliances on the sites with Citrix SD-WAN Orchestrator for On-premises. You can establish connectivity in one of the following ways:

- **One-way Authentication**: The SD-WAN appliance authenticates Citrix SD-WAN Orchestrator for On-premises. On enabling one-way authentication, you must download the Citrix SD-WAN Orchestrator for On-premises certificate and upload it on the SD-WAN appliance.
- **Two-way Authentication**: The SD-WAN authenticate each other using the exchanged certificates. On enabling two-way authentication, you must upload the SD-WAN appliance certificate on Citrix SD-WAN Orchestrator for On-premises and also Citrix SD-WAN Orchestrator for On-premises certificate on the SD-WAN appliance.
- **No Authentication**: The connectivity is established between the Citrix SD-WAN Orchestrator for On-premises and SD-WAN appliances with no authentication. You need not use the SD-WAN Appliance or Citrix SD-WAN Orchestrator for On-premises Certificate. You can use No Authentication when you have a secure network such as MPLS.

> **Note**
>
> It is recommended to use only **one-way authentication** or two-way authentication. In the case of no Authentication, you have to choose the secure DNS server.

You can configure connectivity with each site manually or use the automated zero-touch deployment.

> **Note**
>
> Citrix SD-WAN 11.3.0 is the minimum software version required for an appliance to connect to Citrix SD-WAN Orchestrator for On-premises.

Zero-touch deployment

Zero-touch deployment is an automated process to configure connectivity between the appliances and Citrix SD-WAN Orchestrator for On-premises. You can establish the connectivity automatically using non-cloud zero-touch deployment or cloud brokered zero-touch deployment settings.

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Non-Cloud zero-touch deployment

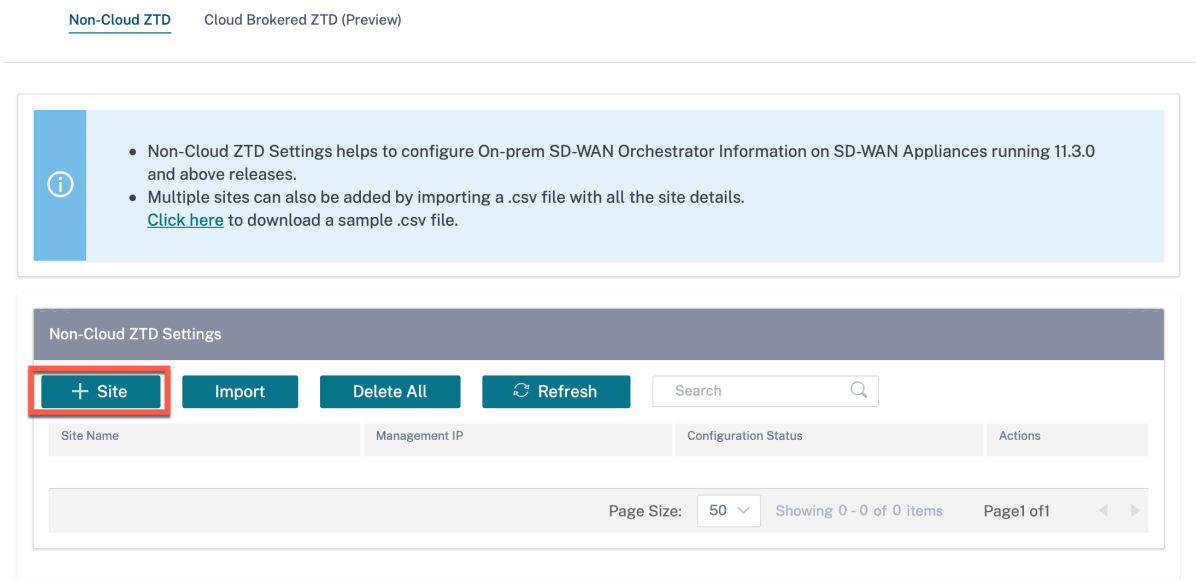
Non-Cloud zero-touch deployment settings allow you to configure Citrix SD-WAN Orchestrator for On-premises information on SD-WAN appliances. The NITRO API running in the back-end handles download and upload of certificates. It downloads the certificate from Citrix SD-WAN Orchestrator for On-premises, logs in to the SD-WAN appliance, and uploads the certificate. It also downloads the SD-WAN appliance certificate and uploads it on Citrix SD-WAN Orchestrator for On-premises.

> **Note**
>
> Non-Cloud zero-touch deployment is supported on SD-WAN appliances running with the 11.3.0 release or later.

Zero-touch deployment supports only **one-way authentication** and **two-way authentication**. **No authentication** is not supported. If **Authentication Type** is enabled on **Administration > Certificate Authentication** page, then two-way authentication is established. If **Authentication Type** is disabled, then one-way authentication is established.

You can either add sites manually or import a CSV file to add multiple sites simultaneously.

To configure Non-cloud zero-touch deployment settings, navigate to **Administration** > **ZTD Settings** > **Non-Cloud ZTD**, and click **+ Site**.



> **Note**
>
> You can also access Non-cloud zero-touch deployment settings for each site from **Network Configuration Home** page. Click the action icon for the site and select **Non-cloud ZTD**.

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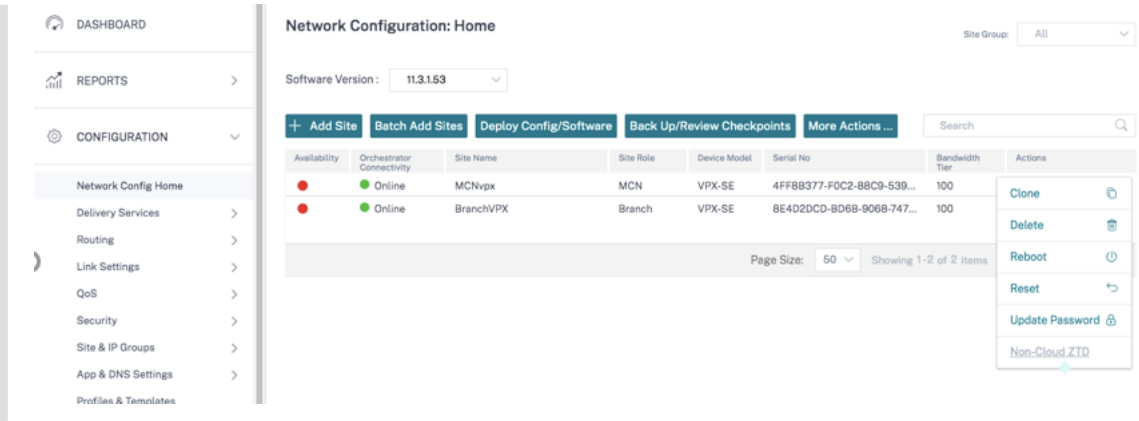
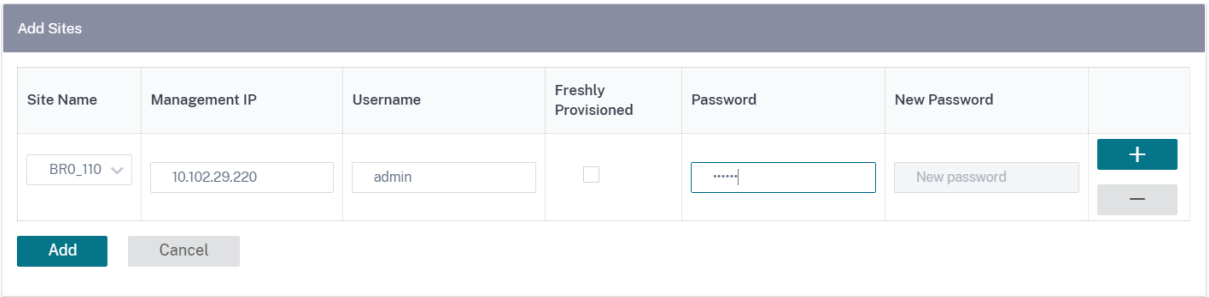


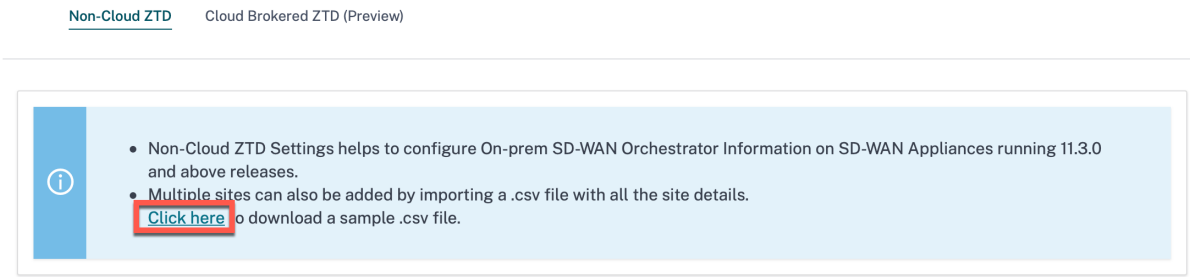
Select a site from the **Site Name** drop-down list and enter the **Management IP** address of the Citrix SD-WAN appliance. Provide the appliance user name and Password. Select the **Freshly Provisioned** check box if you are adding a newly provisioned site on which the default password has not been changed. Provide the **New Password**. The default password is changed to the new password during this zero-touch deployment process.

> **Note**
>
> For a newly provisioned site, it is mandatory to change the default password at the time of first login.



Click **+** to continue to add more sites.

You can also import a CSV file to add multiple sites simultaneously. A sample downloadable template is available in the UI. Download it and provide the site details.



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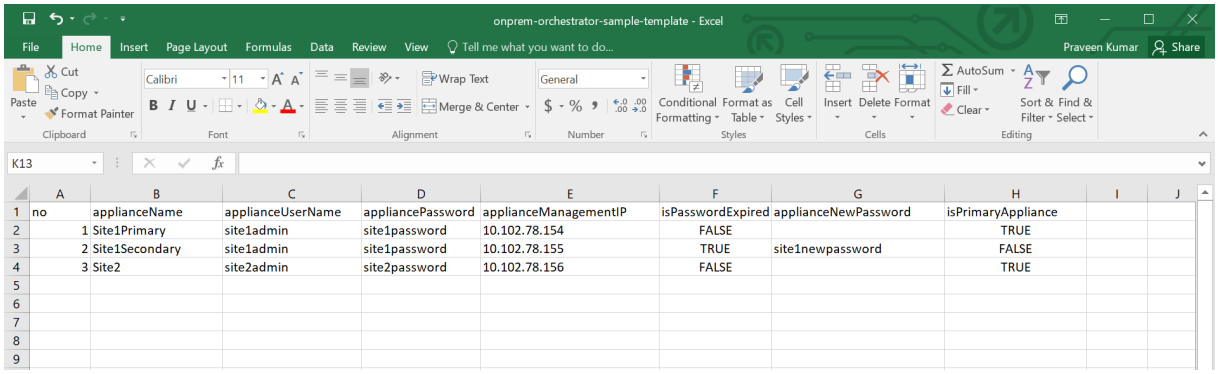
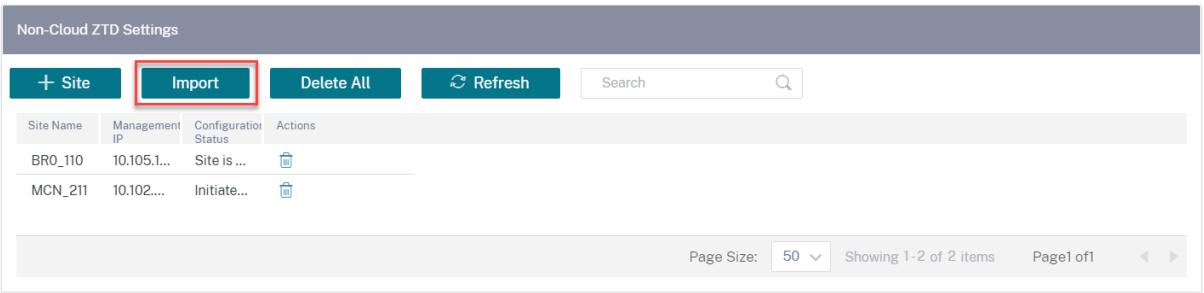
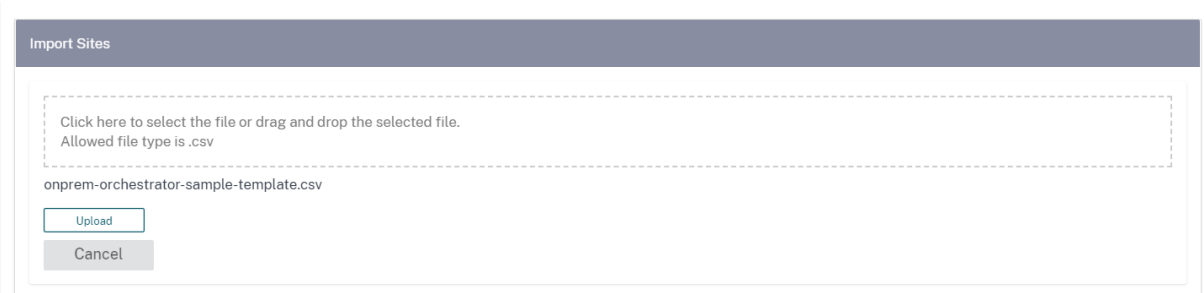


no	applianceName	applianceUserName	appliancePassword	applianceManagementIP	isPasswordExpired	applianceNewPassword	isPrimaryAppliance
1	Site1Primary	site1admin	site1password	10.102.78.154	FALSE		TRUE
2	Site1Secondary	site1admin	site1password	10.102.78.155	TRUE	site1newpassword	FALSE
3	Site2	site2admin	site2password	10.102.78.156	FALSE		TRUE

- **Appliance Name**: The site name configured during site configuration. For more information, see Site Configuration.
- **Appliance Username**: The user name configured on the site appliance.
- **Appliance Password**: The corresponding password for the site appliance.
- **Is password expired**: Determines if the appliance is freshly provisioned. If the value is **True**, provide the **Appliance New Password**.
- **Appliance New Password**: The password for freshly provisioned appliances. If the **Is password expired** value is **True**, provide the **Appliance new password**.
- **Is Primary Appliance**: If High Availability (HA) is configured, the active appliance must have the value True and standby appliance must have the value False. If HA is not configured, the value must be True.

Click **Import**, select the CSV file and click **Upload**.





The configuration status of the sites is displayed, you can choose to delete sites individually or Delete All if sites are not required for zero-touch deployment.

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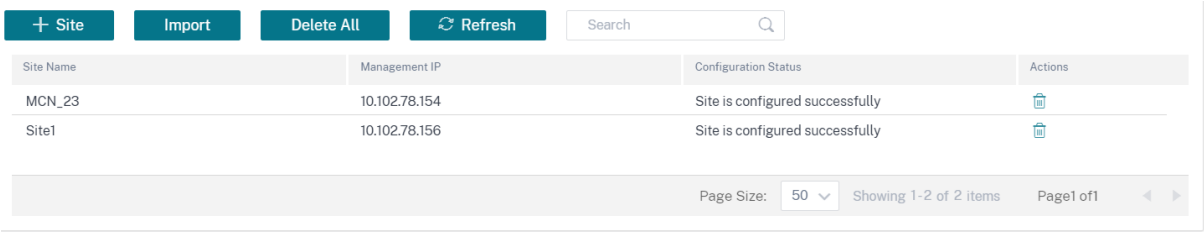

Cloud brokered zero-touch deployment (Preview)

Cloud brokered zero-touch deployment uses Citrix SD-WAN Orchestrator service as a broker between Citrix SD-WAN Orchestrator for On-premises and the Citrix SD-WAN appliances. Citrix SD-WAN Orchestrator for On-premises sends a cloud zero-touch deployment configuration package to Citrix SD-WAN Orchestrator service. The cloud zero-touch deployment configuration package consists of the following information:

- On-prem identity information
- Authentication type
- On-prem certificate
- Appliance details (List of serial numbers)

Citrix SD-WAN Orchestrator service stores the information received from Citrix SD-WAN Orchestrator for On-premises. When an appliance contacts the Citrix SD-WAN Orchestrator service with its serial number, the acquired intelligence of Citrix SD-WAN Orchestrator service determines that the appliance has to be managed by Citrix SD-WAN Orchestrator for On-premises. Citrix SD-WAN Orchestrator service passes on the Citrix SD-WAN Orchestrator for On-premises details to the appliance. Citrix SD-WAN appliance sends its certificate to Orchestrator service. Citrix SD-WAN Orchestrator service receives and stores the appliance certificate.

Citrix SD-WAN Orchestrator for On-premises periodically fetches the appliance certificate from Citrix SD-WAN Orchestrator service. Once a secure connection is established between Citrix SD-WAN Orchestrator for On-premises and the appliance, the Citrix SD-WAN Orchestrator for On-premises pushes the configuration and relevant files to the appliances.

Cloud brokered zero-touch deployment settings are available only for customers in a customer managed setup. Provider managed setup does not support cloud brokered zero-touch deployment settings.

Prerequisites

- Appliances need access to the following domain names to establish connection with Citrix SD-WAN Orchestrator service:
  - sdwanzt.citrixnetworkapi.net
  - download.citrixnetworkapi.net

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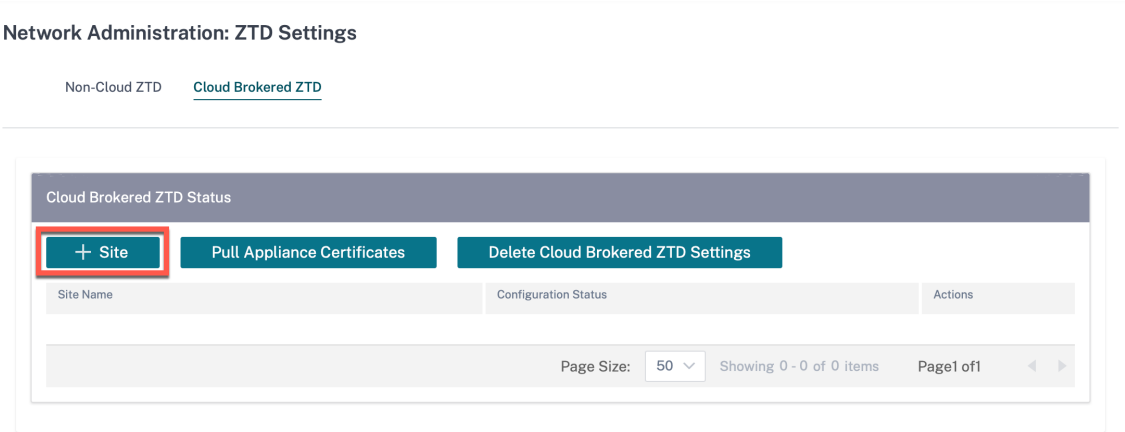
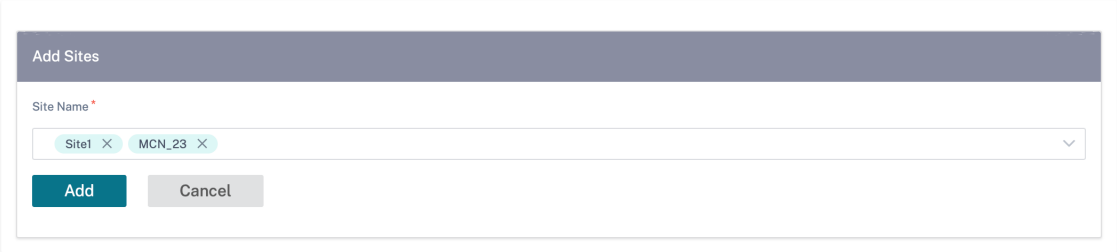
  - trust.citrixnetworkapi.net
  - sdwan-home.citrixnetworkapi.net
- Ensure that Citrix SD-WAN Orchestrator for On-premises always has connectivity to Citrix SD-WAN Orchestrator service to onboard SD-WAN appliances.
- Ensure that Citrix SD-WAN appliance has connectivity to SD-WAN Orchestrator service during the initial on-boarding process and if factory reset is done on the SD-WAN appliance.

To configure Cloud brokered zero-touch deployment settings:

1. In Citrix SD-WAN Orchestrator for On-premises, create and define sites using the guided workflow. For more information, see Site configuration.
2. Verify and compile the configuration using the deployment tracker. For more information, see the Deployment Tracker section in Network configuration topic.
3. Navigate to **Administration > ZTD Settings > Cloud Brokered ZTD** and click **+ Site**.



4. From the drop-down list select a site name and click **Add**. The sites are listed based on your configuration. You can select a single site or multiple sites.



5. The cloud zero-touch deployment configuration is created and sent to Citrix SD-WAN Orchestrator service.

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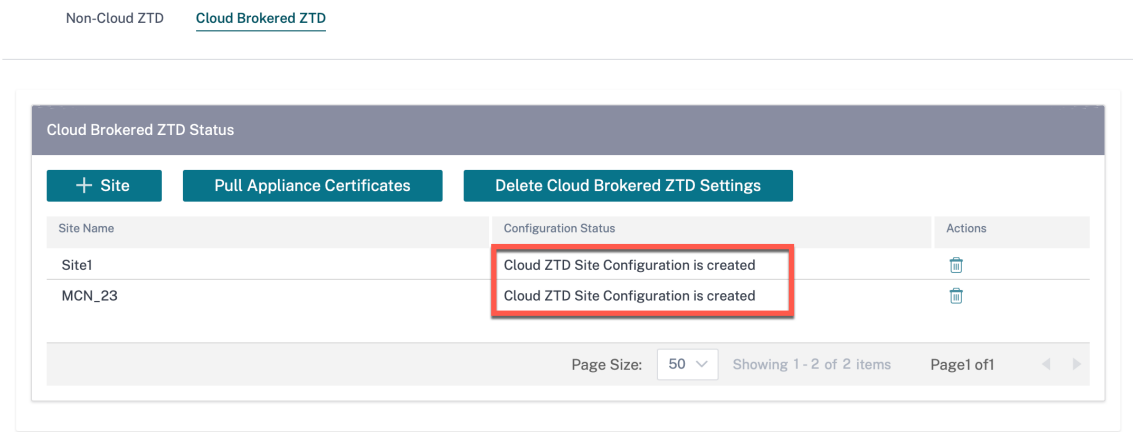

6. Cable up and power on the SD-WAN appliances at the Data Center and branch sites.
7. The appliances contact the Citrix SD-WAN Orchestrator service with their serial number.
8. The Citrix SD-WAN Orchestrator service acts as broker between Citrix SD-WAN Orchestrator for On-premises and the appliances. It allows exchange of certificates and Citrix SD-WAN appliance establishes a secure connection with Citrix SD-WAN Orchestrator for On-premises. Once zero-touch deployment is successful, the configured site comes online and is displayed in the **Orchestrator Connectivity** column under **Configuration > Network Config Home**.
9. **Activate** and **Stage** the configuration to push the configuration and software to the appliances.
10. Once the configuration/software is applied, virtual paths get established and the **Availability** column under **Configuration > Network Config Home** gets updated with the appropriate virtual path status.

> **NOTE**
>
> Citrix SD-WAN Orchestrator for On-premises takes about 30 minutes to fetch the appliance certificate and onboard the appliances completely. To pull the appliance certificates immediately (without waiting for 30 minutes), click **Pull Appliance certificates**.

If necessary, you can choose to click **Delete Cloud Brokered ZTD Settings**. It removes information related to all sites. If you need to delete a particular site information, then click the delete icon corresponding to that site.

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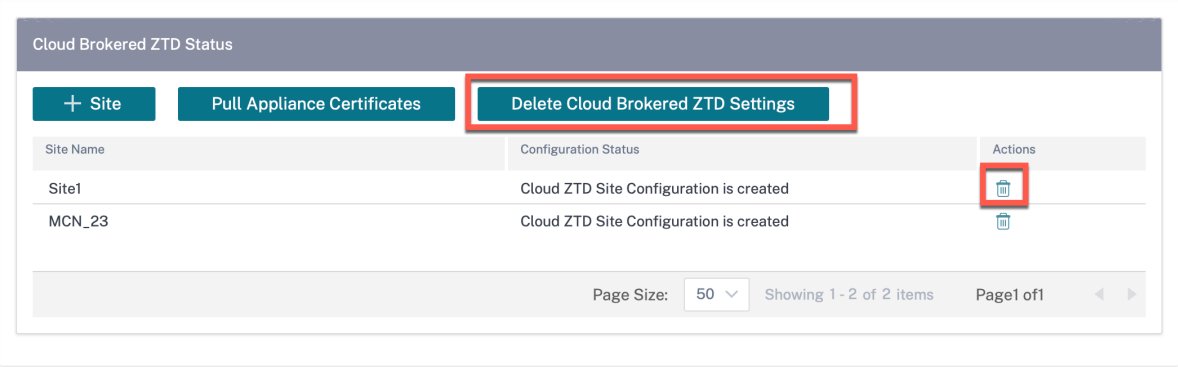

Manual Connectivity Configuration

While configuring connectivity manually, you must download the Citrix SD-WAN Orchestrator for On-premises certificate and upload it on each appliance in the network. It involves logging into each appliance manually for uploading the certificates.

To configure connectivity manually:

1. Navigate to **Administration > Certificate Authentication** and enable **Authentication Type**.

   When Authentication Type is enabled, the SD-WAN appliance can connect to Citrix SD-WAN Orchestrator for On-premises only through Two-way Authentication. When Authentication Type is disabled, the SD-WAN appliance can connect to Citrix SD-WAN Orchestrator for On-premises either through No Authentication, One-way Authentication, or Two-way Authentication.

   > **Note**
   >
   > In a provider managed setup, only providers can enable authentication type and regenerate the Citrix SD-WAN Orchestrator for On-premises certificate.

2. Click **Regenerate** and **Download** the Citrix SD-WAN Orchestrator for On-premises certificate.
3. Choose an appliance from the **Appliance Certificate** section and upload the corresponding certificate downloaded from the SD-WAN appliance. For detailed information on downloading the appliance certificate, see Citrix SD-WAN Orchestrator on-premises configuration on SD-WAN appliance.

   > **NOTE**
   >
   > - Only .pem file type is supported.
   > - Only customer administrators can upload the appliance certificate.

4. Log on to the SD-WAN appliance UI, navigate to **Configuration > Virtual WAN > On-prem SD-WAN Orchestrator**. Upload the certificate downloaded from Citrix SD-WAN Orchestrator for On-premises. For detailed information, see Citrix SD-WAN Orchestrator for On-premises configuration on SD-WAN appliance.

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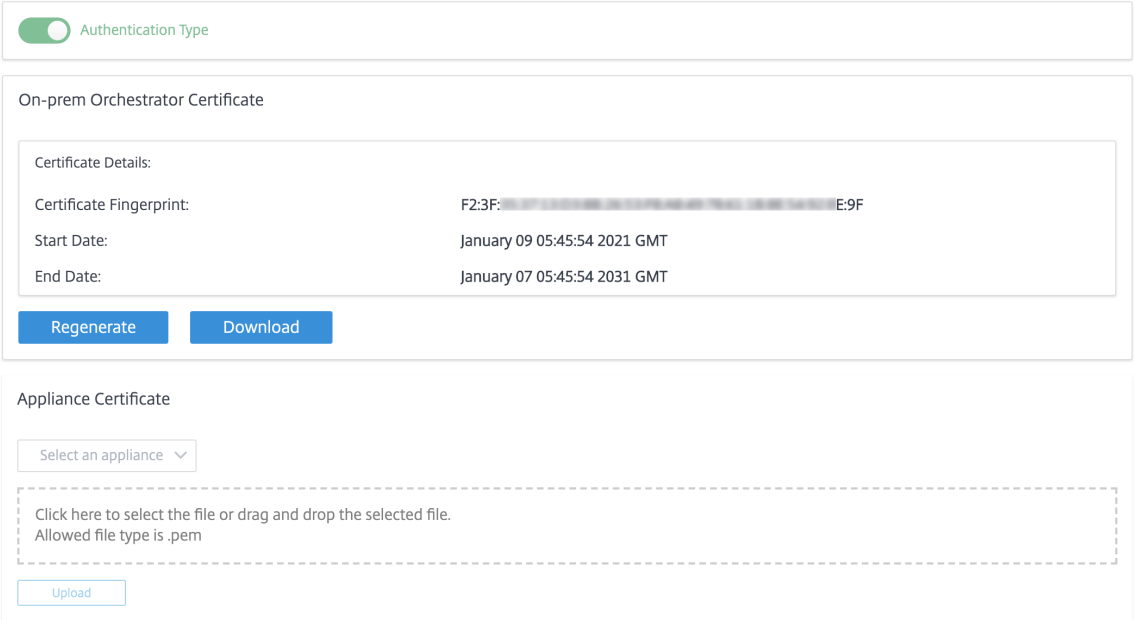
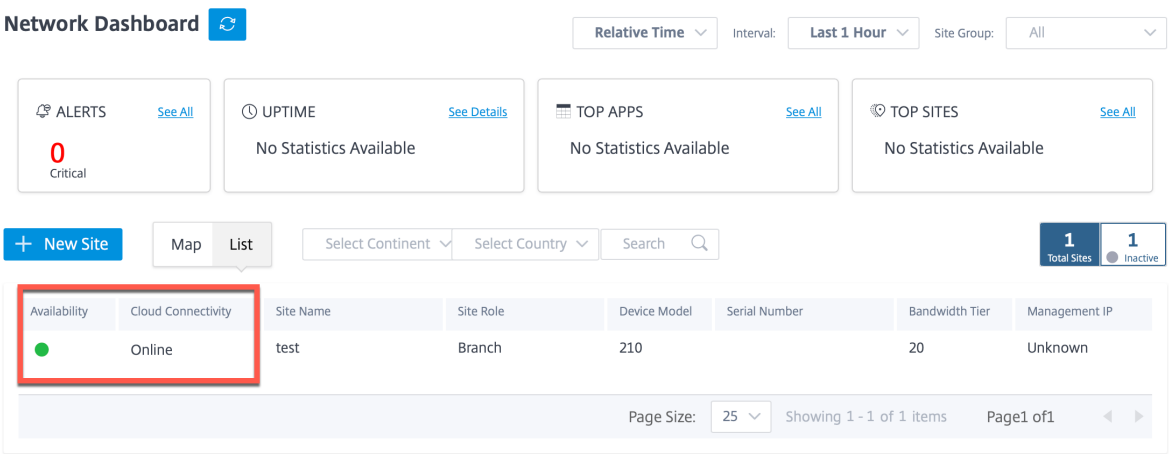


Verify Connectivity

To verify the connectivity status of the appliance, navigate to **Configuration > Network Configuration Home**, and check the **Cloud Connectivity** column corresponding to your site.



> **Note**
>
> You can publish the desired software to upgrade the appliances under **Infrastructure > Orchestrator Administration > Software Images > Appliance**. For more information, see Publish software.

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Provider level configuration

July 16, 2020

Profiles

A profile is a **live configuration template**. A regular template is meant to aid the creation of a new entity. But once the template is created, subsequent changes in the template do not apply to the new entities created using the base template. A profile serves as the live central master entity, which all child entities inherit from, not only during creation but also throughout the life of a profile. All the children entities associated with the profile, automatically inherit any changes made in a profile.

For example, An admin creates a site configuration profile called **the small retail store** and applies it to all the small retail stores owned by a company. Now, any changes made to the small retail store profile at any given time would be applied automatically to all the stores inheriting this profile. Based on what's common across all the entities, and what's not, certain parameters in the profile configuration can be left unset. Such parameters would be customizable and can vary across the entities inheriting the same profile.

Profile templates for service providers

Partners can create profile templates, which their customers can use while creating profiles.

For example, a provider can create four site profile templates – Small Branch, Medium Branch, Large Branch, and Data Center. These templates are automatically made available to the customer accounts associated with the partner. Customers can use these templates while creating profiles.

For instance, let's say a customer decides to create a profile for small branch configuration. The customer can select one of the templates shared by the partner, made available through a drop-down list as part of the profile configuration. The customer can customize it to their network needs before saving the profile. The profile template is not a live entity. It just aids the creation of profiles at the customer level. Profiles can be created only at a customer level, and are meant to be live entities serving as master configuration records.

The provider can create configuration profiles, which can be shared with some or all customers, as needed. Site and WAN profiles are supported currently.

Site profile templates

Site profile templates are site configuration templates created by service providers, to enable the creation of site profiles at a customer level.

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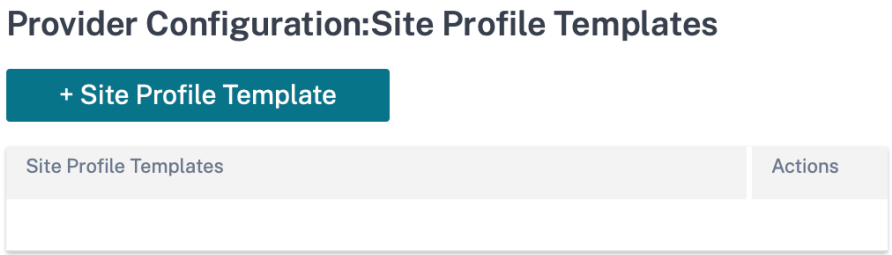
To create profile templates, navigate to **Configuration** > **Site Profile Templates** and click **+ Site Profile Template**.



To create a site profile template, you need to configure the **Site Details**, **Interfaces**, and **WAN Links**. For detailed description of configuring sites, see Site details.

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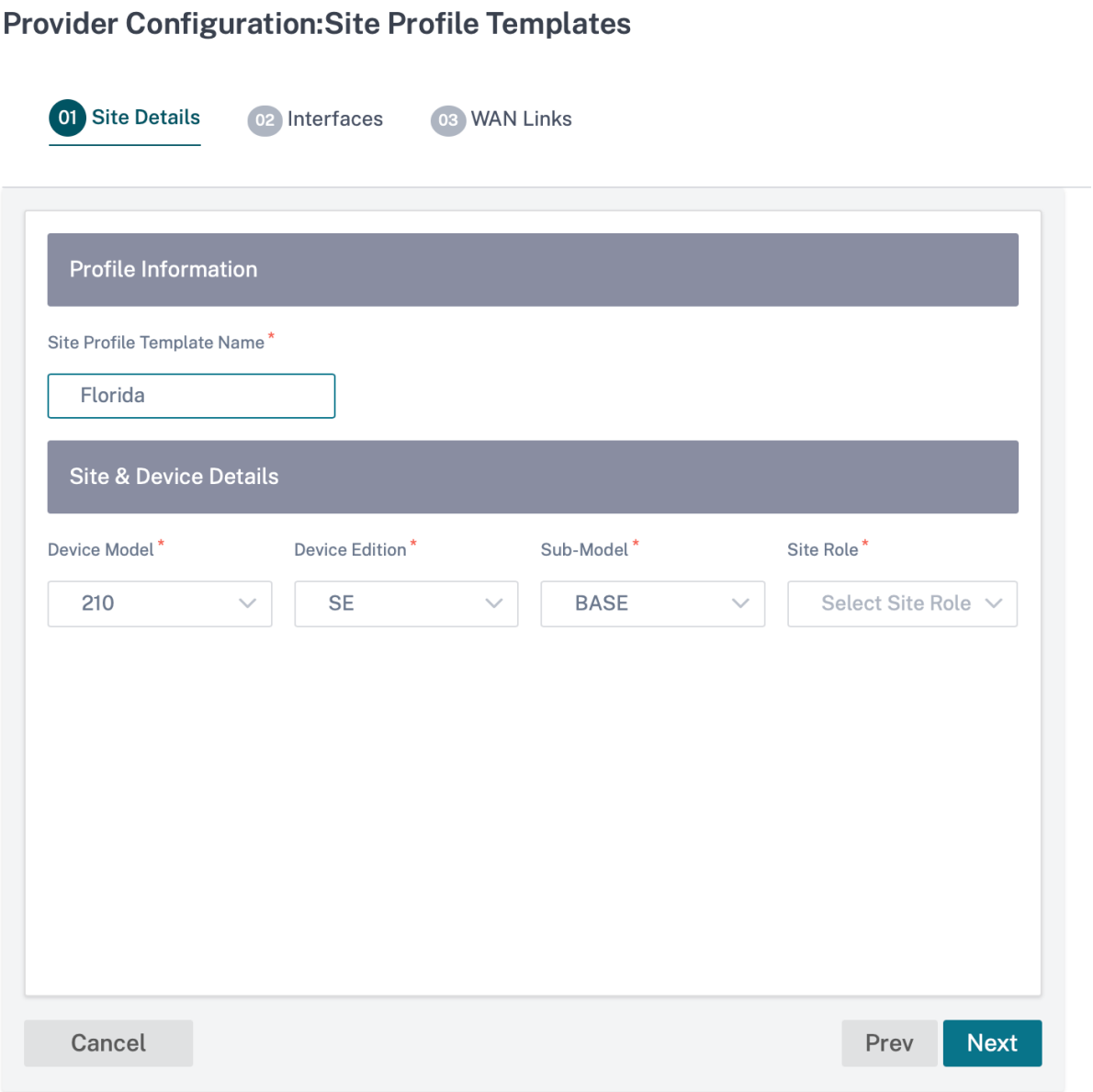

Assign an interface for the site by clicking the **+ Interface** option. To add an interface, you need to fill the **Interface Attributes**, **Physical Interface**, and **Virtual Interfaces** fields. For detailed description of configuring interfaces, see Interfaces.

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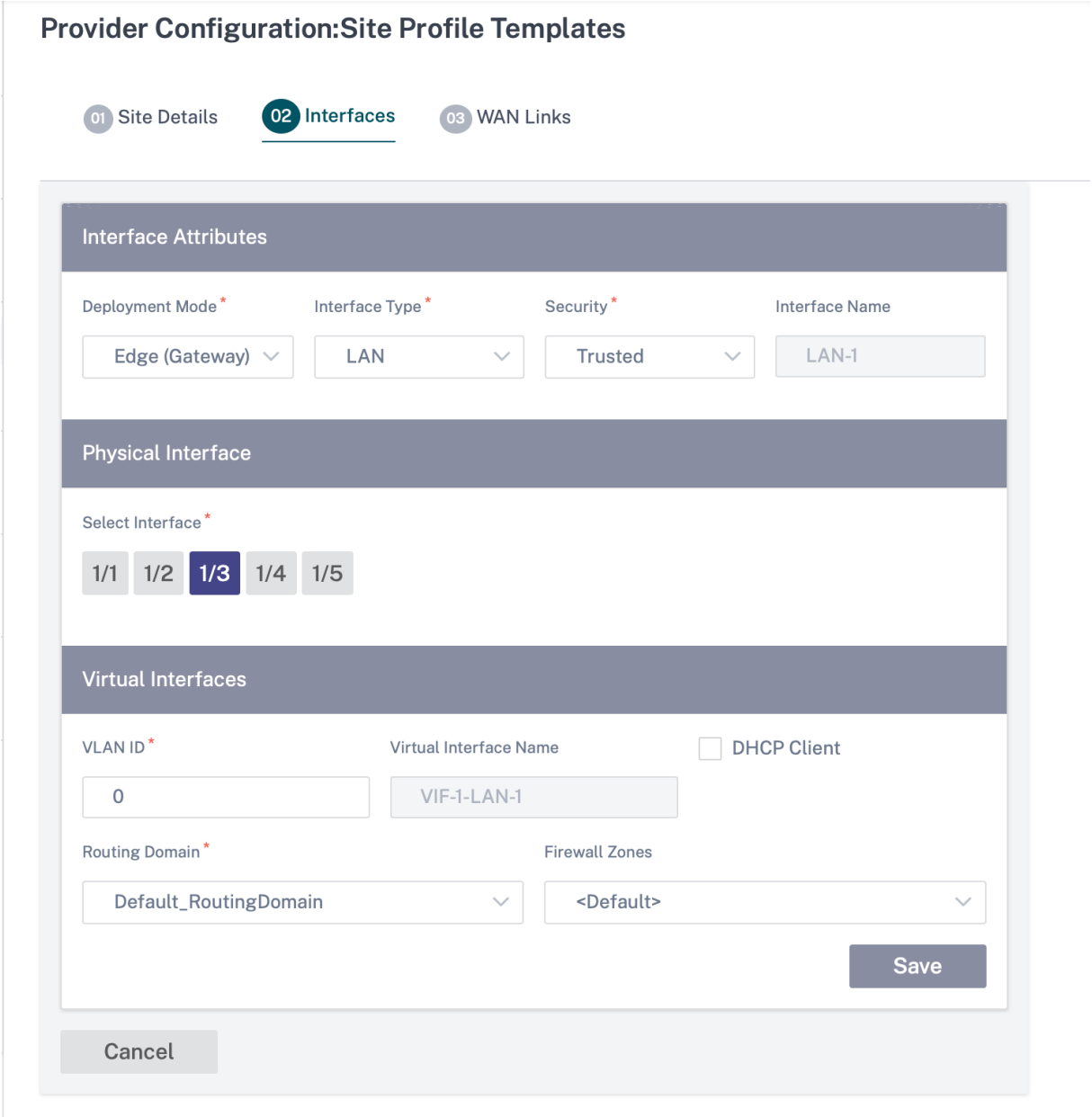

Provide **WAN Link Attributes**, **Access Interfaces**, and **Services** with **Advanced Options**. For detailed description of configuring WAN links, see WAN Links.

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Provider Configuration:Site Profile Templates

01 Site Details 02 Interfaces 03 WAN Links

WAN Link Attributes

Access Type * Public Internet

ISP Name * Verizon Comm

Custom

Internet Category Broadband

Link Name * Broadband-Verizon_Comm-1

Public IP Address Auto Detect

Egress

Speed * 100 Mbps

Ingress

Speed * 100 Mbps

Access Interfaces

Access Interface Name AIF-1

Virtual Interface * VIF-1-LAN-1

Virtual Path Mode * Primary

Save

Advanced WAN Options

Enable Metering

Congestion Threshold (µs) 20000

Provider ID

Frame Cost (Bytes) 1

Standby Mode Disabled

MTU (Bytes) 1350

Cancel

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WAN link templates

WAN profile templates are WAN link configuration templates created by service providers, to enable the creation of WAN link profiles at a customer level.

To create a WAN link template, click **+ WAN Link Template**. You need to fill the WAN link information such as **Profile Name**, **Access Type**, **Internet Category**, **LAN to WAN Rate** and so on. For detailed description of configuring WAN links, see WAN Links.

May 17, 2021

Network configuration

This section offers enterprise network level configuration capabilities, and the starting point for configuring the SD-WAN network of an enterprise.

Network configuration: Home

This section act as an anchor for network configuration. The **Home** page provides the ability to initiate most of the commonly needed configuration actions, such as the ability to:

- Add a site
- Batch adds multiple sites at once
- Deploy configuration or upgrade software, and track the progress
- Back up/Review Checkpoints
- Perform the following operations:
  - Browse and Upload Config
  - Download Config JSON

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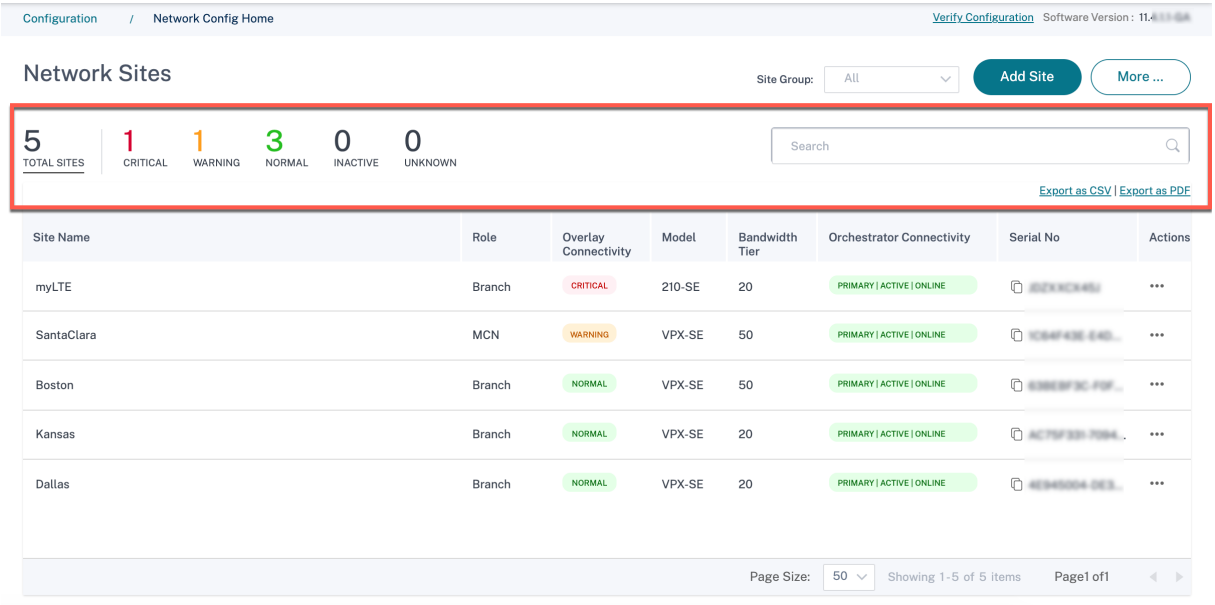
- Download Config DB
- Add Region
- Add Group

All the configured sites are displayed here. You can edit, update, delete, reset, and update the password of any site. You can also reboot the devices associated with a site.



You can upgrade the SD-WAN software on all the appliances across the network, by simply selecting an appliance software version from the **Software Version** drop-down list.

Only the software versions that are published under **Infrastructure > Orchestrator Administration > Software Images > Appliance** get listed in the **Software Version** drop-down list. For more information, see Publish software.

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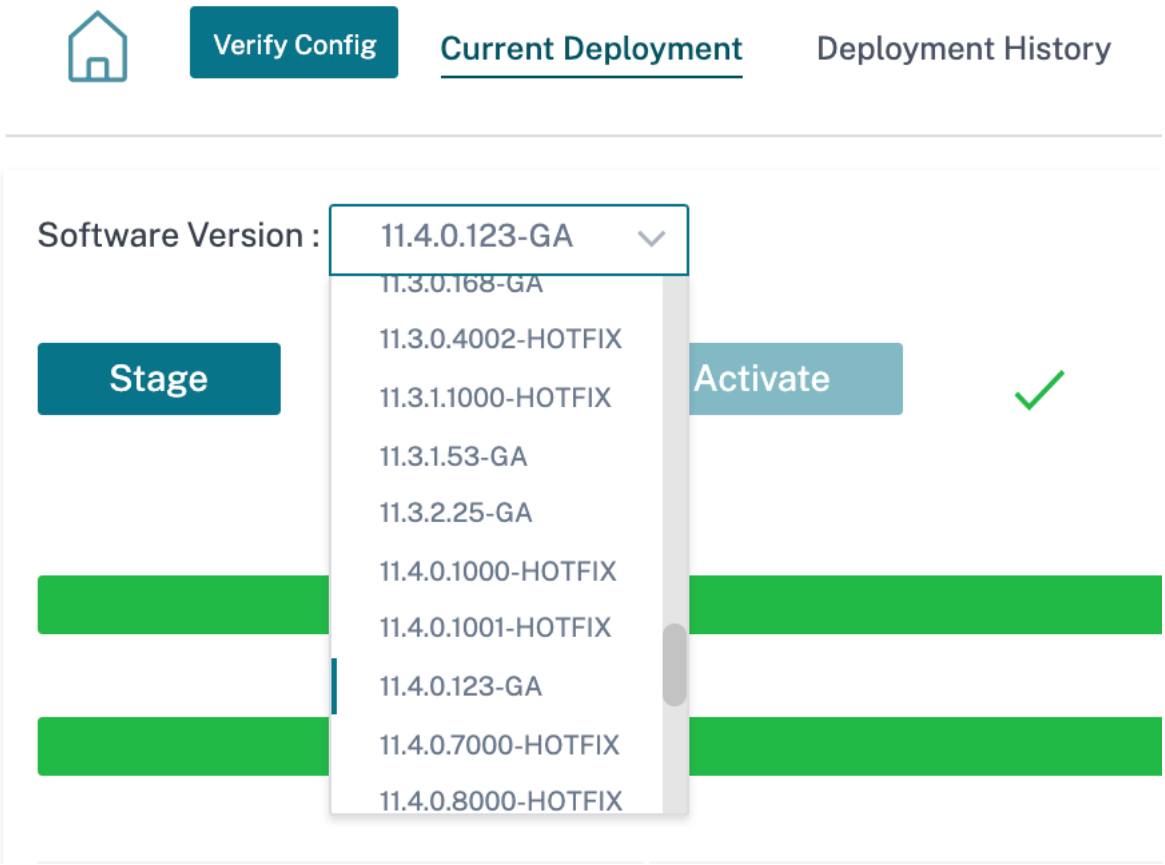
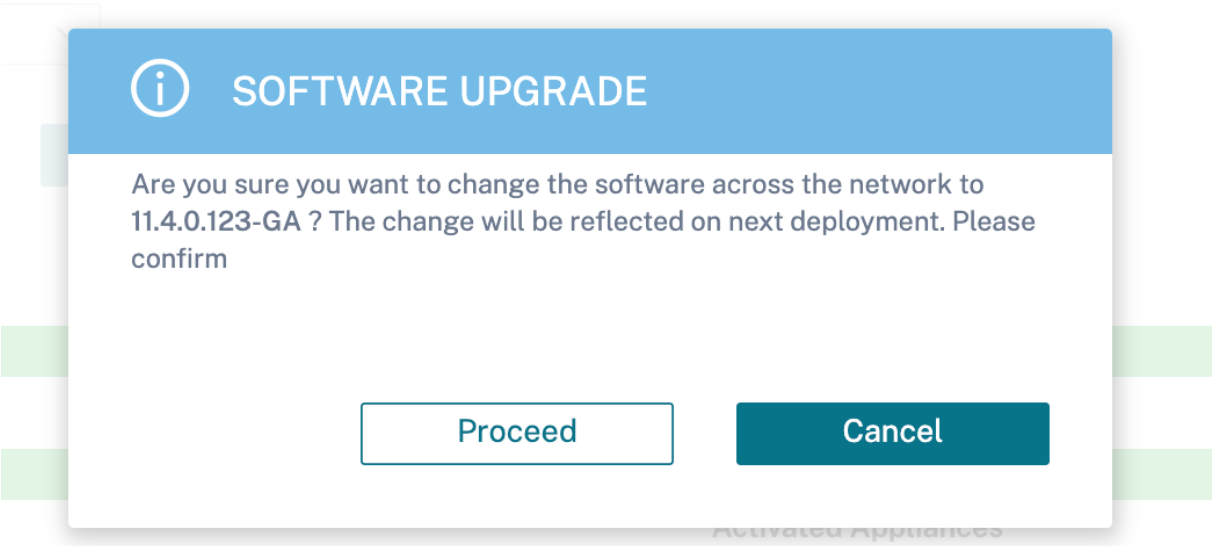


A confirmation message appears. Click **Proceed**.



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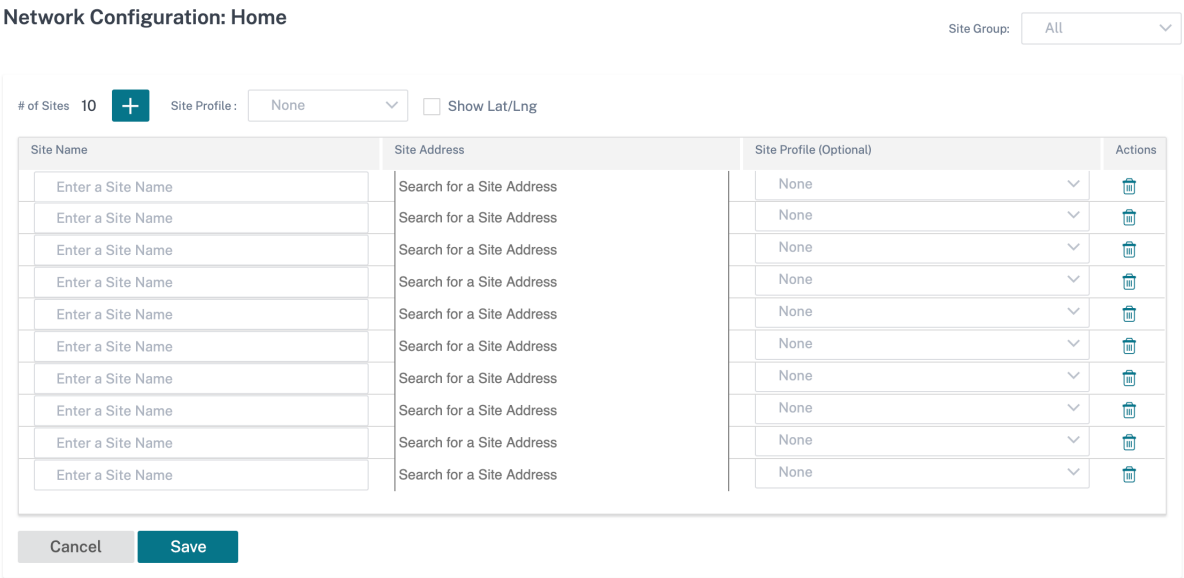
Add site

Use the **+ Add Site** option to add a new site. For more information on site configuration workflow, see Site Configuration.

Batch add sites

The **Batch Add Sites** option allows you to quickly add several sites as a batch. You can also select a site profile to be used for each site, leaving you only with unique parameters such as IP addresses that remain to be configured for each site.



Deploy Config/Software

The **Deploy Config/Software** option allows you to deploy the current configuration and software across the network, once the sites are configured. For more information on the deployment process, see **Deployment Tracker** section.

Deployment tracker

The **Deploy Config/Software** option takes you to the **Deployment Tracker** section to help verify the configuration, stage, and activate the same across the network.

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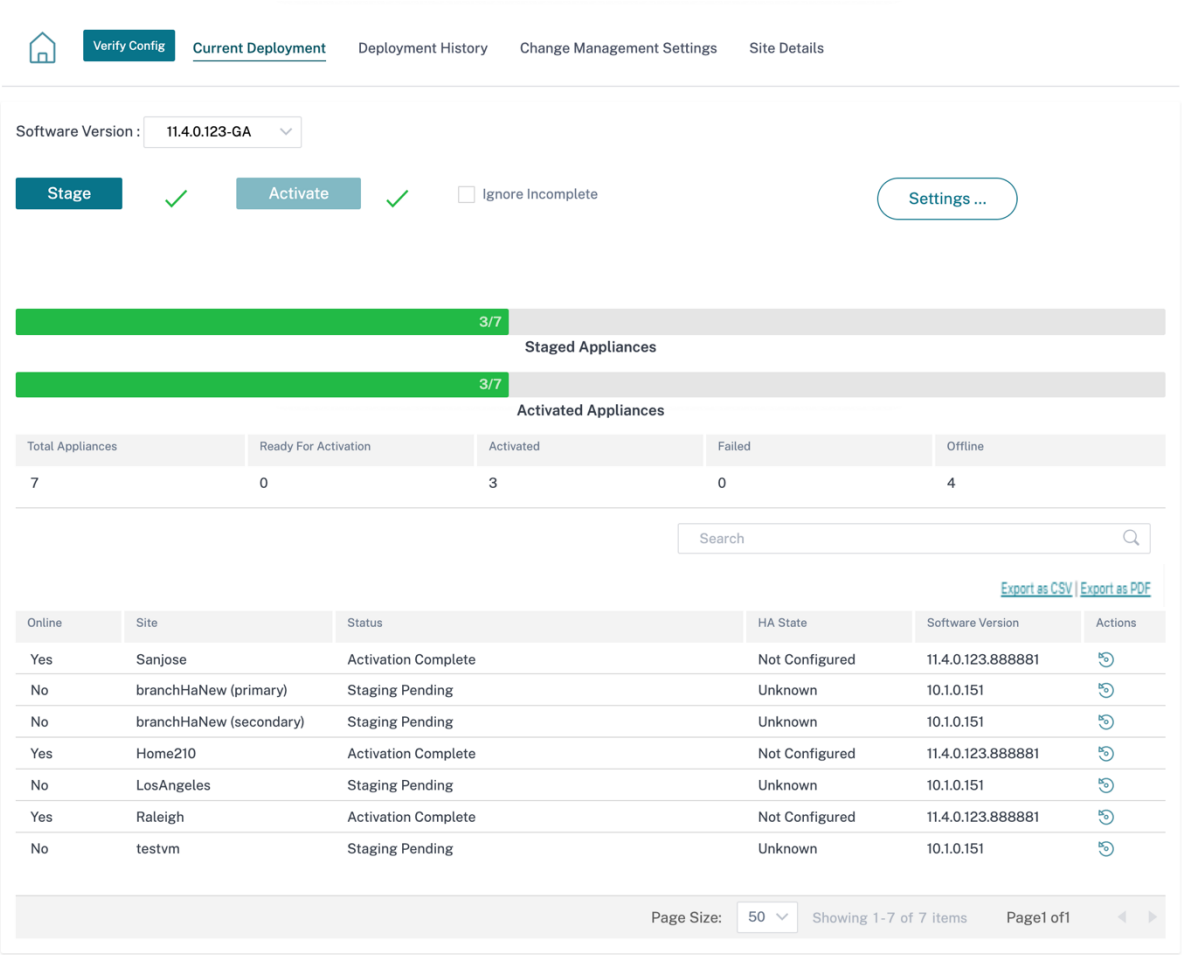

- **Stage**: Once the verification of configuration is successful, click **Stage** to distribute the configuration files to all the appliances in your network.

If the staging process fails at any site, use the **Retry Staging** option, under the **Actions** column, to re-initiate the staging process.

- **Active**: Click **Activate** to activate the staged configuration on all the sites across the network.

The **Deployment History** section helps to review the previous deployment operations and results.

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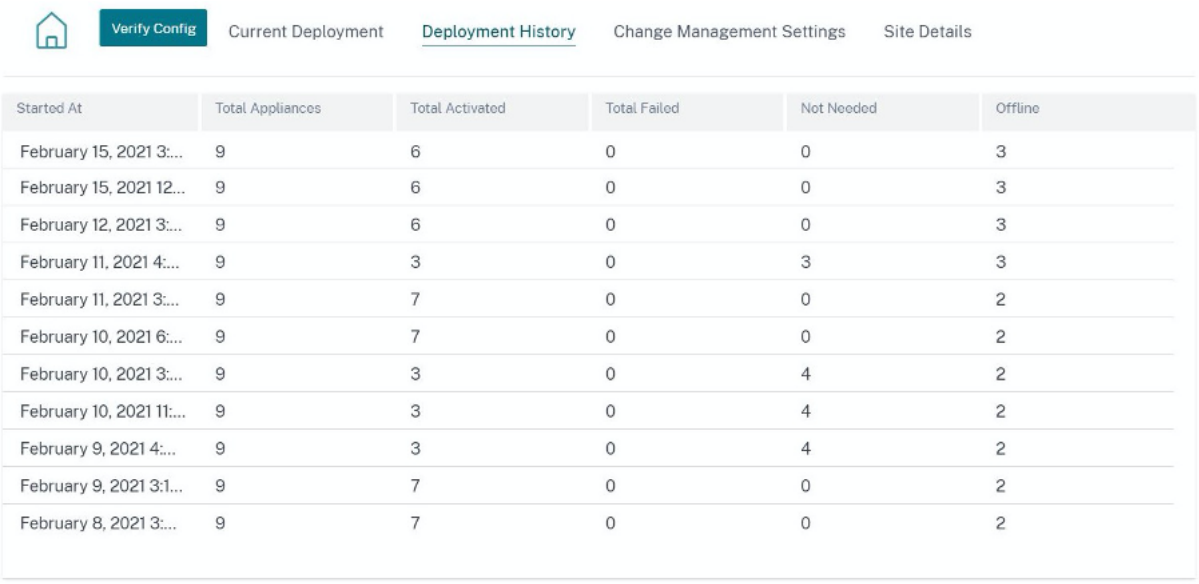

Started At	Total Appliances	Total Activated	Total Failed	Not Needed	Offline
February 15, 2021 3:...	9	6	0	0	3
February 15, 2021 12...	9	6	0	0	3
February 12, 2021 3:...	9	6	0	0	3
February 11, 2021 4:...	9	3	0	3	3
February 11, 2021 3:...	9	7	0	0	2
February 10, 2021 6:...	9	7	0	0	2
February 10, 2021 3:...	9	3	0	4	2
February 10, 2021 11:...	9	3	0	4	2
February 9, 2021 4:...	9	3	0	4	2
February 9, 2021 3:1...	9	7	0	0	2
February 8, 2021 3:...	9	7	0	0	2

HA near-hitless software upgrade

During software upgrade (11.0.x and earlier versions), the staging, and activation of all the appliances in the network are done at the same time. This includes the High Availability (HA) pair, leading to network downtime. With the HA near-hitless software upgrade feature, the Citrix SD-WAN Orchestrator for On-premises ensures that the downtime during the software upgrade (11.1.x and above) process is not more than the HA switch over time.

> **Note**
>
> The HA near-hitless software upgrade is applicable for the following:
>
> - The sites that are deployed in High Availability (HA) mode. It is not applicable for Non-HA sites.
> - Citrix SD-WAN Orchestrator for On-premises based deployments only and not for the networks that are managed using the SD-WAN Center or MCN.
> - Software upgrade only and not configuration updates. If there is configuration change along with the software as part of the upgrade, the Citrix SD-WAN Orchestrator for On-premises does not perform HA near-hitless software upgrade and continues to upgrade in the earlier fashion (single-step upgrade).

The upgrade sequence summary:

1. Citrix SD-WAN Orchestrator for On-premises checks for the HA state of all the appliances in the network.
2. Upgrades all the secondary appliances that are in **Standby** state.
3. HA switch-over is triggered and the state of the **Active** and **Standby** appliances are switched.
4. Upgrades the primary appliances that are now in **Standby** state.

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The HA near-hitless software upgrade is a two-step upgrade process:

Step-1: During software upgrade, after the 11.1 release, the Citrix SD-WAN Orchestrator for On-premises first performs software upgrade on all the appliances that are in the **Standby** state across the network. The network is still up and running with the **Active appliances** in place.

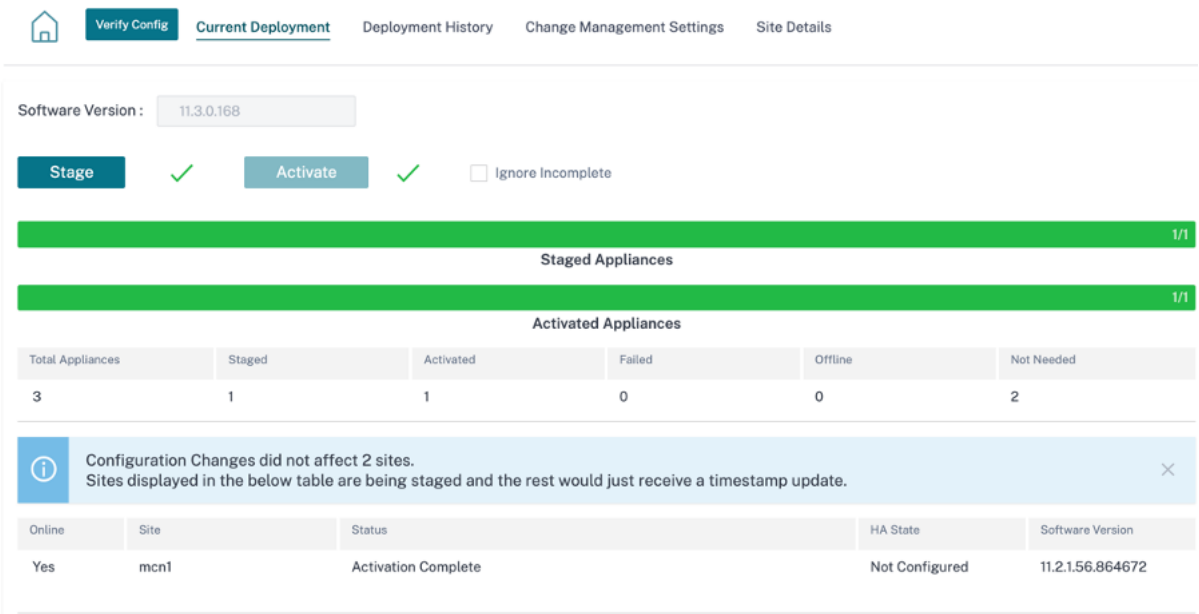
After all the **Standby** appliances are upgraded to the latest software, the HA switch-over is triggered across the network. The **Standby** appliances (with the latest software) become **Active**.

Step-2: The current **Standby** appliances with an old software version are upgraded to the latest software and will continue to run in **Standby** mode.

During this software upgrade process, all other Non-HA sites will also be activated with the latest software.

For more information, see the FAQs.

You can view the upgrade status by navigating to **Deployment Tracker** > **Current deployment**.



- **Stage**: Click Stage to distribute the configuration files to all the appliances in your network.
- **Active**: Click Activate to activate the staged configuration on all the sites across the network.

Auto-correction for configuration and software upgrade

In the Citrix SD-WAN Orchestrator for On-premises, the auto-correction feature is implemented in the change management workflow.

When the staging failed for one site, and if the site that had failed staging is a control node, you need to restage after getting the staging failure message. The **Activate** button will not be enabled if the staging fails for the control nodes. In case, the site that had failed staging is a branch node, you are

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still allowed to move ahead with the activation. But to bring that branch in sync with the network, perform another round of change management.

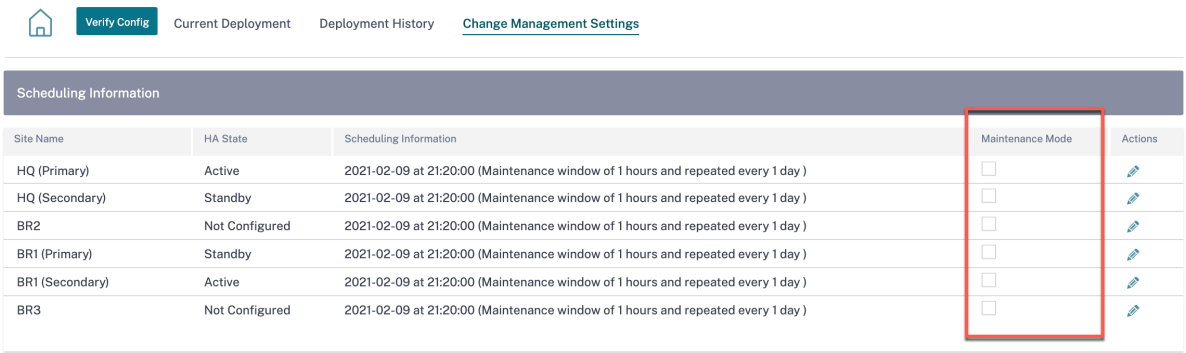
> **Note**
>
> - The auto-correction check starts only after the **Activate** button has been clicked and stops once the next stage is issued from the Citrix SD-WAN Orchestrator for On-premises UI.
> - The maintenance mode functionality is only applicable for the auto-correction feature. If you initiate a **Staging** and **Activation**, the appliance with the maintenance mode enabled also gets updated with the software and configuration changes.

With the auto-correction feature enhancement, when a staging failure happens, the auto-correction mechanism pushes the expected software and configuration version to the failed branch and tries to bring it up in sync with the current network. The auto-correction feature is applicable for staging failure on the branch node and activation failure on any node.

The following are the two trigger points when the auto-correction starts:

- In the Citrix SD-WAN Orchestrator for On-premises deployment tracker UI, once you get a **Staging Failed** or **Activation Failed** message, the auto-correction starts running in the background. The auto-correction check starts once the activation is completed.
- In the case of a software and configuration mismatch, where the appliance didn't come up with the expected software and configuration version, the Citrix SD-WAN Orchestrator for On-premises starts pushing the actual required software and configuration copy down to the appliance for activation.

To troubleshoot an appliance manually, enable the maintenance mode check box under the **Change Management Settings**. This check box is used to control if the device needs to be checked for auto-correction or not. Once the maintenance mode check box is cleared, auto-correction brings the appliance in sync with the network software and configuration version.



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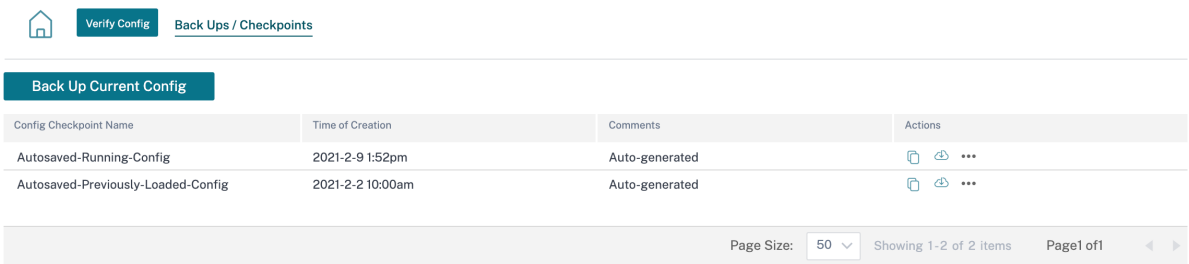
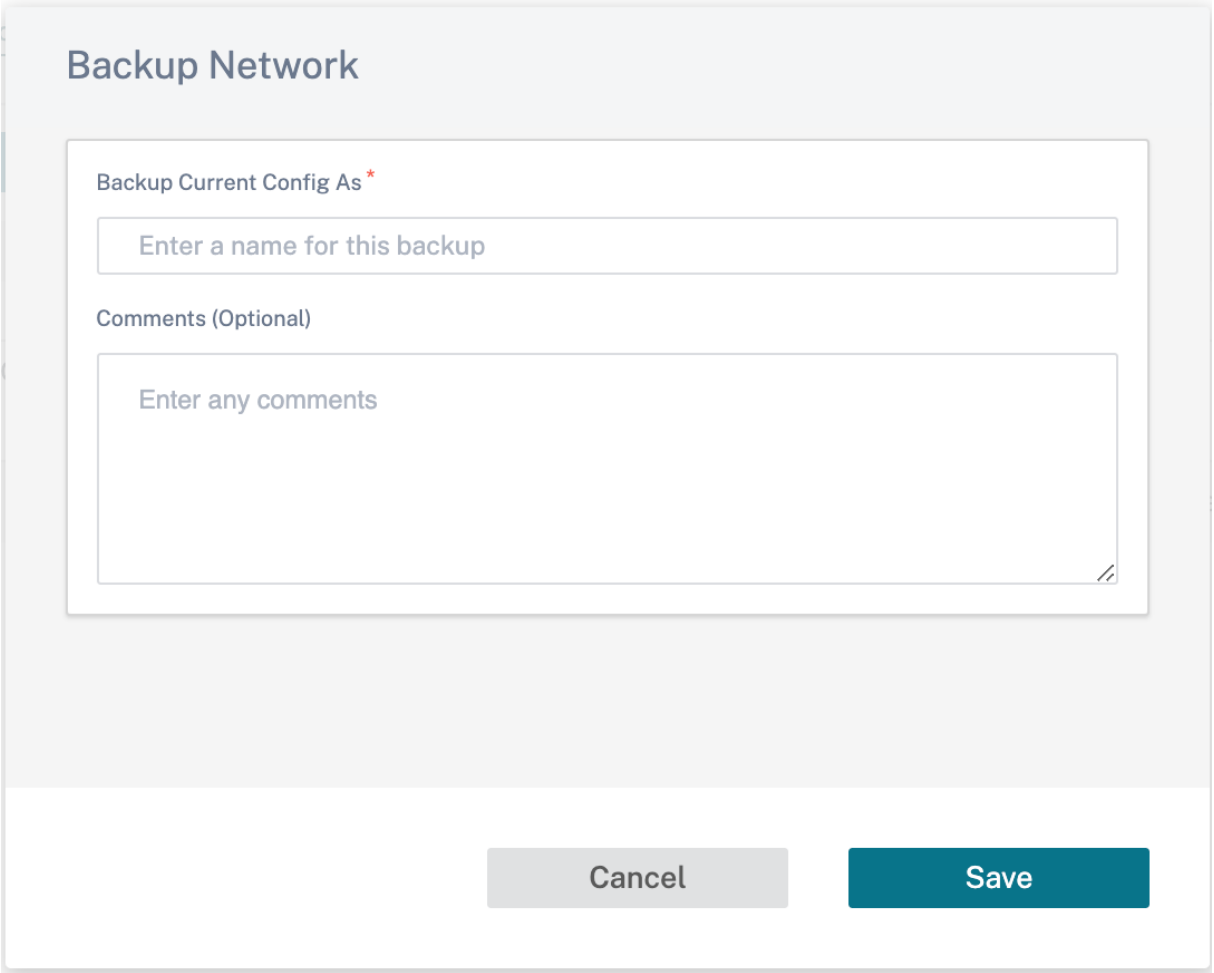
Back up/Review checkpoints

The **Back Up/Review Checkpoints** option has the ability to back-up and restores the configuration, or review the saved checkpoints.



Click **Verify Config** to validate any audit error.

Click **Back Up Current Config** option to back up the current configuration as a checkpoint for future use.



Click the cloud icon (under **Action**) to load a saved configuration. Click **Proceed**.

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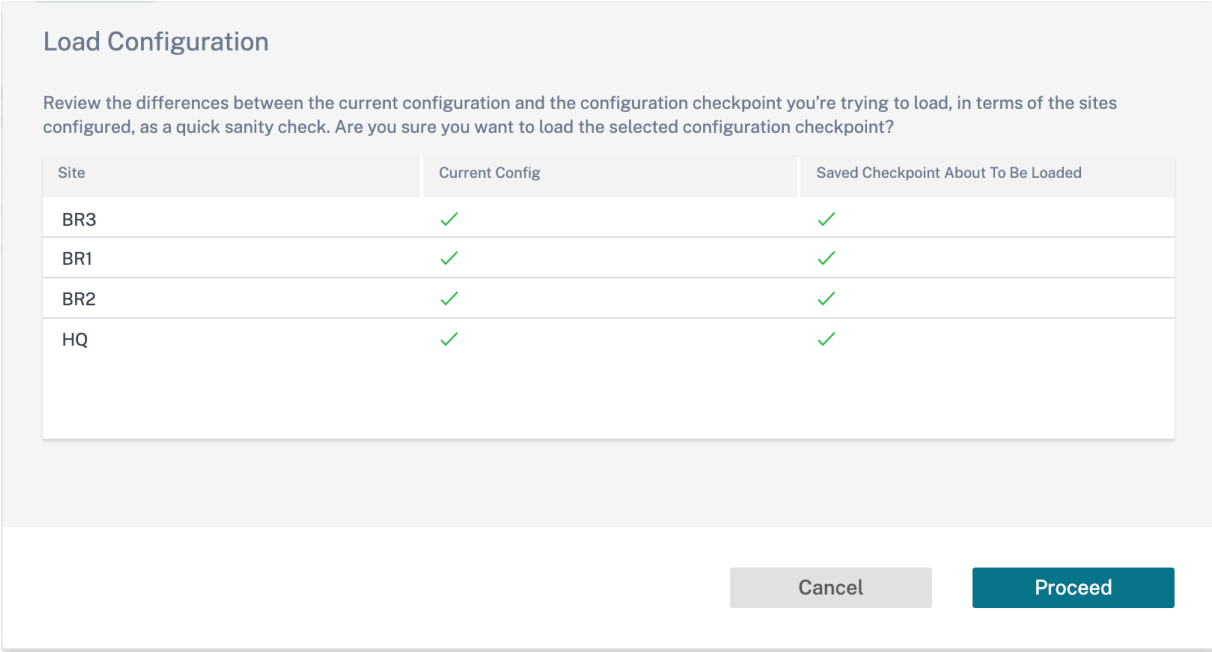

Click the book icon (under **Action**) to make a similar copy of an existing configuration. You can also download, edit, and delete the saved configuration checkpoints. These operations are available under **Action**.

More actions

Following are some of the additional actions available under **More Actions**:

- **Browse and Upload Config**: Browse and upload one of the previously saved configurations, and have that serve as the active configuration for the network.
- **Download Config JSON**: Allows you to download and export the current configuration in JSON format, for offline review.
- **Download Config DB**: Allows you to download and export the current configuration in DB format.
- **Add Region**: Create a Region.
- **Add Group**: Create a Custom Group of sites.

Update password

You can change the password of the SD-WAN appliances at different sites, across the network, through the Citrix SD-WAN Orchestrator for On-premises.

To change the password, for an appliance that is online click the more icon and select **Update Password**.

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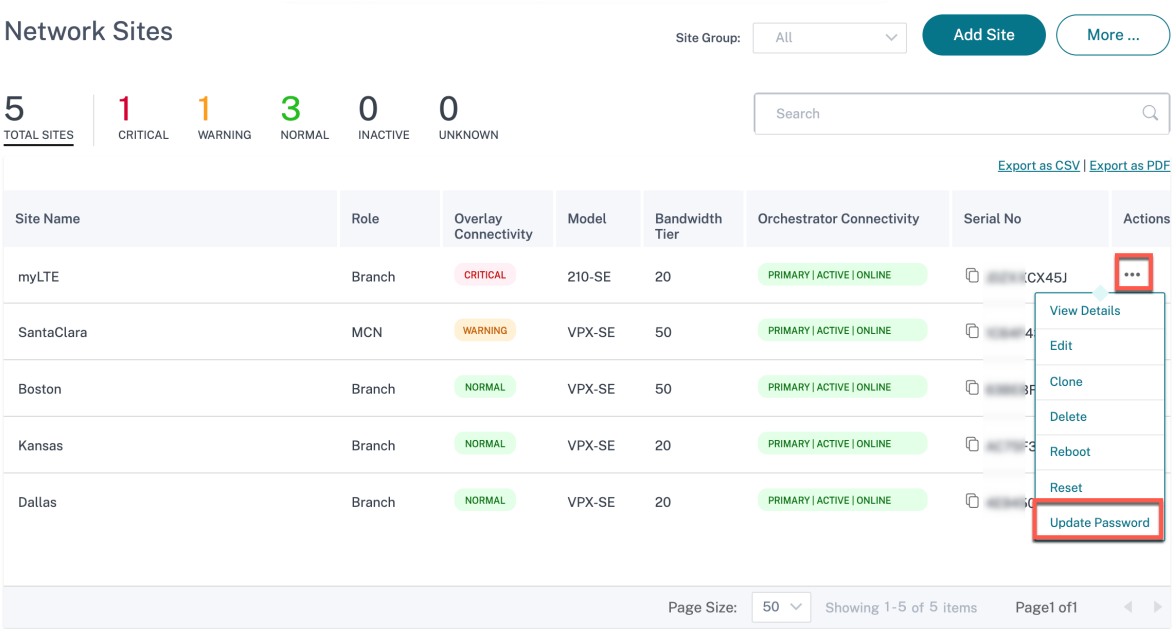

Provide the values for the following fields:

- **User Name**: Select a user name for which you want to change the password from the list of users configured at the site.
- **Current Password**: Enter the current password. This field is optional for admin users.
- **New Password**: Enter a new password of your choice.
- **Confirm Password**: Reenter the password to confirm it.

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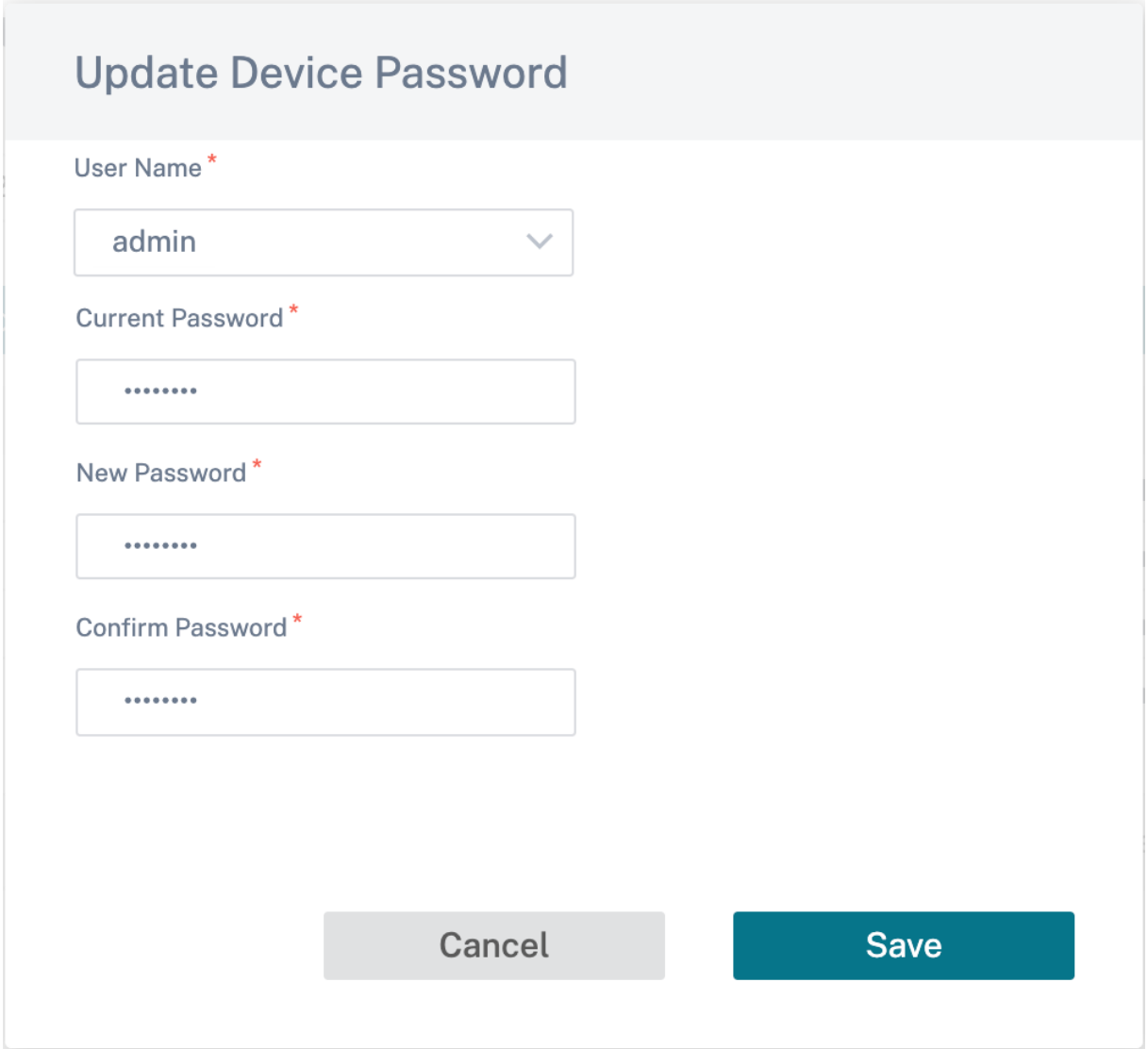

March 8, 2021

Delivery services

Delivery services allow you to configure delivery services such as the Internet, Intranet, IPsec, and LAN GRE. The delivery services are defined globally and applied to WAN links at individual sites, as applicable.

Each WAN link can apply all or a subset of the relevant services, and setup relative shares of bandwidth

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(%) among all the delivery services.

Virtual Path service is available on all the links by default. The other services can be added as needed.

Delivery Services are delivery mechanisms available on Citrix SD-WAN to steer different applications or traffic profiles using the right delivery methods based on business intent.

Delivery Services can be broadly categorized as the following:

- **Virtual Path Service**: The dual-ended overlay SD-WAN tunnel that offers secure, reliable, and high-quality connectivity between two sites hosting SD-WAN appliances or virtual instances.
  - Click the **Setting** option next to the **Virtual Path** service to enable the auto-bandwidth provisioning across virtual paths. Set the minimum reserved bandwidth for each virtual path in Kbps. This setting is applied to all the WAN links across all sites in the network.

- **Internet Service**: Direct channel between an SD-WAN site and public internet, with no SD-WAN encapsulation involved. Citrix SD-WAN supports session load-balancing capability for internet-bound traffic across multiple Internet links.
- **Intranet Service**: Underlay link based connectivity from an SD-WAN site to any non-SD-WAN site.

  The traffic is unencapsulated or can use any non-virtual path encapsulation such as IPsec, GRE. You can set up multiple Intranet services.

Service and bandwidth

Under **Service and Bandwidth** tab, you can view an internet service is created by default. The branch traffic uses the transit sites to reach the internet. This section allows you to define new delivery services and default bandwidth allocation proportion (%) across all the delivery services. The bandwidth allocation needs across delivery services might vary based on the type of link involved.

For example, if you are using multiple SaaS applications, allocate a large proportion of bandwidth on your internet links for **Internet service** for direct internet breakout. On your MPLS links, allocate more bandwidth for **Virtual path service** or **Intranet Service** depending on whether your SD-WAN sites have most of the traffic going to other SD-WAN sites or non-SD-WAN sites.

Based on your requirements, you can define global bandwidth share defaults across delivery services for each link type – Internet links, MPLS links, and Private Intranet links.

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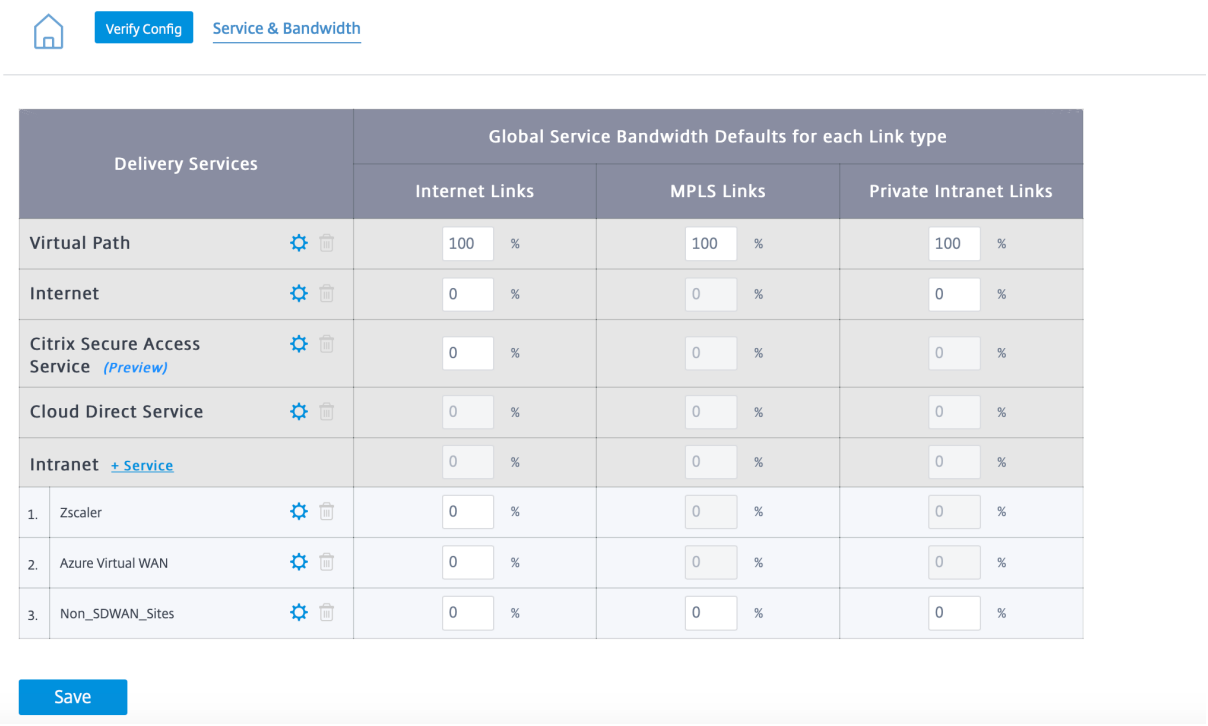

The default values can be overridden on individual links. While configuring WAN links, you can choose to use these global defaults or configure link specific service bandwidth settings. Configuration of a non-zero bandwidth share is required for any delivery service to be enabled and active on a link.

Internet service

Internet Service is available by default as part of the Delivery services. You can configure the internet service route cost relative to other delivery services. You can also preserve the route to the internet from the link even if all the associated paths are down.

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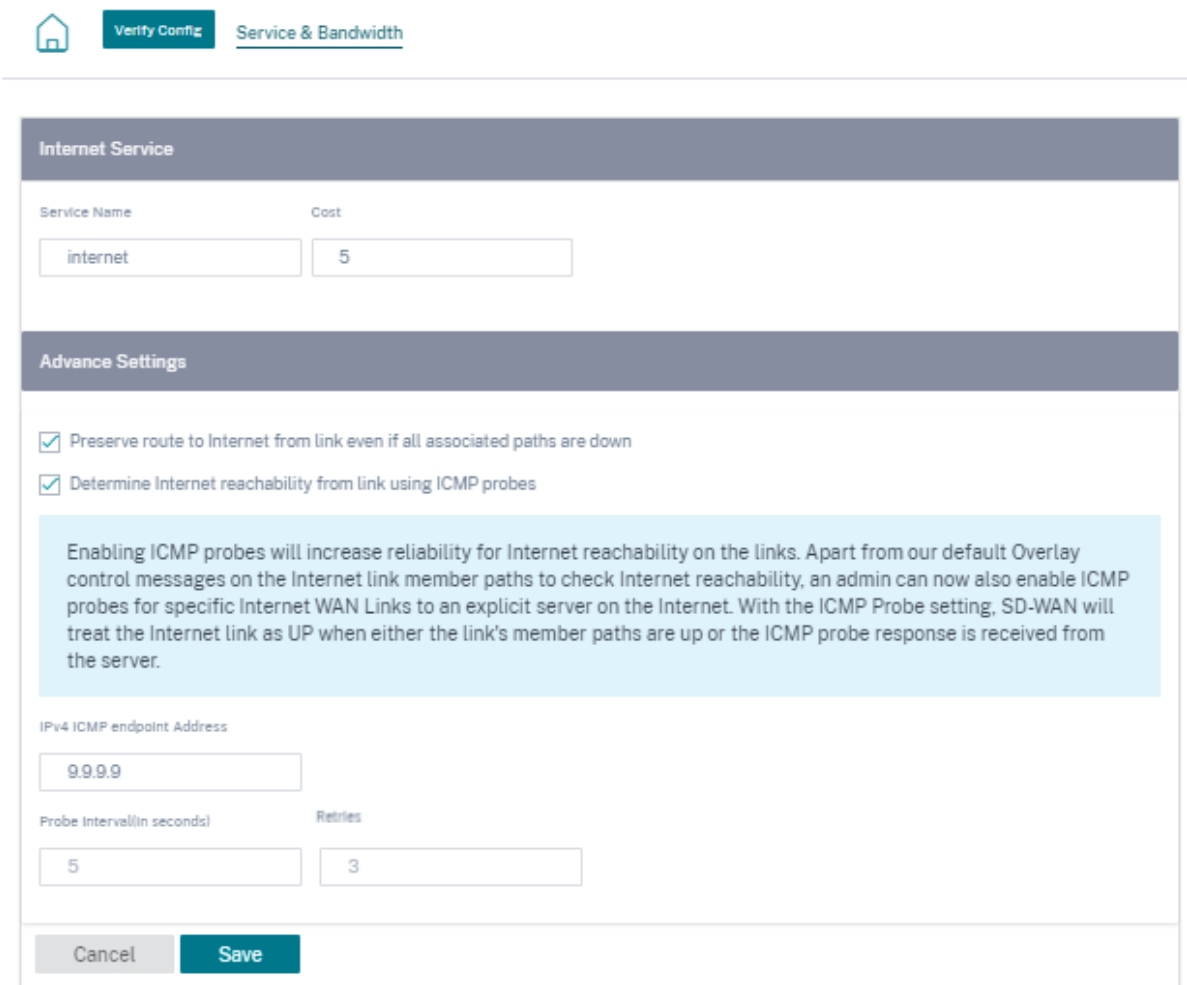

Intranet service

You can create multiple intranet services. Once the intranet service is created at the global level, you can reference it at the WAN Link level. Provide a **Service Name**, select the desired **Routing Domain** and **Firewall Zone**. Add all the intranet IP addresses across the network, that other sites in the network might interact. You can also preserve the route to intranet from the link even if all the associated paths are down.

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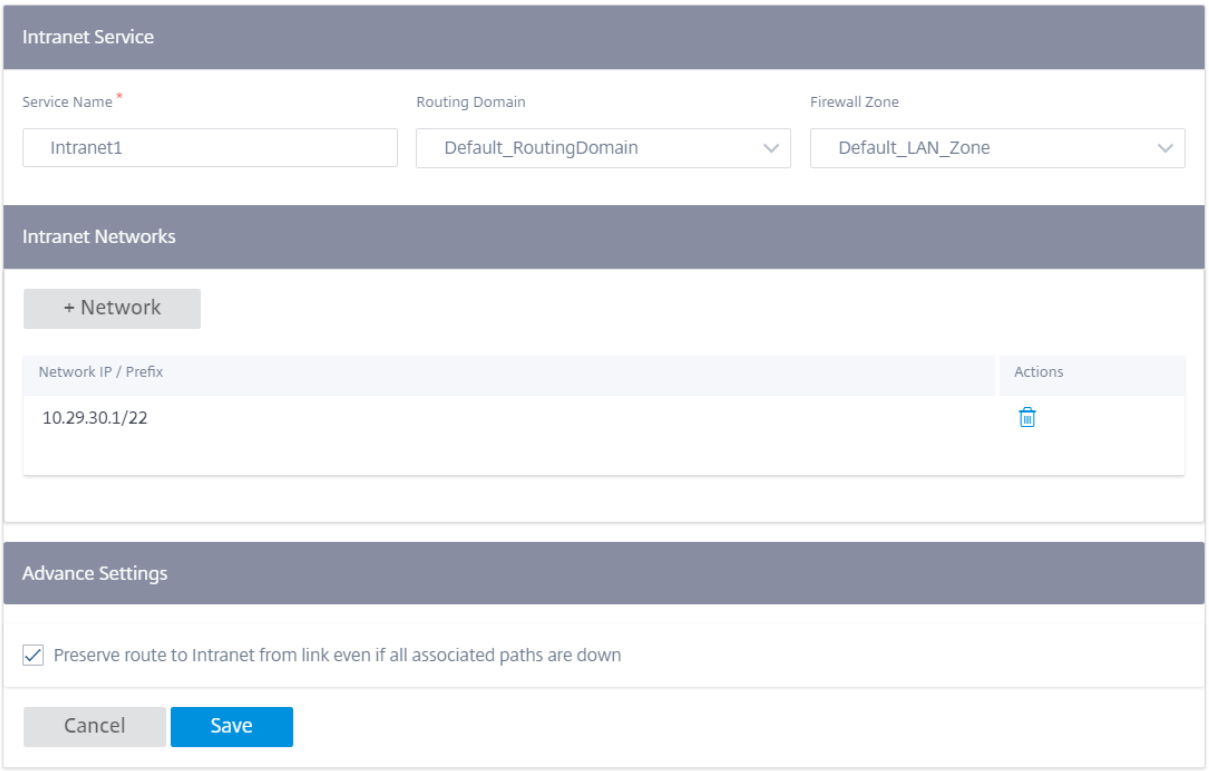

GRE service

You can configure SD-WAN appliances to terminate GRE tunnels on the LAN.

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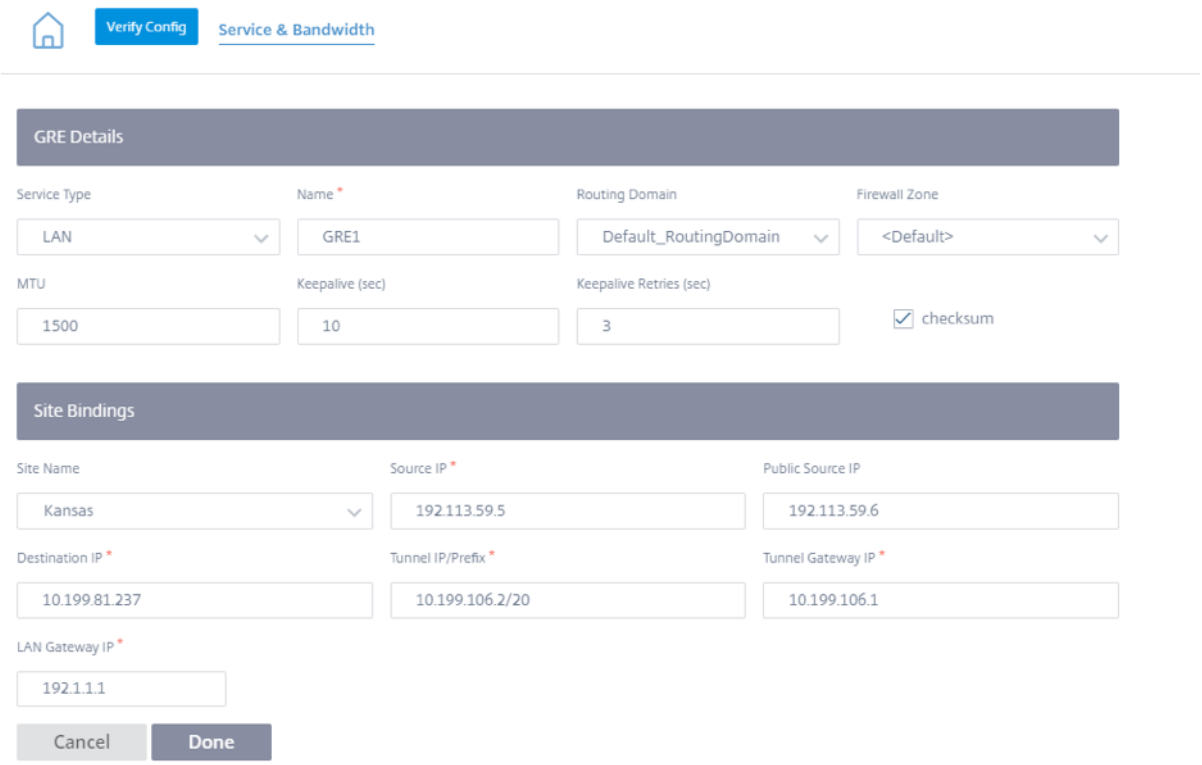

GRE details

- **Service Type**: Select the service that the GRE tunnel uses.
- **Name**: Name of the LAN GRE service.
- **Routing Domain**: The routing domain for the GRE tunnel.
- **Firewall Zone**: The firewall zone chosen for the tunnel. By default, the tunnel is placed into the Default_LAN_Zone.
- **MTU**: Maximum transmission unit — the size of the largest IP datagram that can be transferred through a specific link. The range is from 576 to 1500. Default value is 1500.
- **Keep alive**: The period between sending keep alive messages. If configured to 0, no keep alive packets is sent, but the tunnel stays up.
- **Keep alive Retries**: The number of times that the Citrix SD-WAN Appliance sends keep alive packets without a response before it brings the tunnel-down.
- **Checksum**: Enable or disable Checksum for the tunnel's GRE header.

Site bindings

- **Site Name**: The site to map the GRE tunnel.
- **Source IP**: The source IP address of the tunnel. This is one of the Virtual Interfaces configured

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at this site. The selected routing domain determines the available Source IP addresses.
- **Public Source IP**: The source IP if the tunnel traffic is going through NAT.
- **Destination IP**: The destination IP address of the tunnel.
- **Tunnel IP/Prefix**: The IP address and Prefix of the GRE Tunnel.
- **Tunnel Gateway IP**: The next hop IP Address to route the Tunnel traffic.
- **LAN Gateway IP**: The next hop IP Address to route the LAN traffic.

IPsec service

Citrix SD-WAN appliances can negotiate fixed IPsec tunnels with third-party peers on the LAN or WAN side. You can define the tunnel end-points and map the sites to the tunnel end-points.

You can also select and apply an IPsec security profile that define the security protocol and IPsec settings.

To configure an IPsec tunnel:

1. Specify the service details.
   - **Service Name**: The name of the IPsec service.
   - **Service Type**: Select the service that the IPsec tunnel uses.
   - **Routing Domain**: For IPsec tunnels over LAN, select a routing domain. If the IPsec Tunnel uses an intranet service, the intranet service determines the routing domain.
   - **Firewall Zone**: The firewall zone for the Tunnel. By default, the Tunnel is placed into the Default_LAN_Zone.
2. Add the tunnel end-point.
   - **Name**: When **Service Type** is Intranet, choose an Intranet Service the tunnel protects. Otherwise, enter a name for the service.
   - **Peer IP**: The IP address of the remote peer.
   - **IPsec Profile**: IPsec security profile that define the security protocol and IPsec settings.
   - **Pre Shared Key**: The pre-shared key used for IKE authentication.
   - **Peer Pre Shared Key**: The pre-shared key used for IKEv2 authentication.
   - **Identity Data**: The data to be used as the local identity, when using manual identity or User FQDN type.
   - **Peer Identity Data**: The data to be used as the peer identity, when using manual identity or User FQDN type.
   - **Certificate**: If you choose Certificate as the IKE authentication, choose from the configured certificates.
3. Map sites to the tunnel end-points.
   - **Choose Endpoint**: The end-point to be mapped to a site.
   - **Site Name**: The site to be mapped to the end-point.

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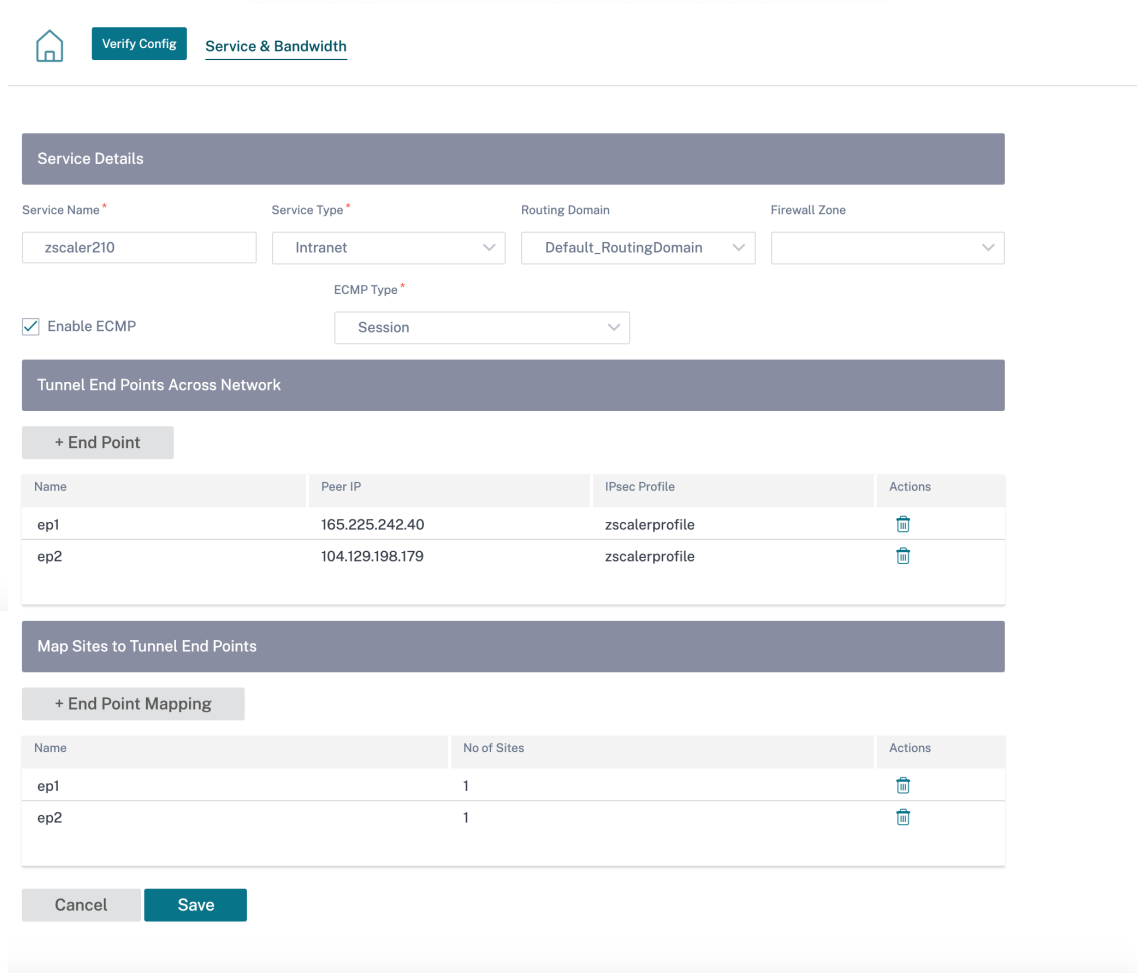
- **Virtual Interface Name**: The virtual interface at the site to be used as the end-point.
- **Local IP**: The local virtual IP address to use as the local tunnel end-point.
- **Gateway IP**: The next hop IP address.

4. Create the protected network.
   - **Source Network IP/Prefix**: The source IP address and Prefix of the network traffic that the IPsec tunnel protects.
   - **Destination Network IP/Prefix**: The destination IP address and Prefix of the network traffic that the IPsec tunnel protects.
5. Ensure that the IPsec configurations are mirrored on the peer appliance.



For more information, see How to configure IPsec tunnels for virtual and dynamic paths.

Dynamic virtual path settings

The global dynamic virtual path settings allow admins to configure dynamic virtual path defaults across the network.

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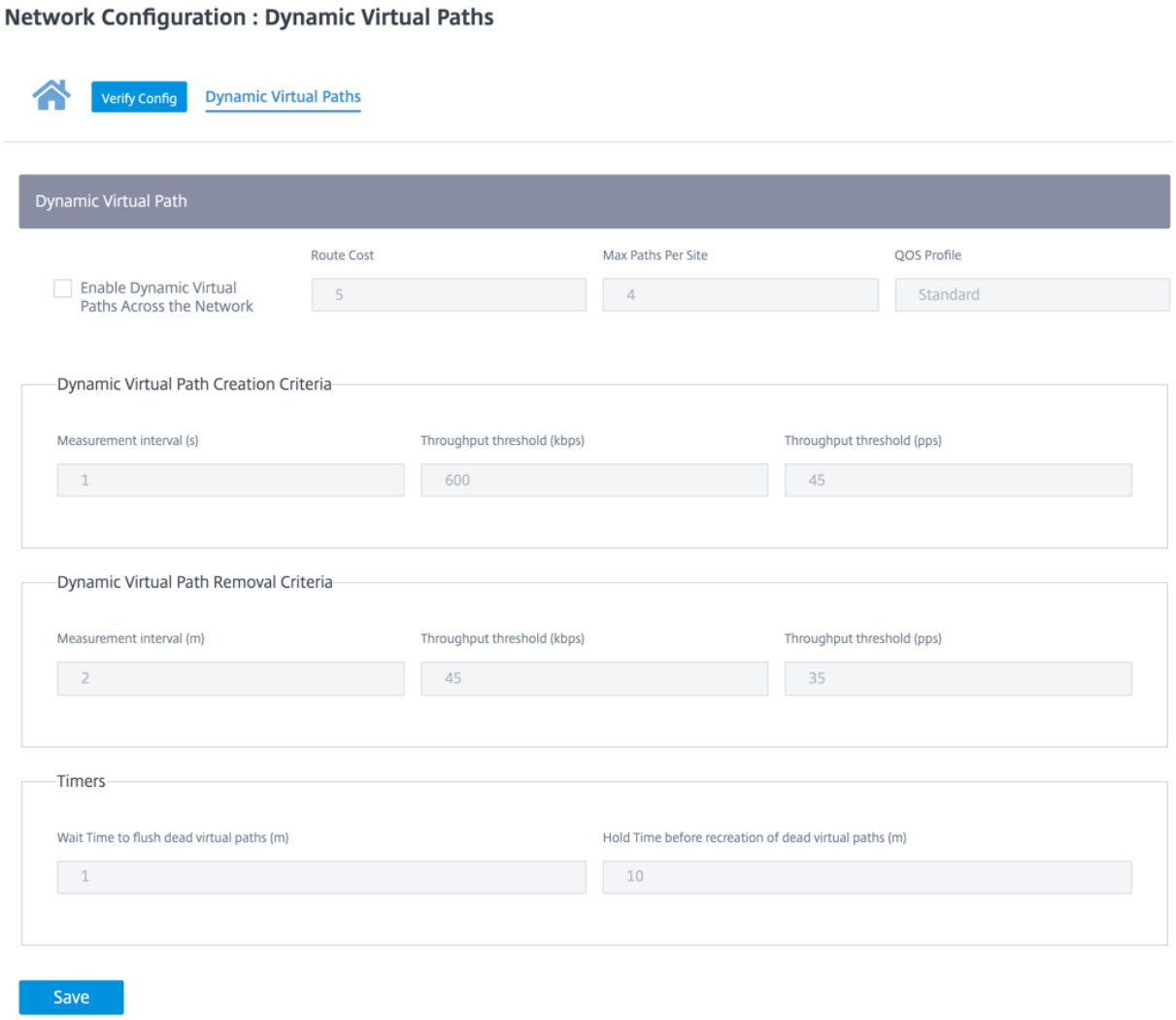
A dynamic virtual path is instantiated dynamically between two sites to enable direct communication, without any intermediate SD-WAN node hops. Similarly, the dynamic virtual path connection is removed dynamically too. Both the creation and removal of dynamic virtual paths are triggered based on bandwidth thresholds and time settings.



Click **Verify Config** to validate any audit error.

The following are some of the supported settings:

- Provision to enable or disable dynamic virtual paths across the network
- The route cost for dynamic virtual paths
- The QoS Profile to be used – **Standard** by default.
- Dynamic Virtual Path Creation Criteria:
  - **Measurement interval (seconds)**: The amount of time over which the packet count and bandwidth are measured to determine if the dynamic virtual path must be created be-

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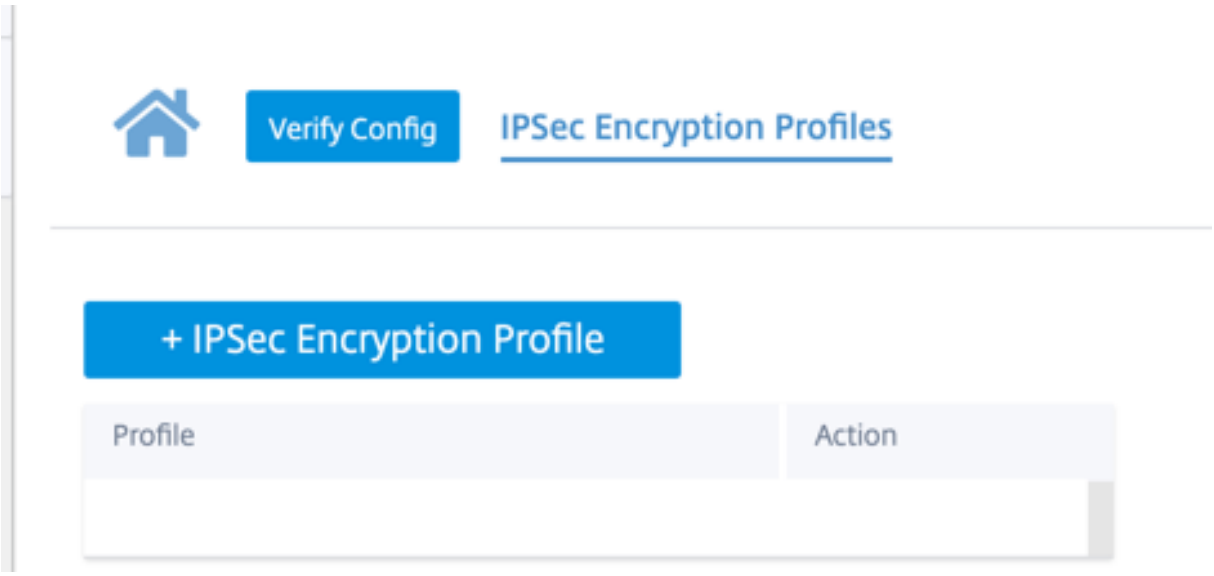
tween two sites – in this case, between a given Branch and the Control Node.
  - **Throughput threshold (kbps)**: The threshold of total throughput between two sites, measured over the **Measurement interval**, at which the Dynamic Virtual Path is triggered. In this case the threshold applies to the Control Node.
  - **Throughput threshold (pps)** - The threshold of total throughput between two sites, measured over the **Measurement interval**, at which the Dynamic Virtual Path is triggered.

- Dynamic Virtual Path Removal Criteria:
  - **Measurement interval (minutes)**: The amount of time over which the packet count and bandwidth are measured to determine if a Dynamic Virtual Path must be removed between two sites – in this case, between a given Branch and the Control Node.
  - **Throughput threshold (kbps)** - The threshold of total throughput between two sites, measured over the **Measurement interval**, at which the Dynamic Virtual Path is removed.
  - **Throughput threshold (pps)** - The threshold of total throughput between two sites, measured over the **Measurement interval**, at which the Dynamic Virtual Path is removed.

- Timers
  - **Wait time to flush dead virtual paths (m)**: The time after which a DEAD Dynamic Virtual Path is removed.
  - **Hold time before the recreation of dead virtual paths (m)**: The time after which a Dynamic Virtual Path removed for being DEAD can be recreated.

IPsec encryption profiles

To add an IPsec encryption profile, navigate to **Configuration** > **Delivery Services** > select **IPsec Encryption Profiles**.



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IPsec provides secure tunnels. Citrix SD-WAN supports IPsec virtual paths, enabling third-party devices to terminate IPsec VPN Tunnels on the LAN or WAN side of a Citrix SD-WAN appliance. You can secure site-to-site IPsec Tunnels terminating on an SD-WAN appliance by using a 140-2 Level 1 FIPS certified IPsec cryptographic binary.

Citrix SD-WAN also supports resilient IPsec tunneling using a differentiated virtual path tunneling mechanism.

IPsec profiles are used while configuring IPsec services as delivery service sets. In the IPsec security profile page, enter the required values for the following **IPsec Encryption Profile, IKE Settings,** and **IPsec Settings**.

Click **Verify Config** to validate any audit error.

IPsec encryption profile information

- **Profile Name**: Provide a profile name.
- **MTU**: Enter the maximum IKE or IPsec packet size in bytes.
- **Keep Alive**: Select the check box to keep the tunnel active and enable route eligibility.
- **IKE Version**: Select an IKE protocol version from the drop-down list.

IKE settings

- **Mode**: Select either Main mode or Aggressive mode from the drop-down list for the IKE Phase 1 negotiation mode.
  - **Main**: No information is exposed to potential attackers during negotiation, but is slower than Aggressive mode. **Main** mode is FIPS compliant.
  - **Aggressive**: Some information (for example, the identity of the negotiating peers) is exposed to potential attackers during negotiation, but is faster than Main mode. **Aggressive** mode is Non-FIPS compliant.
- **Authentication**: Choose the authentication type as Certificate or Pre-shared Key from the drop-down menu.
- **Identity**: Select the identity method from the drop-down list.

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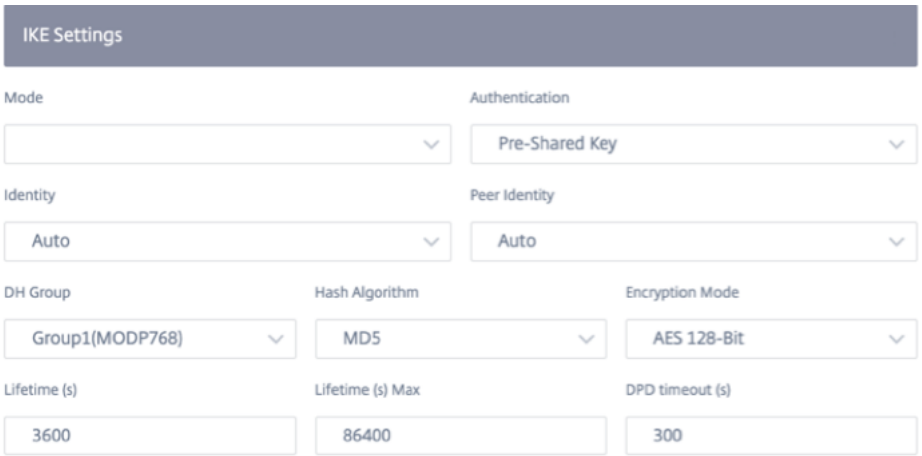
- **Peer Identity**: Select the peer identity method from the drop-down list.
- **DH Group**: Select the Diffie-Hellman (DH) group that are available for IKE key generation.
- **Hash Algorithm**: Choose a hashing algorithm from the drop-down list to authenticate IKE messages.
- **Encryption Mode**: Choose the Encryption Mode for IKE messages from the drop-down list.
- **Lifetime (s)**: Enter the preferred duration (in seconds) for an IKE security association to exist.
- **Lifetime (s) Max**: Enter the maximum preferred duration (in seconds) to allow an IKE security association to exist.
- **DPD timeout (s)**: Enter the Dead Peer Detection timeout (in seconds) for VPN connections.



IPsec settings

- **Tunnel Type**: Choose **ESP**, **ESP+Auth**, **ESP+NULL**, or **AH** as the tunnel encapsulation type from the drop-down list. These are grouped under FIPS compliant and Non-FIPS compliant categories.
  - **ESP**: Encrypts the user data only
  - **ESP+Auth**: Encrypts the user data and includes an HMAC
  - **ESP+NULL**: Packets are authenticated but not encrypted
  - **AH**: Only includes an HMAC
- **PFS Group**: Choose the Diffie-Hellman group to use for perfect forward secrecy key generation from the drop-down menu.
- **Encryption Mode**: Choose the Encryption Mode for IPsec messages from the drop-down menu.
- **Hash Algorithm**: The MD5, SHA1, and SHA-256 hashing algorithms are available for HMAC verification.

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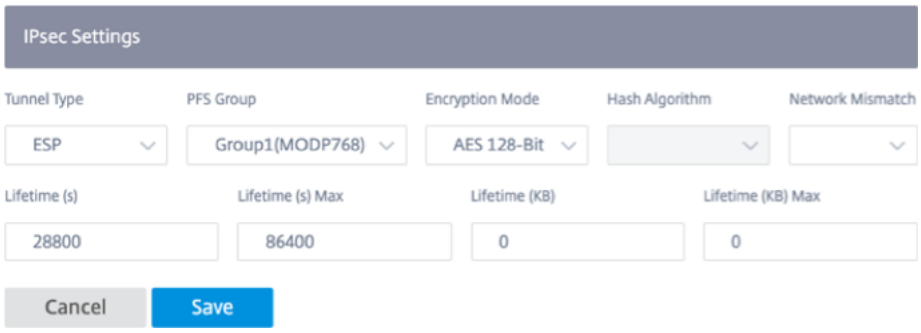
- **Network Mismatch**: Choose an action to take if a packet does not match the IPsec Tunnel's Protected Networks from the drop-down menu.
- **Lifetime (s)**: Enter the amount of time (in seconds) for an IPsec security association to exist.
- **Lifetime (s) Max**: Enter the maximum amount of time (in seconds) to allow an IPsec security association to exist.
- **Lifetime (KB)**: Enter the amount of data (in kilobytes) for an IPsec security association to exist.
- **Lifetime (KB) Max**: Enter the maximum amount of data (in kilobytes) to allow an IPsec security association to exist.



Network location service

Network location service (NLS) is a Citrix Cloud service that determines if the user connecting to Citrix Virtual Apps and Desktops is from the internal network. Using NLS, you can avoid manually configuring IP addresses of Citrix SD-WAN deployed locations through the PowerShell script. For detailed information on NLS, see Citrix Workspace Network Location Service.

You can enable NLS for all sites within the network or specific sites. The site enabled for NLS shares the Public IP address of all its internet WAN links along with other site details such as geographical location, time zone with the NLS database. With these details, the network location service determines if the user connecting to Citrix Virtual Apps and Desktops is on a network front ended by Citrix SD-WAN.

If a user request is coming from a network front ended by Citrix SD-WAN, the user is connected directly to Citrix Virtual Apps and Desktops Virtual Delivery Agent bypassing the Citrix Gateway service.

To enable NLS, at the network level, navigate to **Configuration > Delivery Services > Network Location Service**.

Select **Enable** if you want to enable NLS for all sites in the network. To enable NLS for specific sites, click **Add/Remove Sites**. Choose the **Region** and select the sites accordingly.

Click **Review** to view the sites that you have selected and click **Done**. Click **Deploy**.

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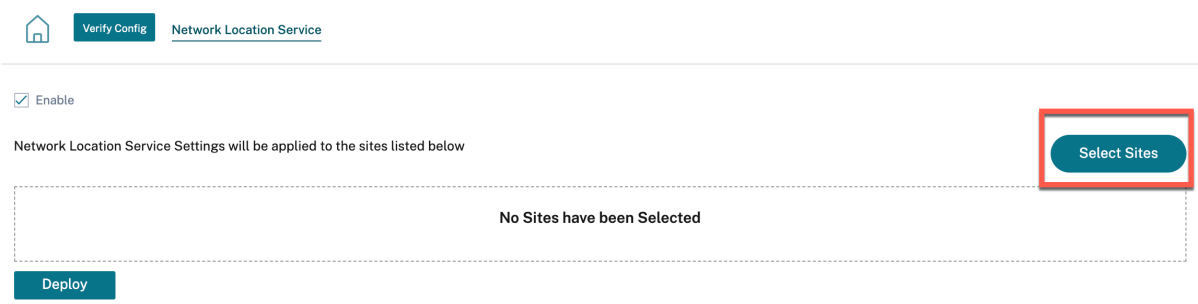


July 26, 2021

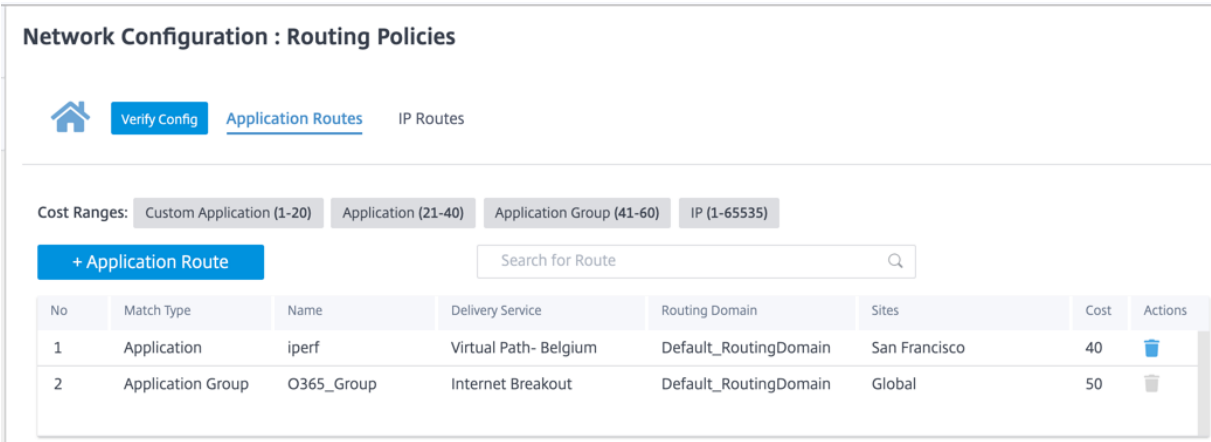
Routing

The **Routing** section provides the following options:

- Routing Policies
- Route Summarization
- Routing Domains
- Import Route Profiles
- Export Route Profiles
- Transit Nodes

Routing policies

Routing policies help to enable traffic steering. Based on the selection (Application routes and IP Routes) you can use different ways to steer traffic.



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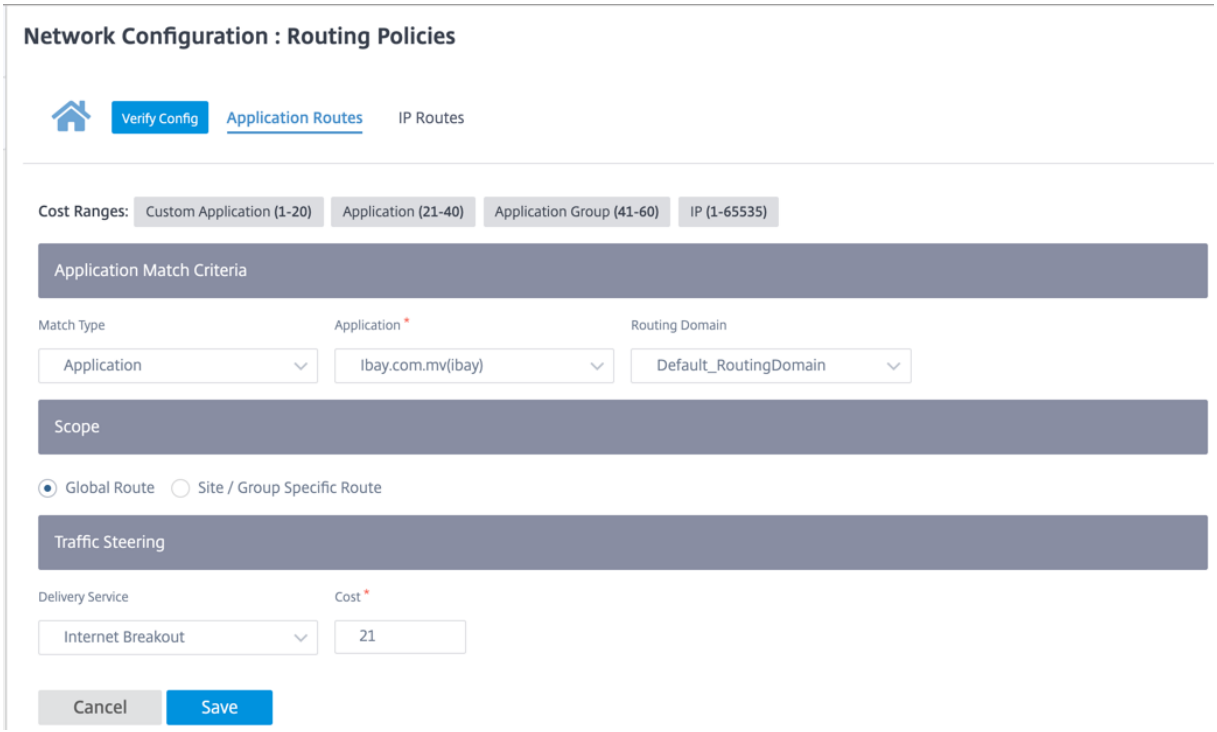
Application Routes

Click **+ Application Route** to create an application route.

- **Custom Application Match Criteria**:
  - **Match Type**: Select the match type as **Application/Custom Application/Application Group** from the drop-down list.
  - **Application**: Choose one application from the list.
  - **Routing Domain**: Select a routing domain.
- **Scope**: You can scope the application route at the global level or site and group specific level.
- **Traffic Steering**;
  - **Delivery Service**: Choose one delivery service from the list.
  - **Cost**: Reflects the relative priority of each route. Lower the cost, the higher the priority.
- **Eligibility Based on Path**:
  - **Add Path**: Choose a site and WAN links. If the chosen path goes down, then the application route does not receive any traffic.



If a new application route gets added, then the route cost must be in the following range:

- **Custom application**: 1–20
- **Application**: 21–40
- **Application group**: 41–60

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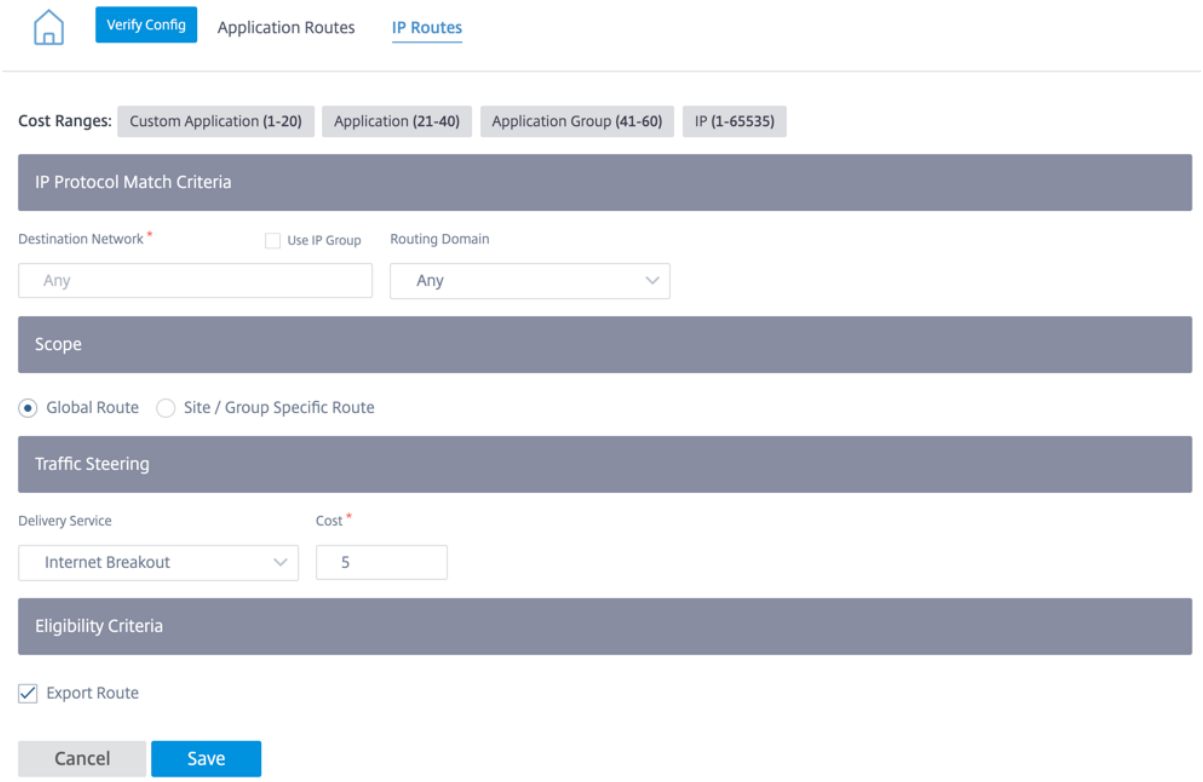
IP Routes

Go to **IP Routes** the tab and click **+ IP Route** to IP Route policy to steer traffic.



- **IP Protocol Match Criteria**:
  - **Destination Network**: Add the destination network that helps to forward the packets.
  - **Use IP Group**: You can add a destination network or enable the **Use IP Group** check box to select any IP group from the drop-down list.
  - **Routing Domain**: Select a routing domain from the drop-down list.
- **Scope**: You can scope the IP route at the global level or site and group specific level.
- **Traffic Steering**:
  - **Delivery Service**: Choose one delivery service from the drop-down list.
  - **Cost**: Reflects the relative priority of each route. Lower the cost, the higher the priority.

  If a new IP route gets added, then the route cost must be in the 1-20 range.
- **Eligibility Criteria**:
  - **Export Route**: If the **Export Route** check box is selected and if the route is a local route, then the route is eligible to be exported by default. If the route is an INTRANET/INTERNET based route, then for the export to work, WAN to WAN forwarding has to be enabled. If the **Export Route** check box is cleared, then the local route is not eligible to be exported to other SD-WAN and has local significance.

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- **Eligibility based on Path**:
  - **Add Path**: Choose a site and WAN links. If the added path goes down, then the IP route does not receive any traffic.

Click **Verify Config** to validate any audit error.

Route Summarization

Route summarization reduces the number of routes that a router must maintain. A summary route is a single route that is used to represent multiple routes. It saves bandwidth by sending a single route advertisement, reducing the number of links between routers. It saves memory because only one route address is maintained. The CPU resources are used more efficiently by avoiding recursive lookups. You can add summary routes without specifying the gateway IP address.

Routing domains

Routing Domains are used for segregate traffic through VLAN. Once the routing domains are created, you can reference them at the global level (for Intranet services) or interface level.

You can also select the default routing domain that applies to all the sites.

To match routes from a specific routing domain, click **+ Routing Domain** and choose one of the configured Routing Domains from the drop-down list. Click **Save**.

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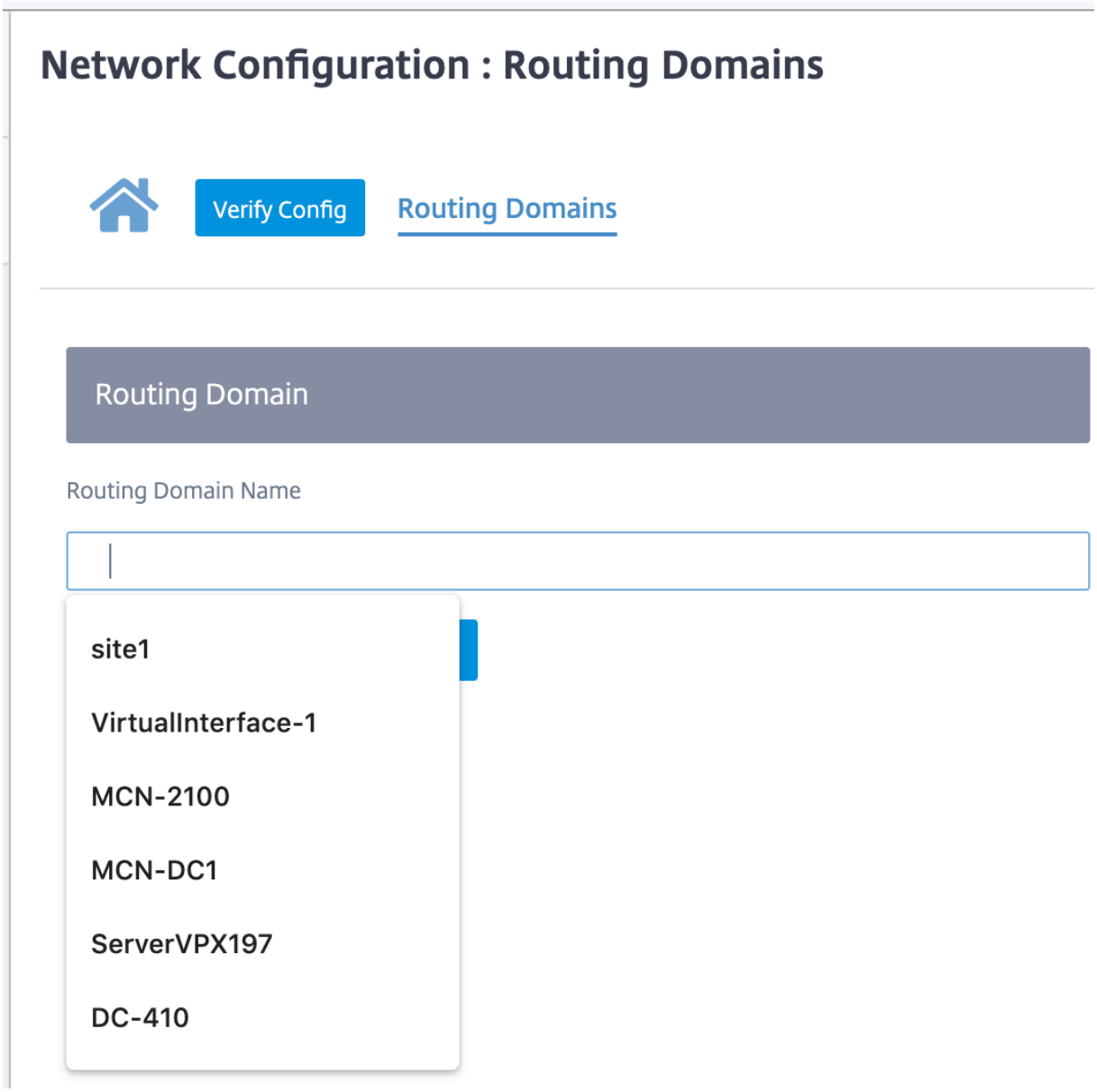

Click **Verify Config** to validate any audit error.

For more information, see Routing Domain.

Inter-routing domain service

Citrix SD-WAN Orchestrator for On-premises provides Static Inter-Routing Domain Service, enabling route leaking between Routing Domains within a site or between different sites. This eliminates the need for an edge router to handle route leaking. The Inter-VRF routing service can further be used to set up routes, firewall policies, and NAT rules.

For more information see, Inter-routing domain service.

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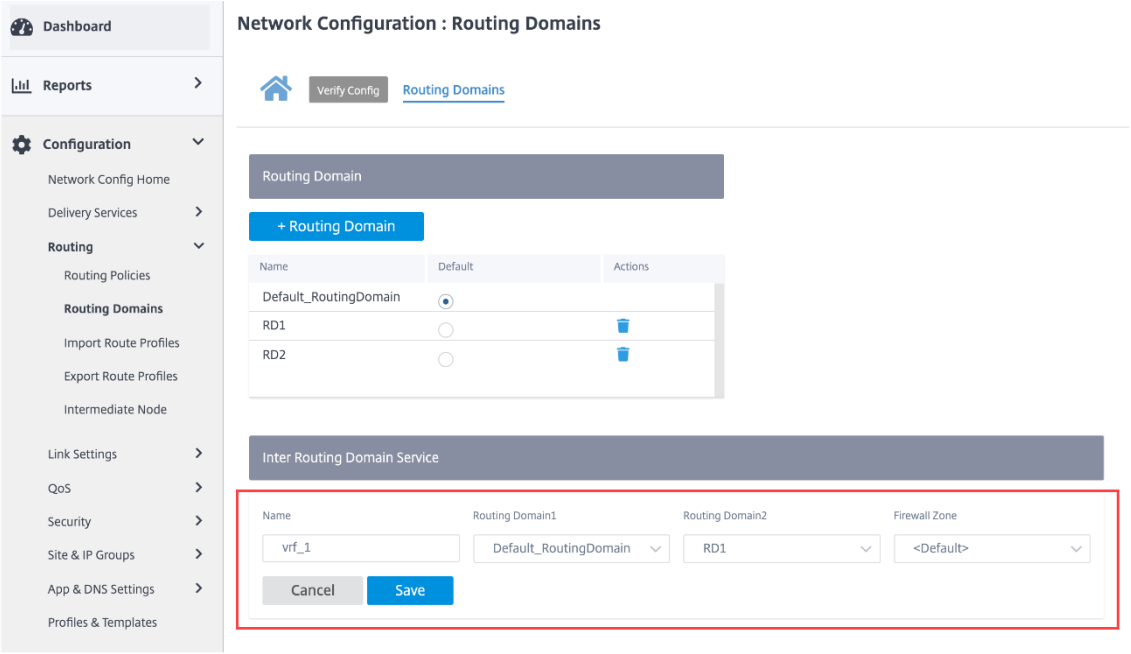
To configure the Inter-Routing Domain service through the Citrix SD-WAN Orchestrator for On-premises:

1. At the network level, navigate to **Configuration** > **Routing** > **Routing Domains** > **Inter-Routing Domain Service**.
2. Click **+ Inter-Routing Domain** and enter values for the following parameters:

- **Name**: The name of the Inter-Routing Domain Service.
- **Routing Domain 1**: The first Routing Domain of the pair.
- **Routing Domain 2**: The second Routing Domain of the pair.
- **Firewall Zone**: The Firewall Zone of the Service.
  - **Default**: The **Inter_Routing_Domain_Zone** firewall zone is assigned.
  - **None**: The service behaves like a conduit, which has no Zone and maintains the original zone of the packet.
  - All Zones configured in the network might be selected.



To create routes using the Inter-routing domain service, create a route with Service type as Inter-Routing Domain Service and select the inter-routing domain service. For more information on configuring Routes, see Routing policies.

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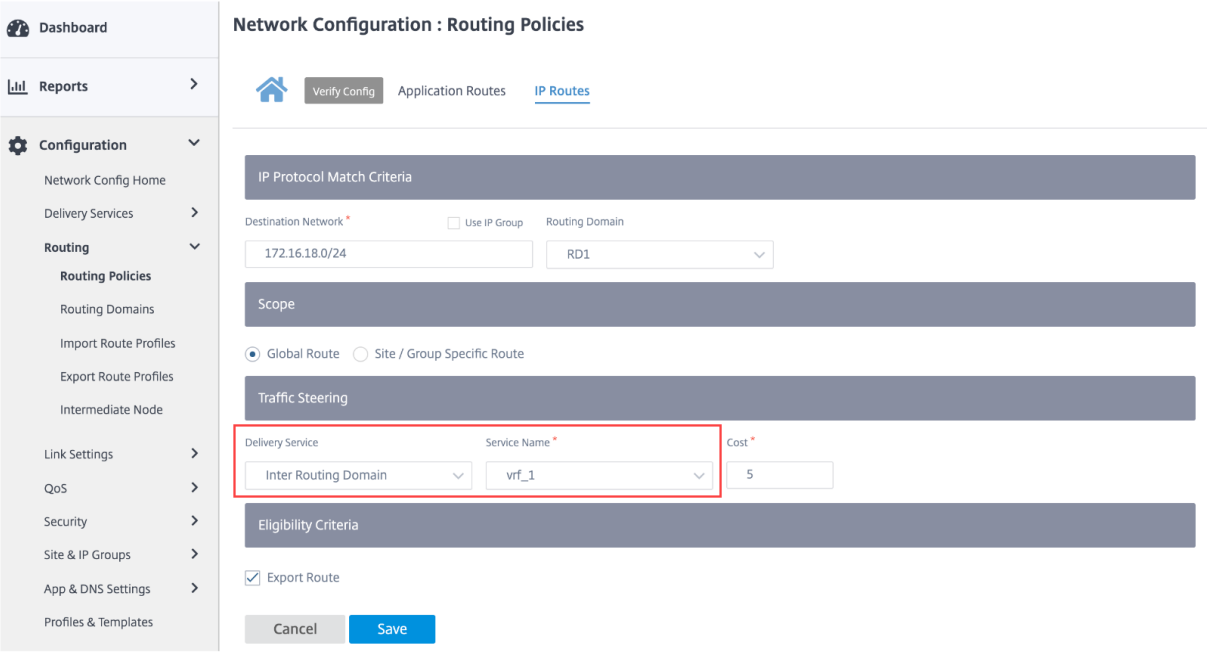
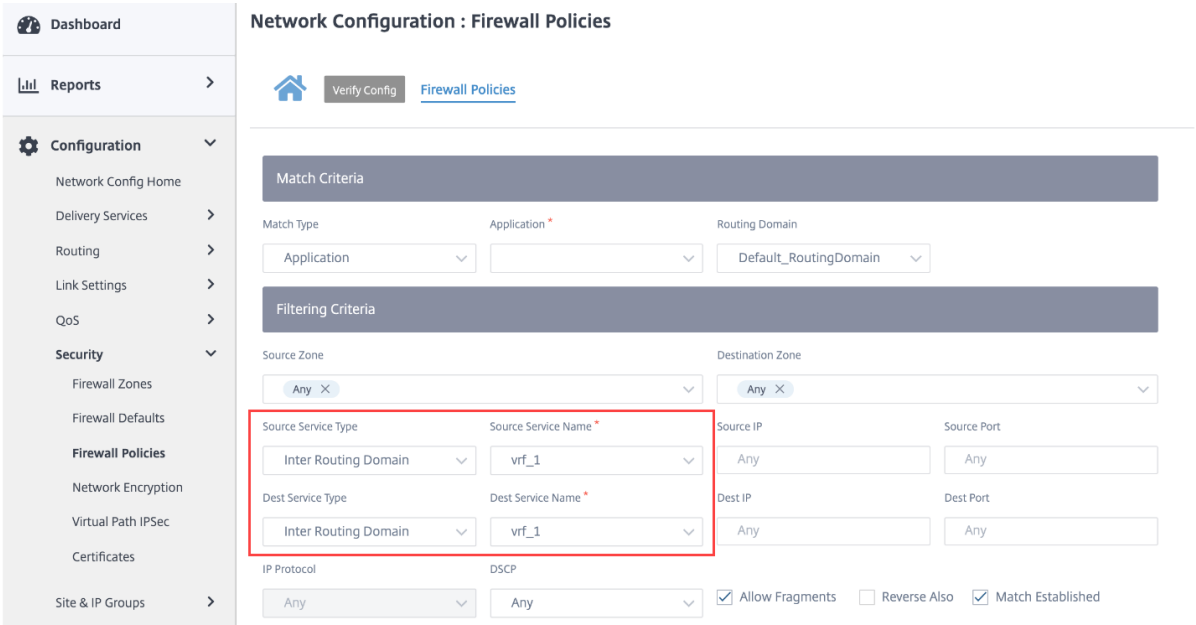


Also add a route from the other Routing Domain pair, to establish connection to and fro between the two routing domains.

You can also configure firewall policies to control the flow of traffic between routing domains. In the firewall policies, select Inter-Routing domain service for the source and destination services and select the required firewall action. For information on configuring Firewall Policies, see Firewall policies.



You can also choose Intranet service type to configure Static and Dynamic NAT policies. For More information on configuring NAT policies, see Network Address Translation.

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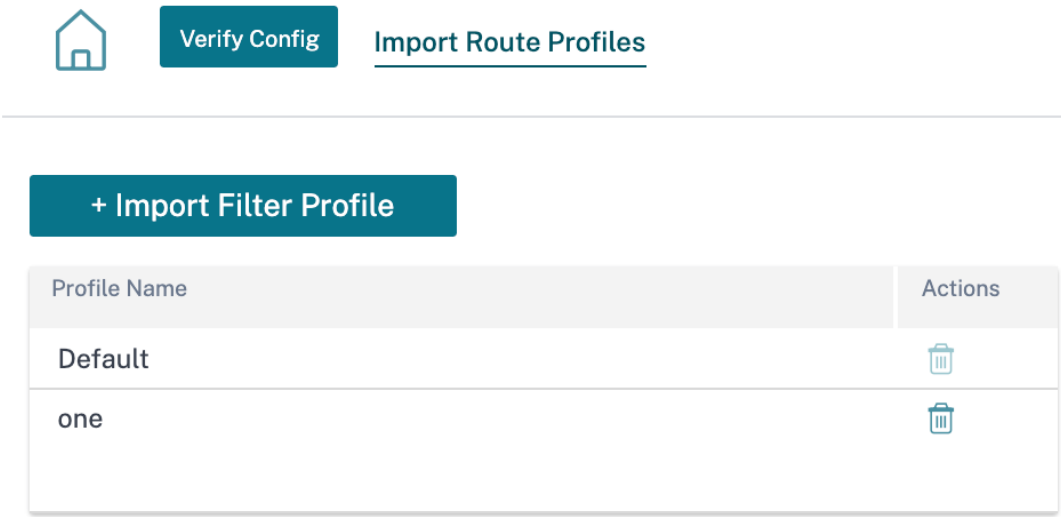
Import route profiles

You can configure Filters to fine-tune how route-learning takes place.

Import filter rules are rules that have to be meet before importing dynamic routes into the SD-WAN route database. By default, no routes are imported.



Add an **Import Filter Profile** with the **Import Profile Name, Profile Availability,** and **Import Filters** along with the following fields:

- **Protocol** - Select the protocol from the list.
- **Routing Domain** - To match routes from a specific routing domain, choose one of the configured Routing Domains from the list.
- **Source Router** - Enter the IP address and netmask of the configured network object that describes the route's network.
- **Destination IP** - Enter the destination IP address.
- **Prefix** - To match routes by prefix, choose a match predicate from the list and enter a Route prefix in the adjacent field.
- **Next Hop** - Enter the next hop destination.
- **Route Tag** - Fill the route tag.
- **Cost** - The method (predicate) and the SD-WAN Route Cost that are used to narrow the selection of routes exported.

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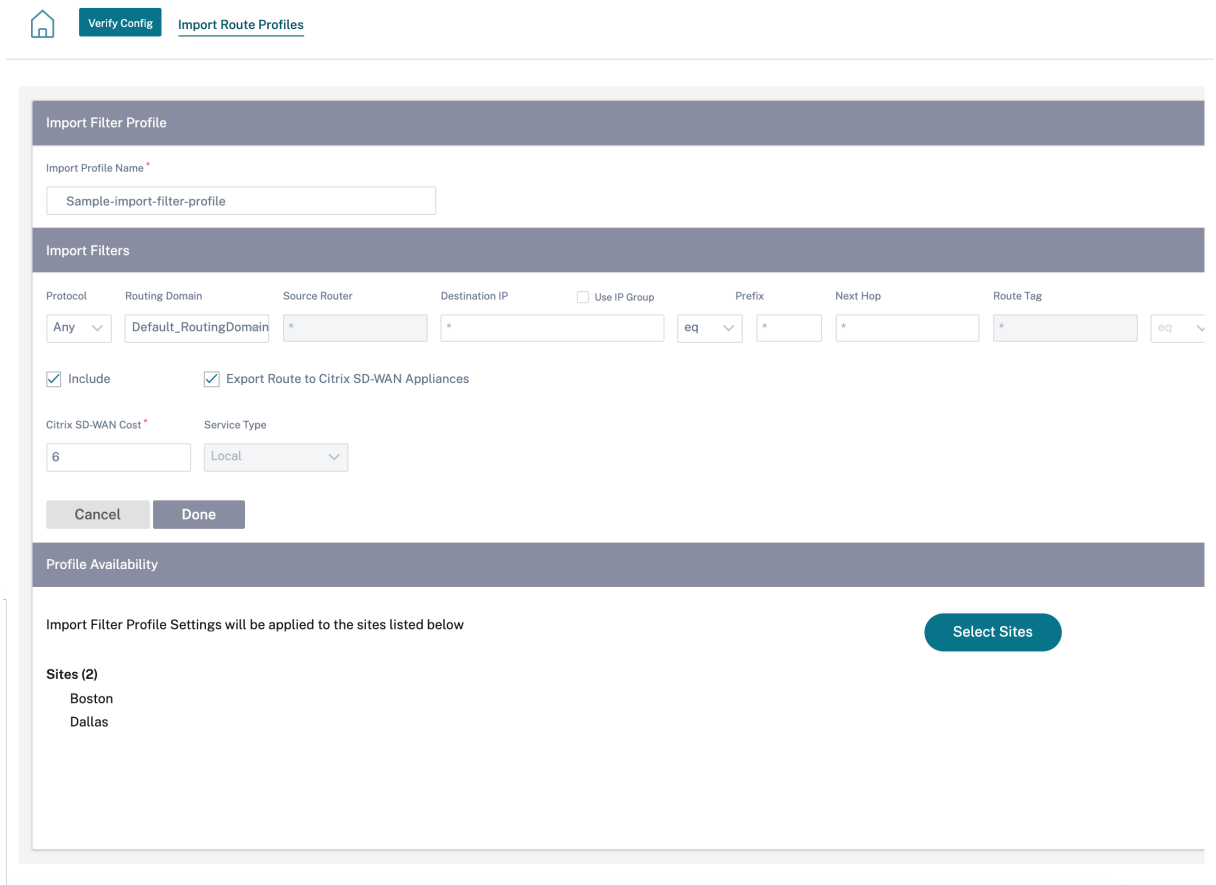

Click **Verify Config** to validate any audit error.

Export route profiles

Define the rules that have to meet when advertising SD-WAN routes over dynamic routing protocols. By default, all routes are advertised to peers.

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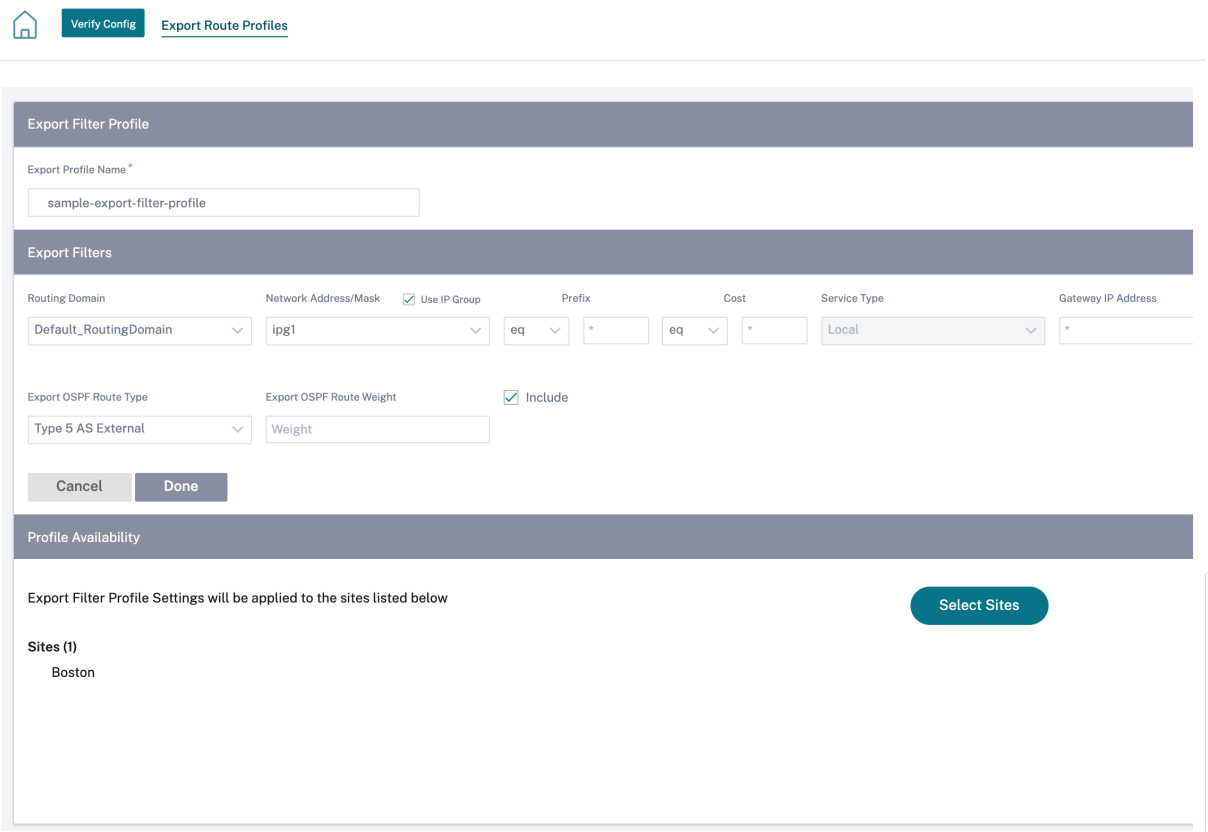

Click **Verify Config** to validate any audit error.

Transit nodes

Virtual overlay Transit Node

Transit nodes are the sites that are able to forward traffic between one or more branches within a region.

The traffic between two nodes can be influenced to pick transit node as an intermediate hop by adjusting the route cost. Transit nodes are used to route data to non-adjacent nodes. For example, if three nodes are connected in series A-B-C, then data from A to C can be routed via B. You can specify the transit node and the sites to be routed through the transit node in the Citrix SD-WAN Orchestrator service. The virtual paths are chosen in the ascending order of cost. Lower the cost, higher the priority.

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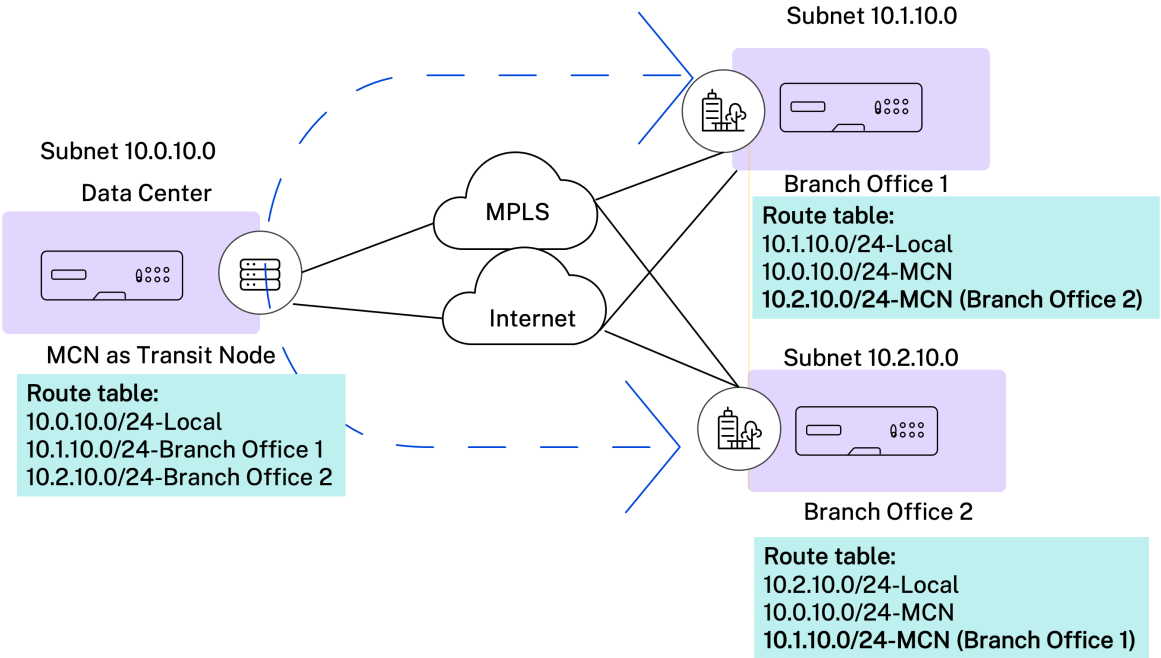
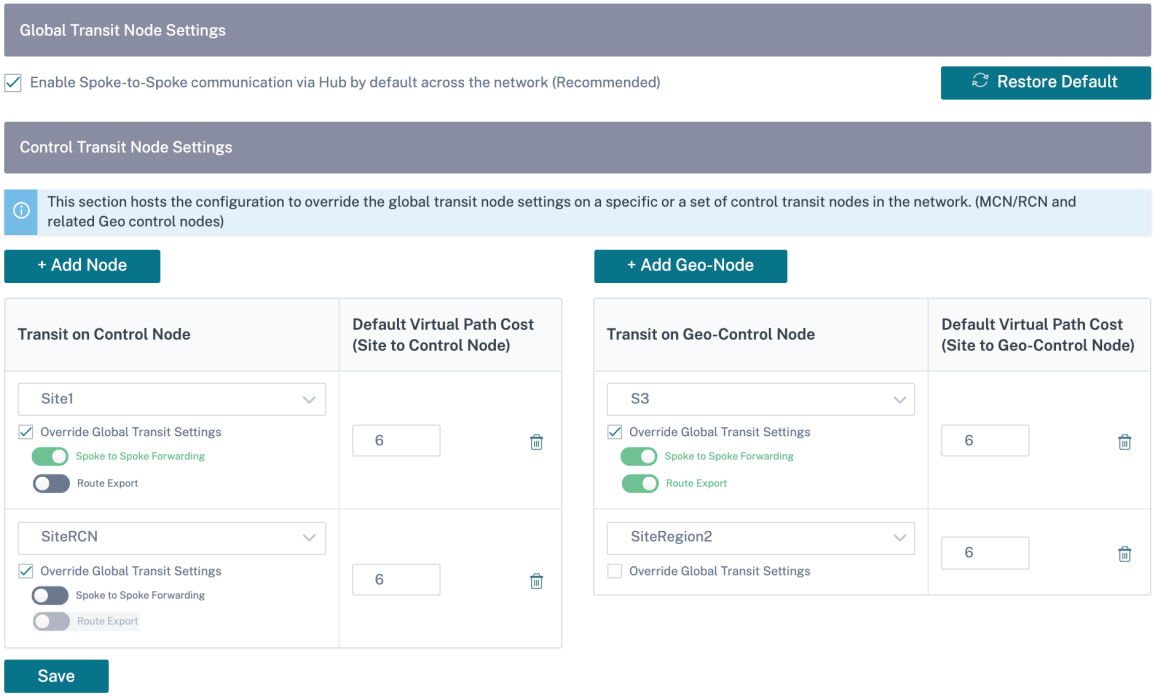


Default global virtual overlay transit nodes

You can specify the control nodes (MCN/RCN) and the geo-control nodes (Geo-MCN/RCN) to act as the default global virtual overlay transit nodes in a network. Enabling spoke-and-spoke communication through Hub as part of global settings allows all the sites to use the configured control nodes as transit nodes, by default, for site-to-site communication.



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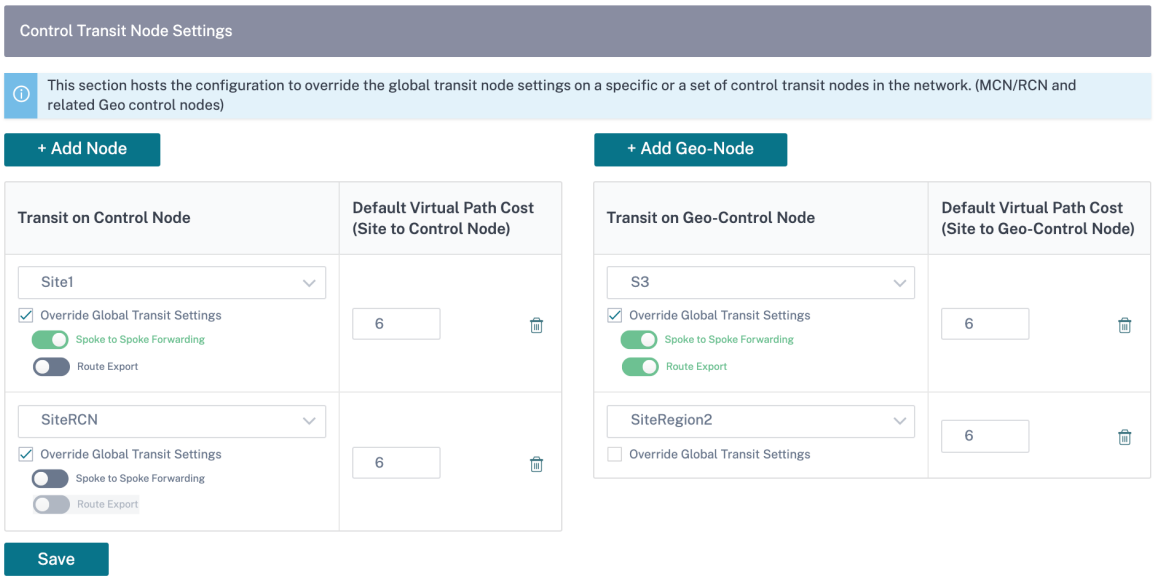
Add the control node and geo-control nodes that you want to use as virtual overlay transit nodes and specify the virtual path cost. The control nodes and geo-control nodes have 6 and 7 as the respective default virtual path costs. You can choose to change the virtual path cost as per your network requirement. Click **Restore Default** to restore the default virtual path costs for the default transit nodes.

> **Note**
>
> You can add a maximum of 3 control nodes and 3 geo-control nodes as transit nodes.

By default, WAN-to-WAN forwarding is enabled on all the paths associated with the selected control and geo-control nodes. WAN-to-WAN forwarding allows a site to act as an intermediate hop between two adjacent sites for any site-to-site, internet or intranet traffic and to act as a mediator for Dynamic Virtual Paths.

You can override the global transit node settings and choose to enable or disable spoke-to-spoke forwarding only on selected control transit nodes. When **Spoke to Spoke Forwarding** is enabled, the transit control node exports routes across the sites connected to it. Site-to-Site communication and Dynamic Virtual path across sites connected to the transit node alone gets enabled.

Enabling **Route Export** enables virtual path-to-virtual path forwarding and route exporting (WAN-to-WAN forwarding) on all the site paths. Disabling the toggle button enables only virtual path-to-virtual path forwarding and disables route exporting on all the site paths. Route Export can be enabled only when **Spoke to Spoke Forwarding** is enabled.



Site specific preferences for virtual overlay transit nodes

Site-specific preferences for virtual overlay transit nodes allow you to override the global virtual overlay transit node settings for all the sites in your network. You can also choose a non-control node as the primary transit node for a site. Choose a control node or geo-control node as the secondary and

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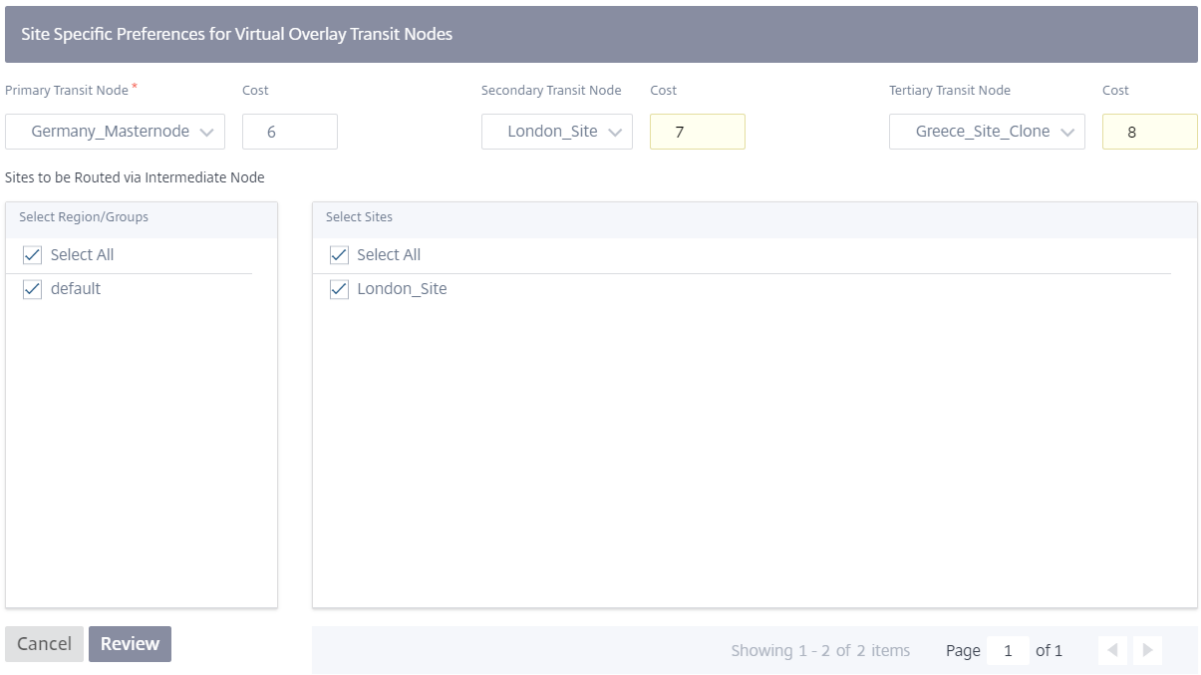
the tertiary transit nodes. If the primary transit node is down, the sites use the secondary transit node. If both primary and secondary transit nodes are down, the sites use the tertiary transit node. Specify the cost for the transit nodes and select the sites to which the site-specific virtual overlay transit node settings are applied.



Internet Transit Node

You can add sites as Internet transit sites to enable Internet access to the sites. Sites that need direct internet connectivity, must have at least one link with Internet service enabled. That means, at least one link set to a non-zero bandwidth share %.

Each transit site can be assigned a route cost. The sites with internet service available access the internet directly since the direct route would be the lowest cost routing path. Sites without internet service can route to the internet through the configured transit sites. When the internet transit sites are configured, routes to the internet through these transit sites are automatically pushed to all the sites. Internet transit sites are the sites with Internet service enabled.

For example, if San Francisco and New York are configured as internet transit sites. Routes to the internet via San Francisco and New York automatically get pushed to all the sites.

The virtual overlay transit node with Internet service enabled acts as the primary internet transit node. If internet service is not enabled on the virtual overlay transit node the secondary / backup internet transit node provides a route to the internet.

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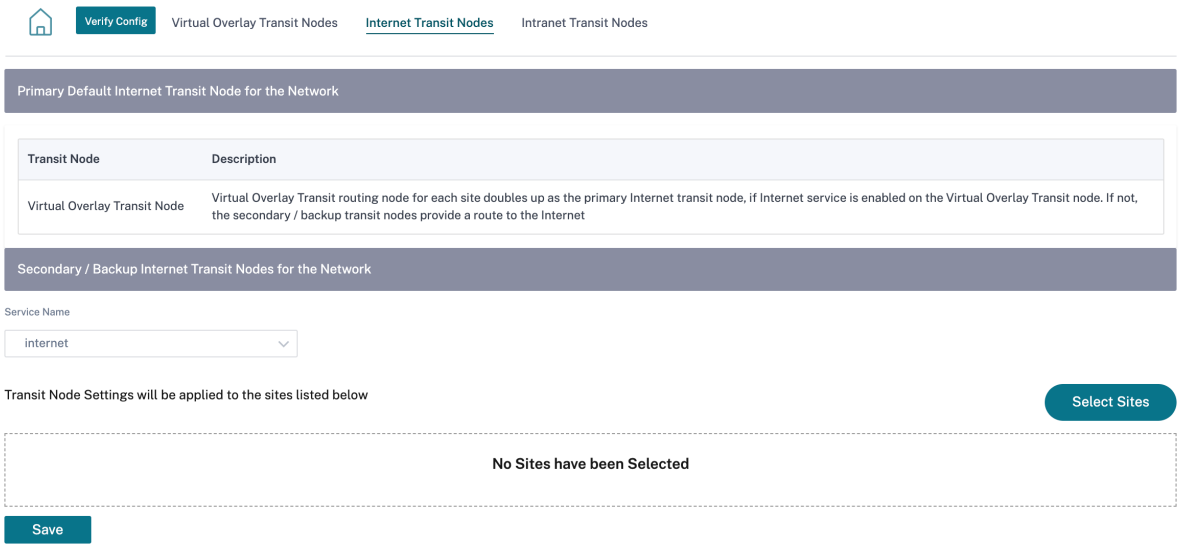

Intranet Transit Node

The intranet transit node enables all the non-intranet sites to access the configured intranet networks. Each transit site can be assigned a route cost. The available sites with intranet service, accesses the intranet networks directly since the direct route would be the lowest cost routing path. Sites without intranet service can route to the intranet networks through the configured transit sites. When the transit sites are configured, routes to intranet networks through these transit sites are automatically pushed to all the sites.

For example, if 10.2.1.0/24 is an intranet network, and Austin and Dallas are the configured transit sites. Routes to that network address through Austin and Dallas automatically get pushed to all the sites.

The virtual overlay transit node with Intranet service enabled acts as the primary intranet transit node. If intranet service is not enabled on the virtual overlay transit node the secondary / backup intranet transit node provides a route to the intranet.

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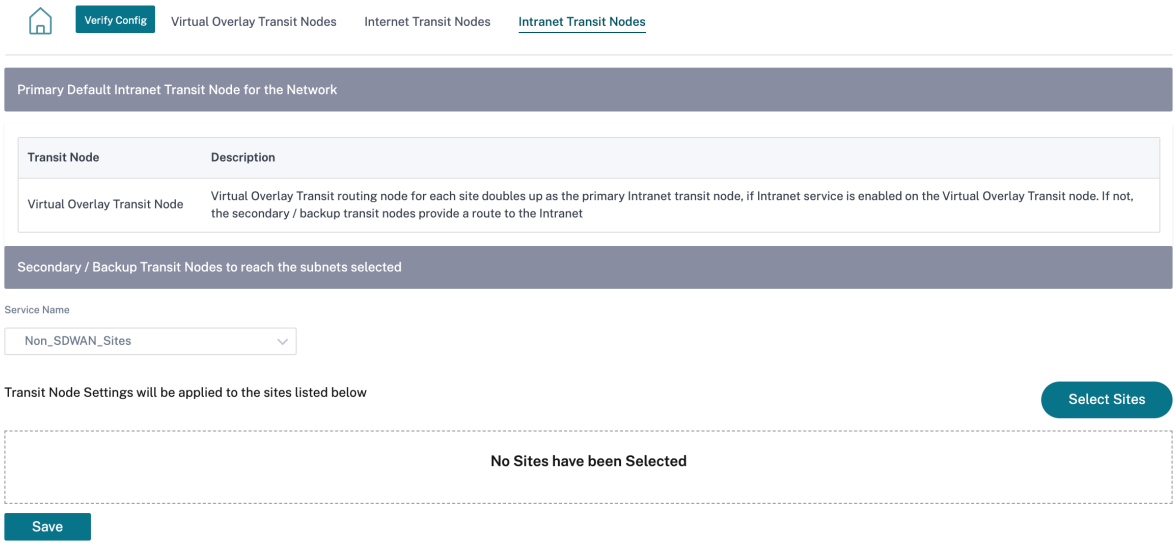

Inter-link communication

October 21, 2020

Inter-link communication settings are used for auto-path creation between compatible WAN links. You can override these settings under **Site Configuration** and **Virtual Paths**, wherein you can select or unselect individual member paths for a given virtual path.

Currently, the following two settings are available:

- Rules to automate the creation of paths between compatible WAN links.
- Global defaults for Dynamic Virtual Paths

These settings are inherited by all WAN links in the customer network.

Click **Verify Config** to validate any audit error.

Default inter-link communication groups

Default inter-link communication groups are intended at automating the creation of paths between:

- Any two internet links
- Any two MPLS links that share the same service provider, and
- Any two Private Intranet links that share service provider

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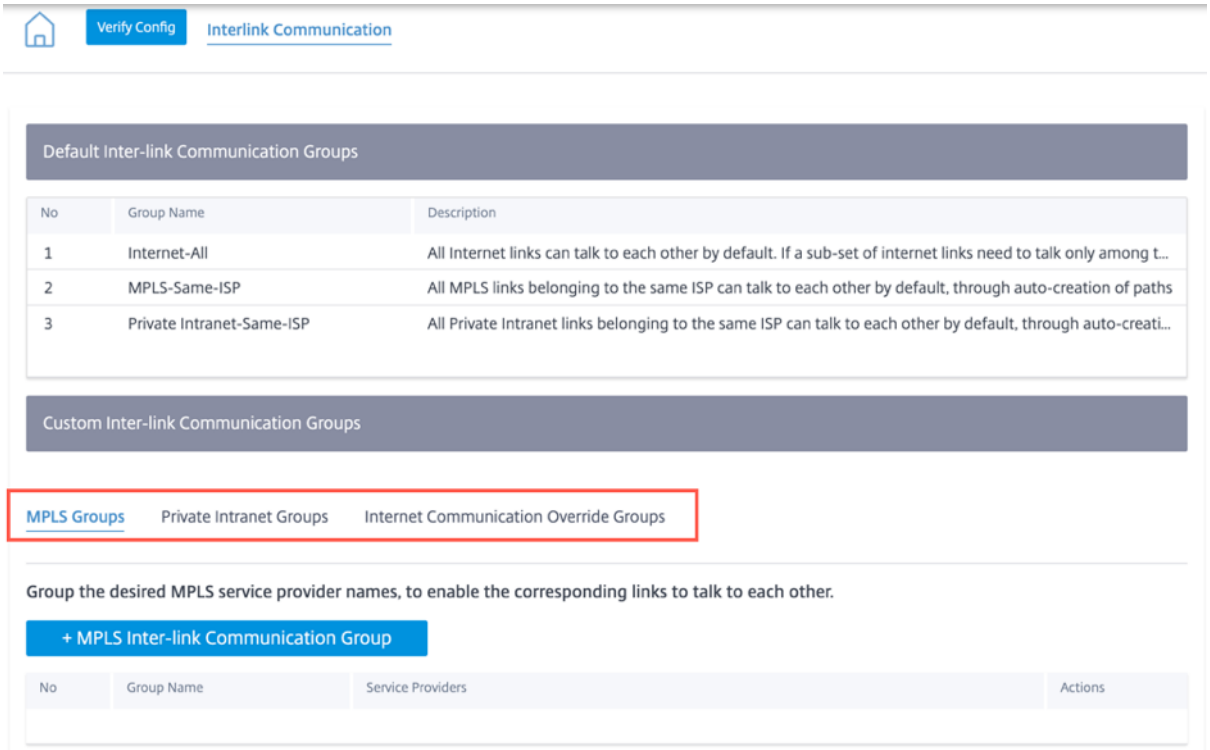
Custom inter-link communication groups

Custom inter-link communication groups enable private Intranet, public Internet, or MPLS links to automatically create paths with other private Intranet, public Internet, or MPLS links across varying service providers.

For example, consider this scenario - A company has offices in the US and India. The US offices use AT&T MPLS links, while the India offices use Airtel MPLS links. Let's say AT&T and Airtel MPLS links are compatible in terms of DSCP tags and related parameters and are amenable for the creation of paths with each other. Custom inter-link communication rules allow you to select an ISP pair (for example ATT – Airtel in this case) and enable auto-creation of paths among the links belonging to these ISPs.



- **MPLS Groups**: You can group the desired MPLS service provider names to enable the corresponding links to communicate with each other. Click **+ MPLS Inter-link Communication Group** and provide an MPLS group name, select the DSCP tag from the drop-down list. You can also add the MPLS provider by selecting the ISP name from the drop-down list. The **Enable Encryption** check box helps to enable/disable the encryption for every custom MPLS Inter-Link Communication Group.
- **Private Intranet Groups**: You can group the desired Intranet service provider names to enable the corresponding links to communicate with each other. Click **+ Private Intranet Inter-link Communication Group** and provide the private intranet group name, select the DSCP tag from the drop-down list. You can also add the private intranet provider by selecting the ISP name from the drop-down list. The **Enable Encryption** check box helps to enable/disable the encryp-

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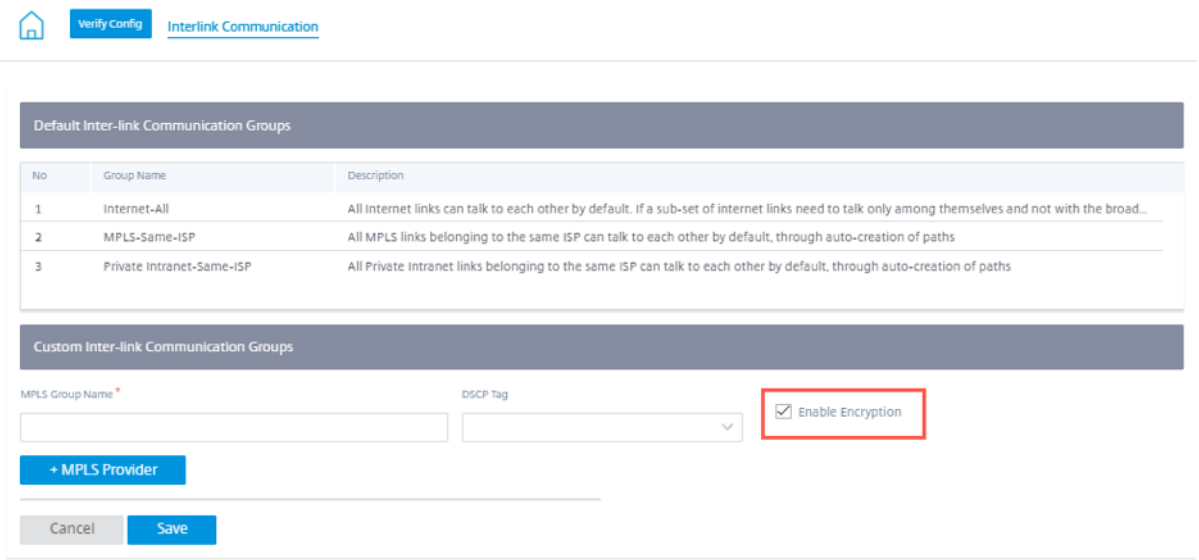
tion for every custom private Intranet Inter-Link Communication Group.

- **Internet Communication Override Groups**: If a subset of Internet links must talk only among themselves and not with the rest of the Internet links, then you can group the corresponding ISP names to enable exclusion from the default group.

The rest of the Internet links can still communicate with each other. Click **+ Public Internet Inter-link Communication Group** and provide a public internet group name, select the DSCP tag from the drop-down list. You can also add the public Internet provider by selecting the ISP name from the drop-down list. The **Enable Encryption** check box helps to enable/disable the encryption for every custom public Internet Inter-Link Communication Group.



QoS policies

June 28, 2021

An administrator can define application and traffic policies. These policies help to enable traffic steering, Quality of Service (QoS), and filtering capabilities for applications. Specify whether a defined rule can be applied globally across all the sites in the network or on certain specific sites.

Policies are defined in the form of multiple rules which get applied in the user-defined order.

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No	Protocol	DSCP	Service	Transmit Mode	QoS Setting
1	SIP	ef	Virtual Path	Duplicate Paths	High : Realtime
2	ICA	Any	Virtual Path	Load Balance Paths	High : Interactive
3	ICACGP	Any	Virtual Path	Load Balance Paths	High : Interactive
4	ICAUDP	Any	Virtual Path	Load Balance Paths	High : Interactive
5	ICACGPUDP	Any	Virtual Path	Load Balance Paths	High : Interactive
6	ICMP	Any	Virtual Path	Persistent Path	Medium : Interactive
7	SSH	Any	Virtual Path	Load Balance Paths	Medium : Interactive
8	TELNET	Any	Virtual Path	Load Balance Paths	Medium : Interactive
9	RDP	Any	Virtual Path	Load Balance Paths	Medium : Interactive
10	RPC	Any	Virtual Path	Load Balance Paths	Medium : Interactive
11	LDAP	Any	Virtual Path	Load Balance Paths	Medium : Interactive
12	HTTP	Any	Virtual Path	Load Balance Paths	High : Bulk
13	ALTHTTP	Any	Virtual Path	Load Balance Paths	High : Bulk
14	HTTPS	Any	Virtual Path	Load Balance Paths	High : Bulk
15	CIFS	Any	Virtual Path	Load Balance Paths	Low : Interactive
16	POP3	Any	Virtual Path	Load Balance Paths	Low : Interactive
17	SMTP	Any	Virtual Path	Load Balance Paths	Low : Interactive
18	IMAP	Any	Virtual Path	Load Balance Paths	Low : Interactive
19	FTP	Any	Virtual Path	Load Balance Paths	Medium : Bulk
20	IPERF	Any	Virtual Path	Load Balance Paths	Medium : Bulk
21	GRE	Any	Virtual Path	Load Balance Paths	Low : Interactive
22	DNS	Any	Virtual Path	Load Balance Paths	Low : Interactive
23	SNMP	Any	Virtual Path	Load Balance Paths	Low : Interactive
24	SNMP	Any	Virtual Path	Load Balance Paths	Low : Interactive
25	Any	ef	Virtual Path	Duplicate Paths	High : Realtime
26	Any	af11	Virtual Path	Persistent Path	Medium : Interactive
27	UDP	Any	Virtual Path	Persistent Path	Medium : Interactive
28	TCP	Any	Virtual Path	Load Balance Paths	Low : Interactive
29	Any	Any	Virtual Path	Persistent Path	Low : Interactive

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Create new rule

An administrator needs to place the defined rule based on the priority. The priorities such as Top of the List, Bottom of the List, or in between two existing entries.

It is recommended to have **more specific** rules for applications or sub applications at the top, followed by **less specific** rules for the ones representing broader traffic.

For example, you can create specific rules for both Facebook Messenger (sub application) and Facebook (application). Put a Facebook Messenger rule on top of the Facebook rule so that the Facebook Messenger rule gets selected. If the order is reversed, Facebook Messenger being a subapplication of the Facebook application, the Facebook Messenger rule would not get select. It is important to get the order right.

Match criteria

Select traffic for a defined rule such as:

- An application
- Custom defined application
- Group of applications or IP protocol based rule

Rule scope

Specify whether a defined rule can be applied globally across all the sites in the network or on certain specific sites.

Application steering

Specify how the traffic needs to be steered.

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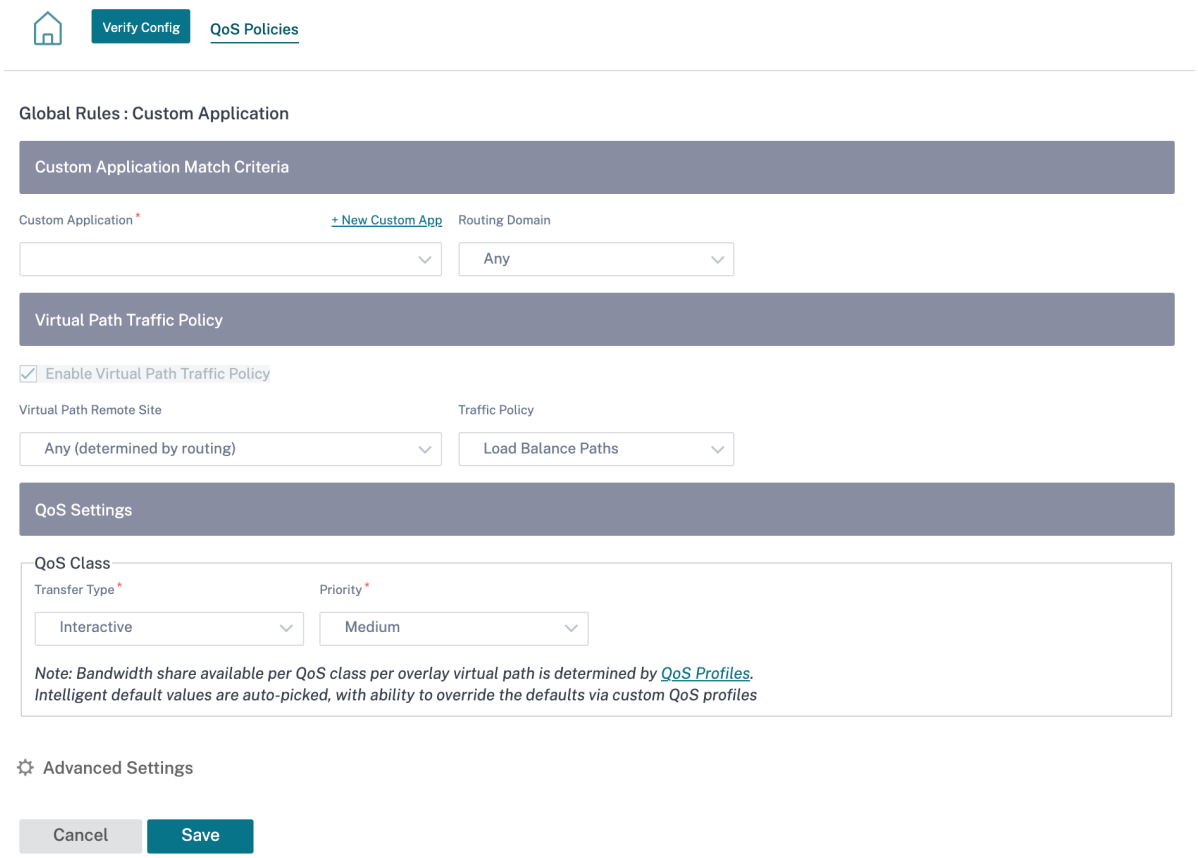

+ New Custom App: Select a match criteria from the list. The administrator can add new custom application by giving a name to:

- Custom application
- protocol (such as TCP, UDP, ICMP)
- Network IP/Prefix
- port
- DSCP tag

You can also create a domain name based custom application.

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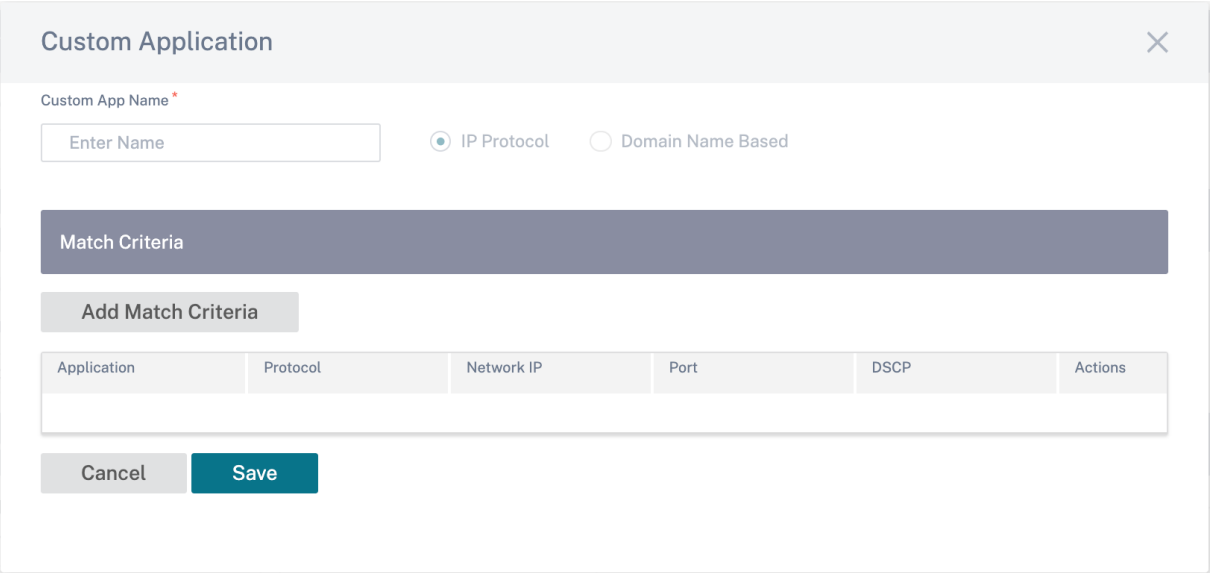

Click **Verify Config** to validate any audit error.

IP Rules

You can create global and site-specific IP rules at the network level by navigating to **Configuration > QoS > QoS Policies**.

- IP Protocol Match Criteria
  - **Add/Remove Sites**: (available only while creating site-specific IP rule) Select the sites, click **Review**, and **Done**.
  - **Source Network**: The source IP address and subnet mask that the rule matches.
  - **Destination Network**: The destination IP address and subnet mask that the rule matches.
  - **Use IP Group**: Select the **Use IP Group** check box to choose any existing IP group from the drop-down list.
  - **Src = Dst**: If selected, the source IP address is also used for the destination IP address.
  - **Source Port**: The source port (or source port range) that the rule matches.
  - **Destination Port**: The destination port (or destination port range) that the rule matches.
  - **Src = Dst**: If selected, the source port is also used for the destination port.
  - **IP Protocol**: The protocol that the rule matches.
  - **DSCP**: The DSCP tag in the IP header that the rule matches.
  - **Routing Domain**: The routing domain that the rule matches.
  - **VLAN ID**: Enter the VLAN ID for the rule. The VLAN ID identifies the traffic to and from the virtual interface. Use VLAN ID as 0 to designate native or untagged traffic.
  - **Rebind Flow On Change**: When selected, flows that are otherwise identical in terms of match criteria are treated as separate if their DSCP fields differ.
- Traffic Policy

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  - **Virtual Path Remote Site**: Select the virtual path for the remote site.
  - **Traffic Policy**: Choose one of the following traffic policies as needed.
    * **Load Balance Paths**: Application traffic for the flow is balanced across multiple paths. Traffic is sent through the best path until that path is used. The remaining packets are sent through the next best path.
    * **Persistent Path**: Application traffic remains on the same path until the path is no longer available. Select one of the following **Persistence Policies**:
      · **Persist on the originating link**: The application traffic remains on the originating link until the path is no longer available.
      · **Persist on MPLS link if available, else on the originating link**: The application traffic remains on the MPLS link. If the MPLS link is unavailable, then the traffic remains on the originating link.
      · **Persist on Internet link if available, else on the originating link**: The application traffic remains on the internet link. If the internet link is unavailable, then the traffic remains on the originating link.
      · **Persist on Private Intranet link if available, else on the originating link**: The application traffic remains on the private intranet link. If the private intranet link is unavailable, then the traffic remains on the originating link.

      Persistence Impedance is the time (in ms) until which the application traffic remains on the link.
    * **Duplicate Paths**: Application traffic is duplicated across multiple paths, increasing reliability.

- QoS Settings
  - **Transfer Type**: Choose one of the following transfer types:
    * **Realtime**: Used for low latency, low bandwidth, time-sensitive traffic. Real-time applications are time-sensitive but don't really need high bandwidth (for example voice over IP). Real-time applications are sensitive to latency and jitter but can tolerate some loss.
    * **Interactive**: Used for interactive traffic with low to medium latency requirements and low to medium bandwidth requirements. The interaction is typically between a client and a server. The communication might not need high bandwidth but is sensitive to loss and latency.
    * **Bulk**: Used for high bandwidth traffic and applications that can tolerate high latency. Applications that handle file transfer and need high bandwidth are categorized as a bulk class. These applications involve little human interference and are mostly handled by the systems themselves.
  - **Priority**: Choose a priority for the selected transfer type.

- Internet Traffic Policy

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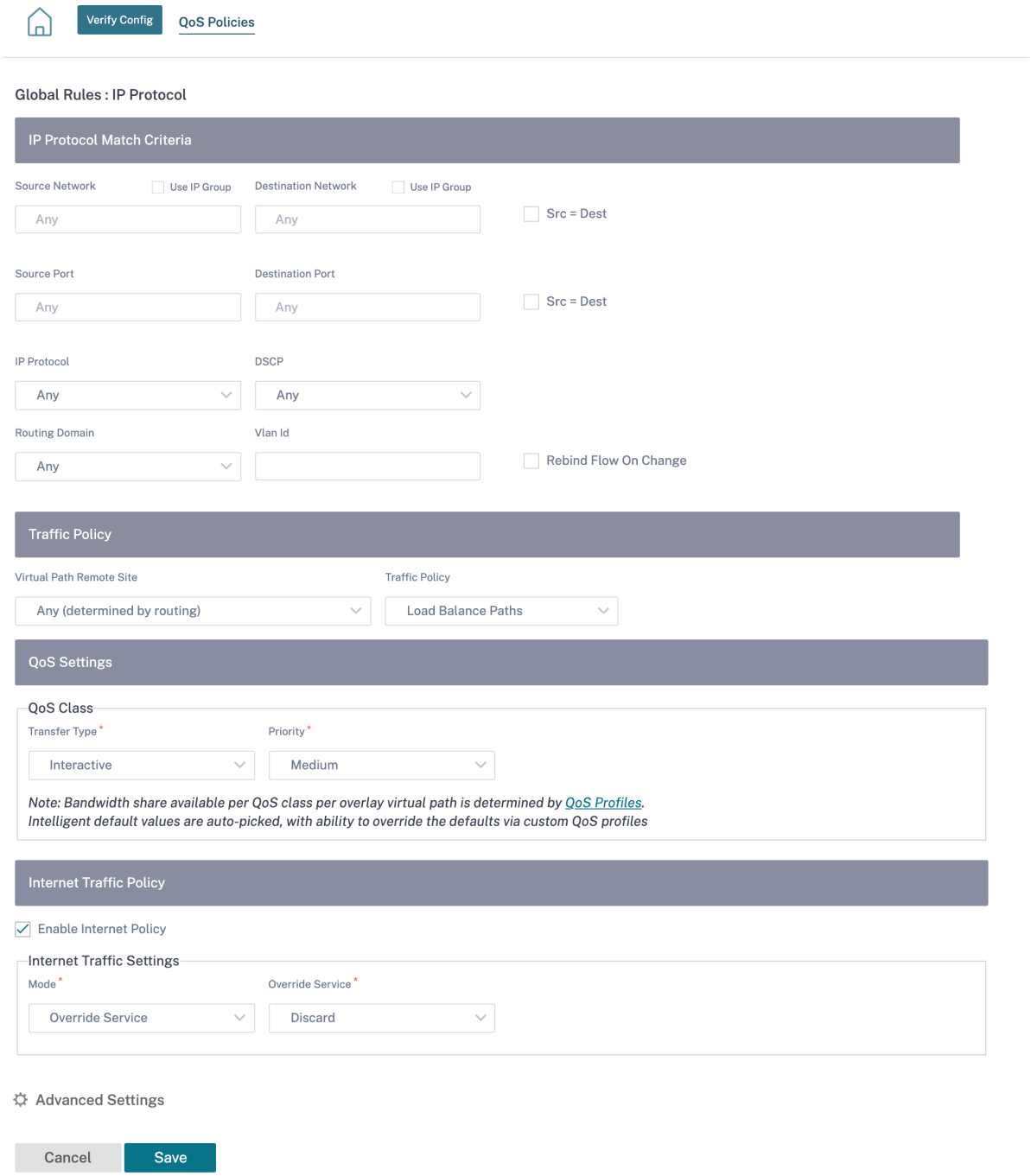
- Select the **Enable Internet Policy** check box to configure internet traffic policy.
- **Mode**: The method of transmitting and receiving packets for flows that match the rule. You can choose Override Service or WAN link as needed.
- **WAN link**: The WAN link to be used by flows matching the rule when Internet Load Balancing is enabled.
- **Override Service**: The destination service for flows matching the rule.



Click **Save** to save the configuration settings. Click **Verify Config** to validate any audit error.

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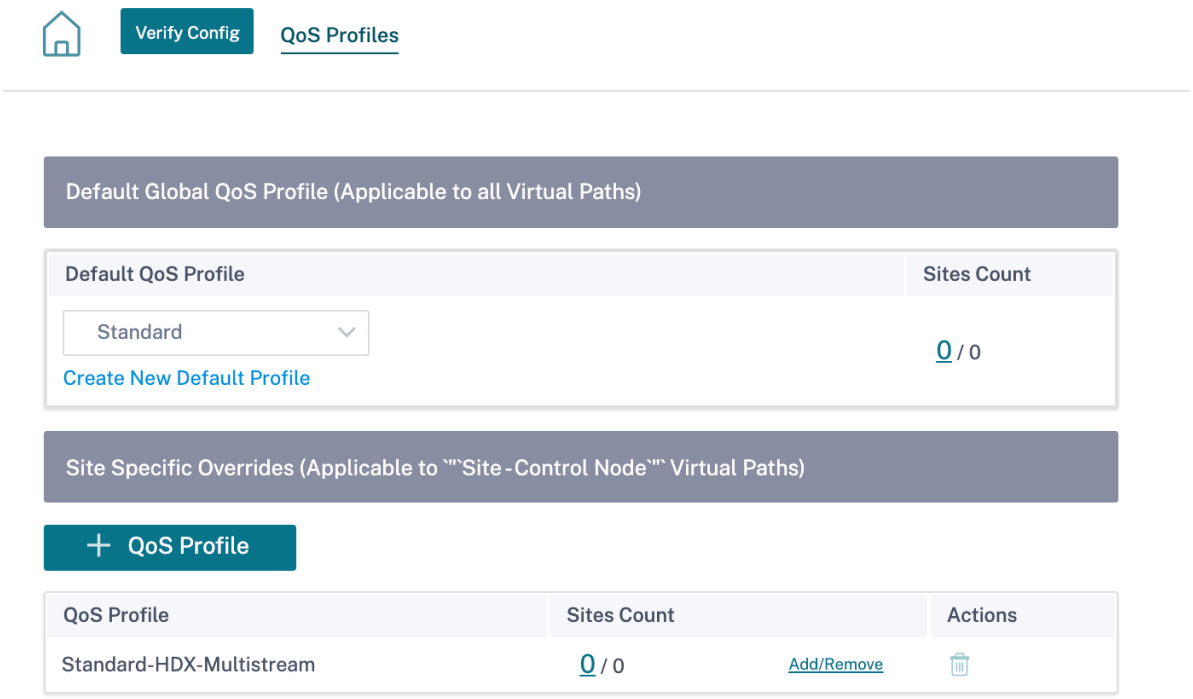
QoS profiles

The Quality of Service (QoS) section helps to create the QoS profile by using the **+ QoS Profile** option. The QoS profile provides improved service to certain traffic. The goal of QoS is to provide priority including traffic type (Real-time, Interactive, and Bulk classes) and dedicated bandwidth. The bandwidth breakups are available in % values. This also improved loss characteristics.



Click **Verify Config** to validate any audit error.

HDX QoE

April 22, 2021

Network parameters such as latency, jitter, and packet drop affect the user experience of HDX users. Quality of Experience (QoE) helps the users to understand and check their ICA quality of experience. QoE is a calculated index, which indicates the ICA traffic performance. The users can tune the rules and policy to improve the QoE.

The QoE is a numeric value between 0–100, the higher the value the better the user experience.

The parameters used to calculate QoE are measured between the two Citrix SD-WAN appliances located at the client and server side and not measured between the client or the server appliances themselves. Latency, jitter, and packet drop are measured at the flow level and it can be different

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from the statistics at the link level. The end host (client or server) application might never know that there is a packet loss on the WAN. If the retransmit succeeds, the flow level packet loss rate is lower than the link level loss. However, as a result, it might increase latency and jitter a bit.

You can view a graphical representation of the overall quality of HDX applications in the HDX dashboard on Citrix SD-WAN Orchestrator service. The HDX applications are classified into the following three quality categories:

Quality	QoE Range
Good	71-100
Fair	51-70
Poor	0-50

Depending on the selected UI page, a list of the bottom (least QoE) five sites, five users, five sessions, or all of them are displayed in the HDX dashboard.

A graphical representation of the QoE for different time intervals allows you to monitor the performance of HDX applications at each site.

Configure HDX QoE

To configure HDX QoE:

1. At the network level, navigate to **Configuration > App & DNS Settings > App Quality Config** and click **+ QoE Configuration**. Add the following applications using the QoE profile that you want to use for the calculation of HDX behavior:
    - ICA Real-time (ica_priority_0)
    - ICA Interactive (ica_priority_1)
    - ICA Bulk-Transfer (ica_priority_2)
    - ICA Background (ica_priority_3)
    - Independent Computing Architecture (Citrix)(ICA)

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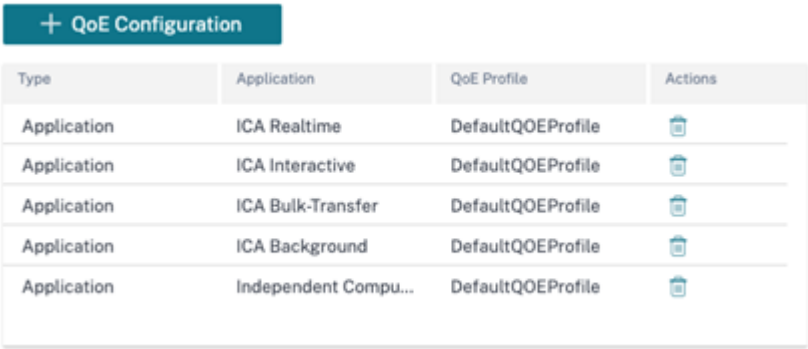
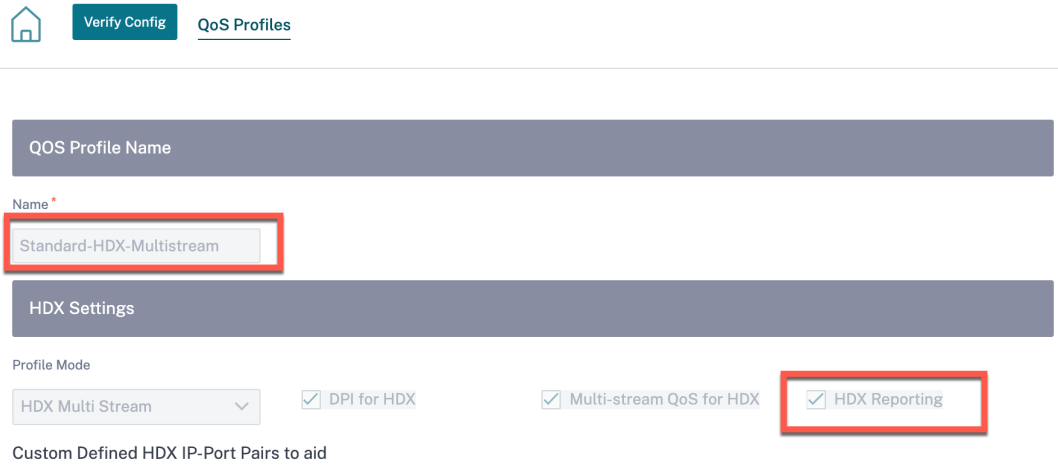


These configurations provide the parameters to measure HDX performance used in HDX report through the profile. Configuration of ICA Real-time, ICA Interactive, ICA Bulk-Transfer, ICA Background are required for HDX Multi-Stream (MSI) connections, Independent Computing Architecture (Citrix) is required for Single Stream (SSI) connections.

2. Navigate to **Configuration > QoS > QoS Profiles**. Select **Standard-HDX-Multistream** as the default QoS Profile and select the **HDX Reporting** check box.



In each QoS profile, there is a pre-defined bandwidth percentage for each class. They are configurable to adjust the bandwidth assigned to the classes that the HDX traffic is using.

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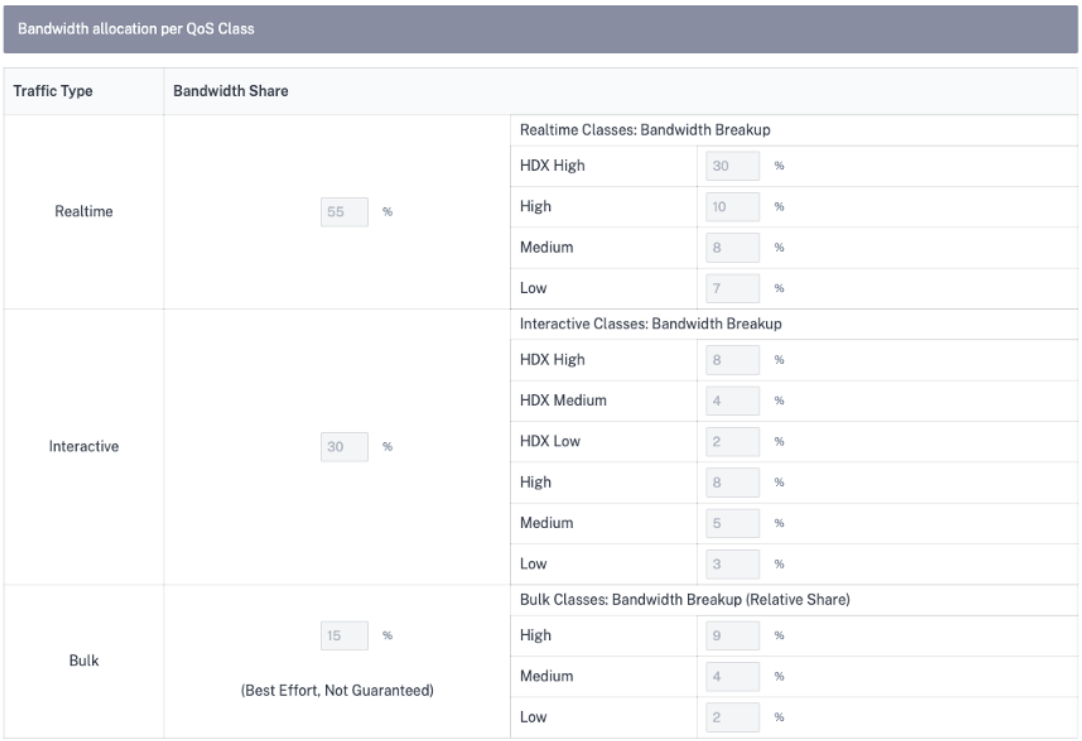
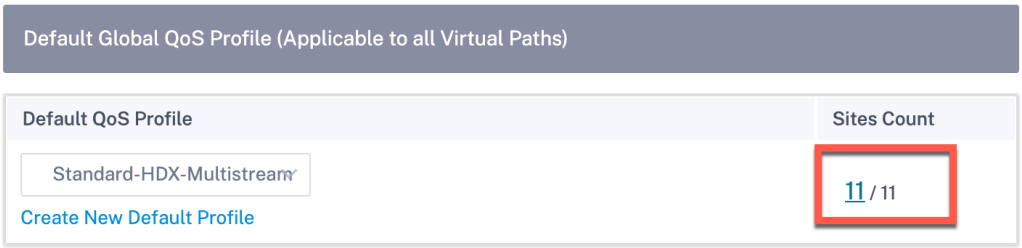


Bandwidth allocation per QoS Class

Traffic Type	Bandwidth Share		
Realtime	55 %	Realtime Classes: Bandwidth Breakup	
		HDX High	30 %
		High	10 %
		Medium	8 %
		Low	7 %
Interactive	30 %	Interactive Classes: Bandwidth Breakup	
		HDX High	8 %
		HDX Medium	4 %
		HDX Low	2 %
		High	8 %
		Medium	5 %
		Low	3 %
Bulk	15 % (Best Effort, Not Guaranteed)	Bulk Classes: Bandwidth Breakup (Relative Share)	
		High	9 %
		Medium	4 %
		Low	2 %

3. Ensure that the new QoS Profile is actively used by checking the Site Count indicator.



4. Navigate to **Configuration > QoS > QoS Policies** and set the new QoS Profile with the enabled HDX reporting as the **Global QoS Bandwidth Default Profile**.

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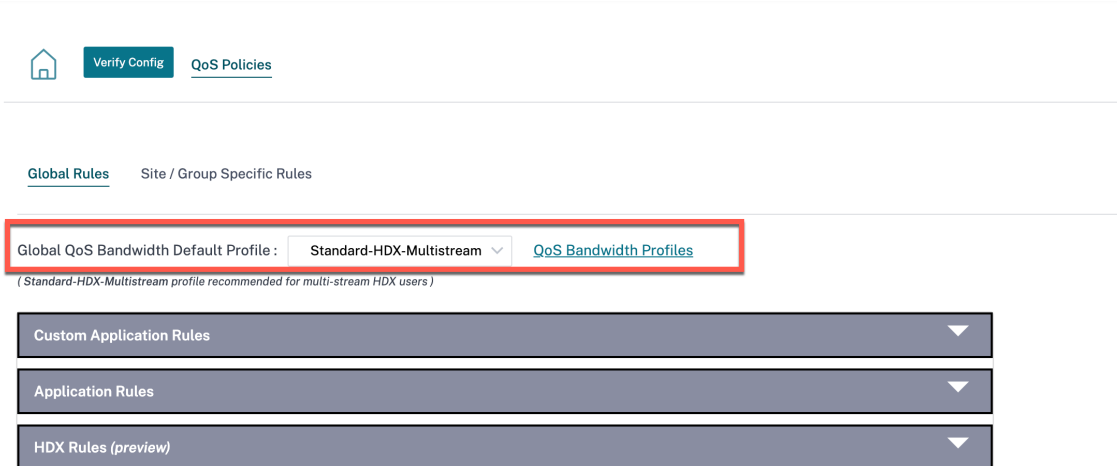
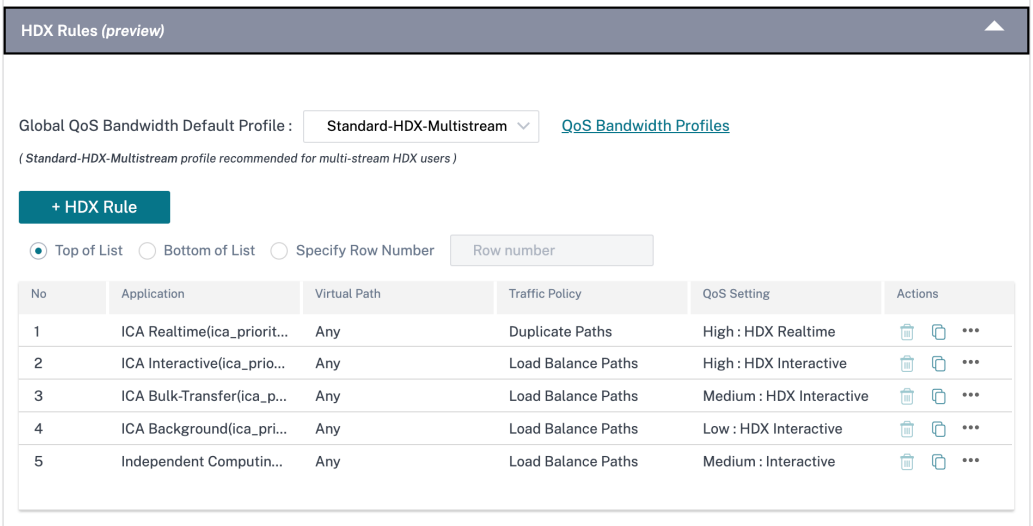


5. Add HDX rules. These configurations assign proper QoS settings to HDX connections. To check the detail of any rules, click the line of the rule. To change the setting of any default rule, click the “Clone” icon and make required modification.



These configurations can be modified:

- QoS class: Real-time, Interactive, Bulk
- Traffic policy:
  - Duplicate Paths: The traffic will be duplicated across multiple paths to increase reliability.
  - Persistent Path: The traffic of a flow will remain on the same path, unless the path becomes unavailable.
  - Load Balance Paths: The traffic of a flow is balanced across multiple paths.
  - Advanced Settings: Set policies retransmission, RED, and late packets.

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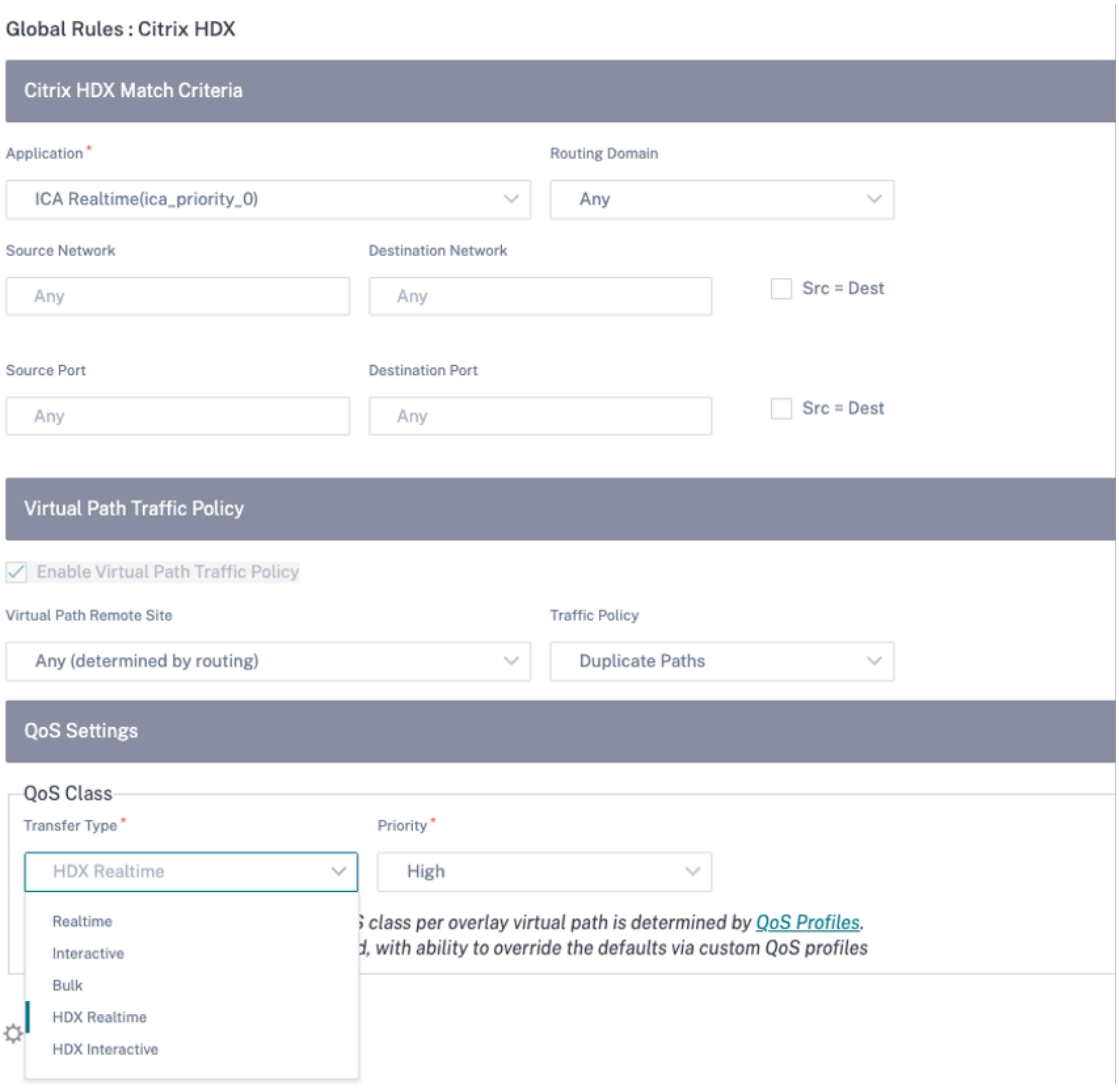

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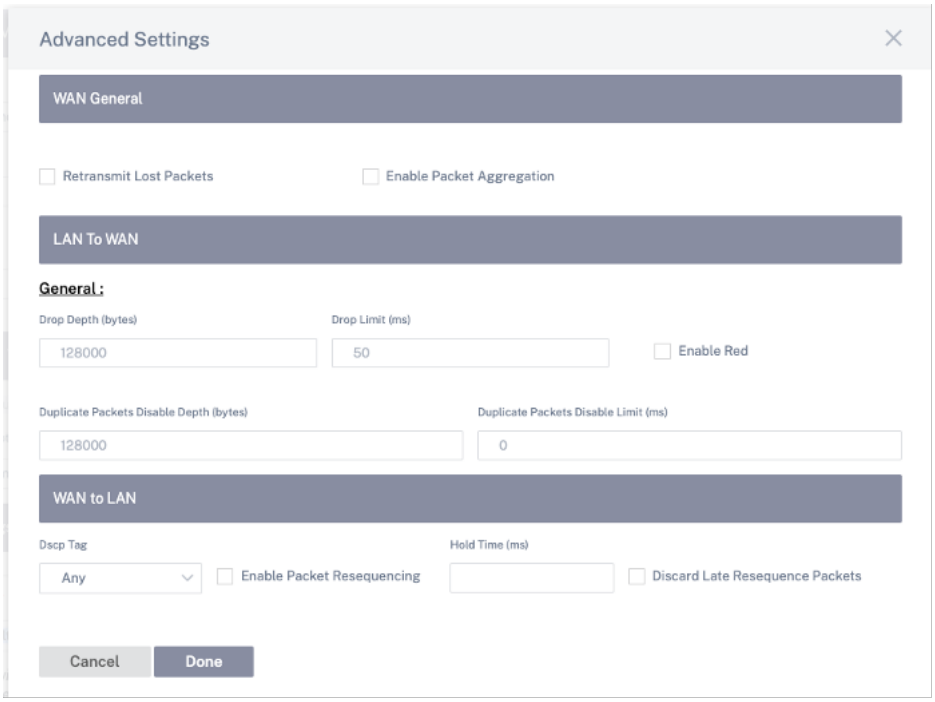

HDX dashboard and reports

Citrix SD-WAN Orchestrator service provides the HDX dashboard for up-to-date, detailed measurements of Citrix Virtual Applications and Desktops user experience across the network, for each site, user, and session.

There are two types of HDX sessions – single-stream and multi-stream. A single-stream session has only one connection in the session, whereas a multi-stream session has four. Multi-stream sessions allow for more advanced QoS. The connection in a single-stream HDX session defaults to interactive class, while the top priority connection of a multi-stream HDX session defaults to real-time class and the other three to interactive class. This is configurable.

The Quality of Experience (QoE) score is a numeric value between 0–100. The higher the value the better the user experience. Real-time class traffic QoE is calculated based on jitter, latency, and loss rate. The interactive class QoE is calculated based on burst rate and loss rate. The QoE of a session is the average across all the connections in the session. The QoE of a user is the average of all the sessions launched by that user. The QoE of a site is the average of all the sessions on that site.

All the statistics are metrics:

- For HDX traffic on that site
- Experienced by that user
- Of all the connections in that session

They do not include the metrics of other types of traffic. The metrics are either the average across the selected period, or the total across the selected period.

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> **Note**
>
> HDX reporting requires minimum software versions:
>
> - Citrix Virtual Apps and Desktops 7–1912 LTSR (or Current Release)
> - Citrix Workspace app for Windows 19.12 LTSR (or Current Release)
> - SD-WAN 11.2.0 (or current version)

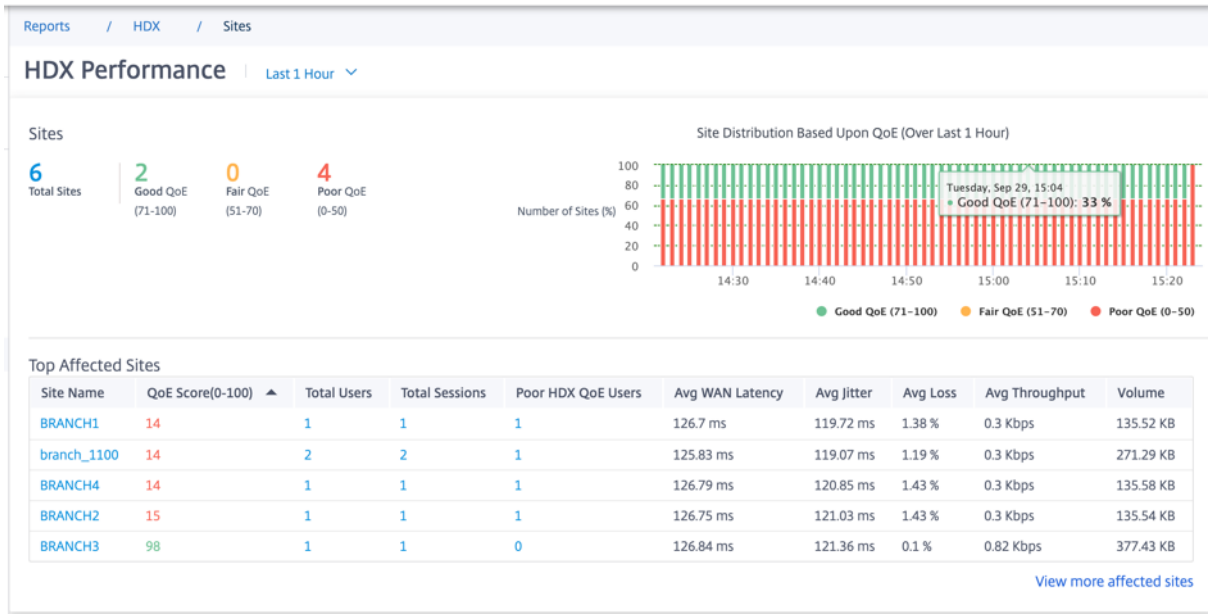
Citrix always recommends using the latest software version to get the latest bug fixes and enhancements. For instance, SD-WAN requires release 11.2.3 or 11.3.1 to have support for new EDT commands introduced in later versions of Citrix Virtual Apps and Desktops LTSR.

Mac clients and Linux clients do not have full support for multi-stream ICA and HDX reporting through Citrix SD-WAN. For instance, Linux clients support multi-stream, however lack detail such as round-trip time and delay. The CWA feature matrix provides insight into which Operating Systems support the **Multiport ICA** and **HDX Insight with NSAP VC** features.

Users need to access HDX outside of Citrix Gateway encryption, either through direct access to StoreFront or usage of Beacon Points or the Network Location Service.

Sites

This HDX report provides detailed HDX data per site. To view the site statistics, navigate to **Report > HDX > Sites**.



The dashboard reports on site with HDX traffic running during the selected time interval (for example, last 5 minutes, last 30 minutes, last 1 day, last 1 month, and so on). Site performance is categorized as good (71-100), fair (51-70), or poor (0-50) based on the QoE of the site's HDX traffic. The QoE value in the summary section and the **Top Affected Sites** table is the average value across the selected period

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of time. The time series graphic report shows detailed history with time lapse. Each bar shows the percentage of good, fair, and poor QoE sites at that time.

You can also view the number of sites in percentage, having Good, Fair, and Poor QoE at that time under the **Site Distribution Based Upon QoE** graph. Hover your mouse to the color bar to see the percentage number of sites in a good/fair/poor state.

> **NOTE**
>
> - The statistics are collected in one direction, from the remote side into the current site. For example, for a session between site-A and site-B, the report of site-A is collected on traffic coming from site-B into site-A, whereas the report of site-B is collected on traffic coming from site-A into site-B. Therefore, the statistics of the same session on site-A and site-B can be different.
> - The **Top Affected Sites** table reflects only the top 5 most affected sites. By default, it shows the 5 sites with the lowest QoE scores. But each column is sortable, ascending, or descending, and used as a query criterion. For example, clicking the **Avg Jitter** column title toggles showing either the 5 sites with the lowest average jitter or the highest average jitter. Same for other columns. To see the details of all the sites with HDX traffic during the selected period of time, click **View more affected sites**.

The following are the details of each site:

- **Site Name**: The site name.
- **QoE Score (0-100)**: The average QoE score of this site.
- **Total Users**: The total number of active HDX users seen on the site during the selected period.
- **Total Sessions**: The total number of HDX sessions seen on the site during the selected period, including both single-stream and multi-stream sessions.
- **Poor HDX QoE Users**: The number of HDX users suffering from poor QoE (below 50).
- **Avg WAN Latency**: Average latency over the WAN, from the remote site to this site.
- **Avg Jitter**: The average jitter value for the selected duration.
- **Avg Loss**: The average packet loss percentage value for the selected duration.
- **Avg Throughput**: The average data throughput value for the selected duration.
- **Volume**: The total traffic volume seen on this site. The Citrix SD-WAN Orchestrator for On-premises GUI might adjust and change the unit based on the number value.

Clicking any column title shows the report sorted on that column. Click **View more affected sites** to see the reports of all sites. Clicking any single row shows the detailed report for that site.

The table in the following screenshot is an example report showing all the sites. It has the same columns as the **Top Affected Sites** table. You can search for any site using the search bar.

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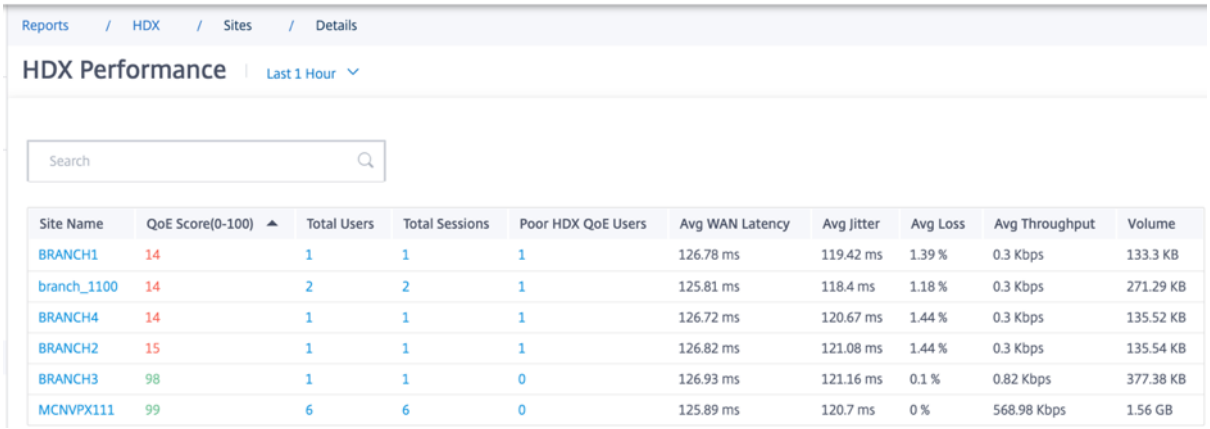
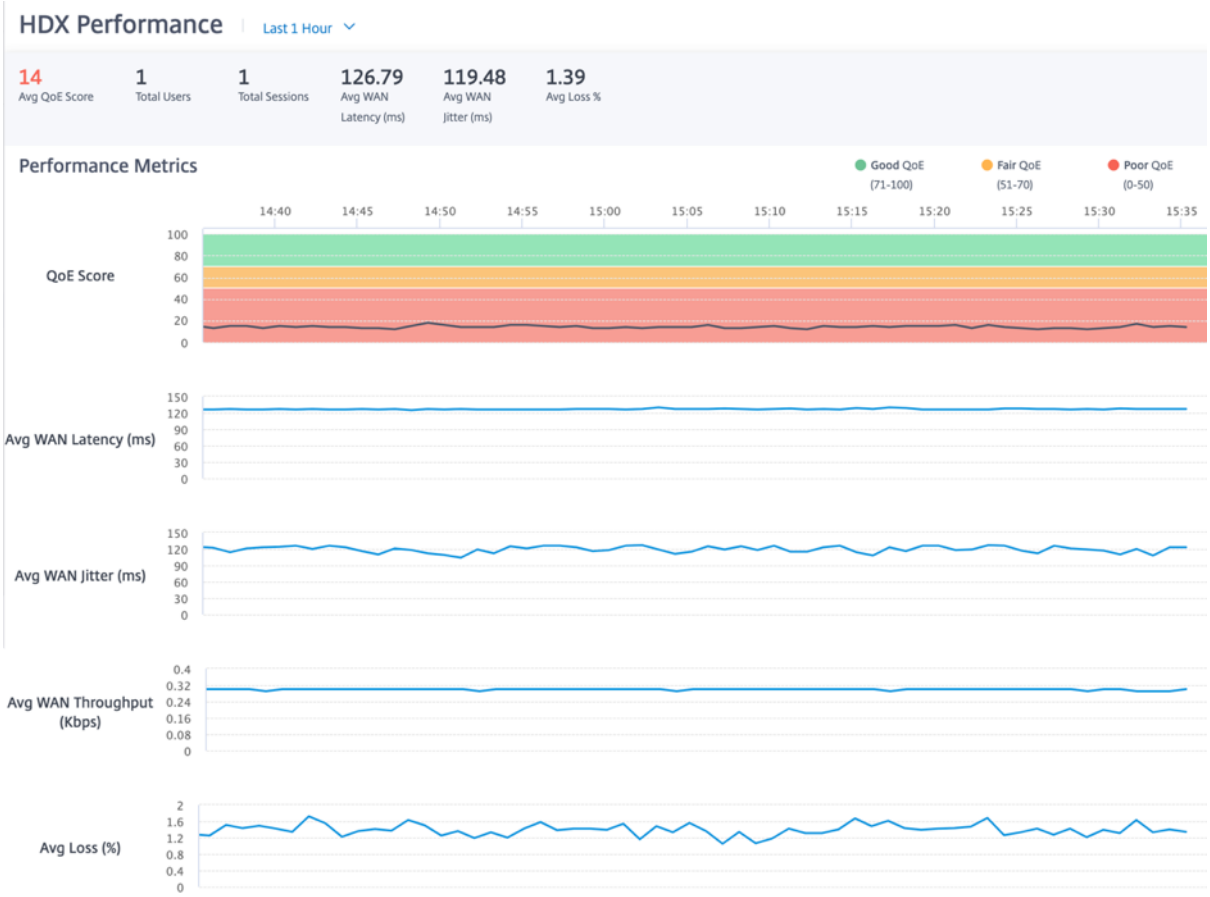


Site Name	QoE Score(0-100)	Total Users	Total Sessions	Poor HDX QoE Users	Avg WAN Latency	Avg Jitter	Avg Loss	Avg Throughput	Volume
BRANCH1	14	1	1	1	126.78 ms	119.42 ms	1.39 %	0.3 Kbps	133.3 KB
branch_1100	14	2	2	1	125.81 ms	118.4 ms	1.18 %	0.3 Kbps	271.29 KB
BRANCH4	14	1	1	1	126.72 ms	120.67 ms	1.44 %	0.3 Kbps	135.52 KB
BRANCH2	15	1	1	1	126.82 ms	121.08 ms	1.44 %	0.3 Kbps	135.54 KB
BRANCH3	98	1	1	0	126.93 ms	121.16 ms	0.1 %	0.82 Kbps	377.38 KB
MCNVPX111	99	6	6	0	125.89 ms	120.7 ms	0 %	568.98 Kbps	1.56 GB

Click the individual site row to view a graphical representation of the performance metrics. Hovering the mouse over the graphic provides more details.



Users

To view the HDX Users report, navigate to **Reports > HDX > Users**.

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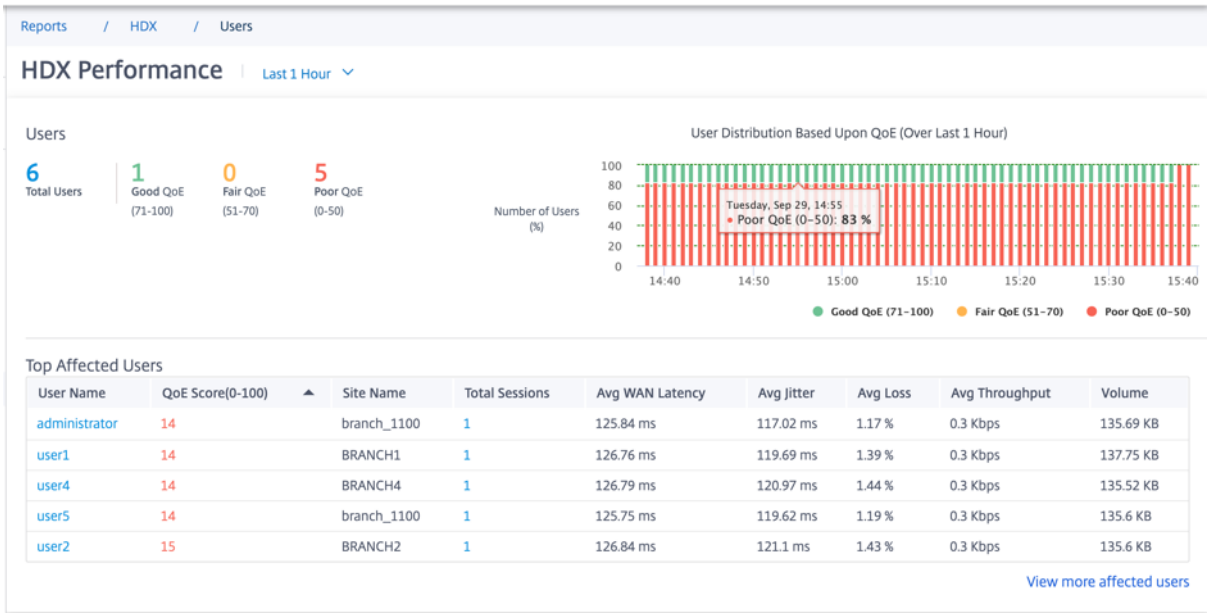

The user report shows the performance experienced by each user during the selected period (for example, last 5 minutes, last 30 minutes, last 1 day, last 1 month, and so on). If the user has been on multiple sites during the selected period, the last site the user logged in from is shown in the report. User experience is categorized as good (71-100), fair (51-70), or poor (0-50) based on the QoE score of their HDX traffic. The QoE values in the summary section and the **Top Affected Users** table are the average values across the selected period of time. The time series graphic report shows detailed history with time lapse. Each bar shows the percentage of users with good, fair, and poor QoE at that time.

You can also view the number of users in percentage, having Good, Fair, and Poor QoE at that time under the **User Distribution Based Upon QoE** graph. Hover your mouse to the color bar to see the percentage number of users in good/fair/poor state.

Personally Identifiable Information

Currently, the HDX QoE reports have the following two Personally Identifiable Information (PII) fields:

- **User Name**: Displays the user name.
- **IP Address**: Displays the client IP address.

> **NOTE**
>
> - When the user name is not available, the IP address is displayed in the **User Name** field.
> - The HDX user reports are based on statistics from the client side SD-WAN, not the Virtual Delivery Agent (VDA) side SD-WAN. This reflects the end user's HDX experience.
> - The **Top Affected Users** table reflects only the top 5 most affected users. By default, it shows the top 5 users with the lowest QoE. But each column is sortable, ascending, or de-

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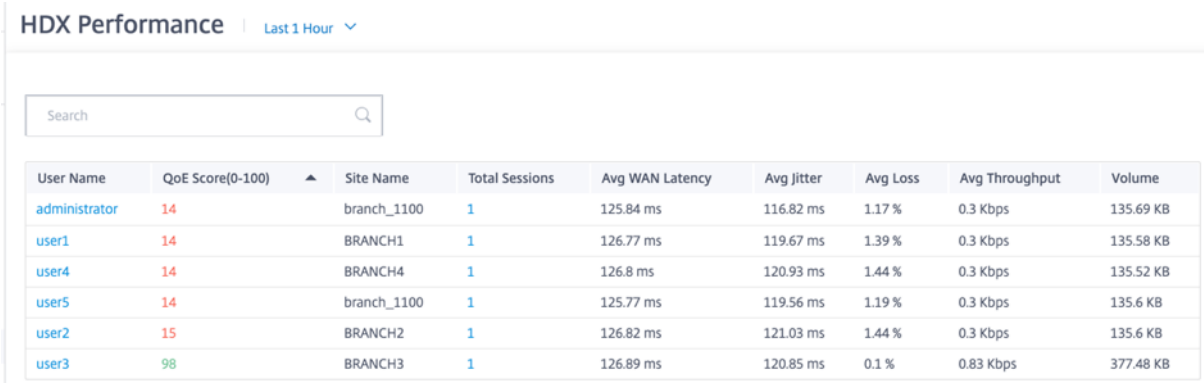
> scending, and used as a query criterion. For example, clicking the **Avg Jitter** column title toggles displaying either the 5 users with the lowest average jitter or the highest average jitter. To see the details of all the users that have HDX traffic during the selected period of time, click **View more affected users**.

The following are the details of each user:

- **User Name**: The user name.
- **QoE Score (0-100)**: The average QoE score of this user.
- **Site Name**: The site name that the user logged in from.
- **Total Sessions**: The total number of active HDX sessions from that user, including both single-stream and multi-stream sessions.
- **Avg WAN Latency**: Average latency over the WAN, experienced at the client side.
- **Avg Jitter**: The average jitter value for the selected duration.
- **Avg Loss**: The average packet loss percentage value for the selected duration.
- **Avg Throughput**: The average data throughput value for the selected duration.
- **Volume**: The total traffic volume used by this user. The Citrix SD-WAN Orchestrator for On-premises GUI might adjust and change the unit based on the number value.

Clicking any column title shows the report sorted on that column. Click **View more affected users** to see the reports of all users. Clicking any single row shows the detailed report for that user.

The following screenshot is an example report table showing all the users. It has the same columns as the **Top Affected Users** table. You can search for any site using the search bar.



User Name	QoE Score(0-100)	Site Name	Total Sessions	Avg WAN Latency	Avg Jitter	Avg Loss	Avg Throughput	Volume
administrator	14	branch_1100	1	125.84 ms	116.82 ms	1.17 %	0.3 Kbps	135.69 KB
user1	14	BRANCH1	1	126.77 ms	119.67 ms	1.39 %	0.3 Kbps	135.58 KB
user4	14	BRANCH4	1	126.8 ms	120.93 ms	1.44 %	0.3 Kbps	135.52 KB
user5	14	branch_1100	1	125.77 ms	119.56 ms	1.19 %	0.3 Kbps	135.6 KB
user2	15	BRANCH2	1	126.82 ms	121.03 ms	1.44 %	0.3 Kbps	135.6 KB
user3	98	BRANCH3	1	126.89 ms	120.85 ms	0.1 %	0.83 Kbps	377.48 KB

Click an individual user row to see a graphical representation of that user's performance metrics.

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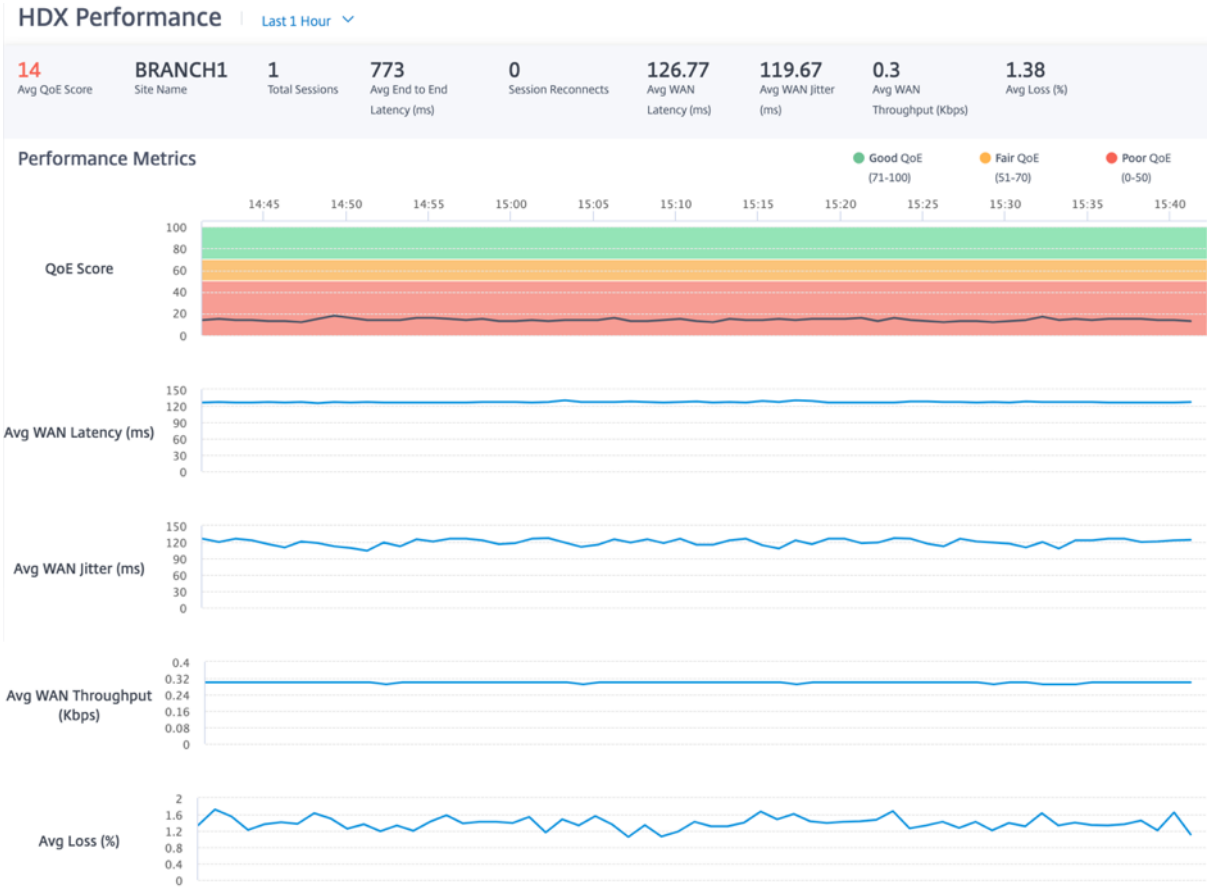

Sessions

The Session report provides details at the session level. To view the session report, navigate to **Reports > HDX > Sessions**.

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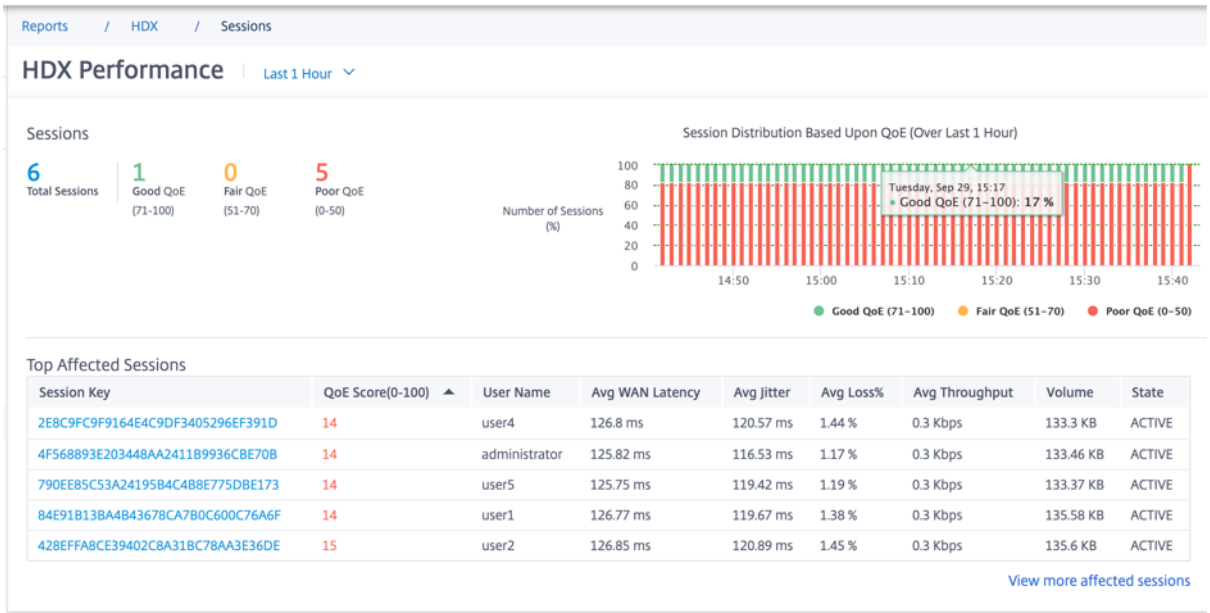

The dashboard shows the reports of HDX sessions running during the selected period (for example, last 5 minutes, last 30 minutes, last 1 day, last 1 month, and so on). Sessions are categorized as good (71-100), fair (51-70), or poor (0-50) based on the QoE of that session. The QoE value in the summary section and the Top Affected table is the average value across the selected period. The time series graphic report shows detailed history with time lapse. Each bar shows the percentage of good, fair, and poor QoE sessions at that time.

You can also view the number of sessions in percentage, having Good, Fair, and Poor QoE at that time under the **Session Distribution Based Upon QoE** graph. Hover your mouse to the color bar to see the percentage number of sessions in good/fair/poor state.

> **Note**
>
> - The HDX session reports are based on statistics from the client side SD-WAN, not the VDA side SD-WAN. This reflects the end user's HDX experience.
> - The **Top Affected Sessions** table reflects only the top 5 most affected sessions. By default, it shows the top 5 sessions with the lowest QoE. But each column is sortable, ascending, or descending, and used as a query criterion. For example, clicking the **Avg Jitter** column title toggles showing either the 5 sessions with the lowest average jitter or the highest average jitter. To see the details of all the HDX sessions during the selected period of time, click **View more affected sessions**.

The following are the Detail of the top each session:

- **Session Key**: The unique identity for an HDX session.
- **QoE Score (0-100)**: The average QoE of this session.
- **User Name**: The user name.
- **Avg WAN Latency**: The average WAN latency of the session for the selected duration, measured

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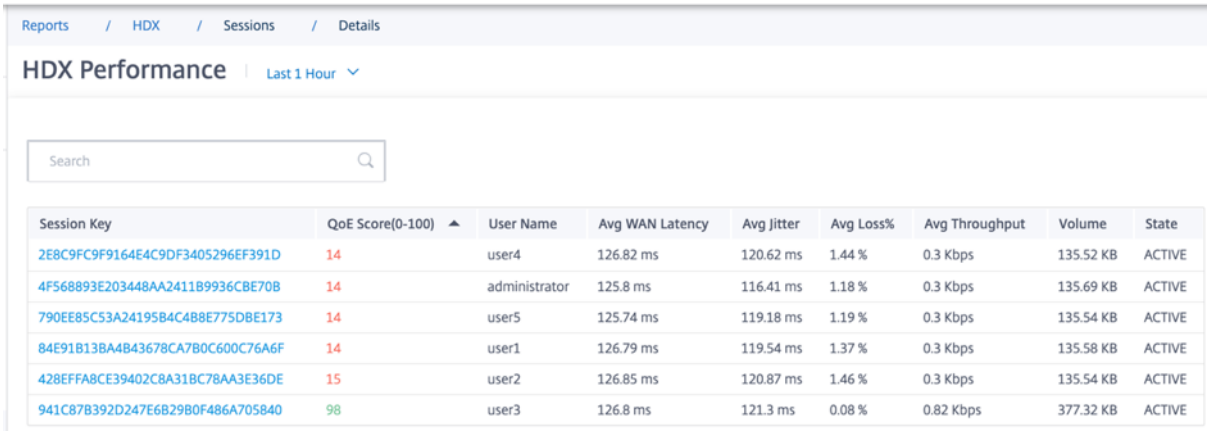
at the client side.

- **Avg Jitter**: The average jitter value of the session for the selected duration.
- **Avg Loss**: The average loss percentage value of the session for the selected duration.
- **Avg Throughput**: The average throughput value of the session for the selected duration.
- **Volume**: The total traffic volume used by this session. The Citrix SD-WAN Orchestrator for On-premises GUI might adjust and change the unit based on the number value.

Clicking any column title, shows the report sorted on that column. Clicking on **View more affected sessions** to see the reports of all the sessions. Clicking any single row shows the detailed report on that session.

The following screenshot is an example report table showing all the sessions. It has the same columns as the **Top Affected Sessions** table.



Session Key	QoE Score(0-100)	User Name	Avg WAN Latency	Avg Jitter	Avg Loss%	Avg Throughput	Volume	State
2E8C9FC9F9164E4C9DF3405296EF391D	14	user4	126.82 ms	120.62 ms	1.44 %	0.3 Kbps	135.52 KB	ACTIVE
4F568893E203448AA2411B9936CBE70B	14	administrator	125.8 ms	116.41 ms	1.18 %	0.3 Kbps	135.69 KB	ACTIVE
790EE85C53A24195B4C4B8E775DBE173	14	user5	125.74 ms	119.18 ms	1.19 %	0.3 Kbps	135.54 KB	ACTIVE
84E91B13BA4B43678CA7B0C600C76A6F	14	user1	126.79 ms	119.54 ms	1.37 %	0.3 Kbps	135.58 KB	ACTIVE
428EFFA8CE39402C8A31BC78AA3E36DE	15	user2	126.85 ms	120.87 ms	1.46 %	0.3 Kbps	135.54 KB	ACTIVE
941C87B392D247E6B29B0F486A705840	98	user3	126.8 ms	121.3 ms	0.08 %	0.82 Kbps	377.32 KB	ACTIVE

Click the individual session key to view a graphical representation of the performance metrics along with the details about all the variables affecting QoE.

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- **Avg QoE Score**: The average QoE over the selected period.
- **User Name**: The user who launched this session.
- **VDA Name**: Name of the VDA from which published Desktop/Application are delivered.
- **Session Duration**: The active time of this session in the selected period.
- **Site Name**: The client site of the user when the session was launched.
- **VD/VA**: Whether this session is a **Virtual Desktop** or a **Virtual Application** session.
- **Session State**: The state of the session at the end of the selected period.
- **Session Type**: Whether the session is Multi-stream session or single-stream session the last

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time the session is launched.

- **WAN Optimized**: Whether this session was WAN optimized. If the SD-WAN is PE platform, WAN Optimization is enabled for HDX, and this session is optimized, then this field shows true.
- **Session Reconnects**: If the session has been disconnect and reconnect automatically due to network issue, this field is the count of such occurrence.
- **Network Service**: This is the service name through which this session is delivered.
- **HDX End to End Latency**: Half of the value of round trip time between the VDA and the client.
- **WAN Latency**: The latency from the VDA side SD-WAN to the client side SD-WAN.

Security

July 14, 2021

You can configure the security settings such as, network encryption, virtual path IPsec, firewall, and certificates that are applicable to all the appliances across the network.

Firewall zones

You can configure zones in the network and define policies to control how traffic enters and leaves the zones. The following zones are available by default:

- **Default_LAN_Zone**: Applies to traffic to or from an object with a configurable zone, where the zone has not been set.
- **Internet_Zone**: Applies to traffic to or from an Internet service using a trusted interface.
- **Untrusted_Internet_Zone**: Applies to traffic to or from an Internet service using an untrusted interface.

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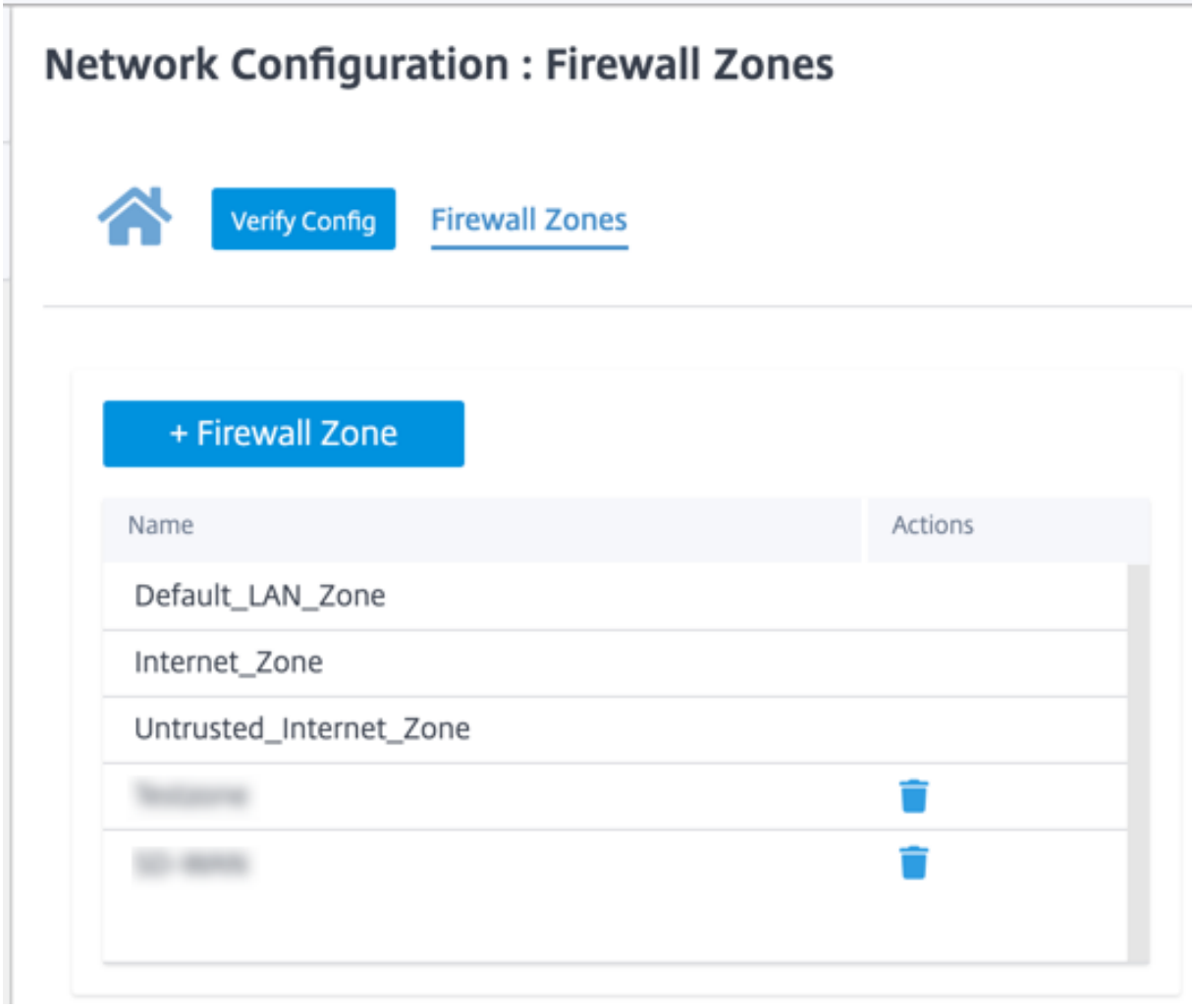

You can also create your own zones and assign them to the following types of objects:

- Virtual Network Interfaces
- Intranet Services
- GRE Tunnels
- LAN IPsec Tunnels

Click **Verify Config** to validate any audit error.

Firewall defaults

You can configure the global default firewall actions and global firewall settings that can be applied to all the appliances in the SD-WAN network. The settings can also be defined at the site level which overrides the global setting.

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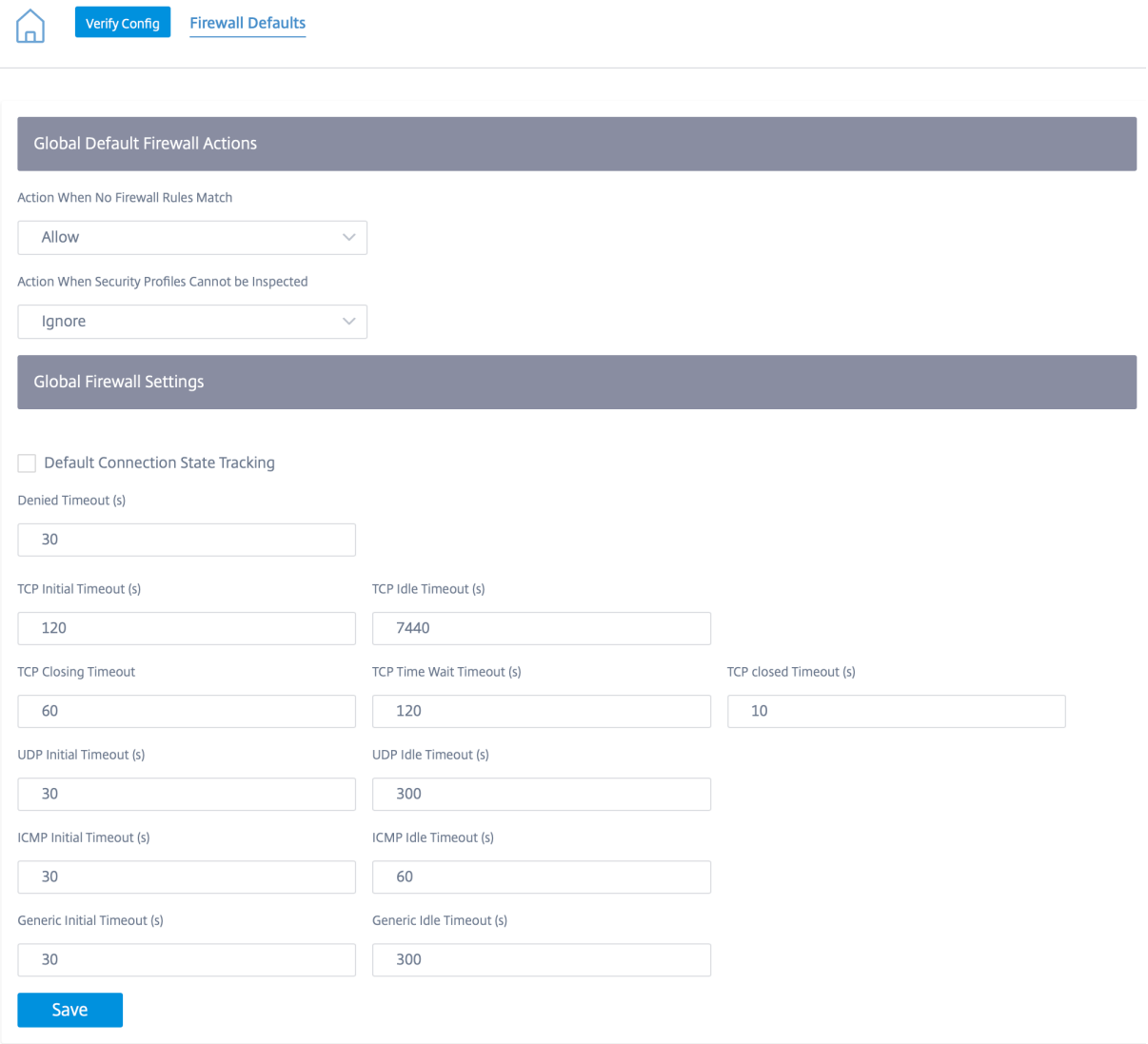

- **Action When No Firewall Rules Match**: Select an action (Allow or Drop) from the list for the packets that do not match a Firewall policy.
- **Action When Security Profiles Cannot be Inspected**: Select an action (Ignore or Drop) for the packets that match a firewall rule and engage a security profile but temporarily cannot be inspected by the Edge Security subsystem. If you select **Ignore**, then the relevant firewall rule is treated as not matched and the next firewall rule in order is evaluated. If you select **Drop**, the packets matching the relevant firewall rule, are dropped.
- **Default Firewall Action**: Select an action (Allow/Drop) from the list for packets that do not match a policy.
- **Default Connection State Tracking**: Enables directional connection state tracking for TCP, UDP, and ICMP flows that do not match a filter policy or NAT rule.

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> **Note**
>
> Asymmetric flows are blocked when **Default Connection State Tracking** is enabled even when there are no Firewall policies defined. If there is the possibility of asymmetric flows at a site, the recommendation is to enable it at a site or policy level and not globally.

- **Denied Timeout (s)**: Time (in seconds) to wait for new packets before closing denied connections.
- **TCP Initial Timeout (s)**: Time (in seconds) to wait for new packets before closing an incomplete TCP session.
- **TCP Idle Timeout (s)**: Time (in seconds) to wait for new packets before closing an active TCP session.
- **TCP Closing Timeout**: Time (in seconds) to wait for new packets before closing a TCP session after a terminate request.
- **TCP Time Wait Timeouts (s)**: Time (in seconds) to wait for new packets before closing a terminated TCP session.
- **TCP Closed Timeout (s)**: Time (in seconds) to wait for new packets before closing an aborted TCP session.
- **UDP Initial Timeout (s)**: Time (in seconds) to wait for new packets before closing the UDP session that has not seen traffic in both directions.
- **UDP Idle Timeout (s)**: Time (in seconds) to wait for new packets before closing an active UDP session.
- **ICMP Initial Timeout (s)**: Time (in seconds) to wait for new packets before closing an ICMP session that has not seen traffic in both directions
- **ICMP Idle Timeout (s)**: Time (in seconds) to wait for new packets before closing an active ICMP session.
- **Generic Initial Timeout (s)**: Time (in seconds) to wait for new packets before closing a generic session that has not seen traffic in both directions.
- **Generic Idle Timeout (s)**: Time (in seconds) to wait for new packets before closing an active generic session.

Click **Verify Config** to validate any audit error.

Firewall policies

Firewall profiles provide security by ensuring that network traffic is restricted only to a specific firewall rule depending on the match criteria and by applying specific actions. The **Firewall Policies** contains three sections.

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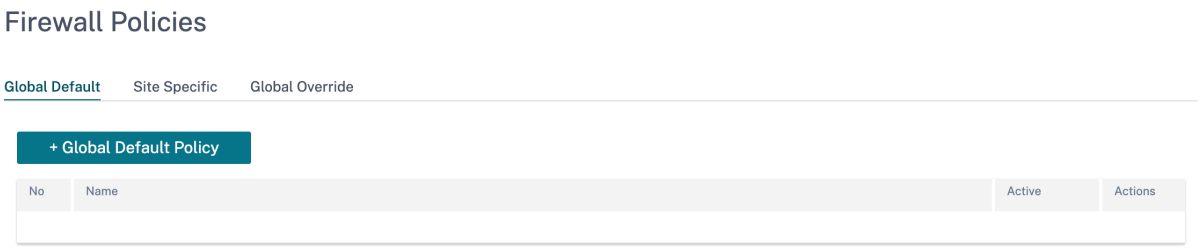
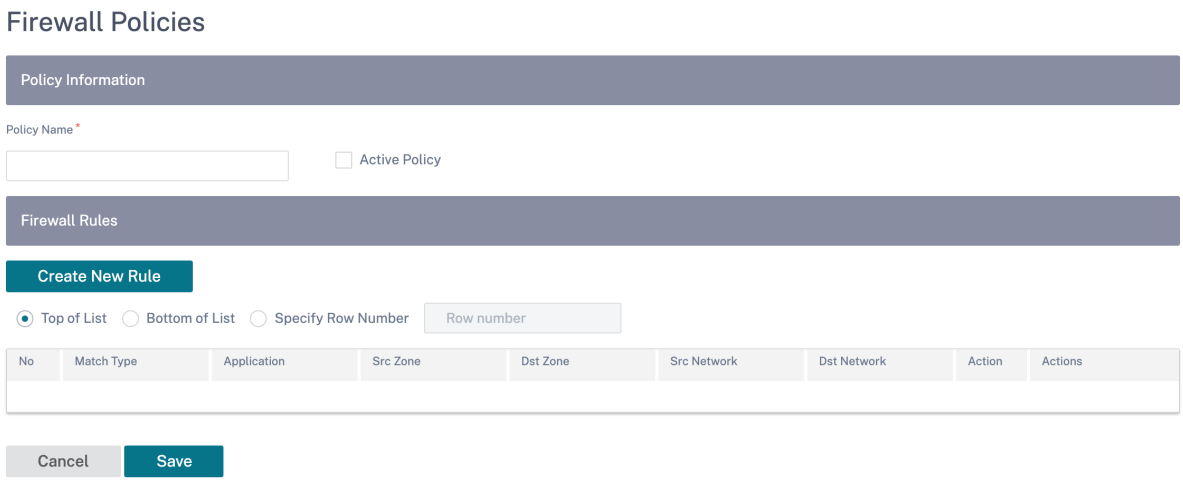
- **Global Default** – Global default policy is an aggregation of a couple of firewall rules. The policy that you create under the **Global Default** section is applied across all the sites in the network.
- **Site Specific** – You can apply the defined firewall rules on certain specific sites.
- **Global Override** – You can override both global and site-specific policies using **Global Override Policy**.



You can define firewall rules and place it based on the priority. You can choose the priority order to begin from the top of the list, bottom of the list, or from a specific row.

It is recommended to have more specific rules for applications or subapplications at the top, followed by less specific rules for the ones representing broader traffic.



To create a firewall rule, click **Create New Rule**.

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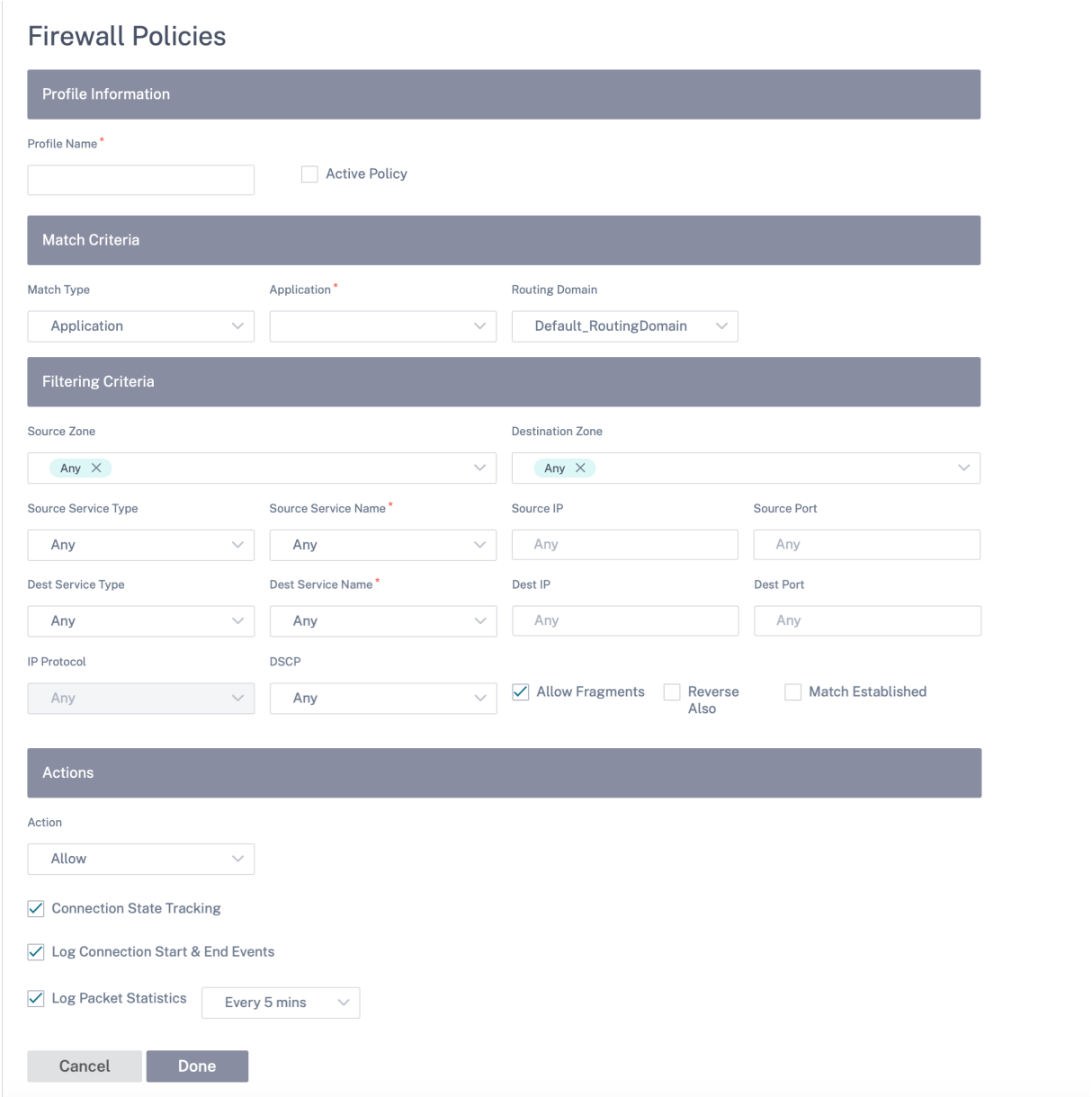

- Provide a policy name and select the **Active Policy** check box if you want to apply all the firewall rules.
- The match criteria defines the traffic for the rule such as, an application, a custom defined application, group of applications, application family, or IP protocol based.
- Filtering criteria:
  - **Source Zone**: The source firewall zone.
  - **Destination Zone**: The destination firewall zone.
  - **Source Service Type**: The source SD-WAN service type – Local, Virtual Path, Intranet, IP Host, or Internet are examples of Service Types.

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  - **Source Service Name**: The name of a service tied to the service type. For example, if the virtual path is selected for Source Service type, it would be the name of the specific virtual path. This is not always required and depends on the service type selected.
  - **Source IP**: The IP address and subnet mask the rule uses to match.
  - **Source Port**: The source port the specific application uses.
  - **Dest Service Type**: The destination SD-WAN service type – Local, Virtual Path, Intranet, IP Host, or Internet are examples of service types.
  - **Dest Service Name**: Name of a service tied to the service type. This is not always required and depends on the service type selected.
  - **Dest IP**: The IP address and subnet mask the filter use to match.
  - **Dest Port**: The destination port the specific application uses (that is, HTTP destination port 80 for the TCP protocol).
  - **IP Protocol**: If this match type is selected, select an IP protocol that the rule matches with. Options include ANY, TCP, UDP ICMP and so on.
  - **DSCP**: Allow the user to match on a DSCP tag setting.
  - **Allow Fragments**: Allow IP fragments that match this rule.
  - **Reverse Also**: Automatically add a copy of this filter policy with source and destination settings reversed.
  - **Match Established**: Match incoming packets for a connection to which outgoing packets were allowed.
- The following actions can be performed on a matched flow:
  - **Allow**: Permit the flow through the Firewall.
  - **Drop**: Deny the flow through the firewall by dropping the packets.
  - **Reject**: Deny the flow through the firewall and send a protocol specific response. TCP sends a reset, ICMP sends an error message.
  - **Count and Continue**: Count the number of packets and bytes for this flow, then continue down the policy list.

Apart from defining the action to be taken, you can also select the logs to be captured.

Network encryption

Select the encryption mechanism to be used across the network. You can configure the global security settings that secure the entire SD-WAN network.

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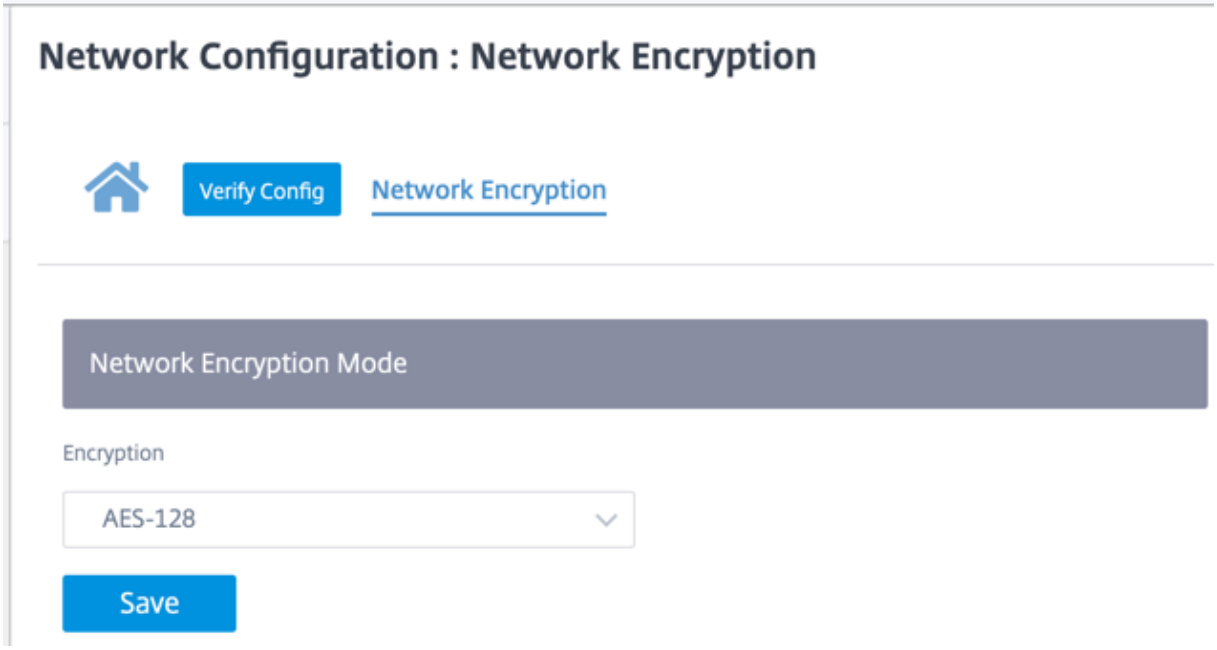
Network Encryption mode defines the algorithm used for all encrypted paths in the SD-WAN network. It is not applicable for non–encrypted paths. You can set the encryption as AES-128 or AES-256.



SSL inspection

Secure Sockets Layer (SSL) inspection is a process of intercepting, decrypting, and scanning the HTTPS and secure SMTP traffic for malicious content. SSL inspection provides security to the traffic flowing to and from your organization. You can generate and upload your organization's root CA certificate and perform the man-in-the-middle inspection of the traffic.

> **NOTE**
>
> SSL inspection is supported from Citrix SD-WAN 11.3.0 release onwards.

To enable SSL inspection, at the network level, navigate to **Configuration > Security > SSL Inspection > Configuration** and define the following SSL configuration settings.

- **Enable SMTPS Traffic Processing**: The secure SMTP traffic undergoes SSL inspection.
- **Enable HTTPS Traffic Processing**: The HTTPS traffic undergoes SSL inspection.
- **Block Invalid HTTPS Traffic**: By default, when the **Block Invalid HTTPS Traffic** check box is cleared, non-HTTPS traffic on port 443 is ignored and allowed to flow unimpeded. When **Block Invalid HTTPS Traffic** is selected, non-HTTPS traffic is blocked for SSL inspection. Enabling this option may result in otherwise legitimate traffic getting blocked, that is, HTTP traffic on port 443 or HTTPS traffic from sites with an expired certificate.
- **Client Connection Protocols**: Select the required client protocols. The protocols available are SSLvHello, SSLv3, TLSv1, TSLv1.1, TLSv1.2, and TLSv1.3.

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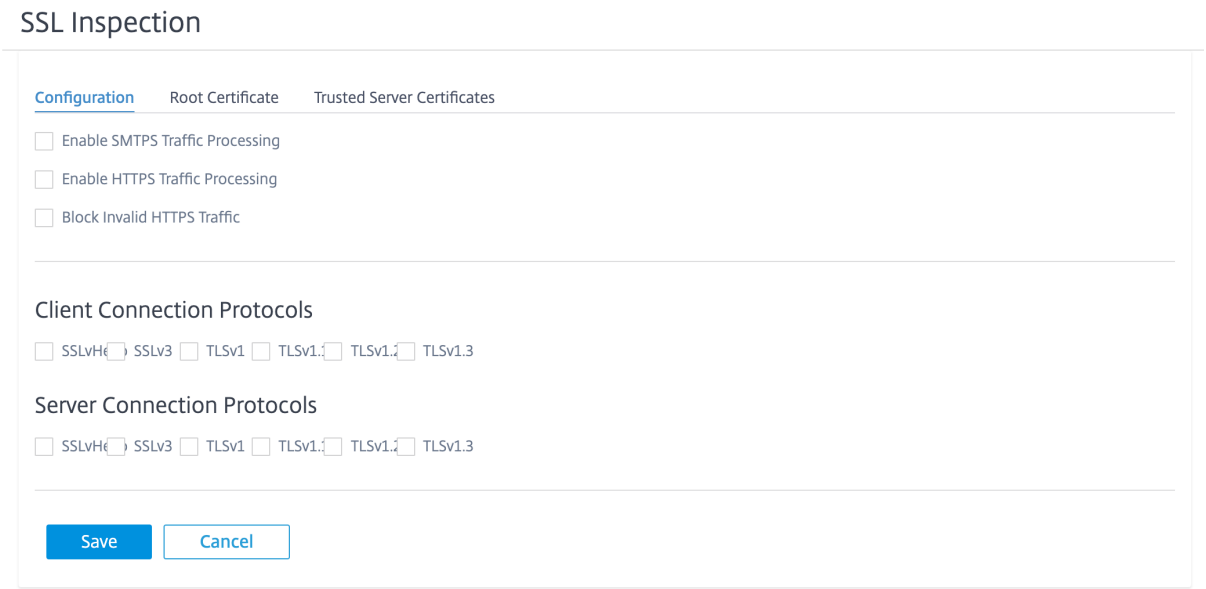
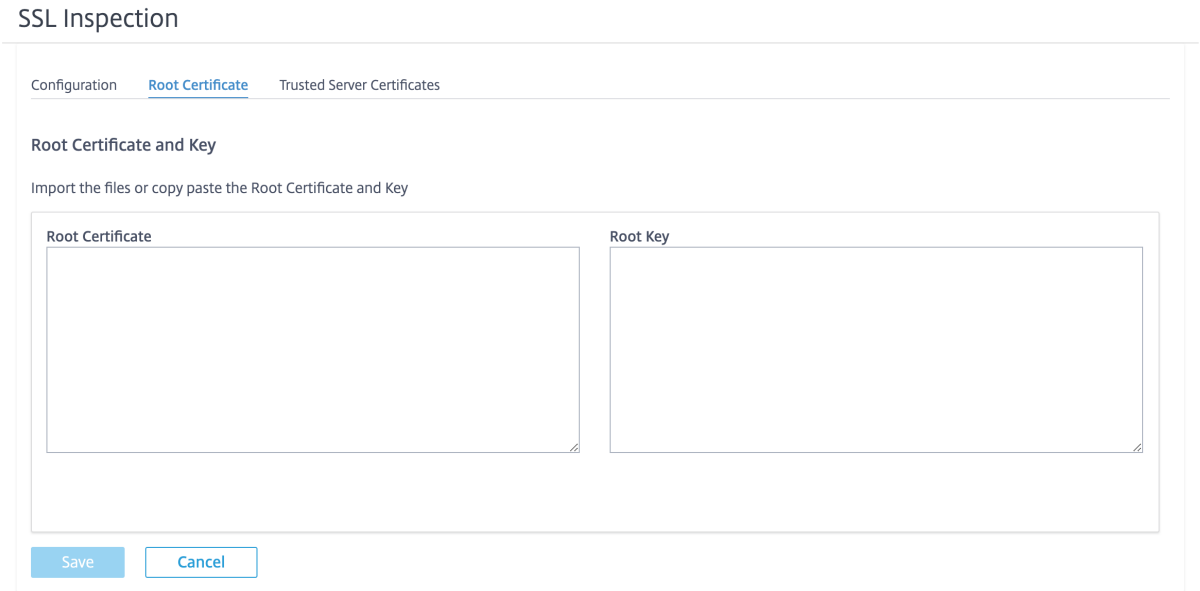
- **Server Connection Protocols**: Select the required server protocols. The protocols available are SSLvHello, SSLv3, TLSv1, TSLv1.1, TLSv1.2, and TLSv1.3.

> **NOTE**
>
> The versions older than TLSv1.2 are considered vulnerable and must not be enabled, unless backward compatibility is important.



On the **Root Certificate** tab, copy and paste the root certificate and key of your organization root certificate authority (CA). The root CA is used to create and sign a forged copy of the certificates of the original sites, so that SSL inspection can be performed. It is implicitly assumed that the root CA certificate is installed on all client workstations and devices that can have their traffic SSL inspected.



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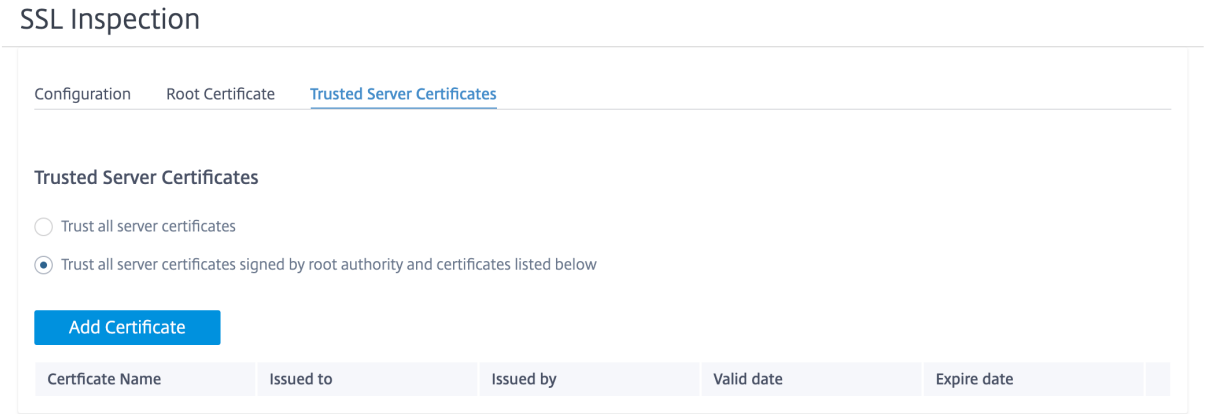
The default, **Trust all server certificates signed by root authority and certificates listed below** option results in SD-WAN validating all server certificates against the standard list of root CAs and the root CA previously configured. It also discards servers that have an invalid certificate. To override this behavior, upload the SSL self-signed certificate of internal servers on the **Trusted Server Certificates** tab. Click **Add Certificate** and provide a name, browse for the certificate, and upload it. Alternately, if you select **Trust all server certificates**, all the servers are considered as trusted by Citrix SD-WAN, regardless of their certificate validation status.



As part of security profiles, you can create SSL rules and enable them for SSL inspection. For more information on creating SSL rules for a security profile, see Edge security.

Intrusion prevention

Intrusion Prevention System (IPS) detects and prevents malicious activity from entering your network. IPS inspects the network traffic and takes automated actions on all incoming traffic flows. It includes a database of over 34,000 signature detections and heuristic signatures for port scans, allowing you to effectively monitor and block most suspicious requests.

IPS uses signature based detection, which matches the incoming packets against a database of uniquely identifiable exploit and attack patterns. The signature database is automatically updated daily. Since there are thousands of signatures, the signatures are grouped into Category and Class types.

You can create IPS rules and enable only the signature categories or class types that your network requires. Since intrusion prevention is a compute sensitive process, use only the minimal set of signature categories or class types that are relevant for your network.

You can create an IPS profile and enable a combination of IPS rules. These IPS profiles can then be associated globally with the entire network or with only specific sites.

Each rule can be associated with multiple IPS profiles and each IPS profile can be associated with multiple sites. When an IPS profile is enabled, it inspects the network traffic for the sites with which

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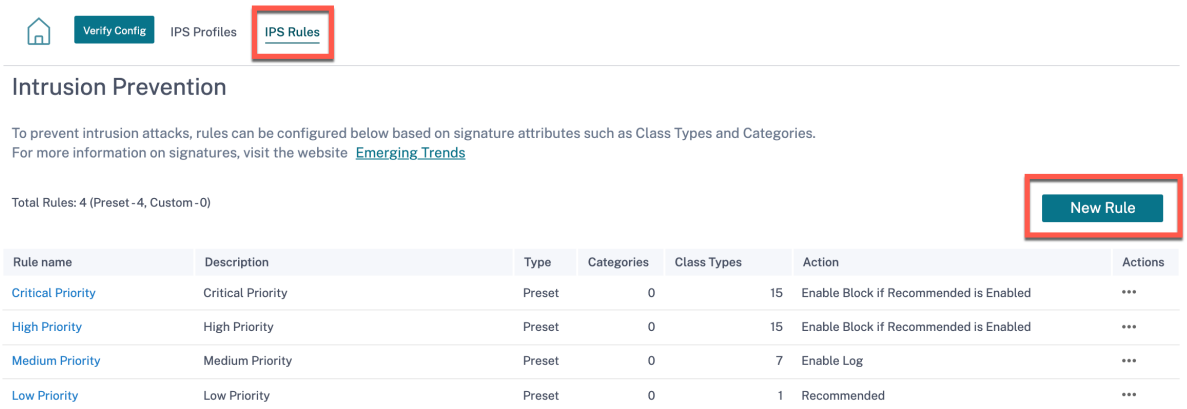
the IPS profile is associated and for the IPS rules enabled within that profile.

To create IPS rules, at the network level, navigate to **Configuration > Security > Intrusion Prevention > IPS Rules** and click **New Rule**.



Provide a rule name and description. Select the match category or class type signature attributes, select an action for the rule, and enable it. You can choose from the following rule actions:

Rule Action	Function
Recommended	There are recommended actions defined for each signature. Perform the recommended action for the signatures.
Enable Log	Allow and log the traffic matching any of the signatures in the rule.
Enable Block if Recommended is Enabled	If the rule action is **Recommended** and the signature's recommended action is **Enable Log**, drop the traffic matching any of the signatures in the rule.
Enable Block	Drop the traffic matching any of the signatures in the rule.

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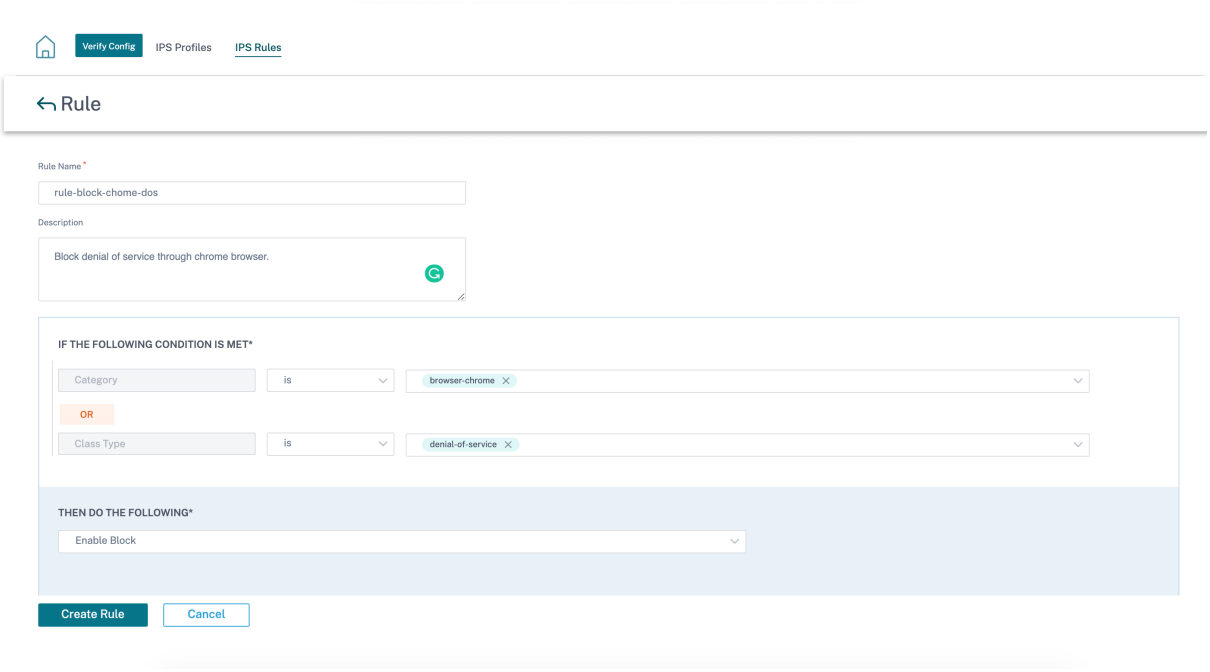
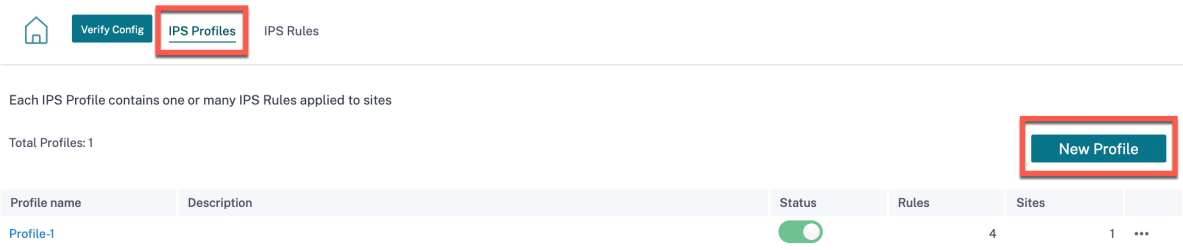


> **Note**
>
> - Since Intrusion Prevention is a compute sensitive process use only the minimal set of signature categories that are relevant to your edge security deployments.
> - The SD-WAN firewall drops the traffic on all WAN L4 ports that are not port-forwarded and are not visible in the IPS engine. This provides an extra security layer against trivial DOS and scan attacks.

To create IPS profiles, at the network level, navigate to **Configuration > Security > Intrusion Prevention > IPS Profiles** and click **New Profile**.



Provide a name and description for the IPS profile. On the **IPS Rules** tab, enable the required **IPS Rules** and turn on **Enable IPS Profiles**.

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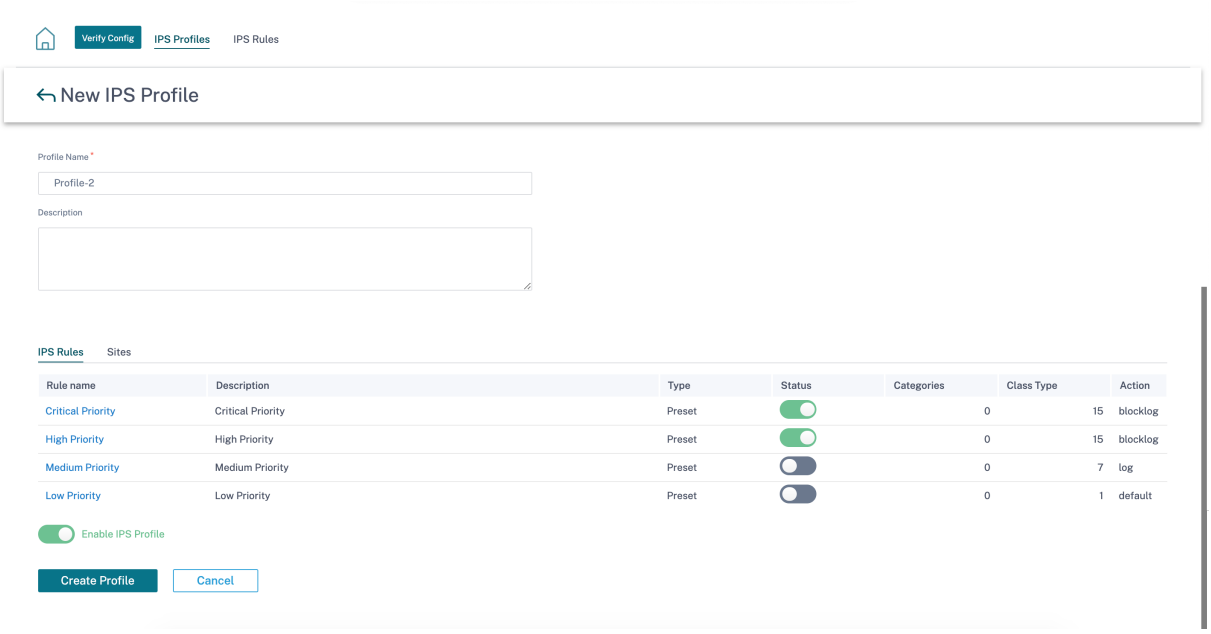
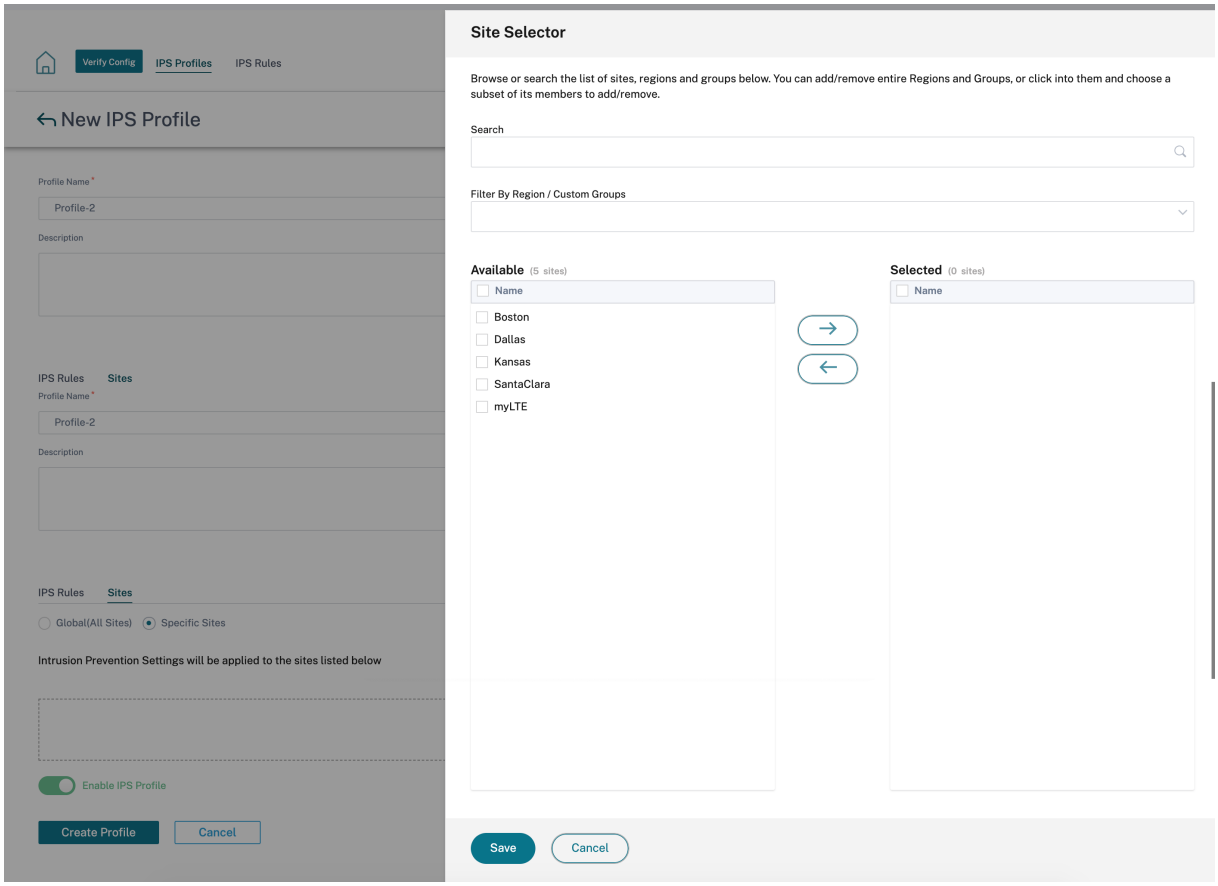


On the **Sites** tab, click **Select Sites**. Select the sites and click **Save**. Click **Create Profile**.



You can enable or disable these IPS profiles while creating security profiles. The security profiles are used to create firewall rules. For more information, see Security profile – Intrusion Prevention.

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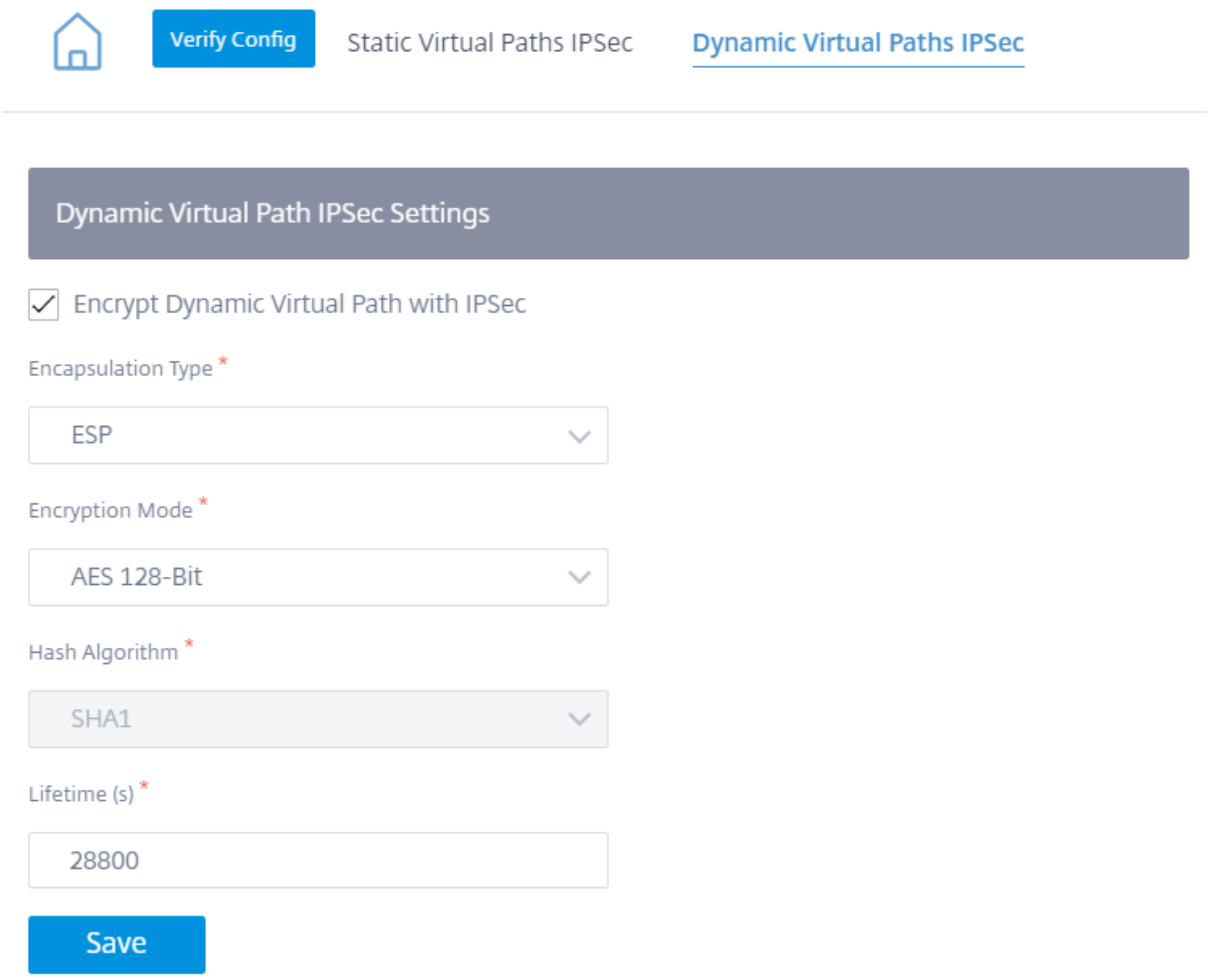
Virtual path IPsec settings

Virtual Path IPsec Settings defines the IPsec tunnel settings to ensure secure transmission of data over the Static Virtual Paths and Dynamic Virtual Paths. Select the **Static Virtual Paths IPSec** or **Dynamic Virtual Paths IPSec** tab to define the IPsec tunnel settings.

- **Encapsulation Type**: Choose one of the following security types:
  - **ESP**: Data is encapsulated and encrypted.
  - **ESP+Auth**: Data is encapsulated, encrypted, and validated with an HMAC.
  - **AH**: Data is validated with an HMAC.
- **Encryption Mode**: The encryption algorithm used when ESP is enabled.
- **Hash Algorithm**: The hash algorithm used to generate an HMAC.
- **Lifetime (s)**: The preferred duration, in seconds, for an IPsec security association to exist. Enter 0 for unlimited.

For information on configuring IPsec service, see IPsec service.



Click **Verify Config** to validate any audit error

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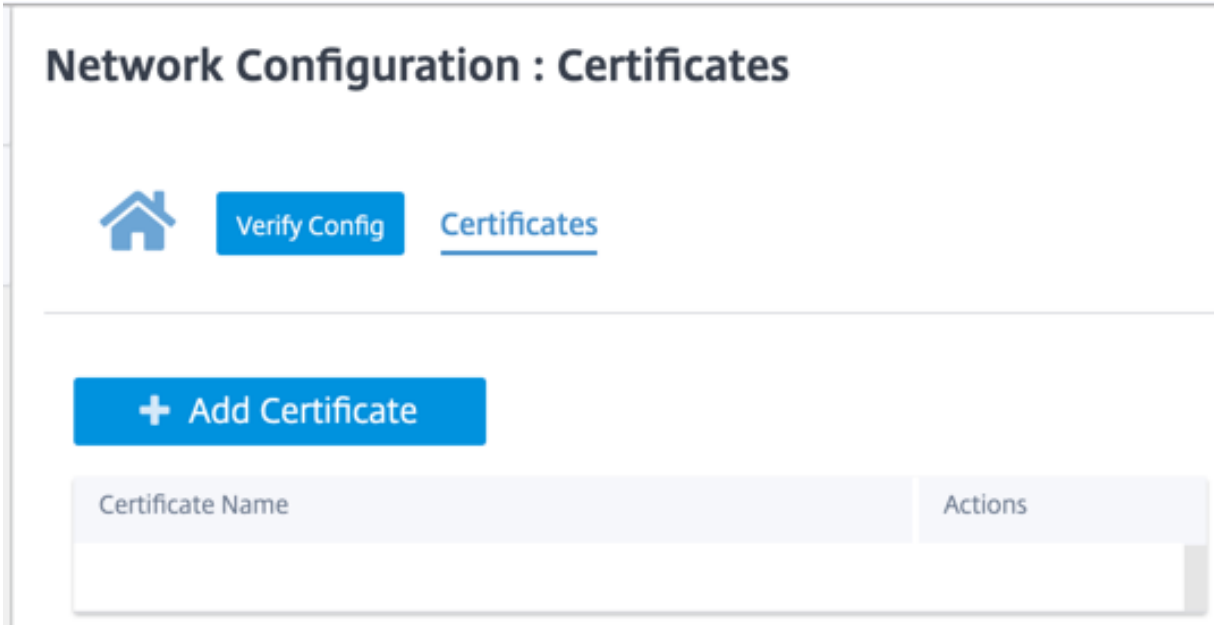
Certificates

There are two types of certificates: Identity and Trusted. Identity Certificates are used to sign or encrypt data to validate the contents of a message and the identity of the sender. Trusted Certificates are used to verify message signatures. Citrix SD-WAN appliances accept both Identity and Trusted Certificates. Administrators can manage certificates in the Configuration Editor.



Click **Verify Config** to validate any audit error

To add a certificate click **Add Certificate**.

- **Certificate Name**: Provide the certificate name.
- **Certificate Type**: Select the certificate type from the drop-down list.
  - **Identity Certificates**: Identity certificates require that the certificate's private key be available to the signer. Identity Certificates or their certificate chains that are trusted by a peer to validate the contents and identity of the sender. The configured Identity Certificates and their respective Fingerprints are displayed in the Configuration Editor.
  - **Trusted Certificates**: Trusted Certificates are self-signed, intermediate certificate authority (CA) or root CA certificates used to validate the identity of a peer. No private key is required for a Trusted Certificate. The configured Trusted Certificates and their respective Fingerprints are listed here.

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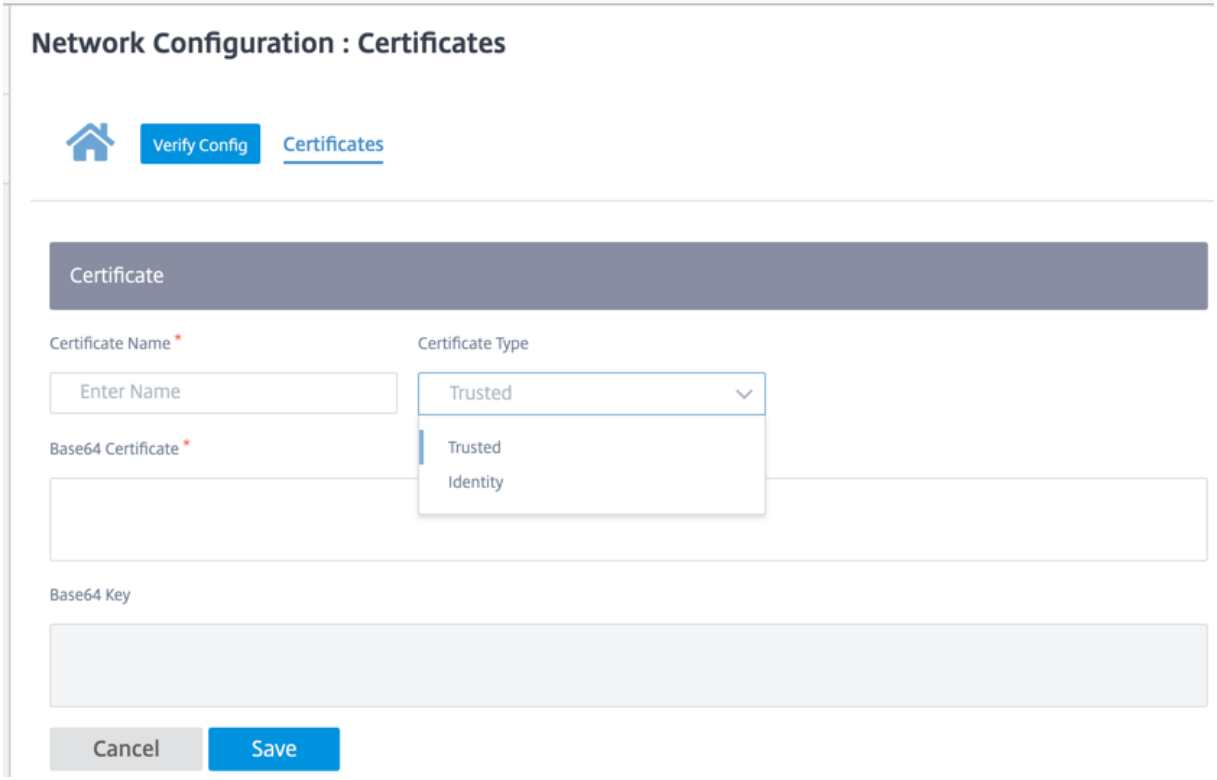

Hosted firewalls

Citrix SD-WAN Orchestrator for On-premises supports the following hosted firewalls:

- Palo Alto Networks
- Check Point

Palo Alto Networks

Citrix SD-WAN Orchestrator for On-premises supports hosting Palo Alto Networks Next-Generation Virtual Machine (VM)-Series Firewall on the SD-WAN 1100 platform. The following are the supported virtual machine models:

- VM 50
- VM 100

The Palo Alto Network virtual machine series firewall runs as a virtual machine on SD-WAN 1100 platform. The firewall virtual machine is integrated in Virtual Wire mode with two data virtual interfaces connected to it. Required traffic can be redirected to the firewall virtual machine by configuring policies on SD-WAN Orchestrator.

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Check Point

Citrix SD-WAN Orchestrator for On-premises supports hosting **Check Point CloudGuard Edge** on SD-WAN 1100 platform.

The **Check Point CloudGuard Edge** runs as a virtual machine on SD-WAN 1100 platform. The firewall virtual machine is integrated in **Bridge** mode with two data virtual interfaces connected to it. Required traffic can be redirected to the firewall virtual machine by configuring policies on SD-WAN Orchestrator.

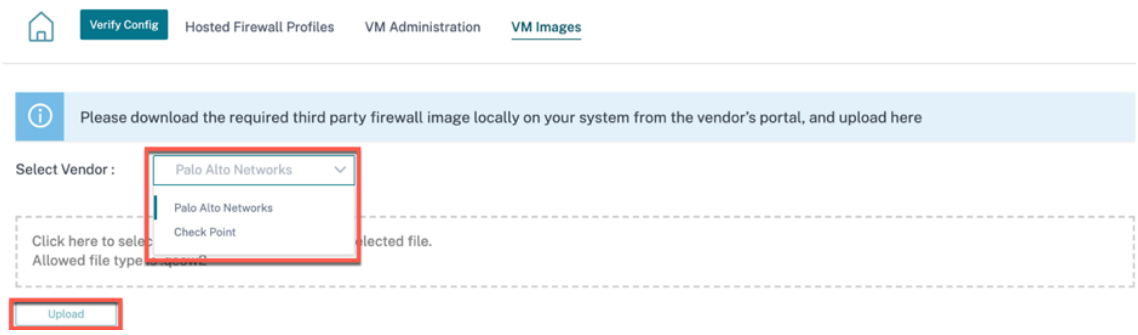
Benefits

The following are the primary goals or benefits of Palo Alto Networks integration on the SD-WAN 1100 platform:

- Branch device consolidation: A single appliance that does both SD-WAN and advanced security
- Branch office security with on-prem NGFW (Next Generation Firewall) to protect LAN-to-LAN, LAN-to-Internet, and Internet-to-LAN traffic

Perform the following steps for provisioning the firewall virtual machine through SD-WAN Orchestrator:

1. From Citrix SD-WAN Orchestrator for On-premises GUI, navigate to **Configuration > Security >** select **Hosted Firewall**.
2. To upload the software image, go to **VM Images** tab. Select the Vendor name as Palo Alto Networks/Check Point from the drop-down list. Click or drop the software image file in the box and click **Upload**.



   A status bar appears with the ongoing upload process. Do not click **Refresh** or perform any other action until the image file shows 100% uploaded.

   After the image is successfully uploaded, it will be available to use and can be selected when initiating the virtual machine provisioning.

3. Go to **VM Administration** tab and click **Provision**.

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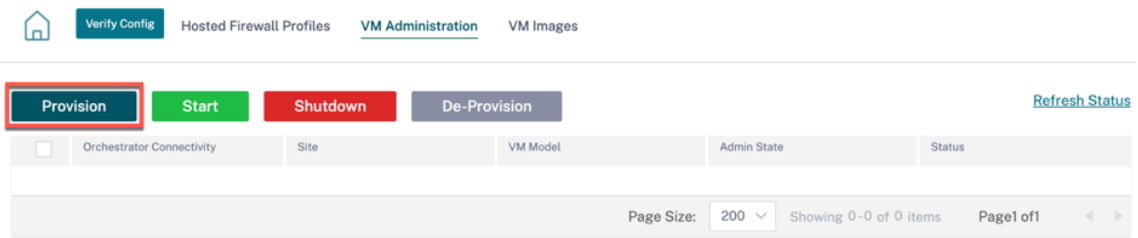
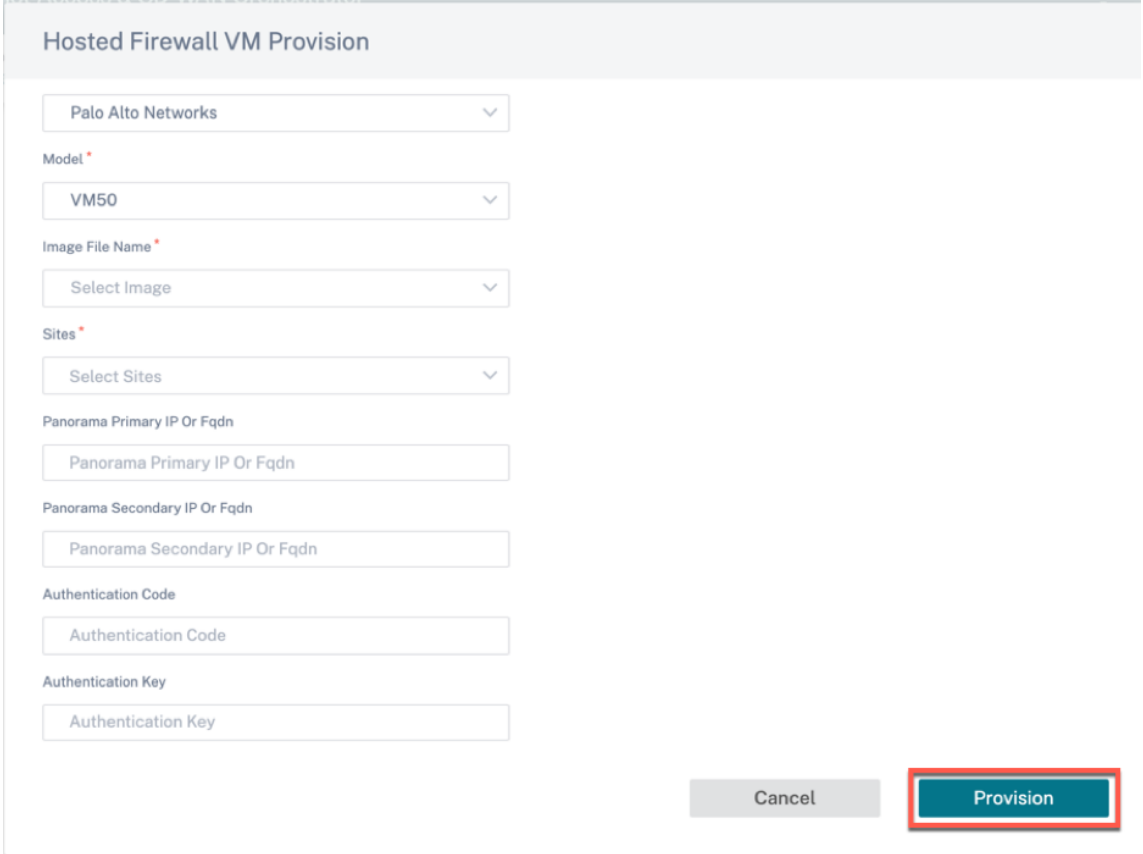


4. Provide the following details:



- **Vendor**: Select the vendor name as **Palo Alto Networks/Check Point**.
- **Model**: Select the virtual machine model number from the drop-down list.
- **Image File Name**: Select the software image from the uploaded files to provision Hosted Firewall virtual machine.

  > **Note**
  >
  > The software image is provided by the vendors (Palo Alto Networks/Check Point).

- **Sites**: Select sites from the drop-down list where Hosted Firewall virtual machine has to be provisioned.
- **Panorama Primary IP or FQDN**: Enter the management server primary IP address or fully qualified domain name (Optional).

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- **Panorama Secondary IP or FQDN**: Enter the management server secondary IP address or fully qualified domain name (Optional).
- **Authentication Code**: Enter the virtual authentication code to be used for licensing.
- **Authentication Key**: Enter the virtual authentication key to be used in the management server.

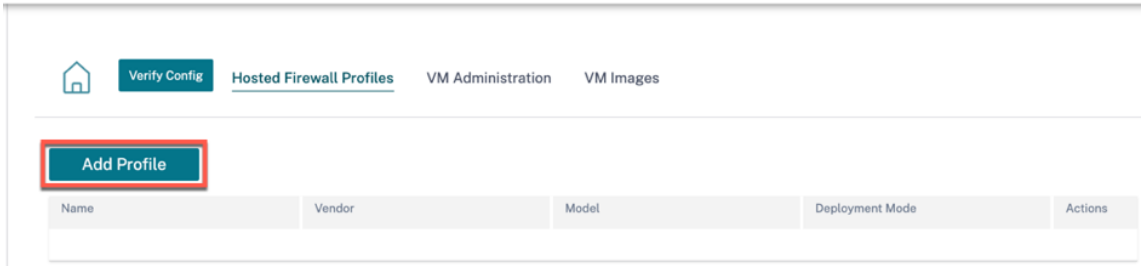
Virtual Machine Authentication Key is needed for automatic registration of the Palo Alto Networks virtual machine to the Panorama.

- Click **Provision**.

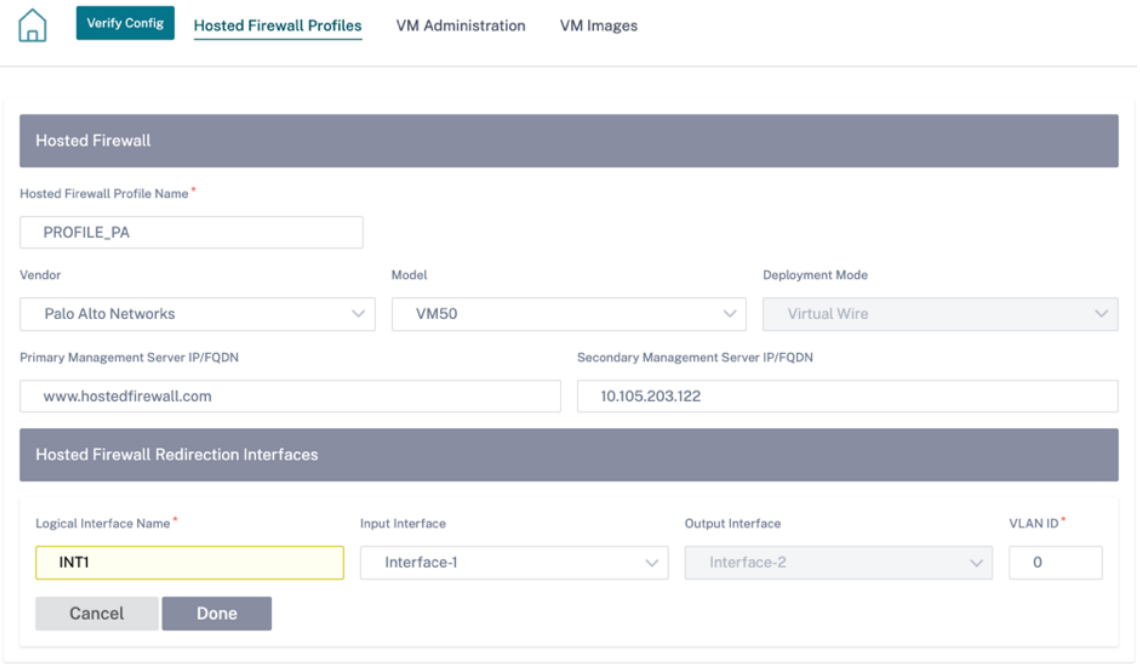
Once the virtual machine is provisioned on the SD-WAN 1100 platform, you can **Start, Shutdown,** or completely **De-Provision** that hosted firewall virtual machine.

Traffic redirection

1. For traffic redirection, go to **Hosted Firewall** Profiles tab and click **Add Profile**.



2. Provide the required information to add the **Hosted Firewall** template and click **Add**.



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The **Hosted Firewall Template** allows you to configure the traffic redirection to the **Firewall virtual machine** hosted on SD-WAN Orchestrator. The following are the inputs needed to configure the template:

- **Hosted Firewall Profile Name**: Name of the hosted firewall template.
- **Vendor**: Name of the firewall vendor.
- **Model**: Virtual Machine model of the hosted firewall. You can select the virtual machine model number as VM 50/VM 100.
- **Deployment Mode**: The Deployment Mode field is auto populated and grayed out. For the Palo Alto Networks vendor, the deployment mode is Virtual Wire and for the Check Point vendor, the deployment mode is Bridge.
- **Primary Management Server IP/FQDN**: Primary management server IP/ fully qualified domain name of Panorama.
- **Secondary Management Server IP/FQDN**: Secondary management server IP/ fully qualified domain name of Panorama.
- **Hosted Firewall Redirection Interfaces**: These are logical interfaces used for traffic redirection between SD-WAN Orchestrator and hosted firewall.

Interface-1, Interface-2 refers to first two interfaces on the hosted firewall. If VLANs are used for traffic redirection then, same VLANs must be configured on the hosted firewall. VLANs configured for traffic redirection are internal to the SD-WAN Orchestrator and hosted firewall.

> **Note**
>
> Redirection input interface has to be selected from connection initiator direction. The redirection interface is automatically chosen for the response traffic. For Example, if outbound internet traffic is redirected to hosted firewall on Interface-1 then, response traffic is automatically redirected to hosted firewall on Interface-2. There is no need of Interface-2, if there is no internet inbound traffic.

Only two physical interfaces are assigned to host the Palo Alto Networks firewall and two data interfaces are assigned to Check Point virtual machine.

If traffic from multiple zones needs to be redirected to the hosted firewall then, multiple sub interfaces can be created using internal VLANs and associated to different firewall zones on the hosted firewall.

> **Note**
>
> SD-WAN firewall policies are auto created to Allow the traffic to/from hosted firewall management servers. This avoids redirection of the management traffic that is originated from (or) destined to hosted firewall.

Traffic redirection to firewall virtual machine can be done using SD-WAN firewall policies.

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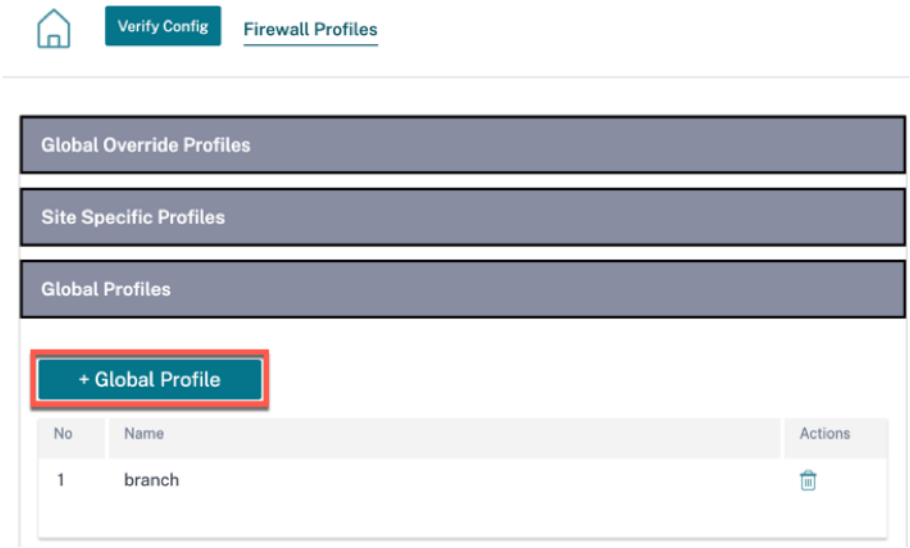
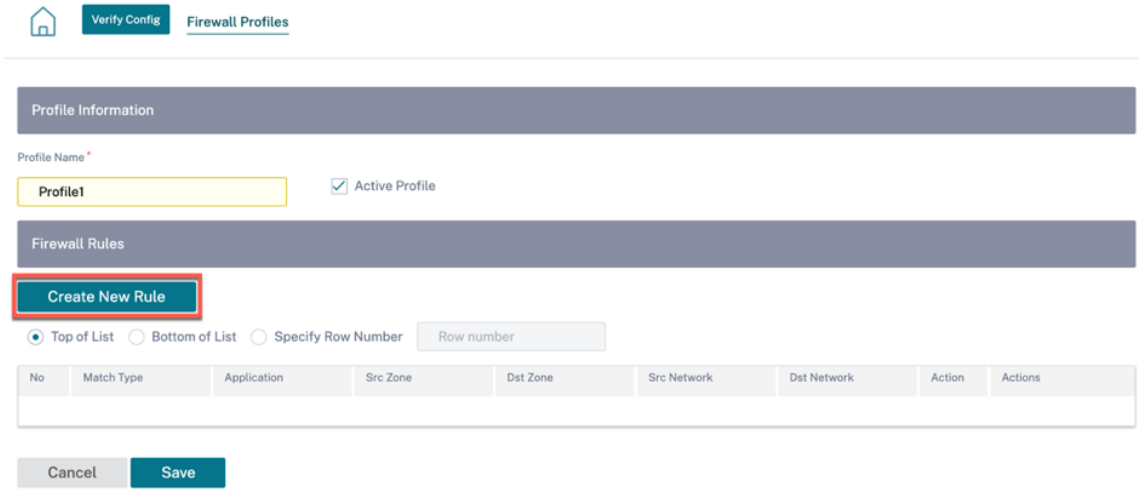
3. Navigate to **Configuration > Security > Firewall Profiles >** go to **Global Profiles** section. Click **+ Global Profile**.



4. Provide a profile name and select the **Active Profile** check box. Click **Create New Rule**.



5. Change the **Policy Type** to **Hosted Firewall**. The **Action** field is auto filled to **Redirect to Hosted Firewall**. Select the **Hosted Firewall Profile** and the **Hosted Firewall Redirection Interface** from the drop-down list.

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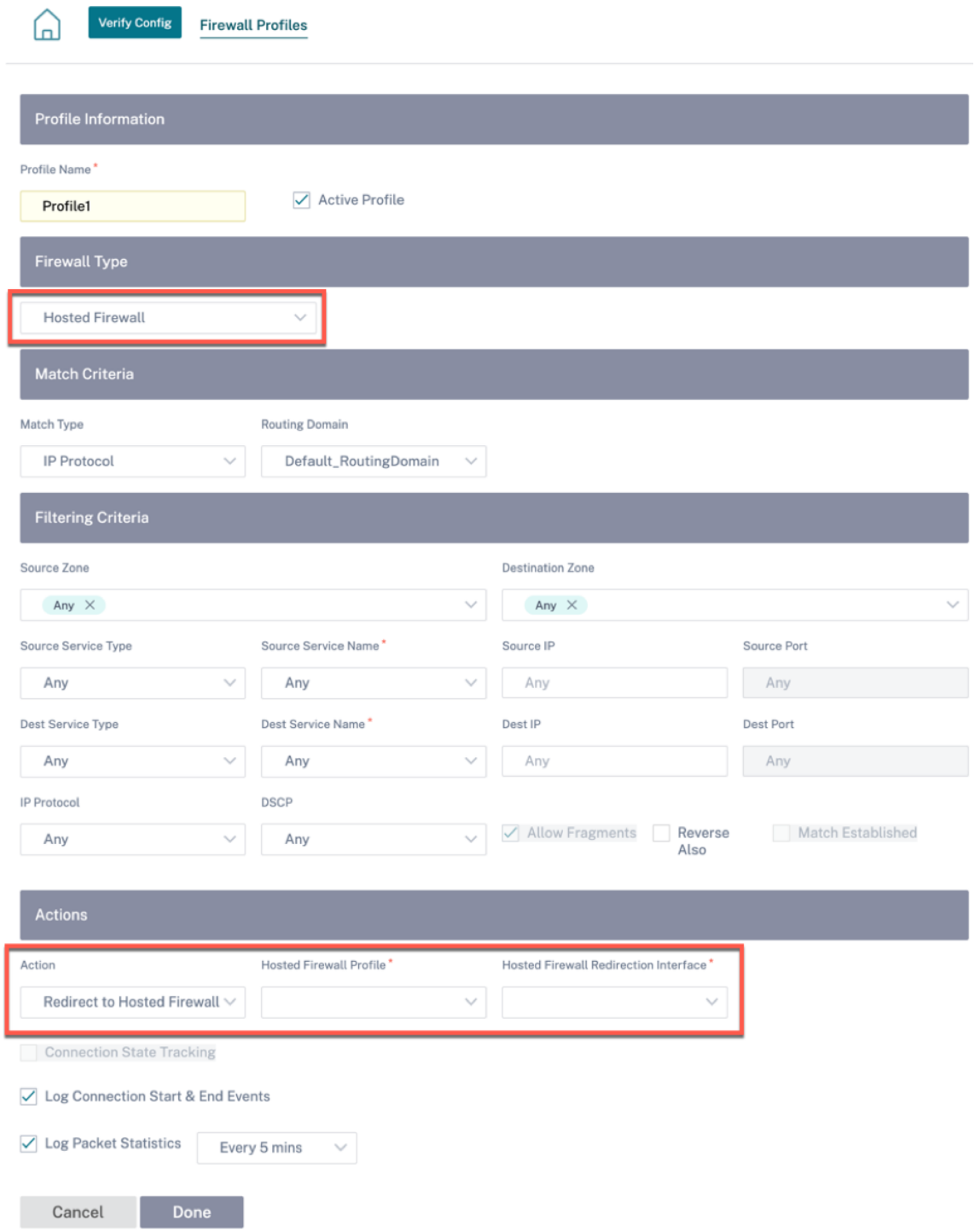

6. Fill the other match criteria as required and click **Done**.

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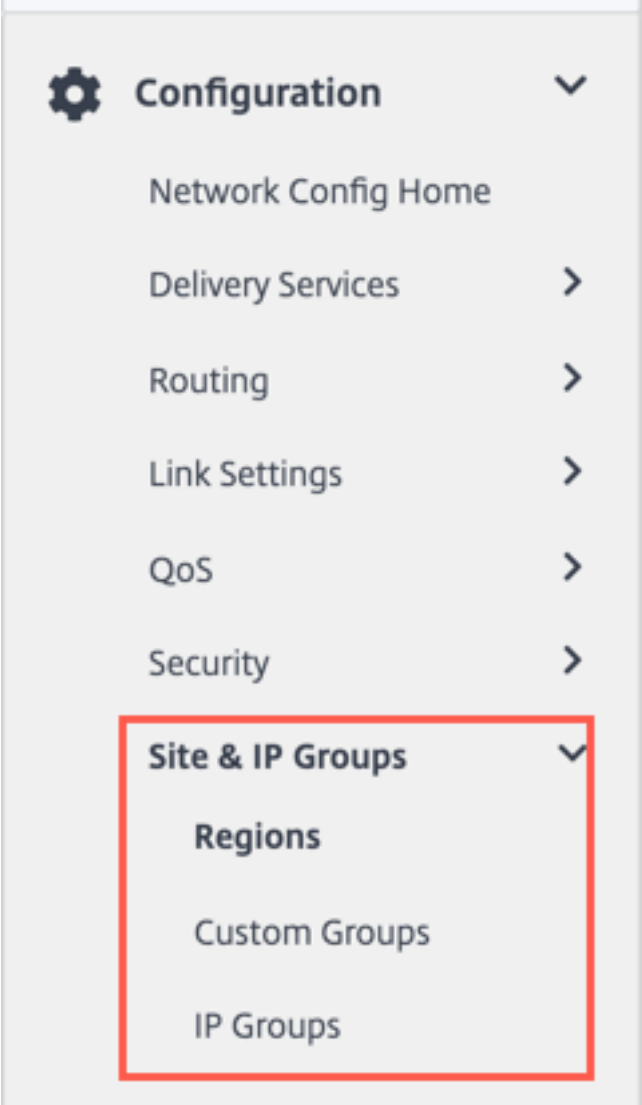
Site and IP Groups

May 28, 2021

Administrators can group sites or IP addresses to simplify common application policies across multiple sites or network addresses, and also serve as filters for reports.

To view Regions, Site and IP Groups, navigate to **Configuration** > **Site & IP Groups**.



Regions

Regions help to create administrative boundaries within large networks spanning hundreds to thousands of sites. If your organization has a large network spanning multiple administrative (or geographical) boundaries, you can consider creating regions to segment the network.

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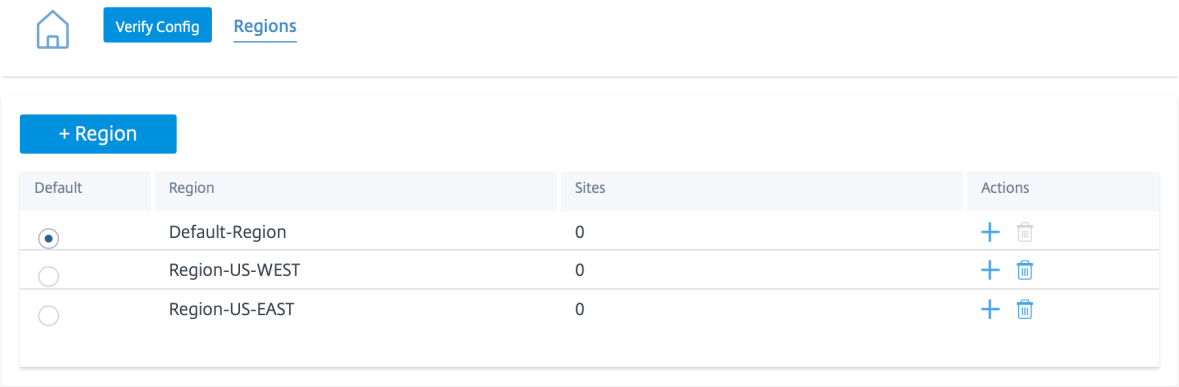

Currently, a maximum of 1000 sites are supported per region. Each region is expected to have a Regional Control Node (RCN), which serves as the hub and controller for the region. So, you would typically consider a multi-region deployment if your network has more than 500 sites. By default, all networks are single region networks, where the Master Control Node (MCN) serves as the hub and the control node for all the sites. On adding one or more regions, the network becomes a multi-region network. The region associated with the MCN is called the **default region**.

A multi-region network supports a hierarchical architecture with an MCN controlling multiple RCNs. Each RCN, in turn, controls multiple branch sites. Even in a multi-region deployment, you can have the MCN double up as the direct hub node for a subset of the sites while having the rest of the sites use their respective RCNs as hub nodes.

The sites being managed directly by the MCN that is, the RCNs and potentially some other sites directly managed by the MCN are said to be in the **default** region. The **default region** would be the only region for a network before other regions are added. After adding other regions, you can select the **Default** option to use a desired region as the default region.

To create a region:

1. Click **+ Region**. Provide a region name and description.
2. Enable Interval VIP matching based on whether you want **Forced Internal VIP Matching** or **Allow External VIP Matching**.
    - Forced Internal VIP Matching: When enabled, all non-private Virtual IP addresses in the Region are forced to match the configured subnets.
    - Allowed External VIP Matching: When enabled, non-private Virtual IP addresses from other regions are allowed to match the configured subnets.
3. Click **+ Subnets** to add subnets. Enter a **Network** address. The network address is the IP address and mask for the subnet.
4. Select the sites.

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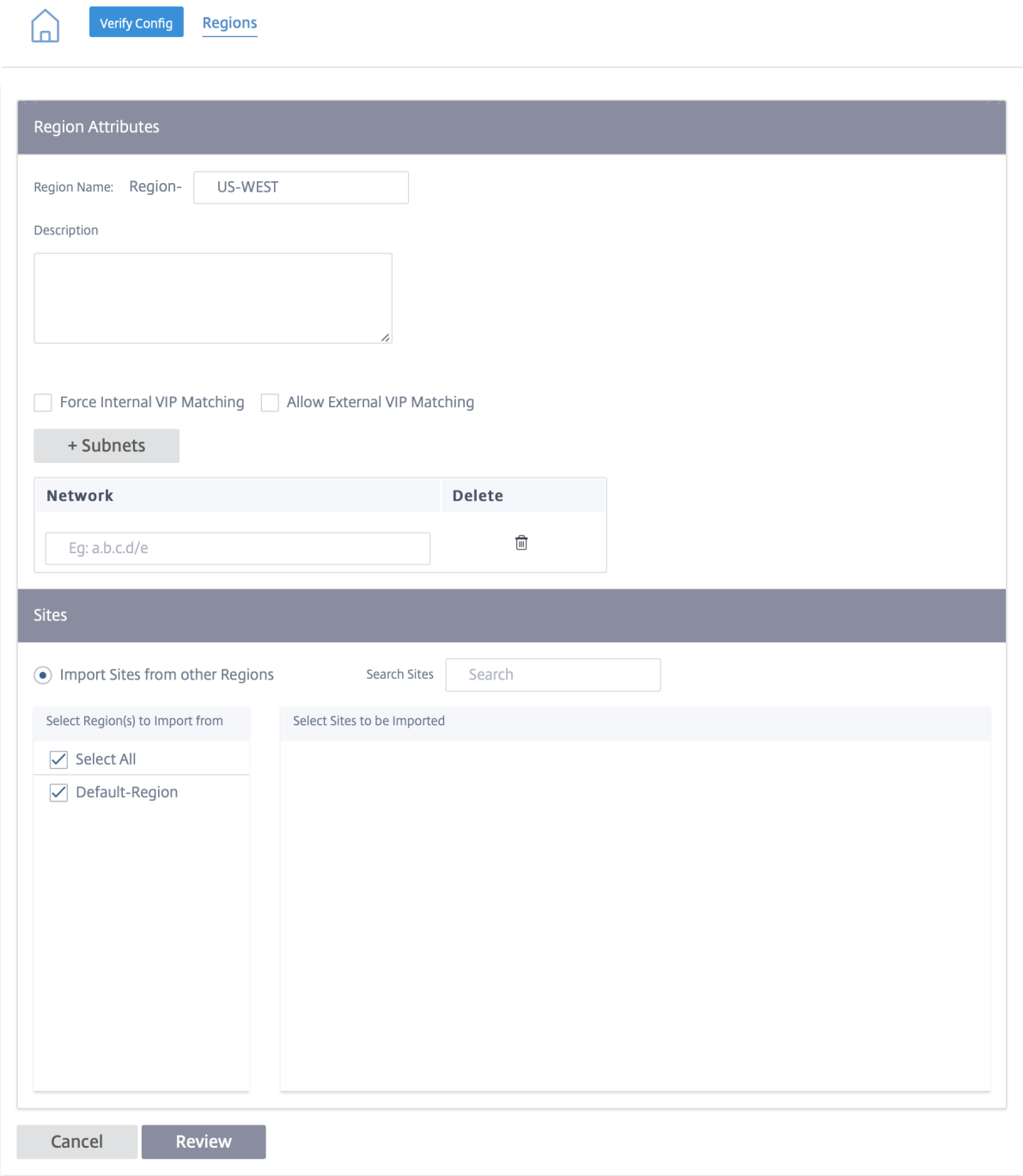
5. Click **Review** and then **Save**. The newly created region is added to the existing list of regions.

> **Note**
>
> A customer can only have Static or Dynamic Virtual paths within a Region.



You can place sites under the region once a Region is created successfully.

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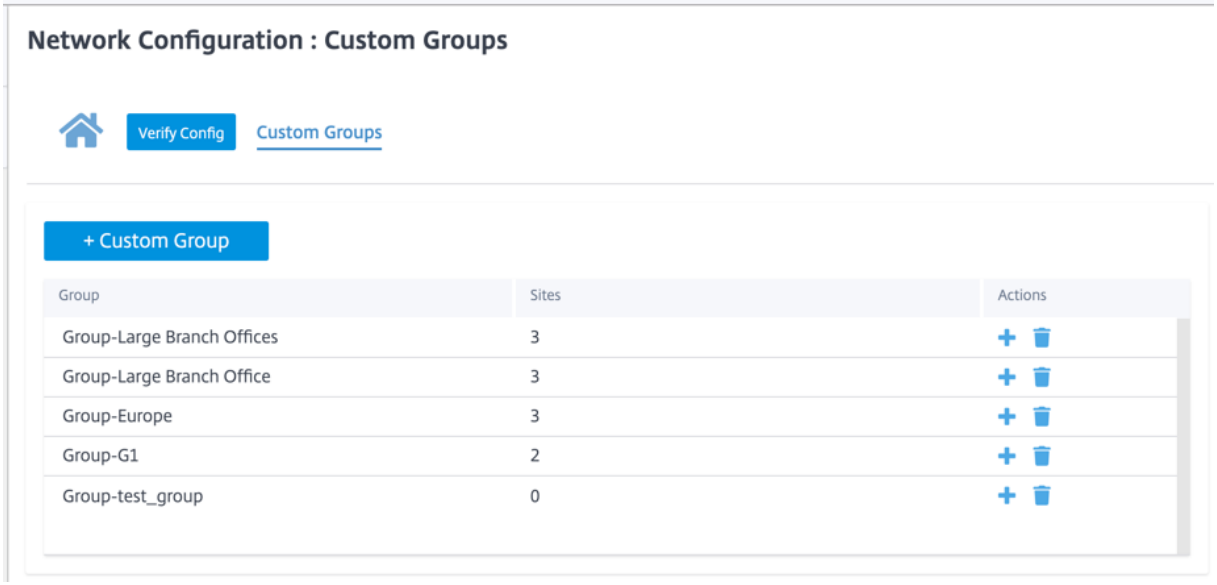
> **Note**
>
> Dynamic virtual paths cannot be established between branches in different regions.

Click **Verify Config** to validate any audit error.

Custom groups

Custom Groups provide users the flexibility to group sites as needed. Users can apply policies for groups of sites at once, without necessarily having to deal with each site individually. Groups can also serve as filters for dashboards, reports, or network configuration. Unlike Regions, groups can overlap in terms of sites. In other words, the same sites can be part of multiple groups.



For example, a user can create a group named **Business Critical Sites** to configure common policies for all your business-critical sites. The user can also monitor their health and performance separately as a group. Some of those sites can also be a part of a **Large Branch Office** group, for instance.

Custom Site Groups provide a way to logically group sites together for reporting purposes. You can create custom groups and add sites to each custom group. To create a custom group click **+ Custom Group**. Provide a group name and select or add sites. Click **Review** and then **Save**.

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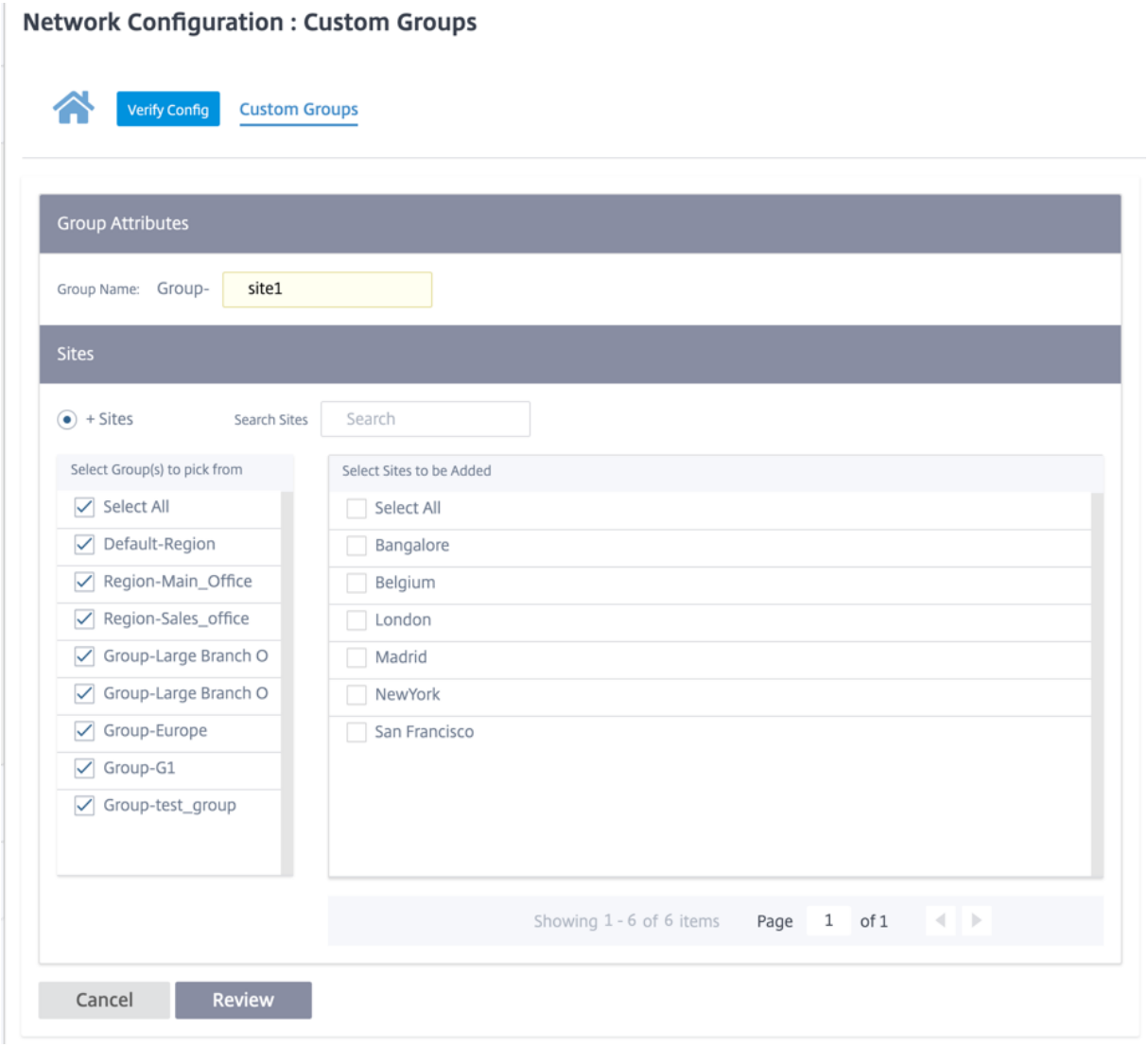

Click **Verify Config** to validate any audit error.

IP groups

Users can group IP and network addresses by using **IP Groups**. These groups can be used in configuration and policies as needed, without necessarily having to key in individual IP addresses each time.

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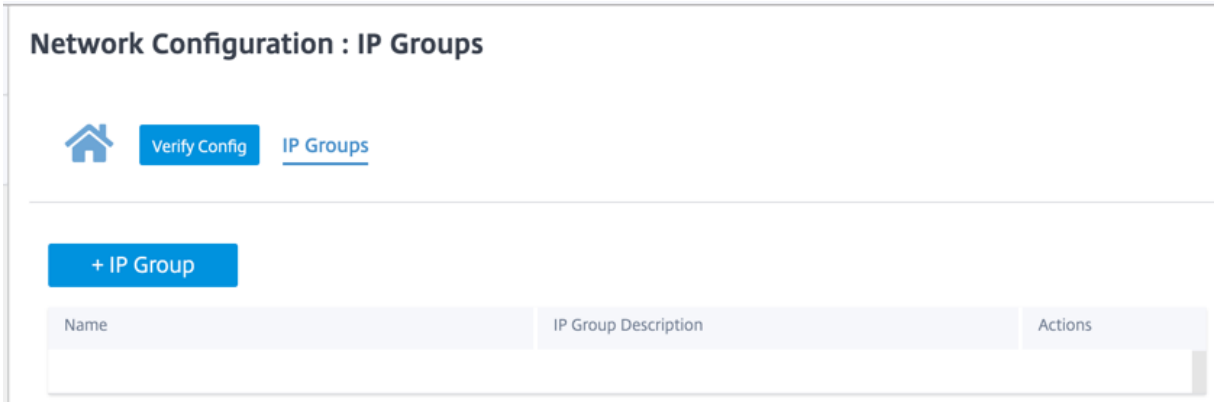
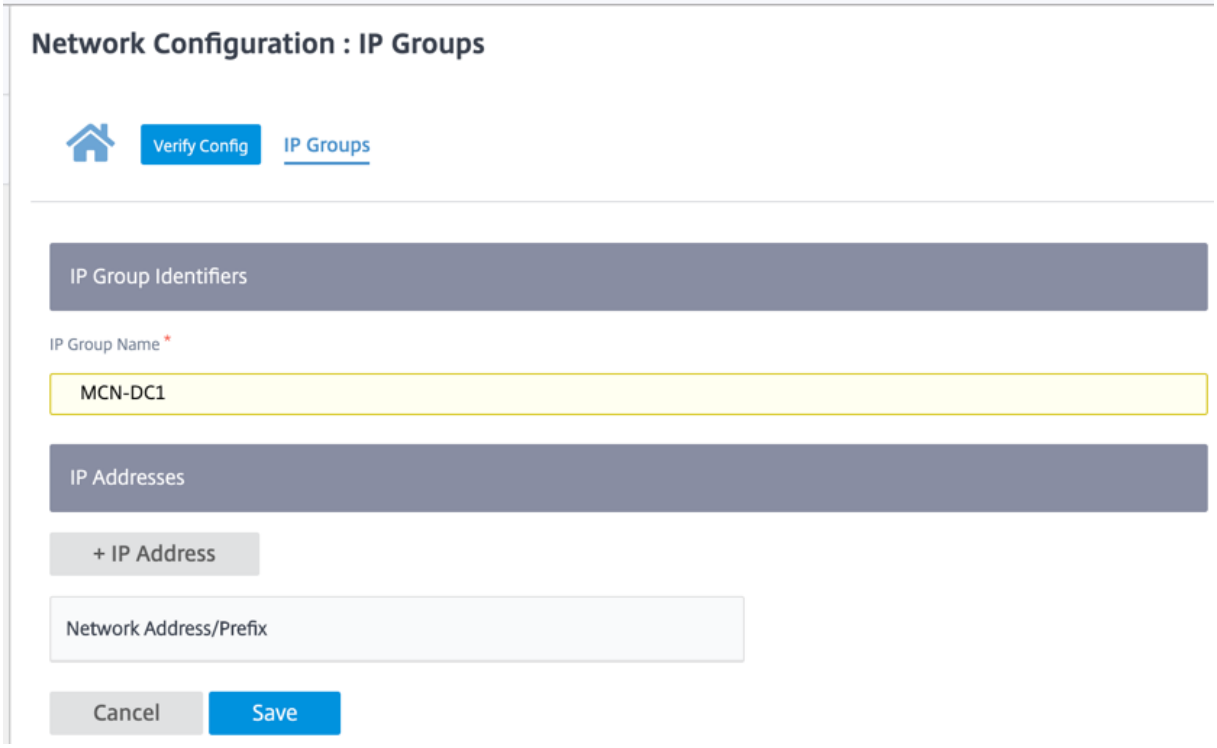


You can create IP groups and add sites to each IP group. Network objects can be grouped based on the IP address. To create an IP group, select **IP Groups** and click **+ IP Group**. Provide a group name. Click **+ IP Address** and enter **IP addresses** to be added to the IP group.



Click **Verify Config** to validate any audit error

Application and DNS settings

July 14, 2021

This section enables users to custom define applications, group applications for use in policies, QoS Profiles, and also DNS settings.

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You can define an **Application Group** for both predefined and custom applications. An **Application Group** contains applications that need similar treatment when defining a security policy.

You can reuse the **Application Groups** frequently when defining policies such as application steering or firewall rules. It eliminates the need to create multiple entries for each individual application. Similarly, while using any application services, Application Groups supports common applications with a unique name for simplified and consistent reuse.

To view **Apps and DNS settings**, navigate to **Configuration > Application & DNS Settings**.

Application settings

The Citrix SD-WAN appliances perform Deep Packet Inspection (DPI) to identify and classify applications. The DPI library recognizes thousands of commercial applications. It enables real-time discovery and classification of applications. Using the DPI technology, the SD-WAN appliance analyses the incoming packets and classifies the traffic as belonging to a particular application or application family.

DPI is enabled globally, by default, for all the sites in your network. Disabling DPI stops DPI classification capability on the appliance. You can no longer use DPI classified application / application categories to configure firewall, QoS, and routing policies. You will also not be able to view the top applications and application categories report.

To disable global DPI, at the Network level, navigate to **Configuration** > **App & DNS Settings** > **Application Settings** and clear the **Enable Global DPI** check box option.

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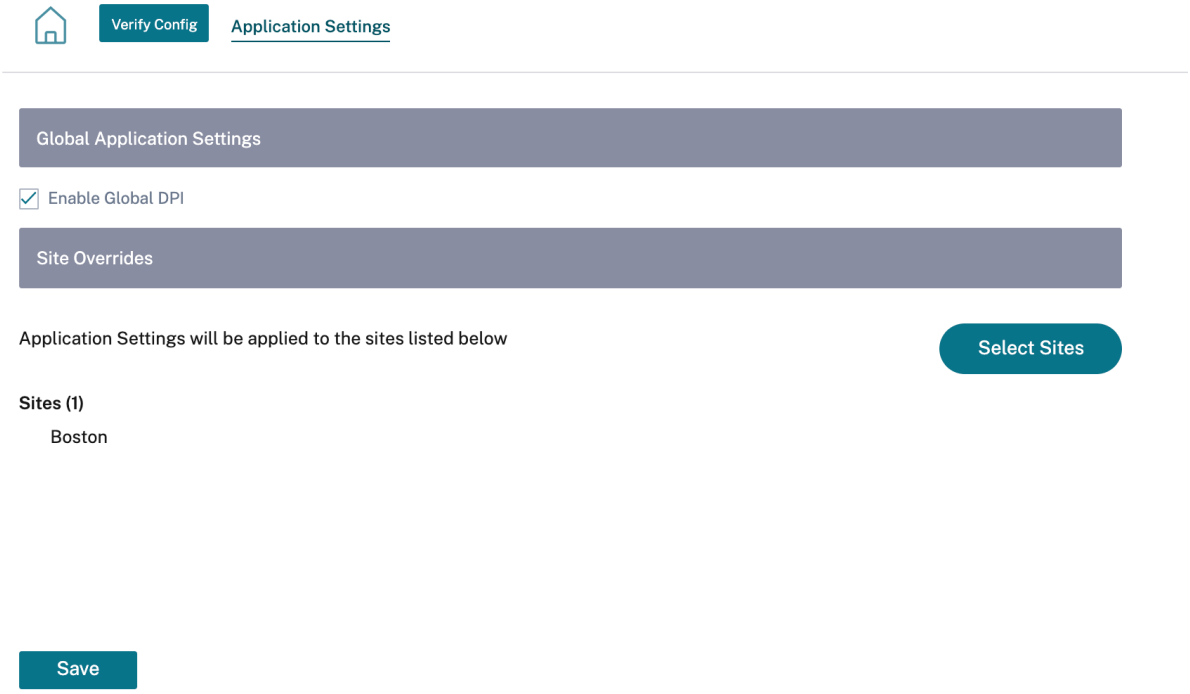

You can also choose to disable DPI for certain sites only by overriding the global DPI settings. To disable DPI for selected sites, add the sites to the **Site Overrides** list.

Custom application

The **Custom Applications** are used to create internal applications or IP-port combinations which are not available in the list of published applications. The administrator needs to define a custom application that can be used in multiple policies as needed, without referring the IP address and port number details each time.

The administrator can define a custom application based on the IP protocol or Domain name.

To create a custom application using an IP protocol, click **+ Custom Application** and provide a name for the custom application. Specify the match criteria such as IP protocol, network IP address, port number, and, DSCP tag. The data flow matching this criteria is grouped as the custom application.

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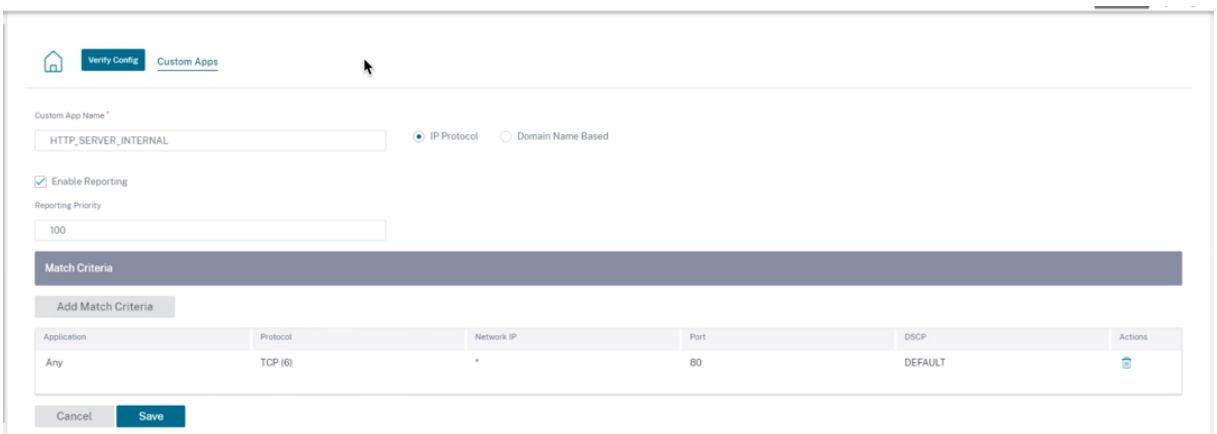

Once saved, the custom applications show up in a list and can be edited or deleted, as required.

The **Enable Reporting** check box is added for the IP Protocol-based custom applications and application groups. You must select the **Enable Reporting** check box and provide the reporting priority.

With the Enable Reporting feature, you can not only view the DPI classified application report but also view the IP protocol and domain name-based custom application traffic under **Reports** > **Usage**.

Reporting priority is the order in which IP protocol-based custom applications or application groups are selected for the reporting. It helps to choose the high-priority custom application or application group for reporting, when there are multiple matches with reporting enabled. For example, if the reporting priority of a custom application is set to 1, it means that the custom application gets the highest priority in reporting. Whereas if the reporting priority is set to 100, the custom application takes a much lesser precedence in reporting.

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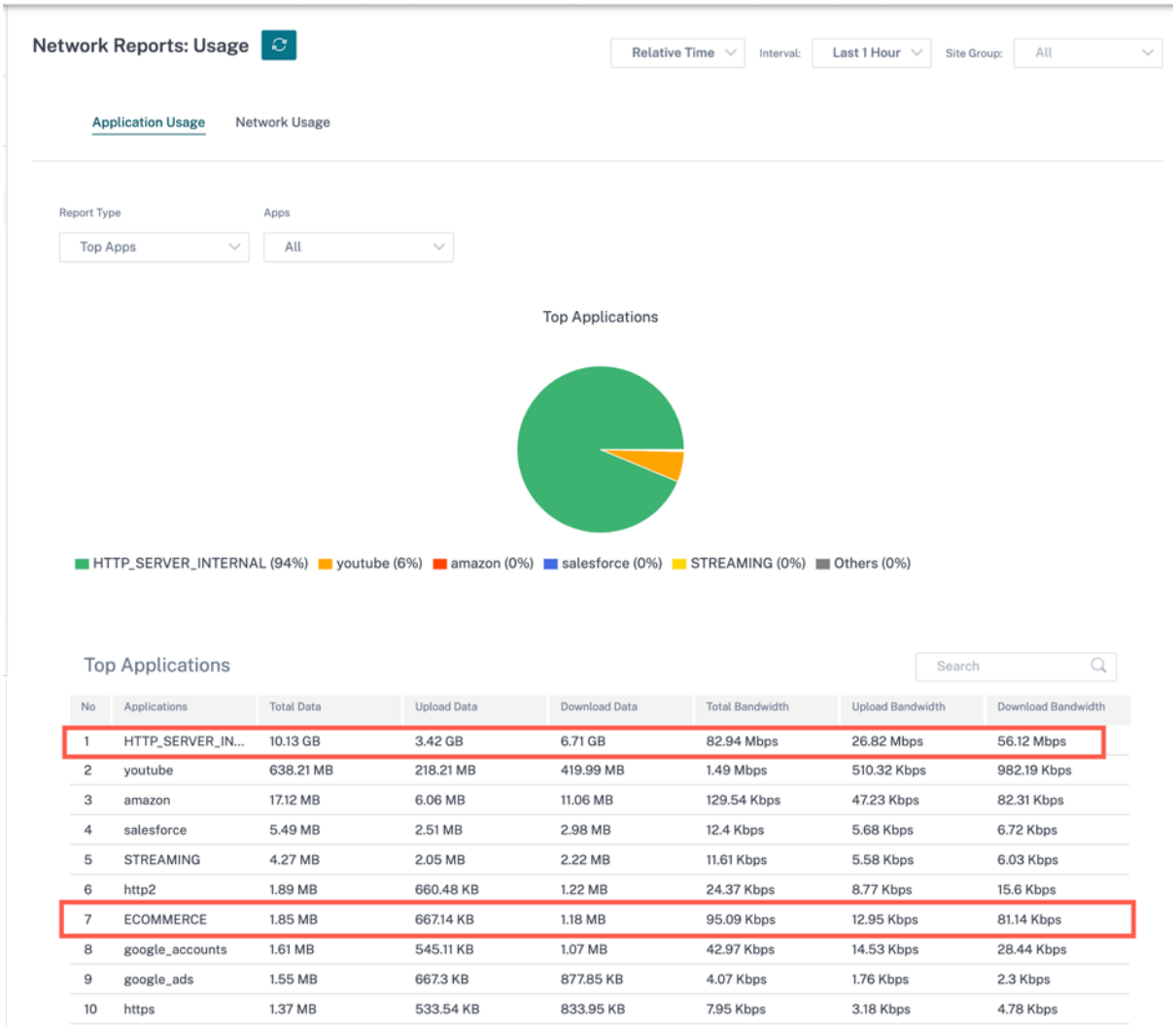

No	Applications	Total Data	Upload Data	Download Data	Total Bandwidth	Upload Bandwidth	Download Bandwidth
1	HTTP_SERVER_IN...	10.13 GB	3.42 GB	6.71 GB	82.94 Mbps	26.82 Mbps	56.12 Mbps
2	youtube	638.21 MB	218.21 MB	419.99 MB	1.49 Mbps	510.32 Kbps	982.19 Kbps
3	amazon	17.12 MB	6.06 MB	11.06 MB	129.54 Kbps	47.23 Kbps	82.31 Kbps
4	salesforce	5.49 MB	2.51 MB	2.98 MB	12.4 Kbps	5.68 Kbps	6.72 Kbps
5	STREAMING	4.27 MB	2.05 MB	2.22 MB	11.61 Kbps	5.58 Kbps	6.03 Kbps
6	http2	1.89 MB	660.48 KB	1.22 MB	24.37 Kbps	8.77 Kbps	15.6 Kbps
7	ECOMMERCE	1.85 MB	667.14 KB	1.18 MB	95.09 Kbps	12.95 Kbps	81.14 Kbps
8	google_accounts	1.61 MB	545.11 KB	1.07 MB	42.97 Kbps	14.53 Kbps	28.44 Kbps
9	google_ads	1.55 MB	667.3 KB	877.85 KB	4.07 Kbps	1.76 Kbps	2.3 Kbps
10	https	1.37 MB	533.54 KB	833.95 KB	7.95 Kbps	3.18 Kbps	4.78 Kbps

You can also group several domain names as an application. To create custom applications based on domain name, select **Domain Name Based**. Enter the application name and the required domain names or patterns. You can either enter the full domain name or use wild cards at the beginning.

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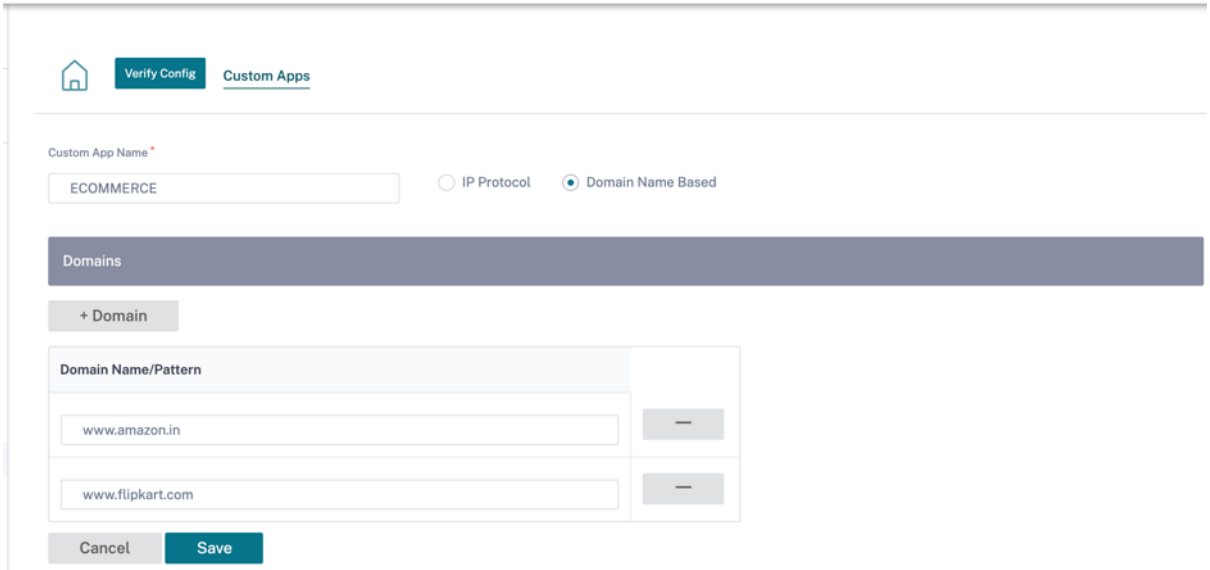
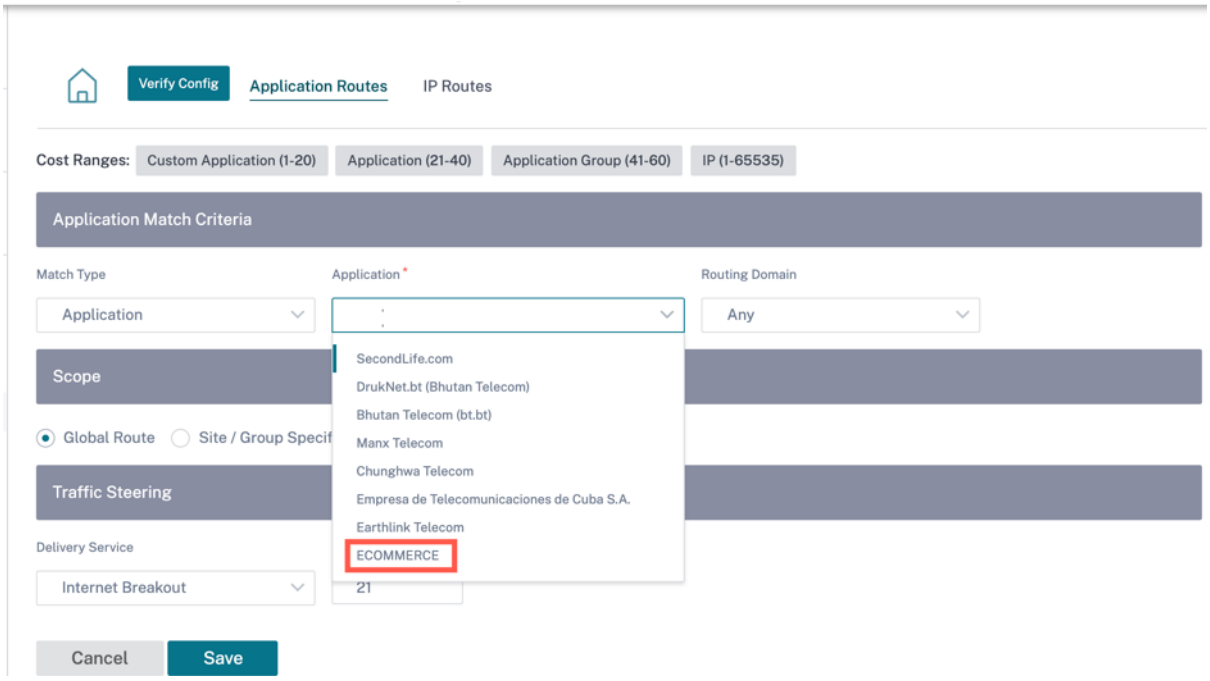


All the domain name based custom applications are visible in **Application Routing, Application Rule,** and **Firewall Profiles**.

> **Note**
>
> To use a custom name based application, the match criteria must be listed as Application while creating the Application Route and firewall policy.

Once you have created the custom application, to perform the application routing, navigate to **Routing > Routing Policies > + Application Route**, select the custom application under the **Application** drop-down list.



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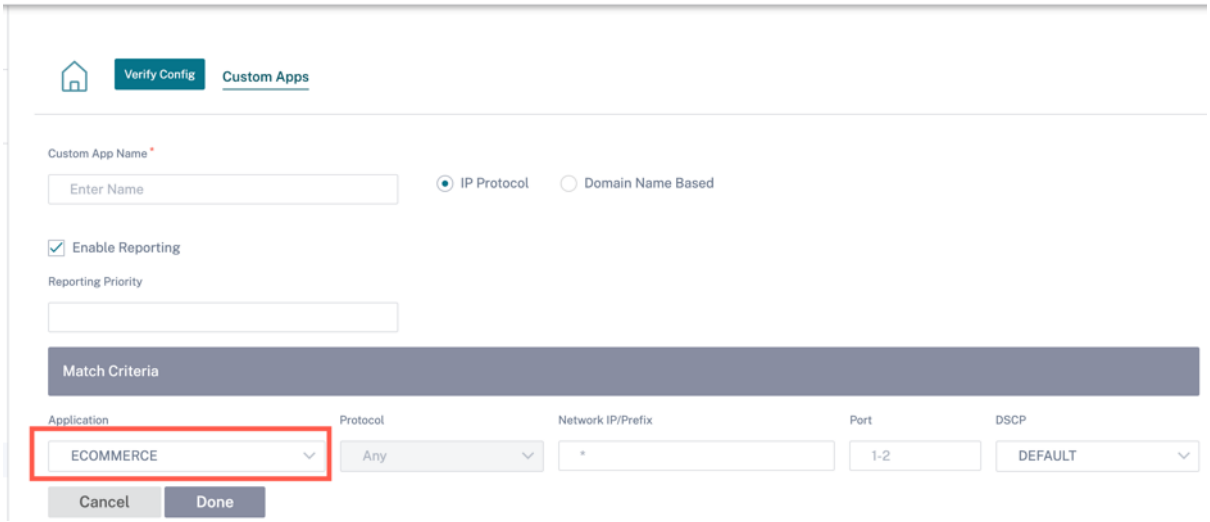
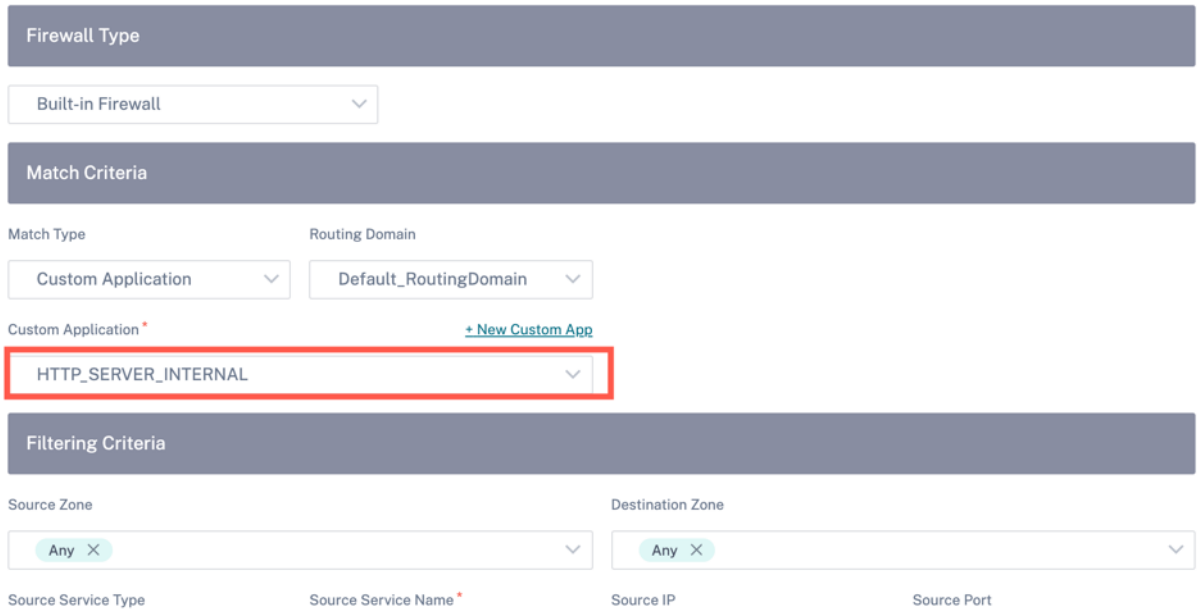
You can also select the DNS based custom application under the match criteria of an **IP Protocol** custom application.



Similarly, to view the custom application under the **Firewall Policies**, navigate to **Security > Firewall Policies**. The application can be used for any type of policy (Global override/Site Specific/Global Policies). Click **Create New Rule** and under **Match Criteria**, select the custom application from the drop-down list.



You can view the DNS based custom applications both under **Global or Site/Group Specific Rule**. To view the custom application under the **Application Rule**, navigate to **QoS > QoS Policies > Global Rules > Application Rule >** under **Application Match Criteria**, select the custom application from the **Application** drop-down list.

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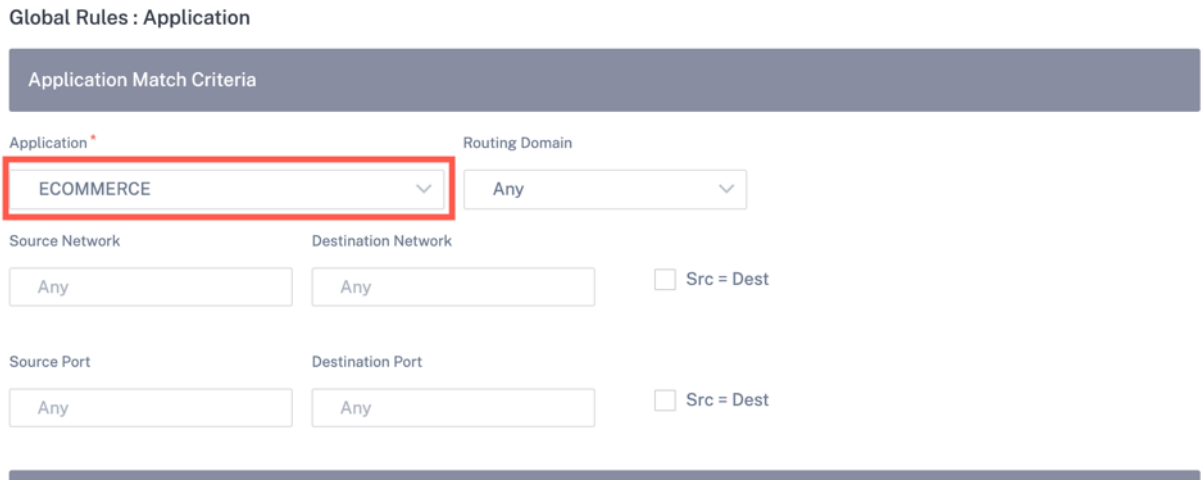

Click **Verify Config** to validate any audit error.

Application groups

An **Application Group** helps administrators group similar applications together for use in common policies, without necessarily having to create a policy for each individual application.

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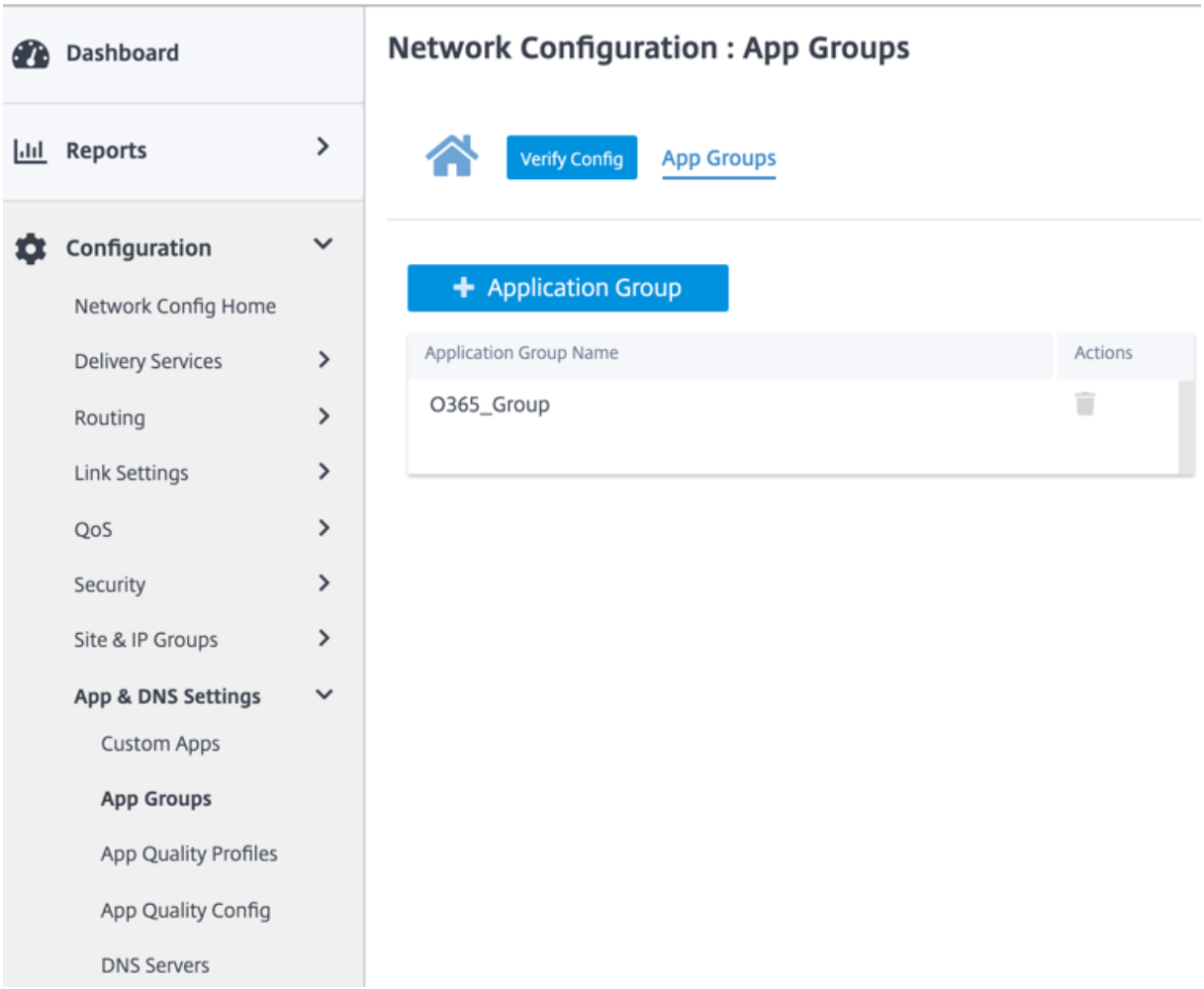

You can create an **Application Group** by using the **Add Application Groups** option. You can refer the same Application Group while creating a policy as per the application role. The policy that is defined for the particular group is applied to each application that matches to the specific category.

For example, you can create an **Application Group** as **Social Networking** and add social networks such as Facebook, LinkedIn, and Twitter to the group to define certain policies for social networking applications.

To create an **Application Group**, specify a group name, search, and add apps from the **Applications** list.

You can always go back and edit your settings or delete **Application Group** as needed.

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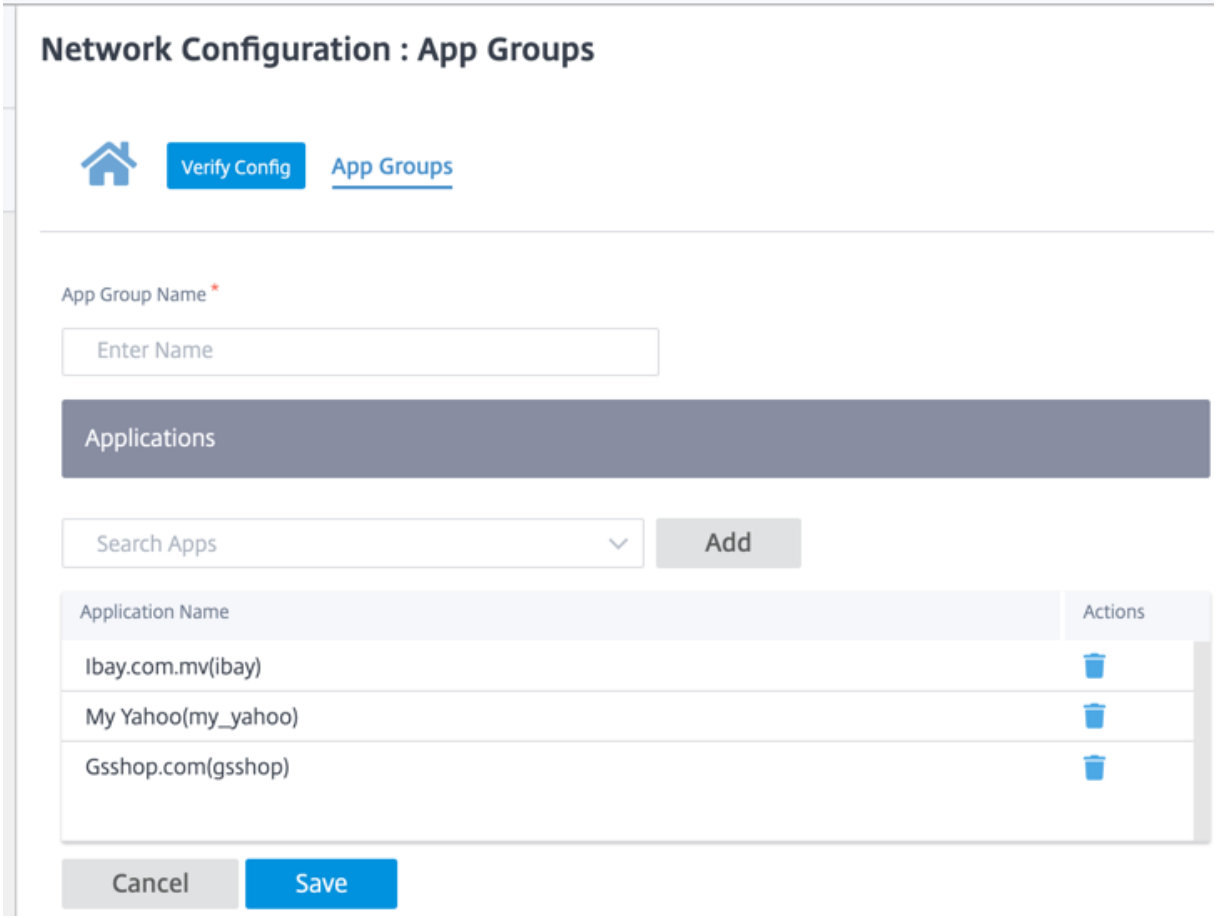

Click **Verify Config** to validate any audit error.

Application quality profiles

This section enables you to view and create application quality profiles.

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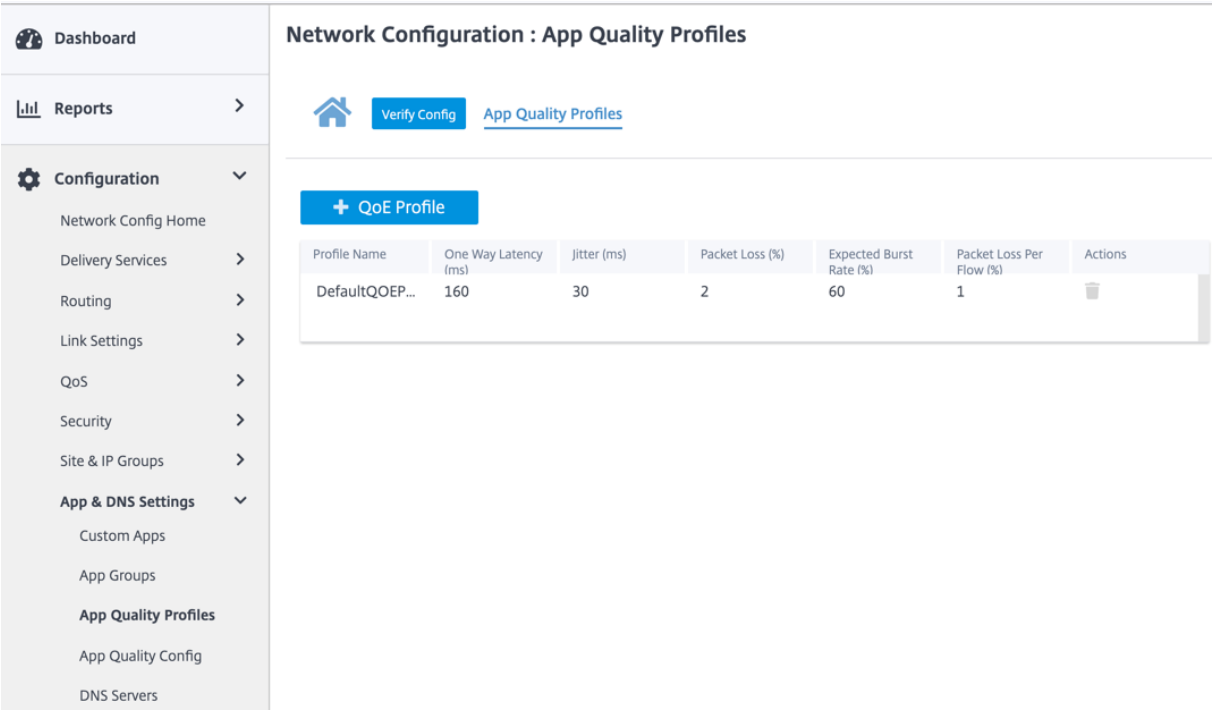

Application QoE is a measure of Quality of Experience of applications in the SD-WAN network. It measures the quality of applications that flow through the virtual paths between two SD-WAN appliances.

The Application QoE score is a value between 0 and 10. The score range that it falls in determines the quality of an application.

Quality	Range
Good	8–10
Fair	4–8
Poor	0–4

Application QoE score can be used to measure the quality of applications and identify problematic trends.

Profile configuration

Click **+ QoE Profile** to create a QoE profile, specify a profile name, and select a traffic type from the drop-down list.

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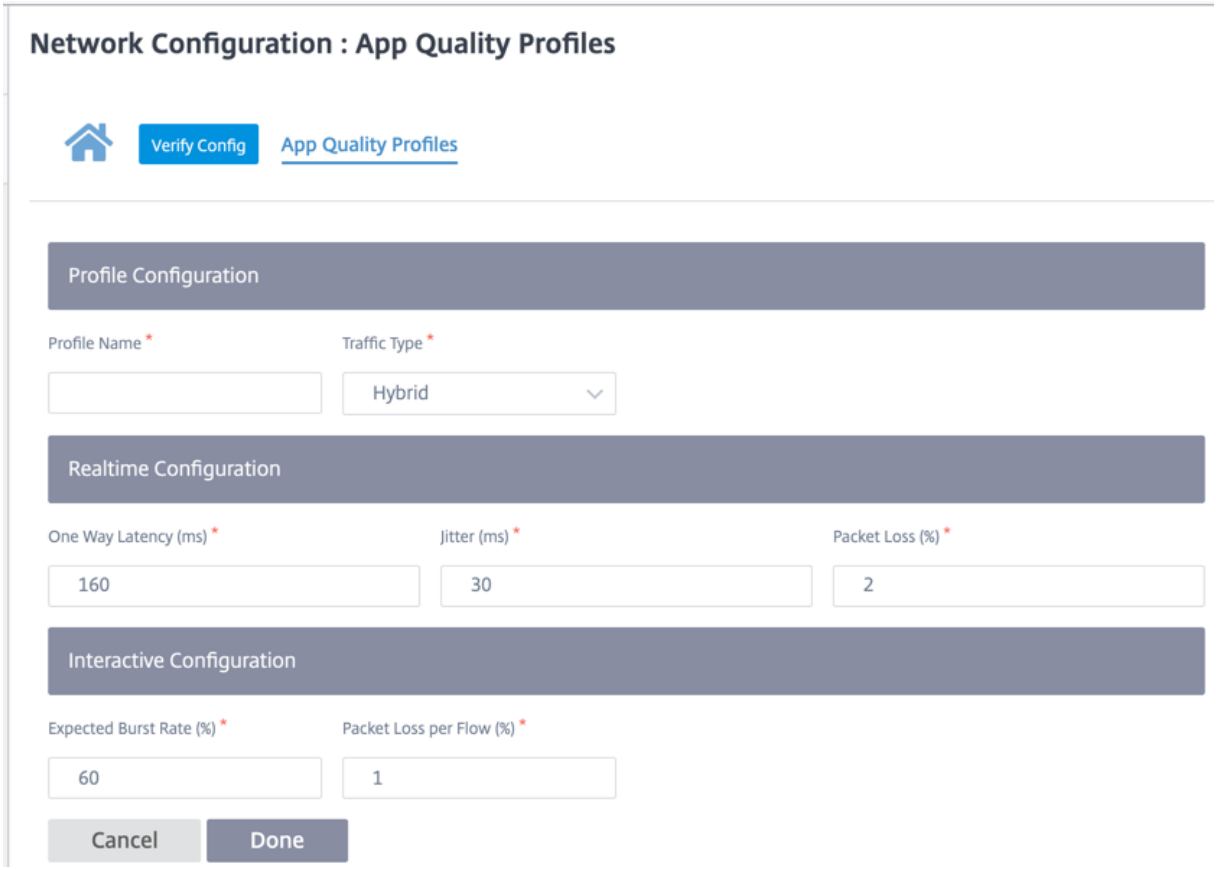

Real-time configuration

You can define the quality thresholds for real-time and interactive appliances using QoE profiles, and map these profiles to applications or applications objects.

The Application QoE calculation for real-time applications uses a Citrix innovative technique, which is derived from the MOS score.

The default threshold values are:

- Latency threshold (ms): 160
- Jitter Threshold (ms): 30
- Packet loss threshold (%): 2

A flow of a real-time application that meets the thresholds for latency, loss, and jitter is considered to be of good quality.

QoE for Real-time applications is determined from the percentage of flows that meet the threshold divided by the total number of flow samples.

QoE for Real-time = (No of flow samples that meet the threshold / Total no of flow samples) * 100

It is represented as QoE score ranging from 0 to 10.

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Interactive configuration

The Application QoE for interactive applications uses a Citrix innovative technique based on packet loss and burst rate thresholds.

Interactive applications are sensitive to packet loss and throughput. Therefore, we measure the packet loss percentage, and the burst rate of ingress and egress traffic in a flow.

The configurable thresholds are:

- Packet loss percentage.
- Percentage of expected egress burst rate in comparison to the ingress burst rate.

The default threshold values are:

- Packet loss threshold: 1%
- Burst rate: 60%

A flow is of good quality if the following conditions are met:

- The percentage loss for a flow is less that the configured threshold.
- The egress burst rate is at least the configured percentage of ingress burst rate.

Application quality configuration

Map application or application objects to default or custom QoE profiles. You can create custom QoE profiles for real-time and interactive traffic.

Click **+QoE Configuration** to create custom QoE profiles:

- **Type**: Select the DPI application or an application object (Application, Custom Apps, and Application Groups).
- **Application**: Search and select an application or application object based on the selected Type.
- **QoE Profile**: Select a QoE profile to map to the application or application object.

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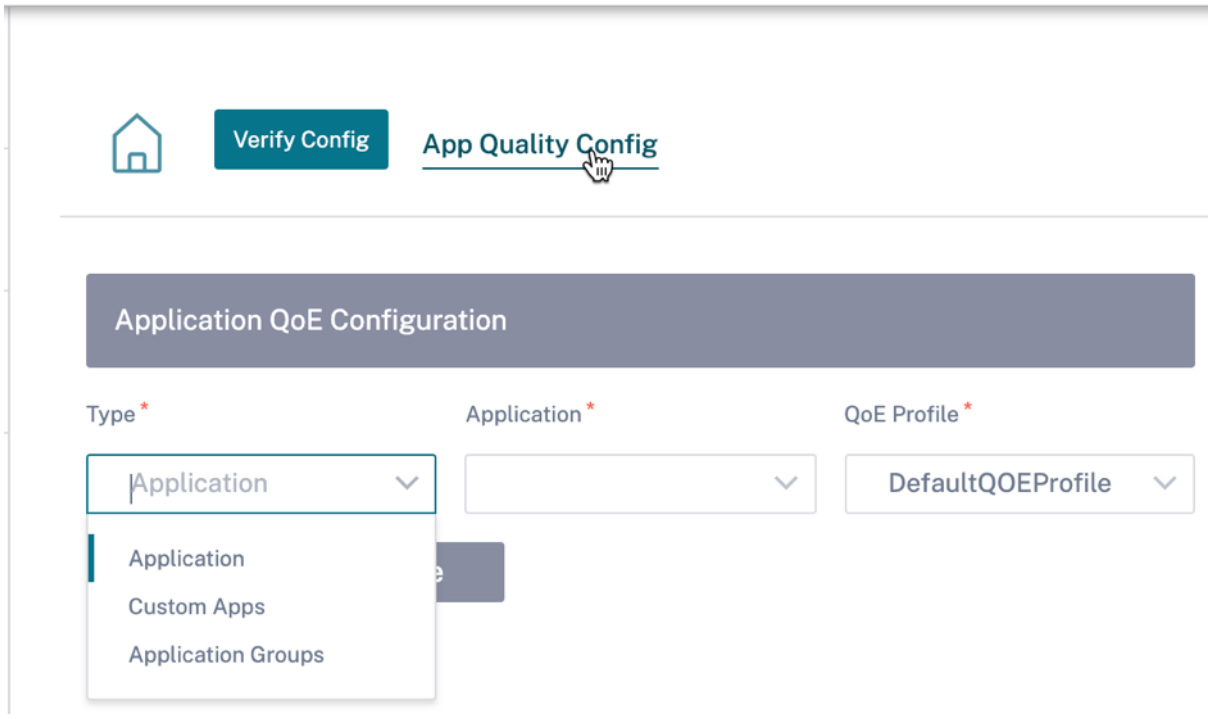
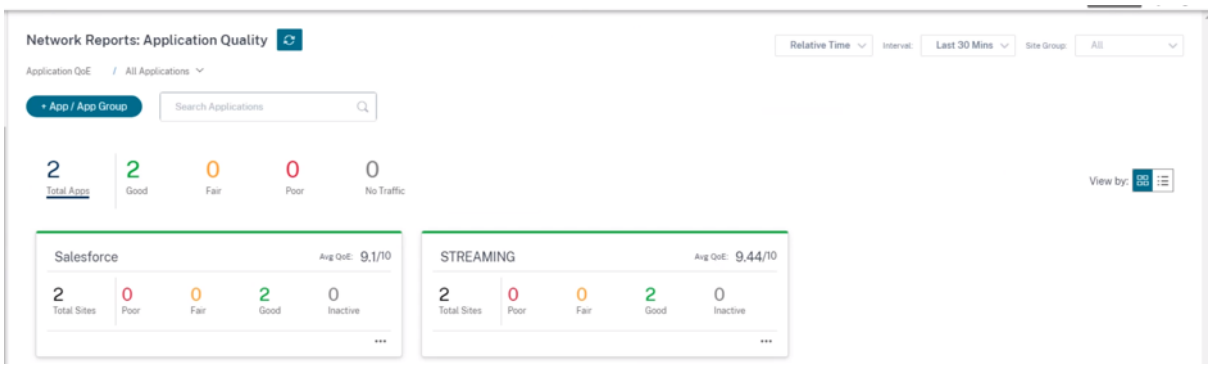


Click **Done**.

Click **Verify Config** to validate any audit error.

Once you configure the application QoE with the custom application type, a relevant application report tile is auto generated under the **Reports > Application Quality**. Any traffic that is matching with the selected application goes over the virtual path for the custom application.



DNS servers

You can configure specific DNS servers to which the DNS requests are routed.

Enter a name for the DNS server and choose **Type** as **Static** (for IPv4 addresses) or **StaticV6** (for IPv6 addresses). Specify the Primary and Secondary DNS server IP addresses. You can create an internal, ISP, google or any other open source DNS service.

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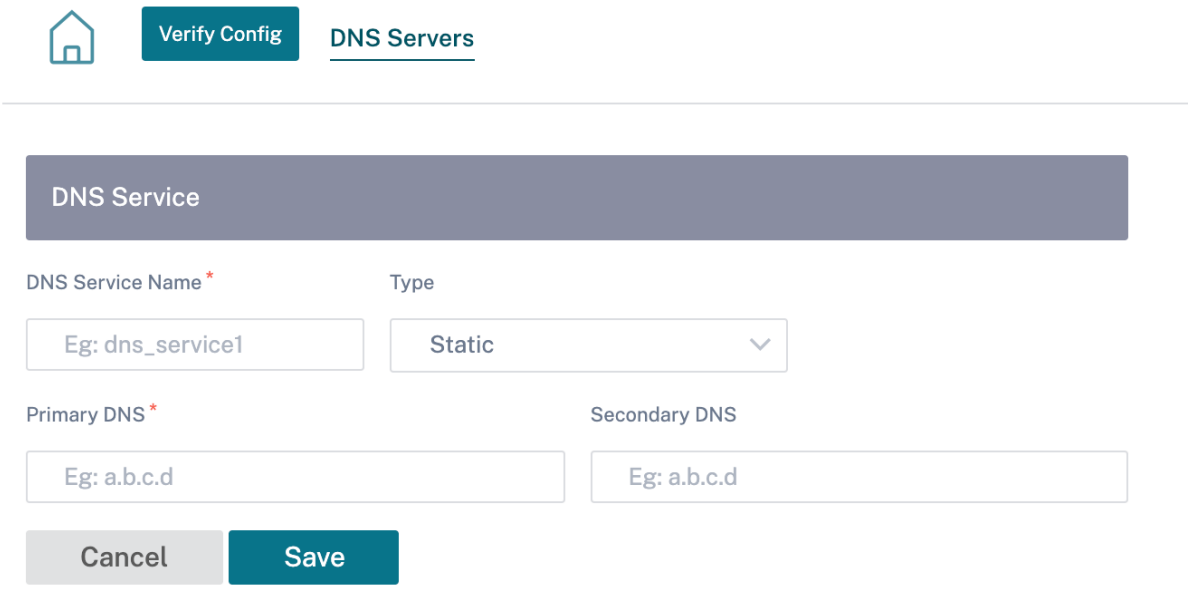

Click **Verify Config** to validate any audit error.

Proxy Auto Config

With the increase in enterprise adoption of mission-critical SaaS applications and distributed workforce, it becomes highly critical to reduce latency and congestion. Latency and congestion are inherent in traditional methods of backhauling traffic through the Data Center. Citrix SD-WAN allows direct internet break out of SaaS applications such as Office 365. For more information, see Office 365 Optimization.

If there are explicit web proxies configured on the enterprise deployment all traffic are steered to the web proxy making it difficult for classification and direct internet breakout. The solution is to exclude SaaS application traffic from getting proxied by customizing the enterprise PAC (Proxy Auto-Config) file.

Citrix SD-WAN 11.0 allows proxy bypass and local Internet breakout for Office 365 application traffic by dynamically generating and serving a custom PAC file. PAC file is a JavaScript function that defines whether web browser requests go directly to the destination or to a web proxy server.

How PAC file customization works

Ideally, the enterprise network host PAC file on the internal web server, these proxy settings are distributed via group policy. The Client browser requests for PAC files from the enterprise web server.

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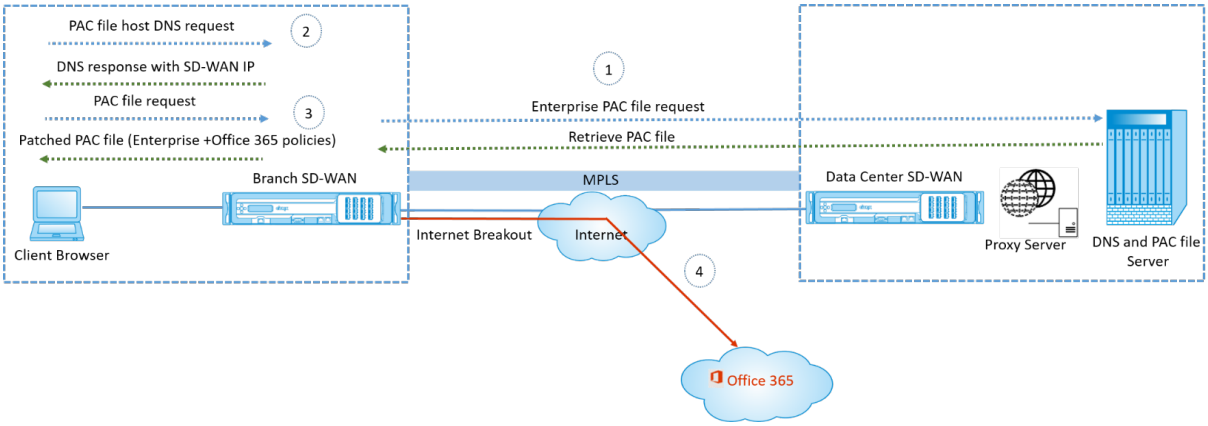
The Citrix SD-WAN appliance serves the customized PAC files for sites where Office 365 breakout is enabled.



1. Citrix SD-WAN periodically requests and retrieves the latest copy of the enterprise PAC file from the enterprise web server. The Citrix SD-WAN appliance patches office 365 URLs to the enterprise PAC file. The enterprise PAC file is expected to have a placeholder (SD-WAN specific tag) where the Office 365 URLs are seamlessly patched.
2. The Client browser raises a DNS request for the enterprise PAC file host. Citrix SD-WAN intercepts the request for the proxy configuration file FQDN and responds with the Citrix SD-WAN VIP.
3. The Client browser requests for the PAC file. Citrix SD-WAN appliance serves the patched PAC file locally. The PAC file includes enterprise proxy configuration and Office 365 URL exclusion policies.
4. On receiving a request for the Office 365 application, the Citrix SD-WAN appliance performs a direct internet breakout.

Prerequisites

1. The enterprises must have a PAC file hosted.
2. The PAC file must have a placeholder *SDWAN_TAG* or one occurrence of the `findproxyforurl` function for patching Office 365 URLs.
3. The PAC file URL must be domain based and not IP based.
4. The PAC file is served only over the trusted identity VIPs.
5. Citrix SD-WAN appliance must be able to download the enterprise PAC file over its management interface.

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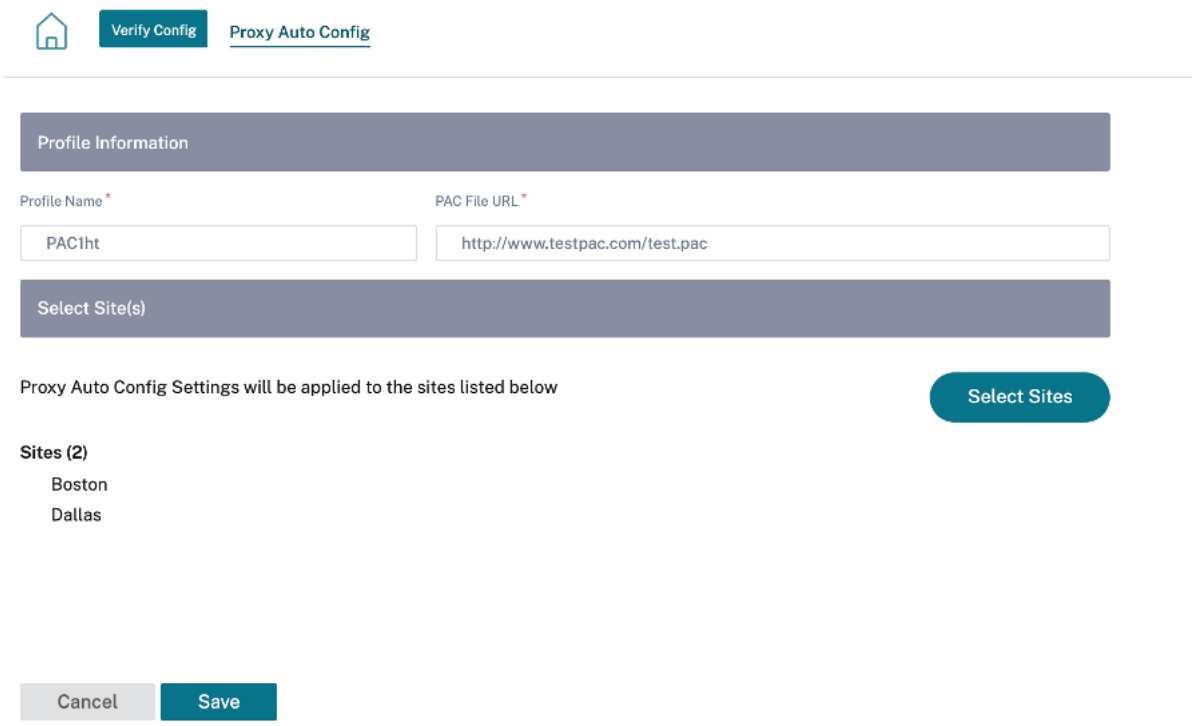
Configure Proxy Auto Config

In the SD-WAN Orchestartor UI, at the network level, navigate to **Configuration** > **App and DNS Settings** > **Proxy Auto Config** and click **+ PAC file profile**.



Enter a name for the PAC file profile, provide the URL of the enterprise PAC file server. The Office 365 breakout rules are dynamically patched to the enterprise PAC file.

Select the sites to which the PAC file profile is applied. If there are different URLs for each site, create a different profile per site.

Limitations

- HTTPS PAC file server requests are not supported.
- Multiple PAC files in a network are not supported, including PAC files for routing domains or security zones.
- Generating a PAC file on Citrix SD-WAN from scratch is not supported.
- WPAD through DHCP is not supported.

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Profiles and Templates

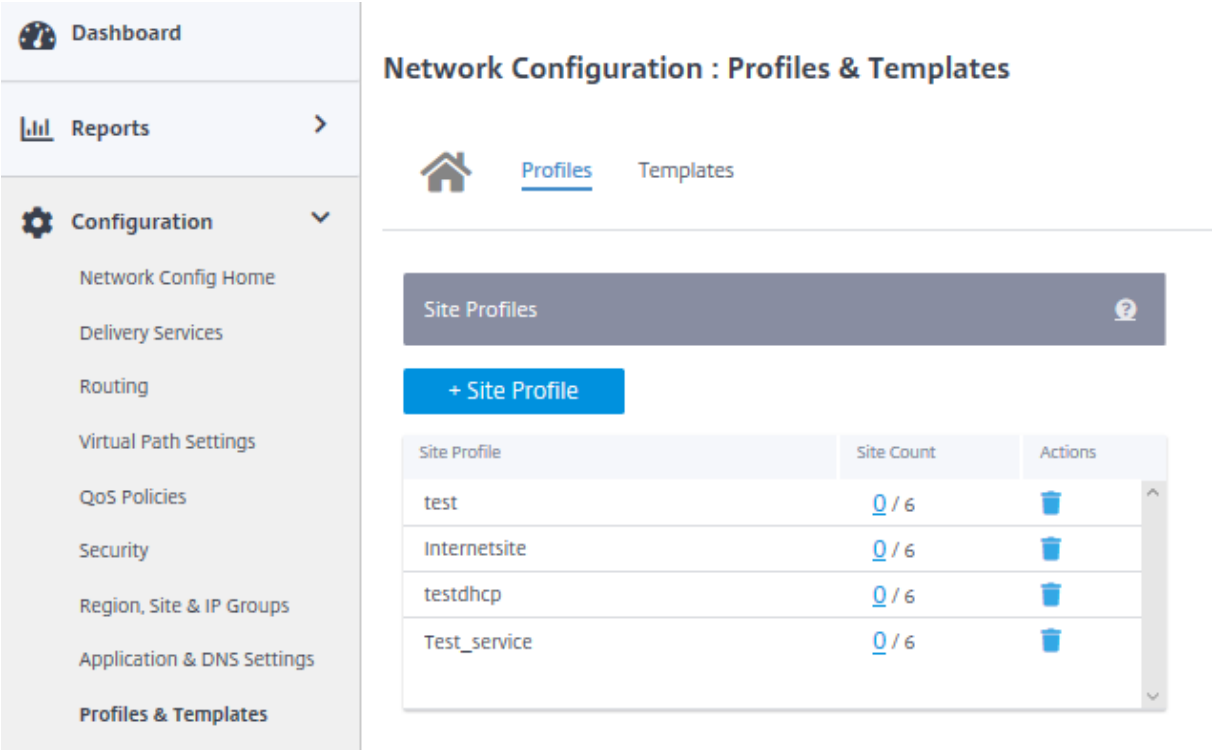
May 4, 2021

A profile is a live configuration template. A regular template aids the creation of a new entity. But once the template is created, subsequent changes in the template do not apply to the existing entities created using the base template. A profile serves as the live central master entity. The all child entities inherit from the profile, not only during creation but also throughout the life of a profile. All the child entities associated with the profile, automatically inherit any changes made in a profile.

For example, an admin creates a site configuration profile called the small retail store and applies it to all the small retail stores owned by a company. Now, any changes made to the small retail store profile at any given time would be applied automatically to all the stores inheriting this profile. Based on what's common across all the entities, and what's not, certain parameters in the profile configuration can be left unset. Such parameters would be customizable and can vary across the entities inheriting the same profile.

Site profile

Site profiles help you to easily and quickly configure sites. You can create a site profile once and reuse it multiple times while creating sites.



To create a site profile, click **+ Site Profile**. You can create a profile from scratch or edit an existing site

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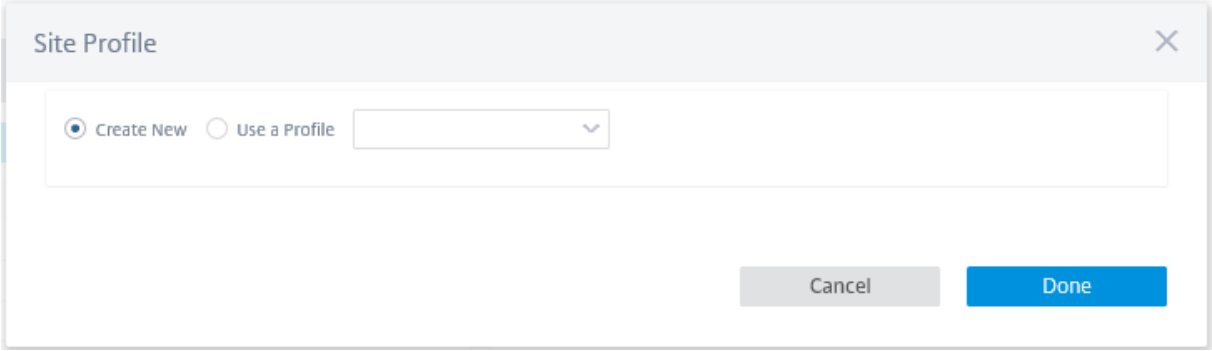
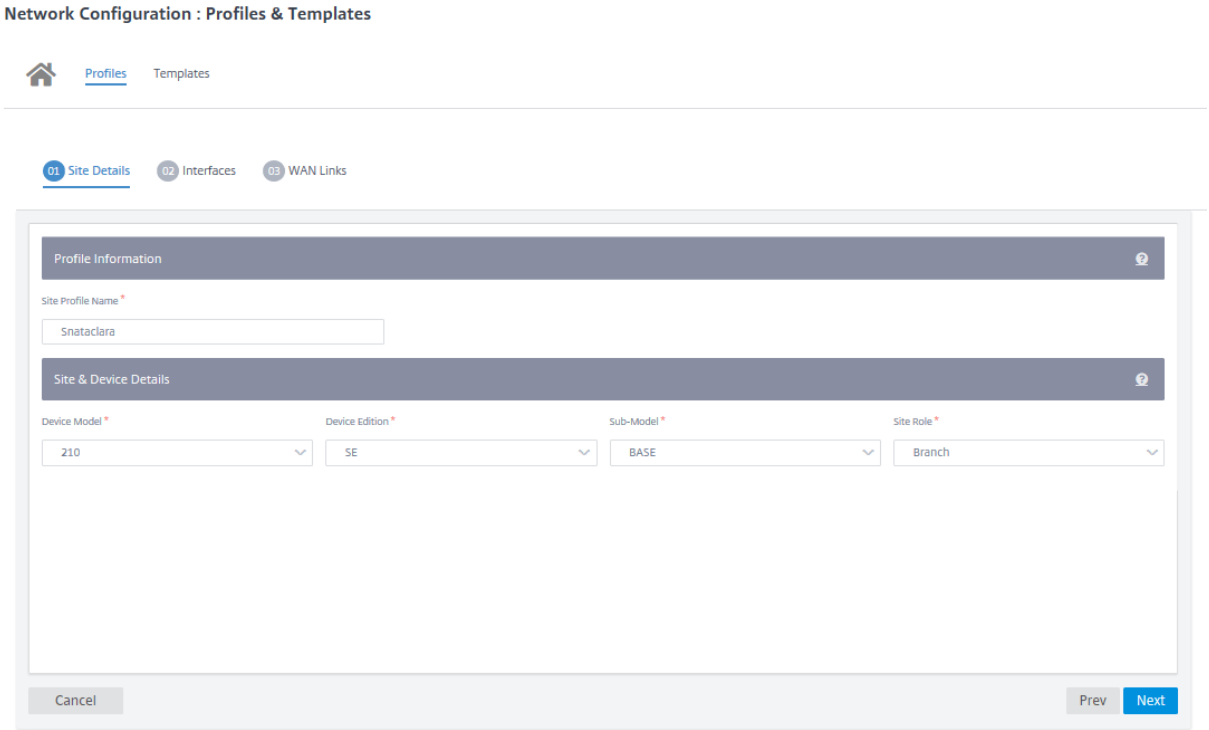
profile and save it as a new profile.



To create a site profile, you need to configure the **Site Details**, **Interfaces**, and **WAN Links**. For detailed description of configuring sites, see Site details.

Provide the device details.



Assign an interface for the site by clicking the **+ Interface** option. To add an interface, you need to fill the **Interface Attributes**, **Physical Interface**, and **Virtual Interfaces** fields. For detailed description of configuring interfaces, see Interfaces.

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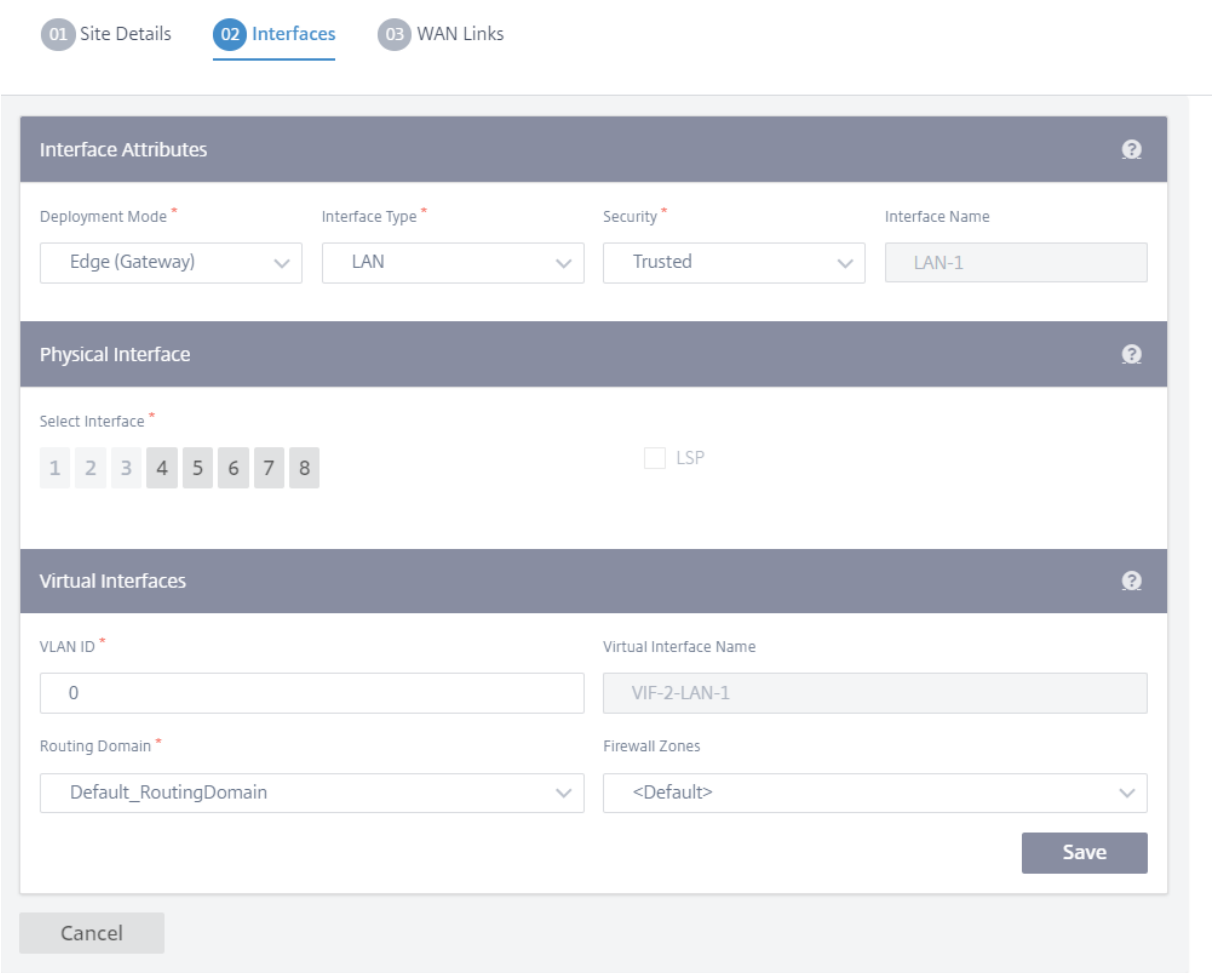

Fill **WAN Link Attributes**, **Access Interfaces**, and **Services** with **Advanced Options**.

For detailed description of configuring WAN links, see WAN links.

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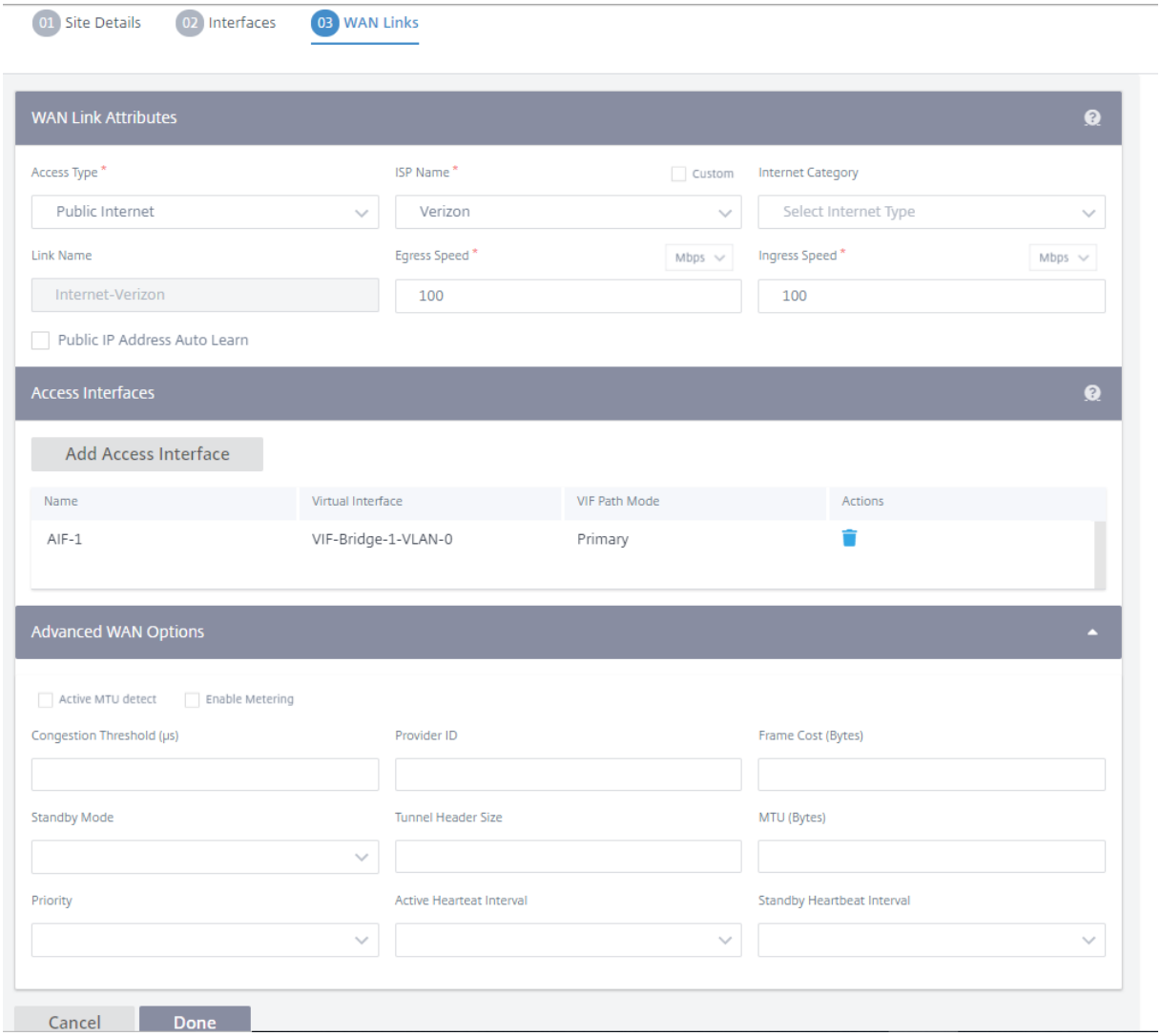

WAN link template

WAN link templates help you to easily and quickly configure WAN links. You can create a WAN link template once and reuse it multiple times while configuring WAN links.

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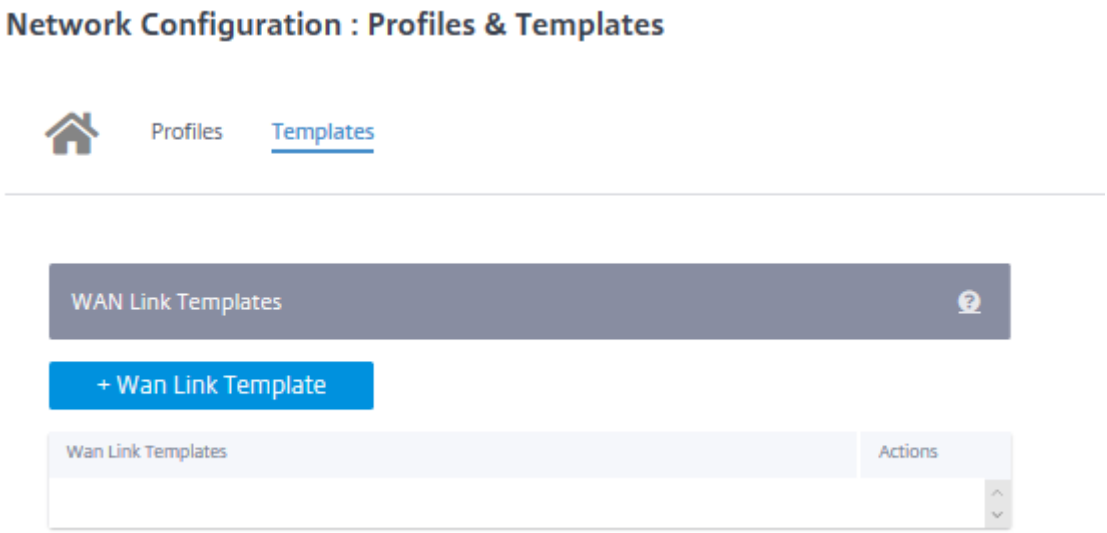
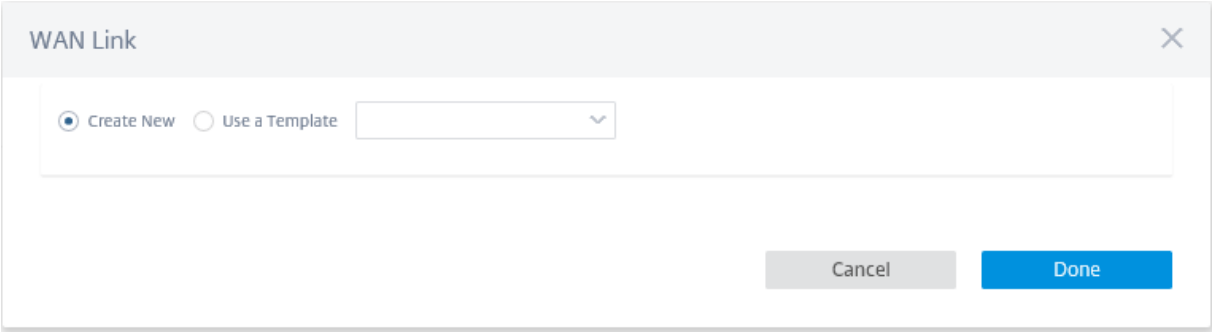
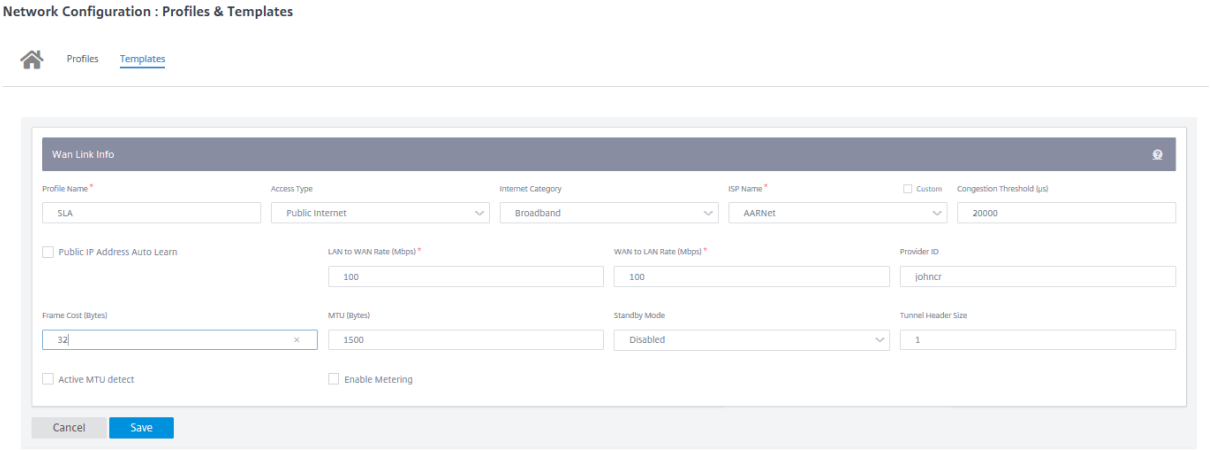


To create a WAN link template, click **+ WAN Link Template**. You can create a template from scratch or edit an existing WAN link template and save it as a new template.



Provide the WAN link information such as **Profile Name**, **Access Type**, **Internet Category**, **LAN to WAN Rate** (Mbps) and so on to create a WAN profile. For detailed description of configuring WAN links, see WAN links.



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ECMP load balancing

July 30, 2021

Equal Cost Multi-Path (ECMP) groups allow you to group multiple paths with the same cost, destination, and service. The connections or session data is load balanced across all the paths in the ECMP group depending on the type of ECMP group. For example, consider a network with two WAN links between a branch and a data center having the same route cost. Traditionally, one of the WAN links would be active and the other remains dormant acting as a fallback link. With ECMP Groups, you can group these WAN links together and allow traffic to be load balanced through both the WAN links. ECMP load balancing ensures:

- Distribution of traffic over multiple equal-cost paths.
- Optimal usage of available bandwidth.
- Dynamic transfer of traffic to other ECMP member path, if a route becomes unreachable.

ECMP load balancing is supported on the following services:

- Virtual Paths
- Internet
- Citrix Secure Internet Access
- Zscaler
- IPsec

You can define a maximum of 254 ECMP groups in your network. The maximum number of ECMP eligible routes in an ECMP group depend on your appliance and license type. The following two types of ECMP groups are supported on Citrix SD-WAN:

- Source/destination IP address: Networks where multiple clients try to connect to the same destination, the connections are load balanced across equal cost WAN links.
- Session: Networks where a single client is connected to a destination and multiple sessions are spawned. The session data is load balanced across equal cost WAN links.

To configure an ECMP group, at the Network level, navigate to **Configuration** > **ECMP Groups**. Provide a name for the ECMP group and select the type as **Src/Dest IP address** or **Session** as required.

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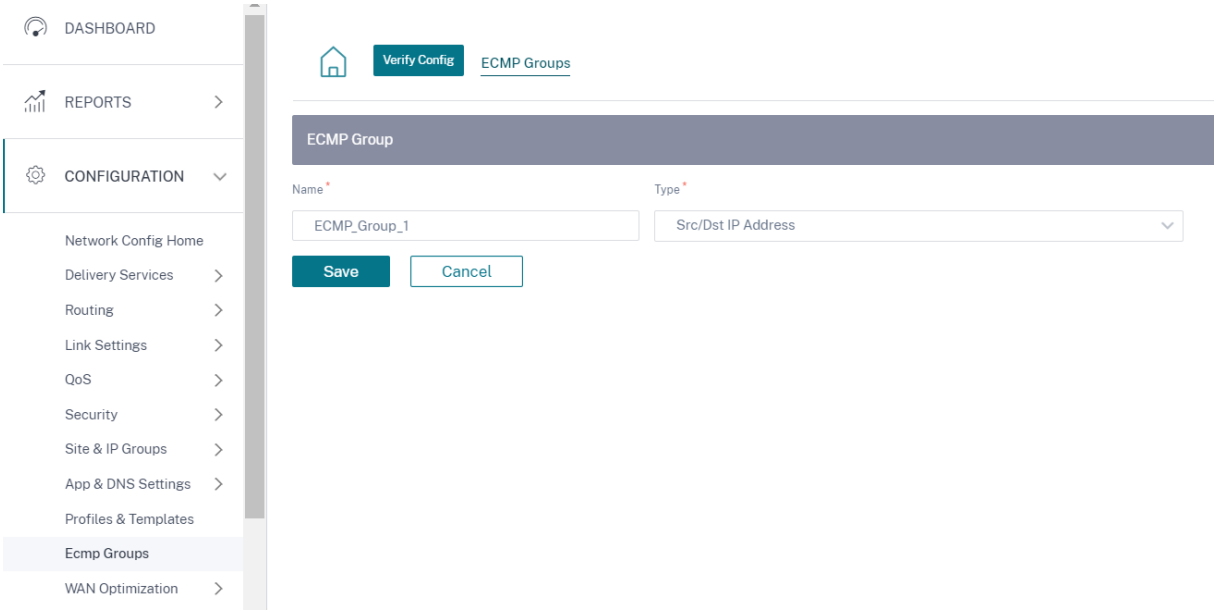

You can associate the ECMP groups to the following services:

- Virtual Paths (at site level)
- Internet services
- Citrix Secure Internet Access
- Zscaler
- IPsec

To enable ECMP configuration on Intranet services, at the Network *level, navigate to **Configuration** > **Services & Bandwidth** > **Intranet + Service** and select the **Service Type** as **Intranet**. Select the ECMP group while configuring the Intranet service.

> **Note**
>
> Selecting **None** will not enable ECMP configuration on the service.

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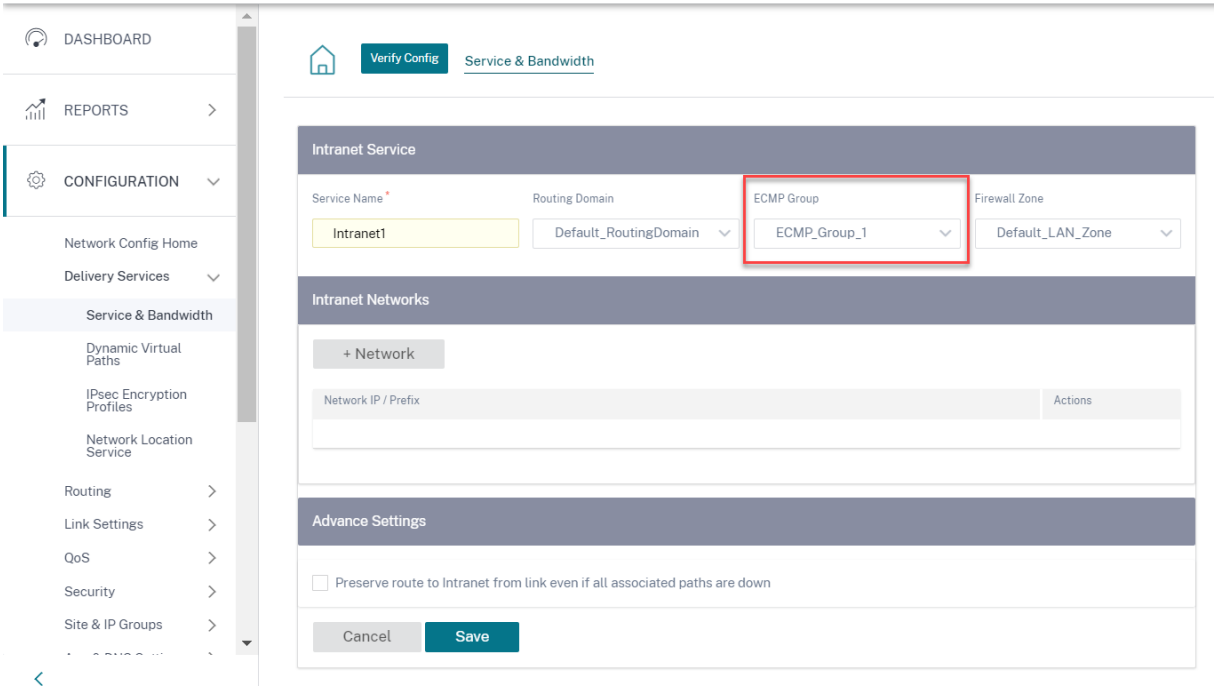
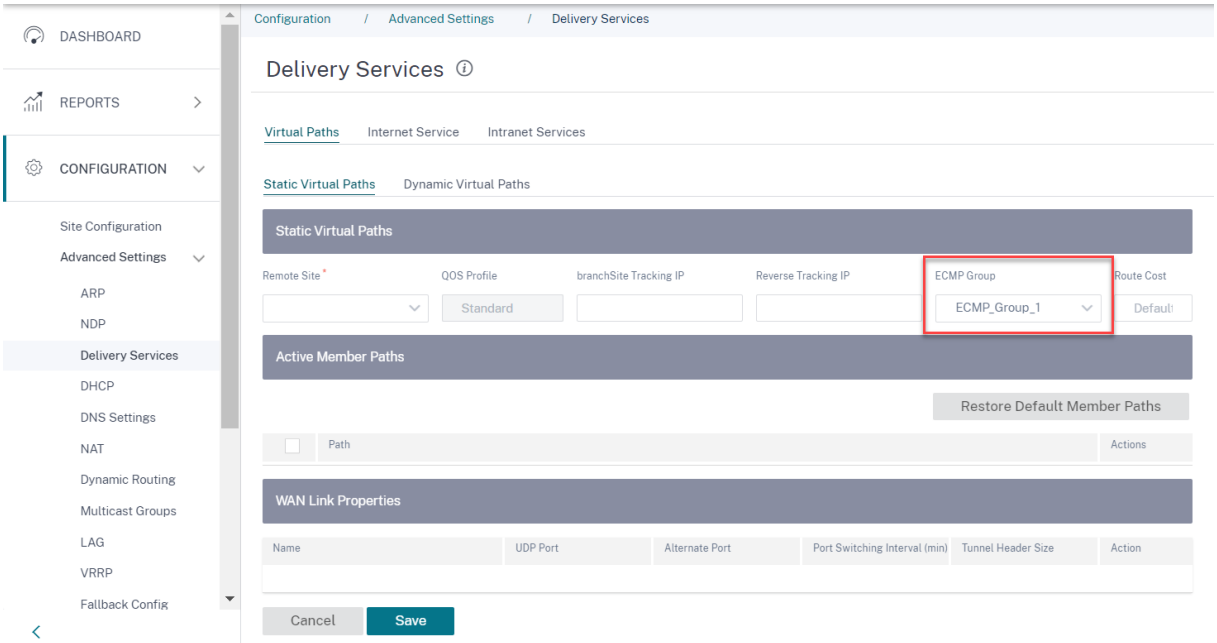


To enable ECMP configuration on Virtual paths, at the Site level, navigate to **Configuration** > **Advanced Settings** > **Delivery Services** > **Virtual Paths** > **Static Virtual paths** > **+ Virtual paths**. Select the ECMP group while configuring the Static Virtual paths.

> **Note**
>
> Selecting **None** will not enable ECMP configuration on the service.



To enable ECMP configuration on Zscaler services, at the Network level, navigate to **Configuration**

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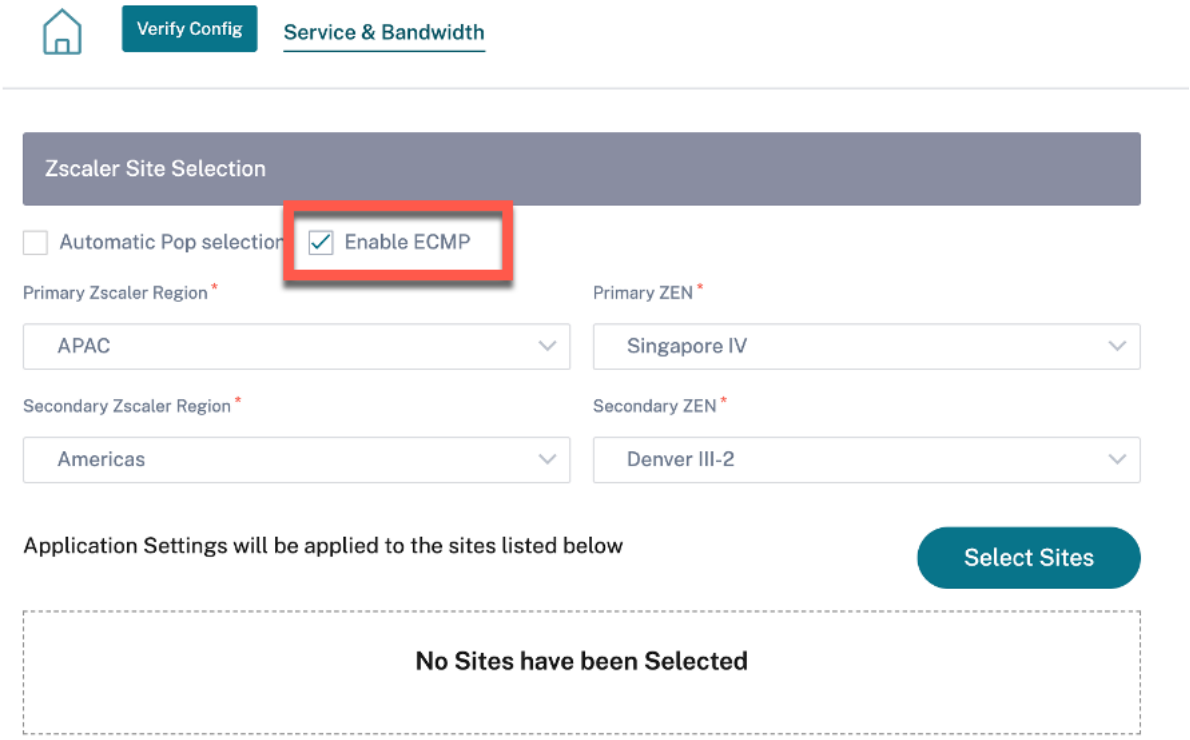
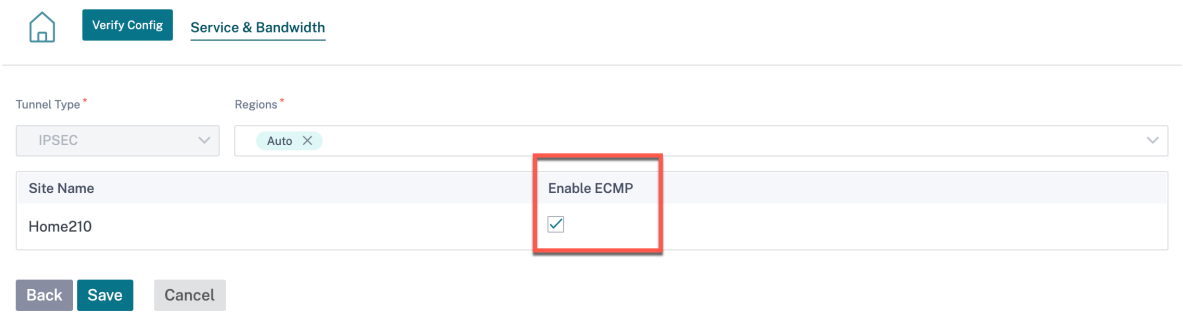
> Services & Bandwidth. Click the **Settings** icon next to Zscaler listed under the **Delivery Services** column. Authenticate and click **+ Site**. Select the **Enable ECMP** check box while adding sites.

> **NOTE**
>
> Zscaler service supports only session-based ECMP load balancing.



To enable ECMP configuration on Citrix Secure Internet Access service, at the Network level, navigate to **Configuration > Services & Bandwidth**. Click the **Settings** icon next to **Secure Internet Access Service** and click **+ Site**. Select the **Enable ECMP** check box after selecting the sites.

> **NOTE**
>
> Citrix Secure Internet Access service supports only session-based ECMP load balancing.



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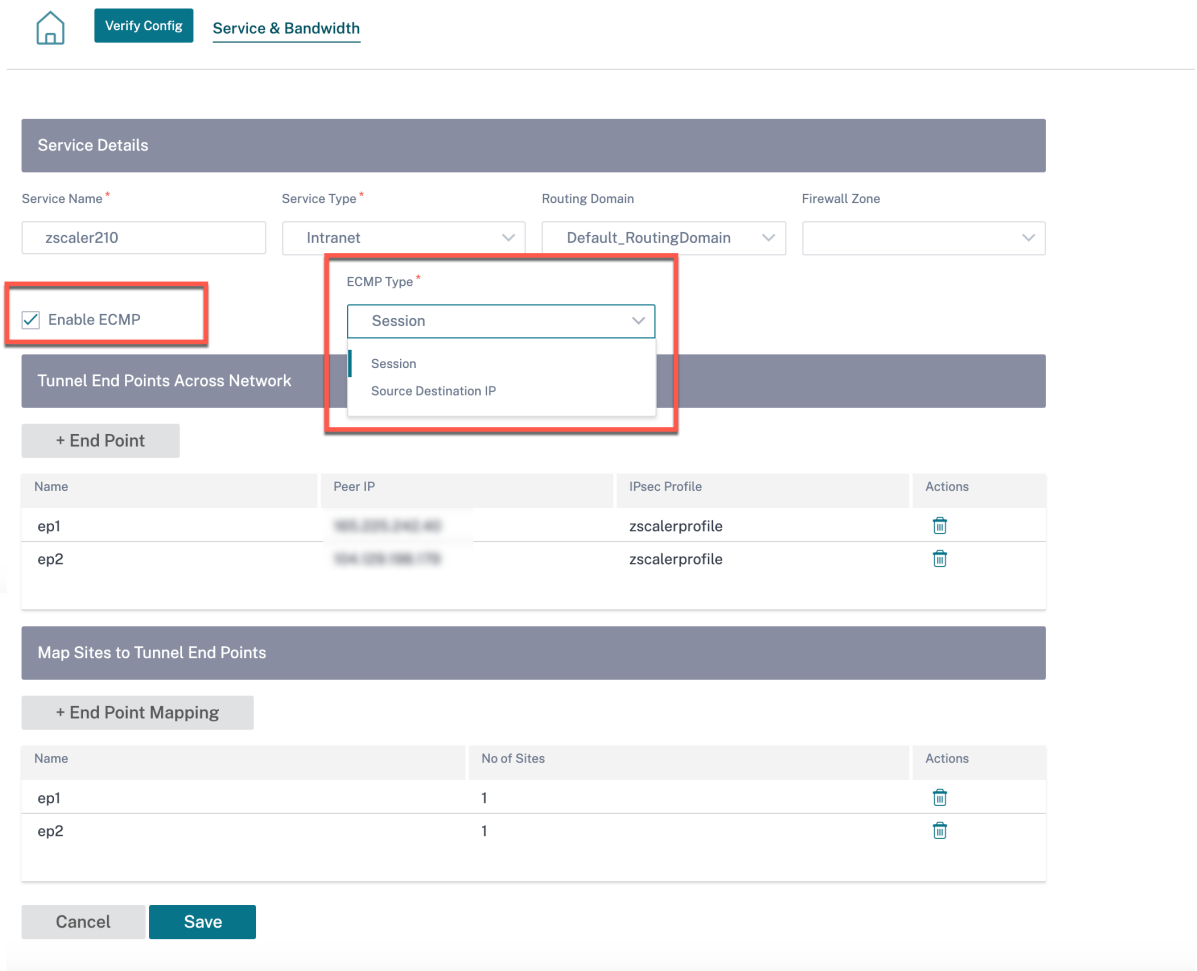
To enable ECMP configuration on fixed IPsec tunnels with third-party peers on the LAN or WAN side, navigate to **Configuration > Services & Bandwidth > Intranet + Service** and select the **Service Type** as **IPsec**. Select the **Enable ECMP** check box and choose a type from the **ECMP Type** drop-down list.



Site configuration

August 19, 2021

You can add new sites from the Network Dashboard and configure your SD-WAN network.

To create a site, click **+ New site** on the Network Dashboard. Provide a name and location for the site.

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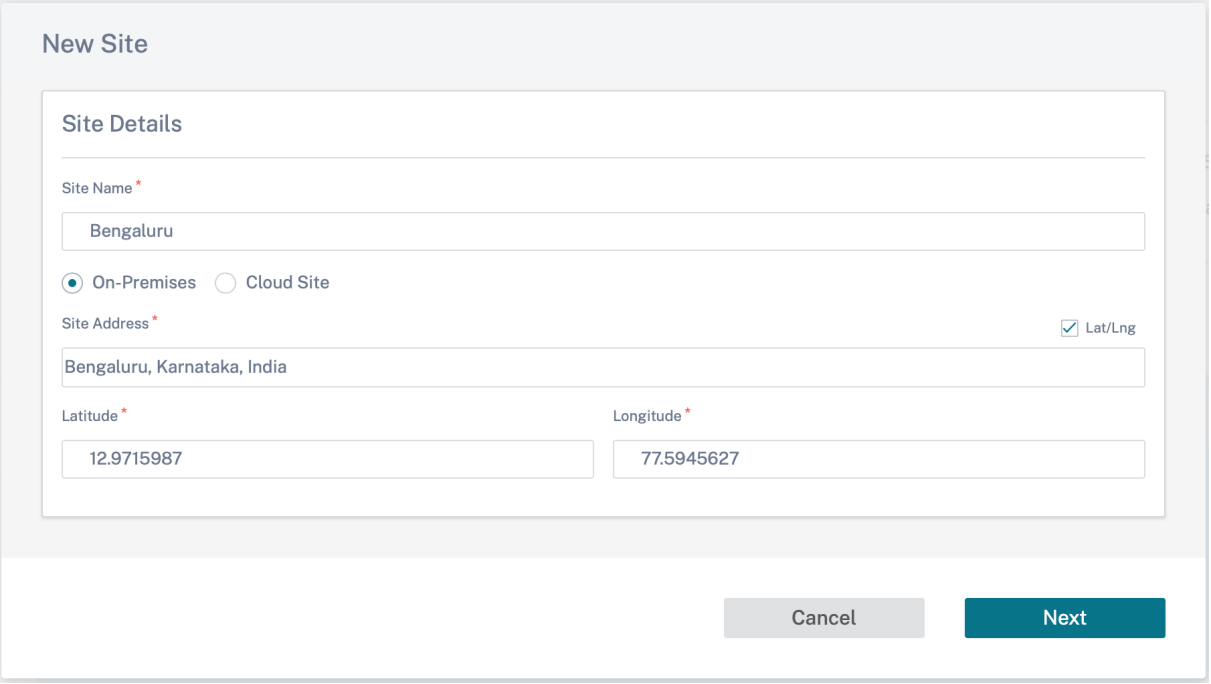

You can create a site from scratch, or use a site profile to configure a site quickly.

A graphical display to the right of the screen provides a dynamic topology diagram as you proceed with the configuration.

To view site configuration, select site and navigate to **Configuration > Site Configuration**.

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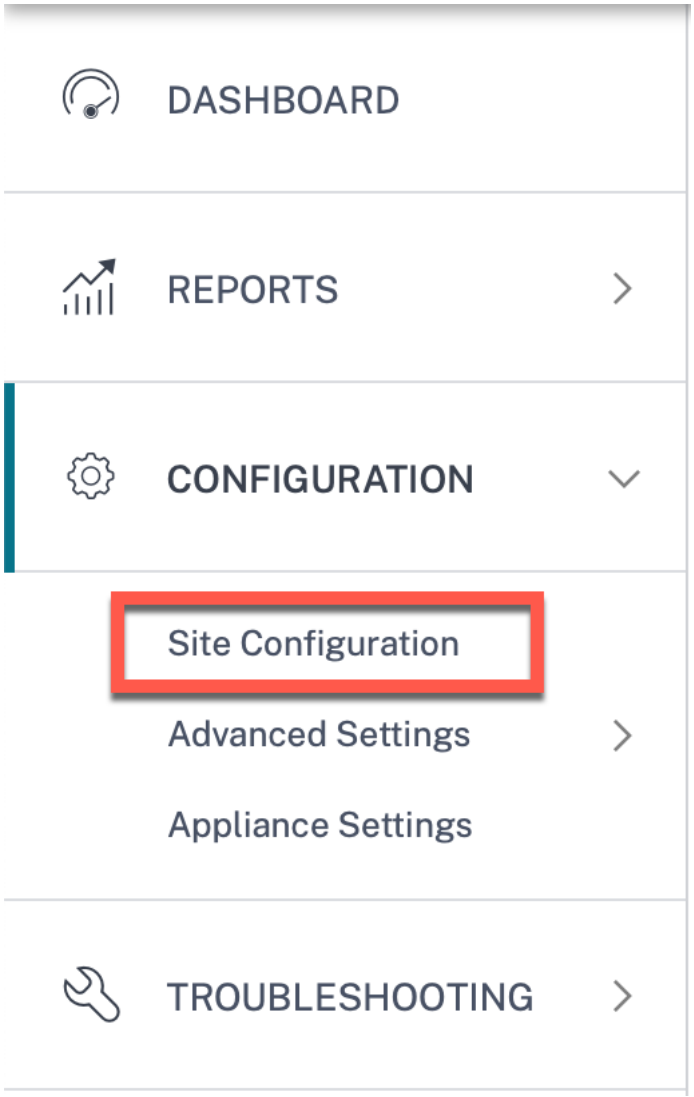

Site details

The first step involves entering the site, device, advanced settings, and site contact details.

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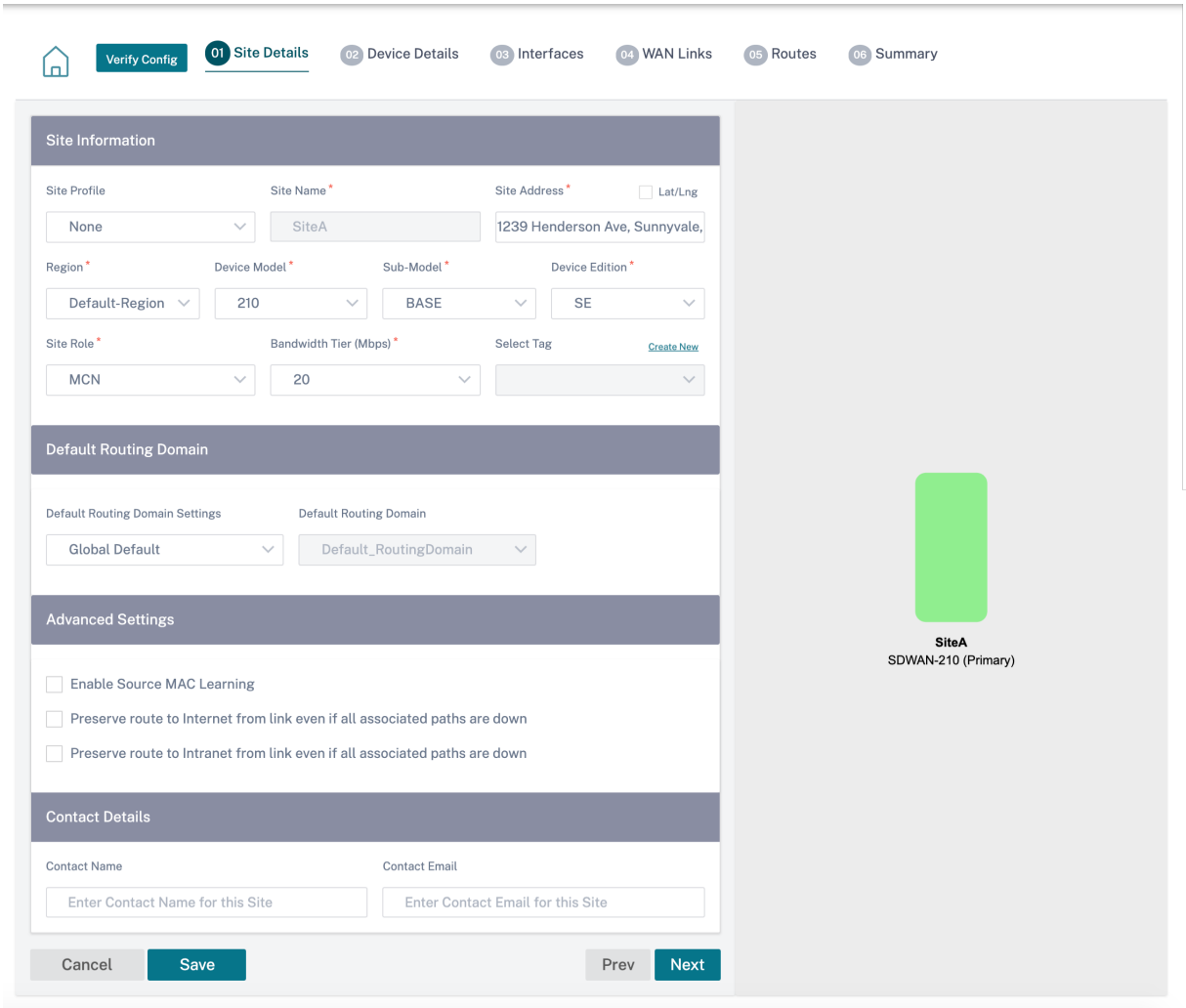

Site information

- Choosing a **Site Profile** auto-populates the site, interface, and WAN links parameters based on the site profile configuration.
- **Site Address** and **Site Name** are auto-populated based on the details provided in the previous step.
- Enable the **Lat/Lng** check box to get the latitude and longitude of a site.
- Select the **Region** from the drop-down list.
- **Device Model** and **Sub-Model** can be picked based on the hardware model or virtual appliance used at a given site.
- **Device Edition** reflects automatically based on the selected device model. Currently, Premium Edition (PE), Advanced Edition (AE), and Standard Edition (SE) are supported. The PE model is

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only supported on 1100, 2100, 5100, and 6100 platforms. The AE model is supported on 210 and 1100 platforms.

> **Note**
>
> SD-WAN Orchestrator for On-premises does not support Advanced Edition and Premium Edition platforms.

- **Site Role** defines the role of the device. You can assign one of the following roles to a site:
  - **MCN**: Master Control Node (MCN) serves as the controller of the network, and only one active device in a network can be designated as the MCN.
  - **Branch**: Appliances at the branch sites that receive configuration from the MCN and participate in establishing virtual WAN functionalities to the branch offices. There can be multiple branch sites.
  - **RCN**: Regional Control Node (RCN) supports hierarchical network architecture, enabling multi-region network deployment. MCN controls multiple RCNs and each RCN, in turn, controls multiple branch sites.
  - **Geo-redundant MCN**: A site in a different location, that takes over the management functions of the MCN, if it is not available, ensuring disaster recovery. Note that the geo-redundant MCN does not provide High Availability or failover capabilities for the MCN.
  - **Geo-Redundant RCN**: A site in a different location, that takes over the management functions of the RCN, if it is not available, ensuring disaster recovery. Note that the geo-redundant RCN does not provide High Availability or failover capabilities for the RCN.
- **Bandwidth Tier** is the billable bandwidth capacity you can configure on any device, depending on the device model. For instance, the SD-WAN 410 Standard Edition (SE) appliance supports 20, 50, 100, 150, and 200 Mbps bandwidth tiers. Depending on your bandwidth needs for a given site, you can select the desired tier. Each site is billed for the configured bandwidth tier.

Routing domain

The **Routing Domain** section allows you to select the default routing domain for the site. **Routing Domain** settings can either be global or site specific. If you select **Global Defaults**, the default routing domain that is applicable globally is auto-selected. If you select **Site Specific**, you can select the default routing domain from the **Routing Domain** drop-down list.

Advanced settings

- **Enable Source MAC Learning**: Stores the source MAC address of received packets so that outgoing packets to the same destination can be sent to the same port.

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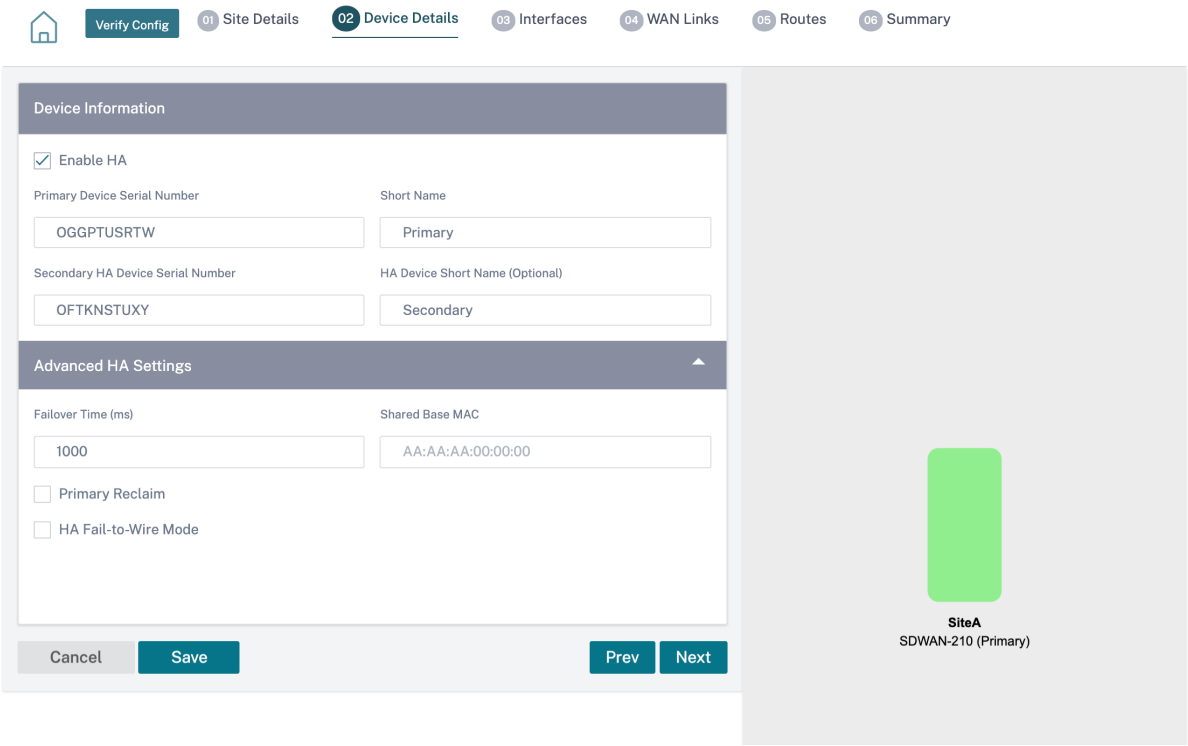
- **Preserve route to Internet from link even if all associated paths are down**: When enabled, the packets destined for the internet service continue to choose the internet service even if all WAN Links for the internet service are unavailable.
- **Preserve route to Intranet from link even if all associated paths are down**: When enabled, the packets destined for the intranet service continue to choose the intranet service even if all WAN Links for the intranet service are unavailable.
- Contact details of the admin available at the site.

A dynamic network diagram to the right of the configuration panel, provides visual feedback on an ongoing basis, as you go through the configuration process.

Device details

The device details section allows you to configure and enable High Availability (HA) at a site. With HA, two appliances can be deployed at a site as an active primary and a passive secondary. The secondary appliance takes over when the primary fails. For more information, see High Availability.



Device information

Enable HA and enter the serial number and a short name for the primary and the secondary appliances.

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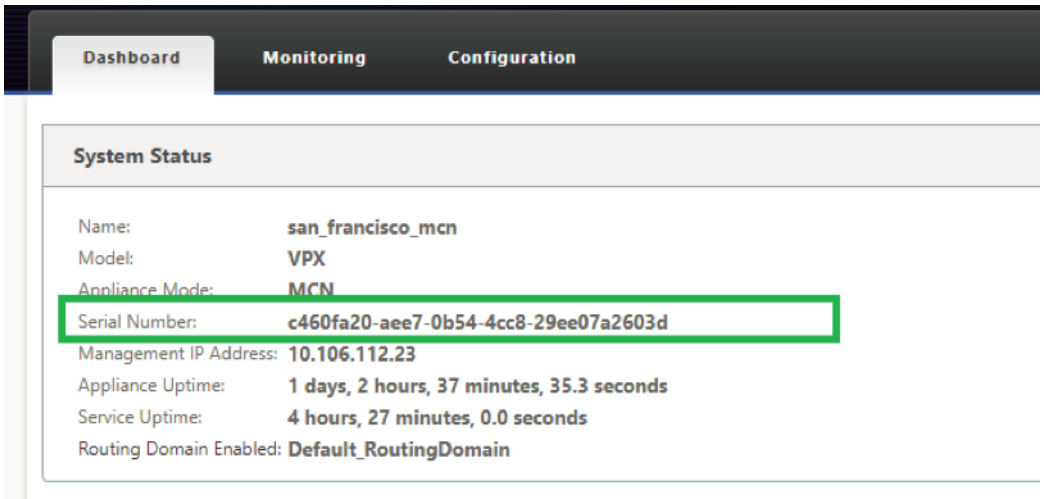
- **Serial Number**: The **Serial Number** of a virtual SD-WAN instance (VPX) can be accessed from the VPX web console, as highlighted in the following screen-shot. A serial number of a hardware appliance can be found on the device label too.



- **Short Name**: The **Short Name** field is used to specify an easily identifiable short name for a site or to tag a site if desired.

Advanced HA settings

- **Failover Time (ms)**: The wait time after contact with the primary appliance is lost, before the standby appliance becomes active.
- **Shared base MAC**: The shared MAC address for the high availability pair appliances. When a failover occurs, the secondary appliance has the same virtual MAC addresses as the failed primary appliance.
- **Disable Shared Base MAC**: This option is available on hypervisor and cloud based platforms only. Choose this option to disable the shared virtual MAC address.
- **Primary Reclaim**: The designated primary appliance reclaims control upon restart after a failover event.
- **HA Fail-to-Wire Mode**: The HA Fail-to-wire mode is enabled. For more details, see HA deployment modes.
- **Enable Y-Cable Support**: The Small Form-factor Pluggable (SFP) ports can be used with a fiber optic Y-Cable to enable the high availability feature for Edge Mode deployment. This option is available on Citrix SD-WAN 1100 SE/PE appliances only. For more information, see Enable Edge Mode High Availability Using Fiber Optic Y-Cable.

Wi-Fi details

You can configure a Citrix SD-WAN appliance that supports Wi-Fi as a Wi-Fi Access Point.

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The following two variants of Citrix SD-WAN 110 platform support Wi-Fi and can be configured as a Wi-Fi access point:

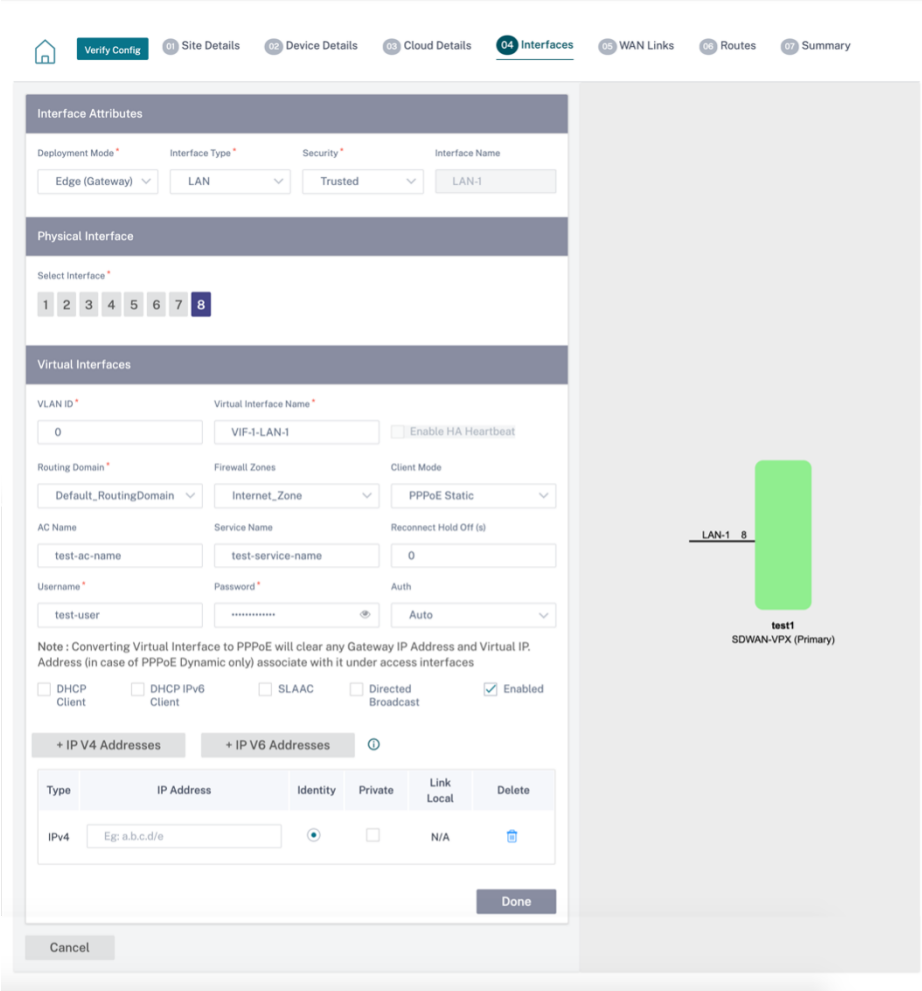
- Citrix SD-WAN 110-WiFi-SE
- Citrix SD-WAN 110-LTE-WiFi

For more details on Wi-Fi configuration, see Wi-Fi Access Point

Interfaces

The next step is to add and configure the interfaces. Click **+ Interface** to start configuring the interface. Click **+ HA Interface** to start configuring HA interface. The **+ HA Interface** option is available only if you have configured a secondary appliance for high availability.

Interface configuration involves selecting the deployment mode and setting the interface level attributes. This configuration is applicable to both LAN and WAN links.



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In-band management

In-band management allows you to use the SD-WAN data ports for management. It carries both data and management traffic, without having to configure an extra management path. In-band management allows virtual IP addresses to connect to management services such as web UI and SSH. You can access the web UI and SSH using the management IP and in-band virtual IPs.

To enable in-band management, choose an IPv4 address from the **InBand Management IP** drop-down list or an IPv6 address from the **InBand Management IPv6** drop-down list. Select the DNS proxy to which all DNS requests over the in-band and backup management plane is forwarded to from the **InBand Management DNS** or **InBand Management DNS V6** drop-down list.

For more information on in-band management, see In-band management.

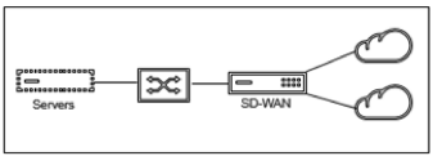
The IP addresses configured for interfaces get listed under the **InBand Management IP** drop-down list. The DNS proxy services configured under **Advanced Settings > DNS** get listed in the **InBand Management DNS** drop-down list.

Interface attributes

The following deployment modes are supported:

1. Edge (Gateway)
2. Inline – Fail-to-wire, Fail-to-block, and Virtual inline.

- **Deployment Mode**: Select one of the following deployment modes.
  - **Edge (Gateway)**:

    Gateway Mode implies SD-WAN serves as the “gateway” to the WAN for all the LAN traffic. The **Gateway Mode** is the default mode. You can deploy the appliance as a gateway on the LAN side or the WAN side.

  - **Inline**:

    When SD-WAN is deployed in-line between a LAN switch and a WAN router, SD-WAN is expected to “bridge” LAN and WAN.

    All the Citrix SD-WAN appliances have pre-defined bridge-paired interfaces. With “Bridge” option enabled, selection of any interface on the LAN end automatically highlights the paired interface that is reserved for the WAN end of the bridge. For example, physical interfaces 1 and 2 are a bridged pair.

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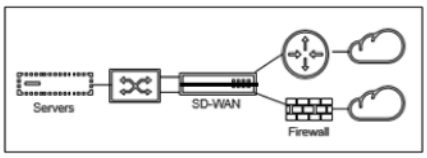
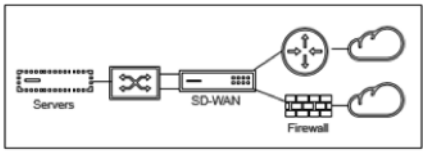
* **Fail-To-Wire**: Enables a physical connection between the bridged pair of interfaces, allowing traffic to bypass SD-WAN and flow directly across the bridge in the event of appliance restart or failure.

  > **Note**
  >
  > Inline (Fail-to-Wire) option is available only on hardware appliances and not on virtual appliances (VPX / VPXL).

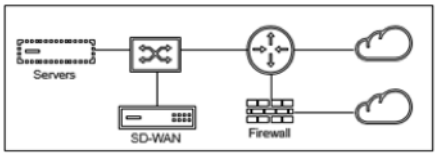
  

* **Fail-to-Block**: This option disables the physical connection between the bridged pair of interfaces on hardware appliances, preventing traffic from flowing across the bridge in the event of appliance restart or failure.

  > **Note**
  >
  > Inline (Fail-to-Block) is the only bridge mode option available on virtual appliances (VPX / VPXL).

* **Virtual Inline (One-Arm)**:

  When SD-WAN is deployed in this mode, it has a **single arm** connecting it to the WAN router, LAN, and WAN sharing the same interface on SD-WAN. Therefore, the interface settings are shared between the LAN and WAN links.

- **Interface Type:** Select the interface type from the drop-down list.
- **Security (Trusted / Untrusted)**: Specifies the security level of the interface. Trusted segments are protected by a Firewall.
- **Interface Name:** Based on the selected deployment mode, the **Interface Name** field is auto filled.

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Physical interface

- **Select Interface:** Select the configurable Ethernet port that is available on the appliance.

Virtual interface

- **VLAN ID**: The ID for identifying and marking traffic to and from the interface.
- **Virtual Interface Name:** Based on the selected deployment mode, the **Virtual Interface Name** field is auto filled.
- **Enable HA Heartbeat**: Enable syncing of HA heartbeats over this interface. This option is enabled if you have configured a secondary appliance for HA. Select this option to allow primary and secondary appliances to synchronize the HA heartbeats over this interface. Specify the IP address of the primary and secondary appliance.
- **Routing Domain**: The routing domain that provides a single point of administration of the branch office network, or a data center network.
- **Firewall Zones**: The firewall zone to which the interface belongs. Firewall zones secure and control the interfaces in the logical zone.
- **Client Mode:** Select **Client Mode** from the drop-down list. On selection of PPPoE Static displays more settings.

  > **Note:**
  >
  > When the Site mode (under Site Details tab) is selected as **Branch** and the **Security field** (under **Interface** tab) is selected as **Untrusted**, the **PPPoE Dynamic** option is available under **Client Mode**.

  Citrix SD-WAN act as a PPPoE client. It authenticates with the PPPoE server and obtains dynamic IP address, or uses static IP address to establish PPPoE connections.
- **DHCP Client**: When enabled on the virtual interfaces, the DHCP Server assigns dynamically IPv4 addresses to the connected client.
- **DHCP IPv6 Client**: When enabled on the virtual interfaces, the DHCP Server dynamically assigns IPv6 addresses to the connected client.
- **SLAAC**: This option is available only for IPv6 addresses. When selected, the interface obtains IPv6 addresses through Stateless Address Auto-configuration (SLAAC).
- **Directed Broadcast**: When the **Directed Broadcast** check box is selected, the directed broadcasts are sent to the virtual IP subnets on the virtual interface.
- **Enabled**: By default, the **Enabled** check box is selected for all virtual interfaces. If you want to disable the virtual interface, clear the **Enabled** check box.

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> **Note**
>
> - The **Enabled** check box is available only from Citrix SD-WAN release 11.3.1 onwards.
> - The option to disable a virtual interface is only available when it is not used by a WAN Link Access Interface. If the virtual interface is used by a WAN Link Access Interface, then the check box is read-only and selected by default.
> - While configuring other features, along with enabled virtual interfaces, the disabled virtual interfaces also get listed, except under **Access Interfaces** for a **WAN Link**. Even if you select a disabled virtual interface, the virtual interface is not considered and does not impact the network configuration.

- **+ IPv4 Address**: The virtual IPv4 address and netmask of the interface.
- **+ IPv6 Address**: The virtual IPv6 address and prefix of the interface.
- **Identity**: Choose an identity to be used for IP services. For example, **Identity** is used as the Source IP Address to communicate with BGP neighbors.
- **Private**: When enabled, the Virtual IP Address is only routable on the local appliance.

> **Note**
>
> - LTE ports do not support static IP addresses (IPv4 and IPv6).
> - LTE ports support both DHCP and SLAAC. Configuring DHCPv4 or DHCPv6 is mandatory. SLAAC is optional.
> - In LTE ports, Link-Local addresses can be configured for IPv6 or SLAAC.

PPPoE credentials

Point-to-Point Protocol over Ethernet (PPPoE) connects multiple computer users on an Ethernet LAN to a remote site through common customer premises appliances.

Citrix SD-WAN appliances use PPPoE to provide support to the ISP to have ongoing and continuous DSL and cable modem connections unlike dialup connections. For more information, see PPPoE configuration.

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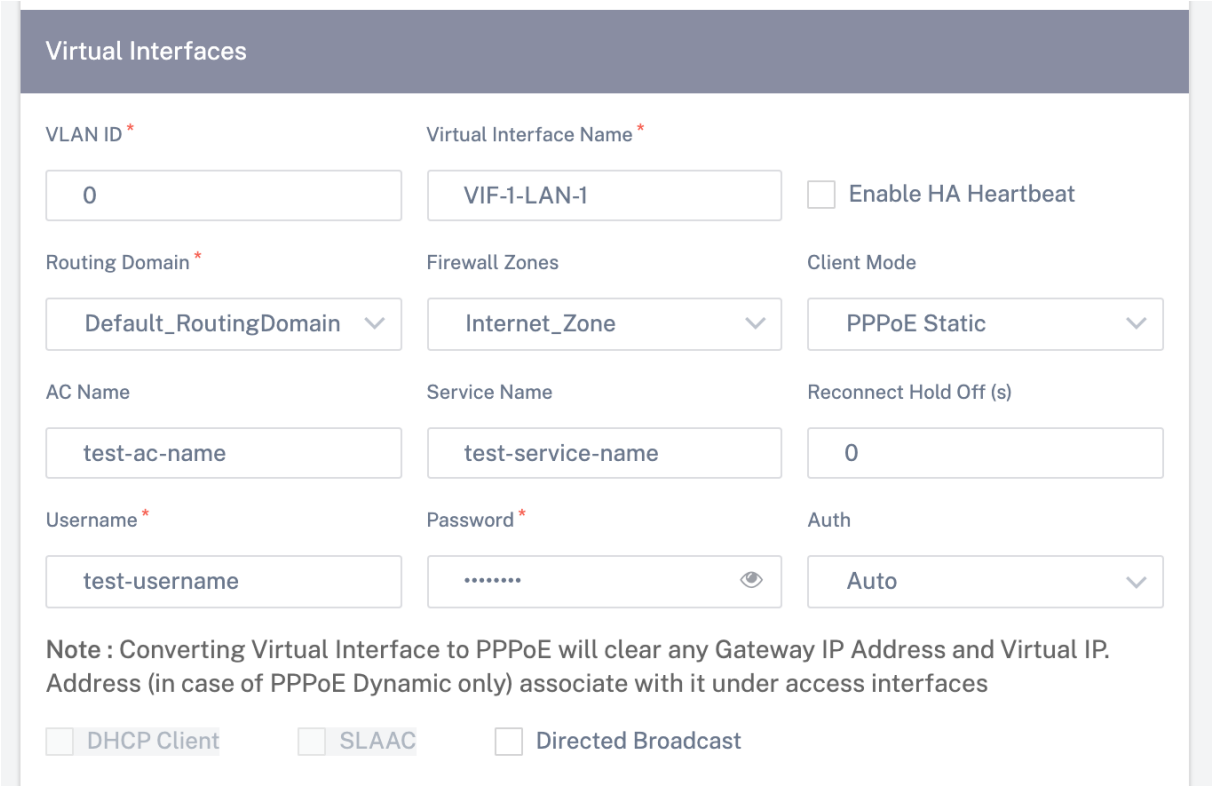

- **AC Name:** Provide the Access Concentrator (AC) name for the PPPoE configuration.
- **Service Name:** Enter a service name.
- **Reconnect Hold Off (s):** Enter the reconnect attempt hold off time.
- **User Name:** Enter the user name for the PPPoE configuration.
- **Password:** Enter the password for the PPPoE configuration.
- **Auth:** Select the authorization protocol from the drop-down list.
  - When the **Auth** option is set to Auto, the SD-WAN appliance honors the supported authentication protocol request received from the server.
  - When the **Auth** option is set to PAP/CHAP/EAP, then only specific authentication protocols are honored. If PAP is in the configuration and the server sends an authentication request with CHAP, the connection request is rejected. If the server does not negotiate with PAP, an authentication failure occurs.

> **Tip**
>
> Optionally, create subinterfaces to add multiple VLANs.

Continue to add interfaces as per your network requirement.

Wired 802.1X configuration

Wired 802.1X is an authentication mechanism that requires clients to authenticate before being able to access the LAN resources. Citrix SD-WAN Orchestrator service supports configuring wired 802.1X

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authentication on LAN interfaces.

In the Citrix SD-WAN network, the clients send authentication requests to the Citrix SD-WAN appliance to access the LAN resources. The Citrix SD-WAN appliance acts as an authenticator and sends the authentication requests to the authentication server. Citrix SD-WAN Orchestrator service supports only RADIUS servers to be configured as authentication servers.

When authenticating for the first time, only EAPOL packets can be processed or DHCP packets that can initialize the 802.1X authentication from the default virtual LAN. A newly connected client must be authenticated within 90 seconds. If the authentication is successful, it gets access to the LAN resources.

If the authentication fails, the client is not granted network access and all packets are dropped. The clients that are directly connected to the Citrix SD-WAN appliance can retry authentication by unplugging the Ethernet cable and reinserting it. Optionally, you can define a specific virtual LAN to grant access to limited LAN resources for the failed authentication requests. In such cases, the failed authentication requests get access to the specified virtual LAN. You can restrict access to the authenticated traffic using different routing domains or firewall zones while creating the virtual LAN.

> **Note**
>
> - The default virtual LAN must always have 802.1X enabled.
> - Dynamic virtual LANs are not supported.

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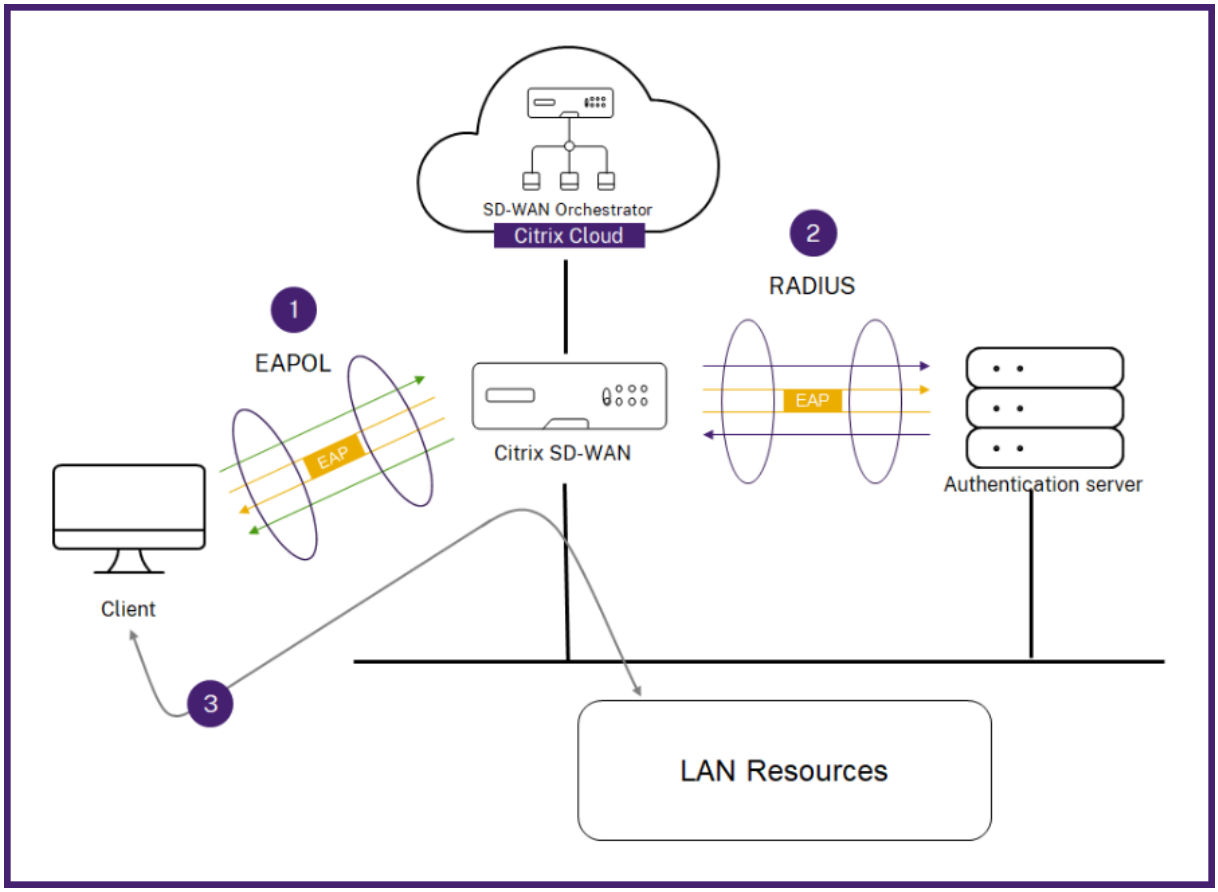

The Citrix SD-WAN appliance expects to receive packets without an 802.1Q tag (untagged packets). If the Citrix SD-WAN appliance receives a packet with an 802.1Q tag set to the assigned virtual LAN, then all the packets originated from the MAC must be tagged. If a packet is received with no 802.1Q tag in the header or with a tag other than the virtual LAN that the MAC address belongs to, then the packet is dropped.

When multiple clients connected to a switch try to authenticate at the same time over a single port, each client is authenticated individually, before it can gain access to the LAN resources. The clients that fail to authenticate can retry authentication by unplugging the Ethernet cable, waiting for 3 minutes, and reinserting the Ethernet cable. Citrix SD-WAN 110, 210, and 410 platforms support a maximum of 32 clients (both authenticated and unauthenticated). All other platforms support a maximum of 64 clients (both authenticated and unauthenticated).

To configure 802.1X authentication, navigate to **Site Configuration > Interfaces** and turn on the **Enable 802.1x** toggle button. Select an existing RADIUS profile or click **Create RADIUS Profile** to create a RADIUS profile. For details on creating a RADIUS profile, see RADIUS server profiles. You can use the same RADIUS profile(s) for wired 802.1x and wireless WPA2-enterprise authentication, provided your appliance supports wireless WPA2-enterprise.

Select a virtual interface from the **Authenticated VIF** drop-down list. The selected virtual interface grants access to the LAN resources for successful authentication requests.

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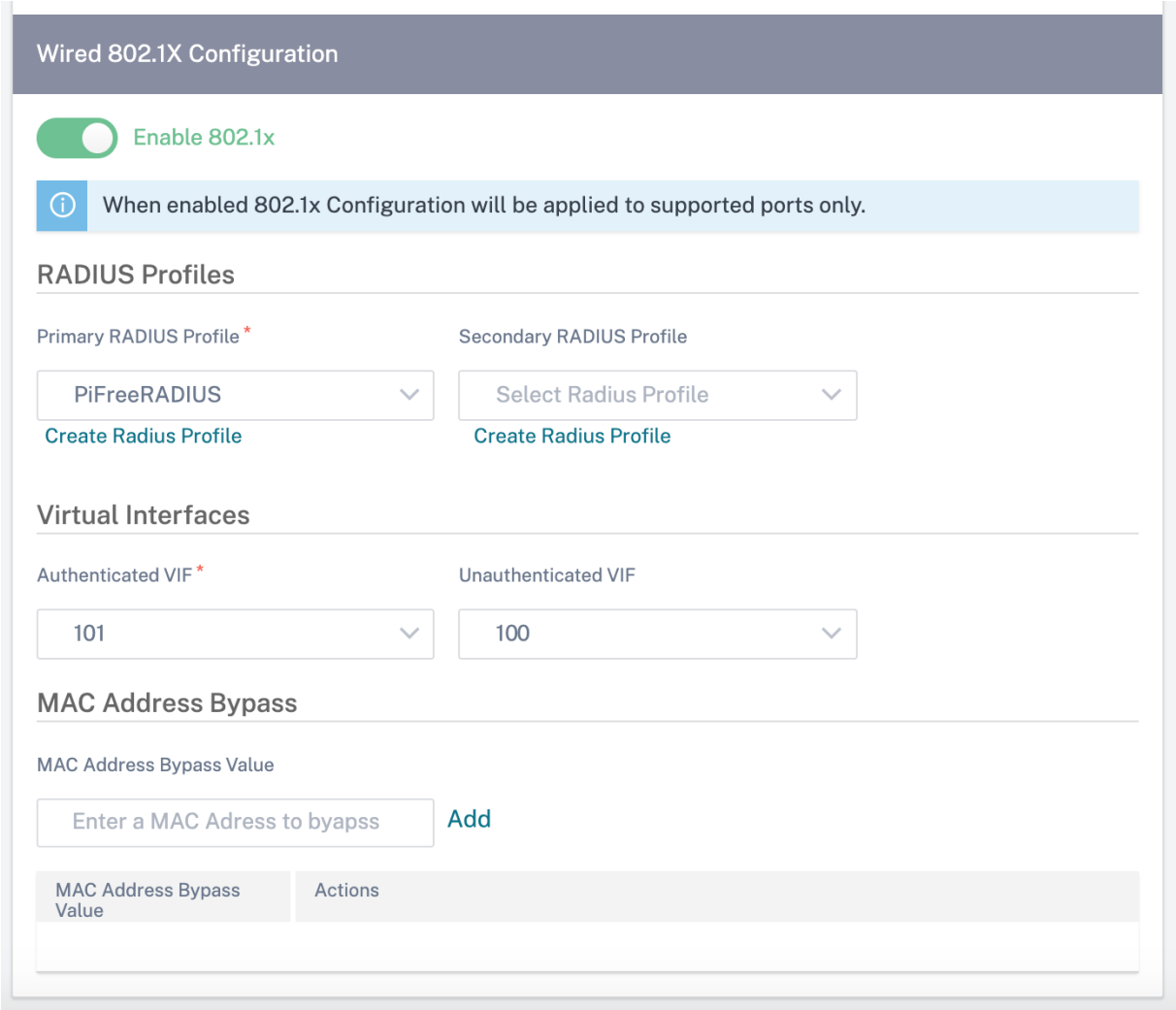
Optionally, you can select an interface from the **Unauthenticated VIF** drop-down list. The selected virtual interface grants access to a specific LAN resource for the failed authenticated requests.

You can add a list of MAC addresses which bypasses the authentication process. Traffic from these MAC addresses will be implicitly treated as authenticated. These MAC addresses are susceptible to malicious attacks. So, use this capability only in physically secure environments and for legacy hardware that does not support wired 802.1x authentication.



You can view the alerts associated with wired 802.1x authentication requests under **Reports > Alerts**. For more information, see Alerts.

WAN links

The next step is to configure WAN links. Click **+ WAN Link** to start configuring a WAN link.

WAN link configuration involves setting up the WAN link access type and access interface attributes.

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You can configure the **WAN link** attribute from scratch, or use a WAN link profile to configure WAN link attributes quickly. If you have already used a site profile, the **WAN link** attributes auto-populate.

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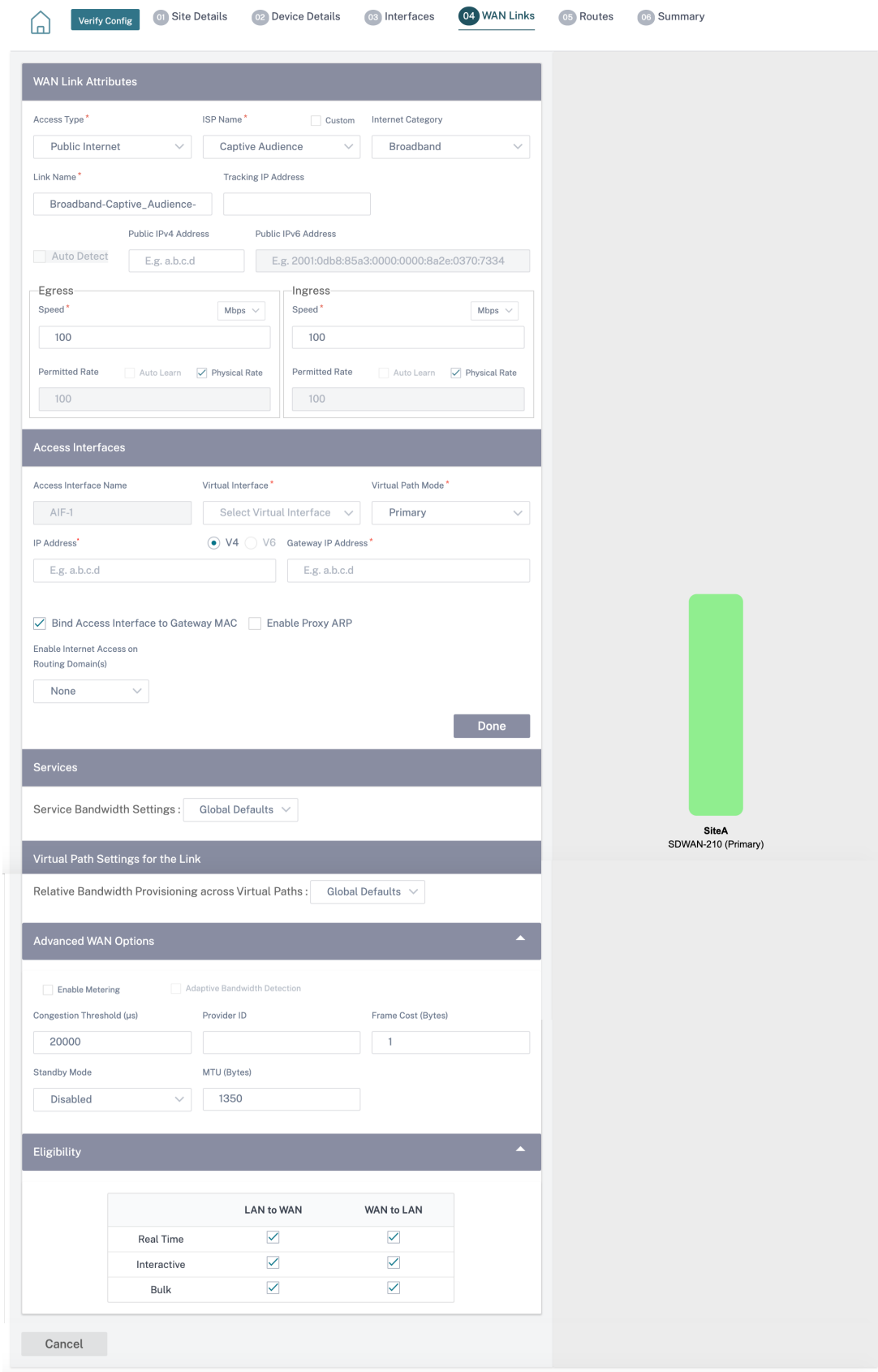
WAN link attributes



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- **Access Type**: Specifies the WAN connection type of the link.
  - **Public Internet**: Indicates that the link is connected to the Internet through an ISP.
  - **Private Intranet**: Indicates that the link is connected to one or more sites within the SD-WAN network and cannot connect to locations outside the SD-WAN network.
  - **MPLS**: Specialized variant of Private Intranet. Indicates the link uses one or more DSCP tags to control the Quality of Service between two or more points on an Intranet and cannot connect to locations outside of the SD-WAN network.
- **ISP Name**: The name of the service provider.
- **Link Name**: Auto-populated based on the previous inputs.
- **Tracking IP Address**: The Virtual IP Address on the Virtual Path that can be pinged to determine the state of the path.
- **Public IPv4 Address** and **Public IPv6 Address**: The IP address of the NAT or DNS Server. This address is applicable and exposed, only when the WAN link access type is Public Internet or Private Intranet in Serial HA deployment. Public IP can either be manually configured or auto-learned using the Auto Learn option.
- **Auto Detect**: When enabled, the SD-WAN appliance automatically detects the public IP address. This option is available only when the device role is a **branch** and not the **Master Control Node (MCN)**.
- **Egress Speed**: The WAN to LAN speed.
  - **Speed**: The available or allowed speed of the WAN to LAN traffic in Kbps or Mbps.
  - **Permitted Rate**: In cases where the entire WAN link capacity is not supposed to be used by the SD-WAN appliance, change the permitted rate accordingly.
  - **Auto Learn**: When you are unsure of the bandwidth and if the links are non-reliable, you can enable the Auto Learn feature. The Auto Learn feature learns the underlying link capacity only, and uses the same value in the future.
  - **Physical Rate**: The actual bandwidth capacity of the WAN link.
- **Ingress Speed**: The LAN to WAN speed.
  - **Speed**: The available or allowed speed of the LAN to WAN traffic in Kbps or Mbps.
  - **Permitted Rate**: In cases where the entire LAN link capacity is not supposed to be used by the SD-WAN appliance, change the permitted rate accordingly.
  - **Auto Learn**: When you are unsure of the bandwidth and if the links are non-reliable, you can enable the Auto Learn feature. The Auto Learn feature learns the underlying link capacity only, and uses the same value in the future.
  - **Physical Rate**: The actual bandwidth capacity of the LAN link.

MPLS Queues

The **MPLS queue** settings are available for WAN link access type MPLS only. This option is meant to enable definition of queues corresponding to the Service Provider MPLS queues, on the MPLS WAN Link. For more information, see MPLS Queues.

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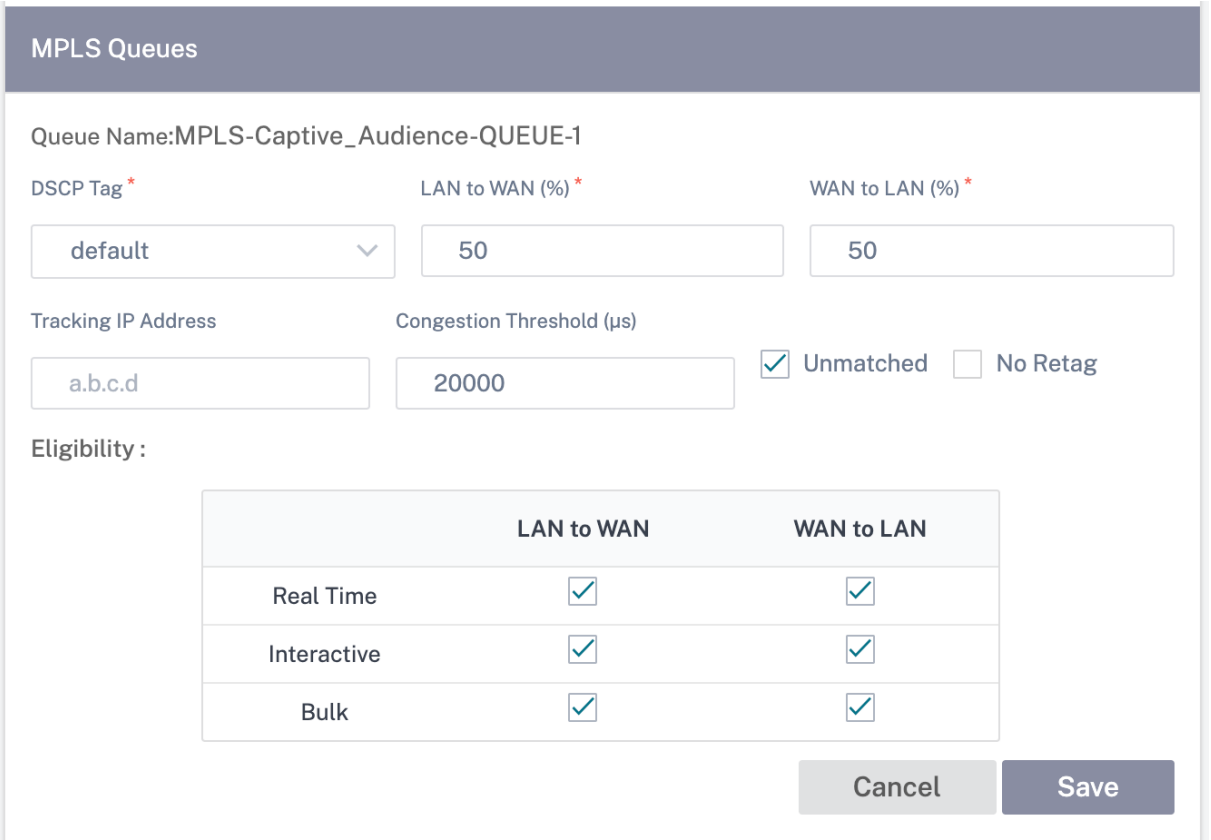

Following are the queue parameters:

- **Queue Name**: The name of the MPLS queue.
- **DSCP Tag**: The unique **Differentiated Services Code Point(DSCP)** tag of the MPLS queue.
- **LAN to WAN (%)**: The proportion (%) of bandwidth used for upload cannot exceed the defined physical upload rate.
- **WAN to LAN (%)**: The proportion (%) of bandwidth used for download cannot exceed the defined physical download rate.
- **Tracking IP Address**: The Virtual IP Address on the Virtual Path that can be pinged to determine the state of the path.
- **Congestion Threshold**: The amount of congestion (in microseconds) after which the MPLS Queue throttles packet transmission to avoid further congestion.
- **Unmatched option**: If enabled, DCSP tags not matched by other MPLS Queues would use this Class. Only one MPLS Queue can be marked for use by unmatched tags.
- **No retag option**: If enabled, the LAN to WAN intranet traffic retains the original tag and no retag with the default DSCP tag.
- **Eligibility**: The eligibility settings for an MPLS Queue allow the user to add an extra penalty for using the MPLS Queue for certain Classes of traffic. When a Class of traffic is marked as not-eligible for the MPLS Queue, a penalty is added that makes the WAN Link unlikely to be used unless network conditions require it.

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Access Interface

An Access Interface defines the IP Address and Gateway IP Address for a WAN Link. At least one Access Interface is required for each WAN Link. The following are the access interface parameters:

- **Access Interface Name**: The name by which Access interface is referenced. The default uses the following naming convention: WAN_link_name-AI-number: Where WAN_link_name is the name of the WAN link you are associating with this interface, and number is the number of Access Interfaces currently configured for this link, incremented by 1.
- **Virtual Interface**: The Virtual Interface that the Access Interface uses. Select an entry from the drop-down menu of Virtual Interfaces configured for the current branch site.
- **Virtual Path Mode**: Specifies the priority for Virtual Path traffic on the current WAN link. The options are: Primary, Secondary, or Exclude. If set to Exclude, the Access Interface is used for Internet and Intranet traffic, only.
- **IP Address**: The IP Address for the Access Interface endpoint from the appliance to the WAN. Select V4 (IPv4) or V6 (IPv6) as required.
- **Gateway IP Address**: The IP Address for the gateway router.
- **Bind Access Interface to Gateway MAC**: If enabled, the source MAC address of packets received on Internet or Intranet services must match the gateway MAC addressWANK links > Advances WAN Options.
- **Enable Proxy ARP**: If enabled, the Virtual WAN Appliance replies to ARP requests for the Gateway IP Address, when the gateway is unreachable.
- **Enable Internet Access on Routing Domain(s)**: Auto-creates a DEFAULT route (0.0.0.0/0) in all the routing tables of the respective routing domains. You can enable for ALL routing domains or NONE. It avoids the need for creating exclusive static route across all the routing domains if they needed internet access.

Services

The **Services** section allows you to add service types and allocate the percentage of bandwidth to be used for each service type. You can define the service types and configure attributes for it from the Delivery services section. You can choose to use these global defaults or configure link specific service bandwidth settings from the **Service Bandwidth Settings** drop-down list. If you choose link specific, enter the following details:

- **Service Name**: The name of the WAN link service.
- **Allocation %**: The guaranteed fair share of bandwidth allocated to the service from the link's total capacity.
- **Mode**: The operation mode of the WAN Link, based on the service selected. For Internet, there is one of Primary, Secondary, and Balance and for Intranet there is Primary and Secondary.
- **LAN to WAN Tag**: The DHCP tag to apply to LAN to WAN packets on the service.
- **WAN to LAN Tag**: The DHCP tag to apply to WAN to LAN packets on the service.

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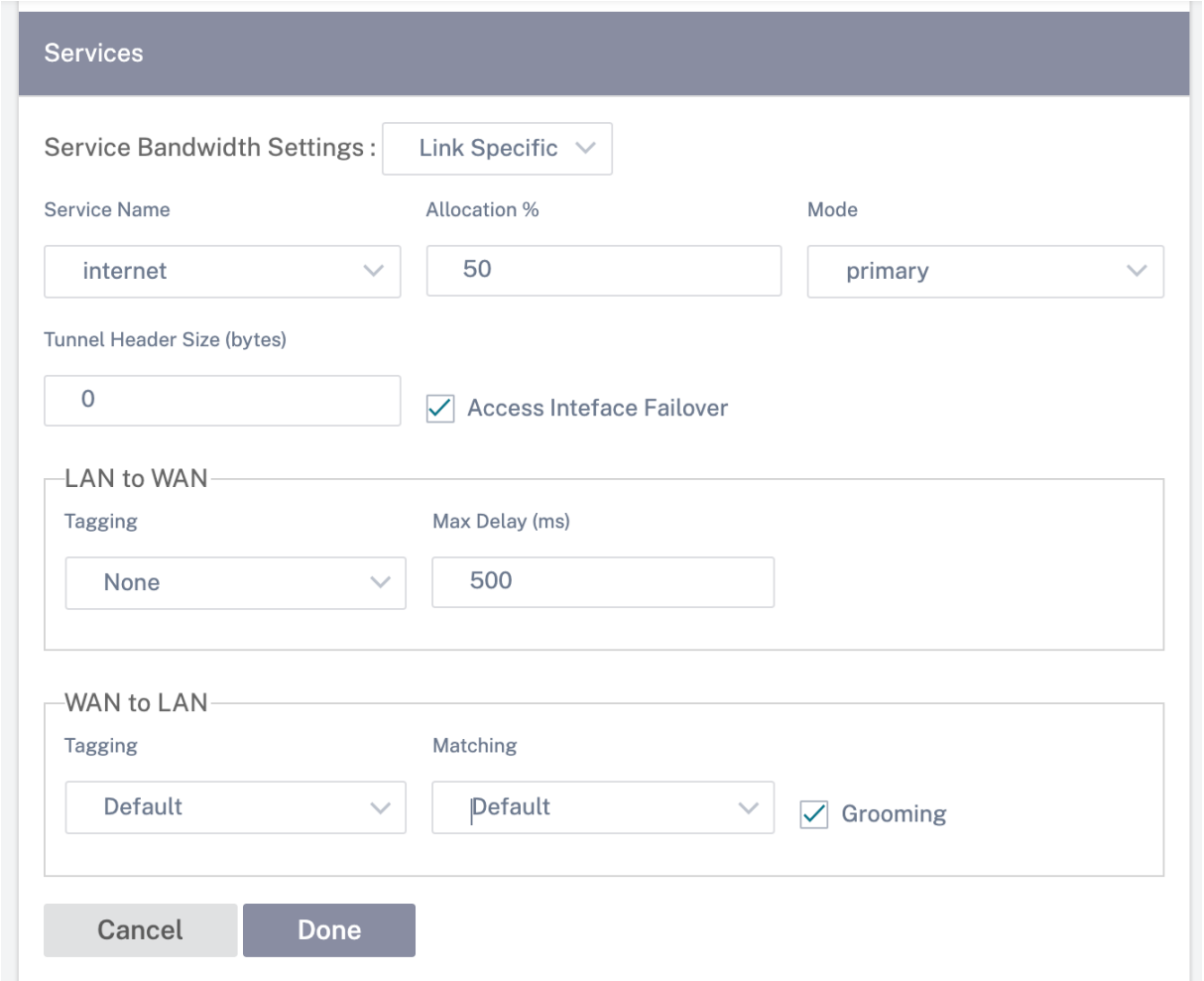
- **WAN to LAN Match**: The match criteria for Internet WAN to LAN packets to get assigned to the service.
- **LAN to WAN Delay**: The maximum time, to buffer packets when the WAN Links bandwidth is exceeded.
- **Tunnel Header Size**: The size of the tunnel header, in bytes.
- **WAN to LAN Grooming**: If enabled, packets are randomly discarded to prevent WAN to LAN traffic from exceeded the Service's provisioned bandwidth.



Virtual Path settings for the link

Select the relative bandwidth provisioning across virtual paths as **Global Default** or **Link Specific** as required. On selecting **Link Specific**, when you enable the auto-bandwidth provisioning, the share of the bandwidth for the virtual path service is automatically calculated and applied accordingly to the magnitude of bandwidth that might be consumed by remote sites.

- **Max to Min Virtual Path Bandwidth Ratio for the Link**: You can set the maximum to minimum virtual path ratio that can be applied to the selected WAN link.

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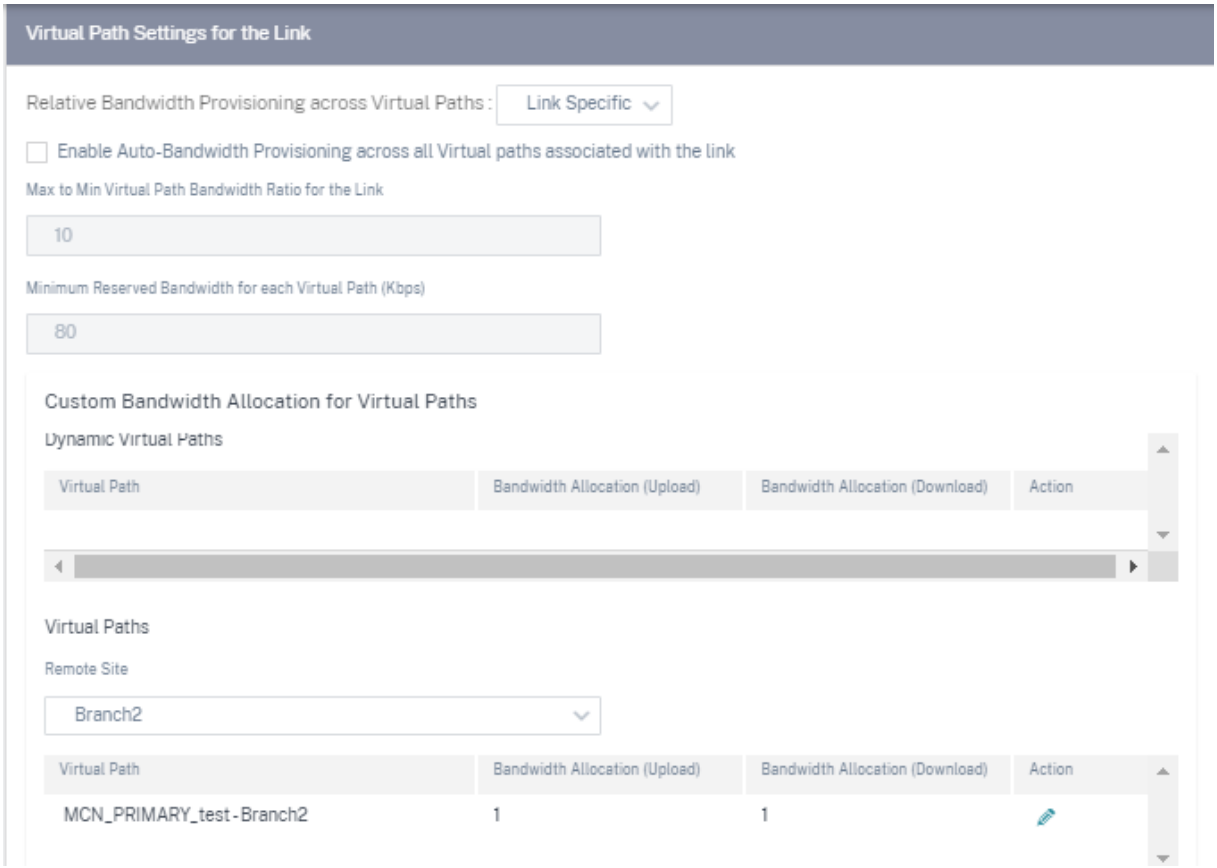
- **Minimum Reserved Bandwidth for each Virtual Path (Kbps)**: You can set the minimum reserved bandwidth value in Kbps for each virtual path.



To customize the bandwidths for the virtual paths associated with a WAN link:

1. Clear the **Enable Auto-Bandwidth Provisioning across all virtual paths associated with the link** check box.
2. In the **Custom Bandwidth Allocation for Virtual Paths** section, select a remote site. You can provision bandwidths for the virtual paths to the remote site.
   - **Minimum Bandwidth (Kbps)**: The minimum bandwidth reserved for the virtual path. The minimum bandwidth that you can set for a virtual path is 80 Kbps.
   - **Maximum Bandwidth (Kbps)**: The maximum bandwidth that the virtual path can utilize from the WAN link. If the maximum bandwidth is not set, the site utilizes all of the available bandwidth.
   - **Bandwidth Allocation (Relative Measure)**: The bandwidth share allocated to a virtual path out of its group's eligible bandwidth. For example, if a WAN link group of 3 virtual paths is eligible for 30 Mbps bandwidth and you want to allocate equal bandwidth for each virtual path, update 10 as the bandwidth allocation on the remote site.

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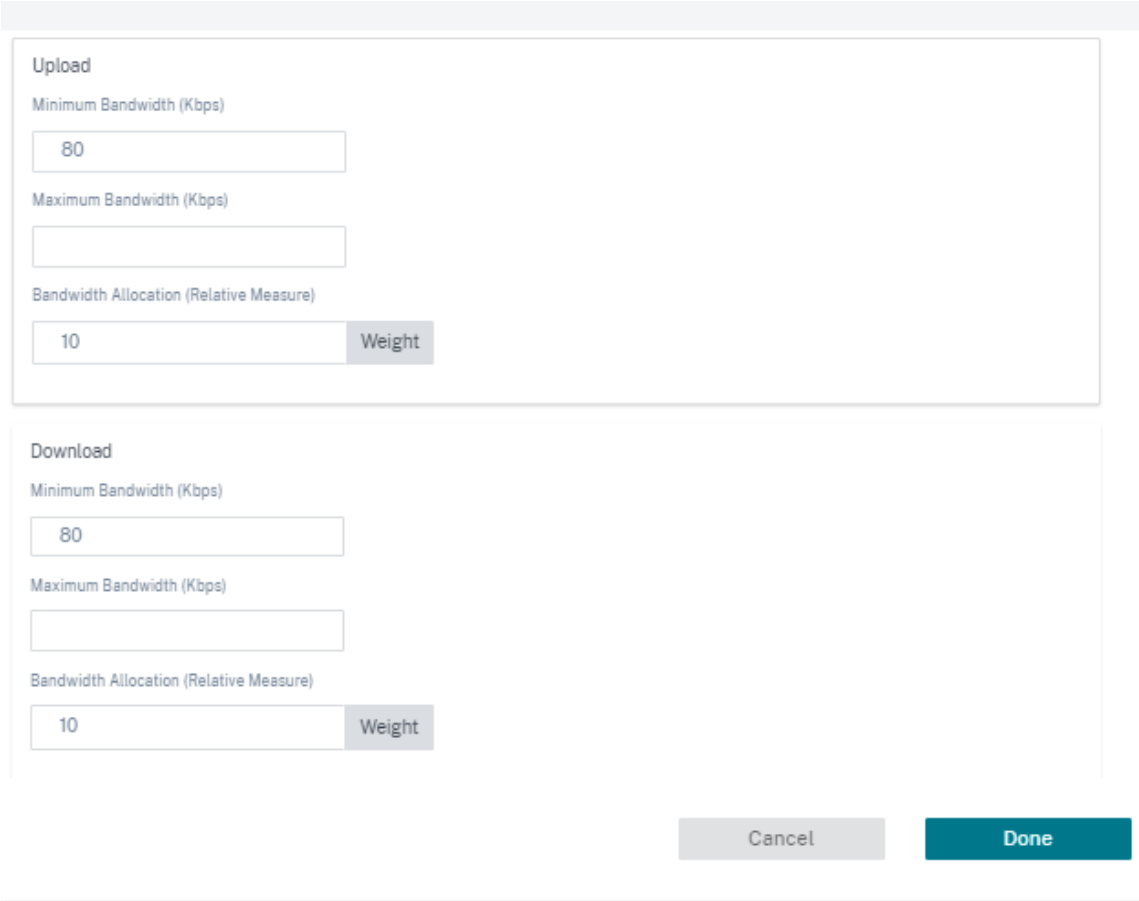

3. Click **Done**.

> **Note**
>
> Citrix SD-WAN Orchestrator for On-premises retains the previously configured custom bandwidth settings even after the previously configured dynamic virtual paths are disabled between two sites. Ensure to update the custom bandwidth settings manually when you reconfigure the dynamic virtual paths.

Points to consider for bandwidth provisioning

- By default, all branches and WAN services (Virtual Path/Internet/Intranet) receive a weightage of 1 each.
- Bandwidth customization is required when there is a high disparity in terms of bandwidth requirement.
- When dynamic virtual paths are enabled between the available sites, the WAN link capacity is shared between the static virtual path to the data center and the dynamic virtual paths.

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Advanced WAN options

The WAN Link Advanced Settings allows the configuration of the **ISP specific** attributes.

- **Congestion Threshold**: The amount of congestion after which the WAN link throttles packet transmission to avoid further congestion.
- **Provider ID**: Unique Identifier for the provider to differentiate paths when sending duplicate packets.
- **Frame Cost (Bytes)**: Extra header/trailer bytes added to every packet, such as for Ethernet IPG or AAL5 trailers.
- **MTU (Bytes)**: The largest raw packet size in bytes, not including the Frame Cost.
- **Standby Mode**: A standby link is not used to carry user traffic unless it becomes active.
  - **Disabled**: The standby mode of a WAN link is disabled by default.
  - **On-Demand**: An on-demand standby WAN link will also become active if all non-standby WAN links are dead or disabled.
  - **Last-Resort**: A last-resort standby WAN link becomes active only when all non-standby WAN links and all on-demand standby WAN links are dead or disabled.

```
![Advanced wan option](/en-us/citrix-sd-wan-orchestrator/media/advanced
    -wan-option.png)
```

- **Enable Metering**: Tracks usage on a WAN link and alerts the user when the link usage exceeds the configured data cap.
  - **Data Cap (MB)**: The maximum data threshold in MB.
  - **Billing Cycle**: The billing frequency, weekly or monthly.
  - **Starting From**: The date from which the billing cycle starts.
  - **Approximate Data Already Used**: The approximate data already used in MB for the metered link. This is applicable only for the first cycle. To track the proper metered link usage, specify the approximate metered link usage, if the link has already been used for few days in the current billing cycle.
  - **Disable link if Data Cap Reached**: If the data usage reaches the specified data cap, the metered link and all its related paths are disabled until the next billing cycle. If this option is not selected, the metered link remains in the current state, after the data cap is reached, until the next billing cycle.

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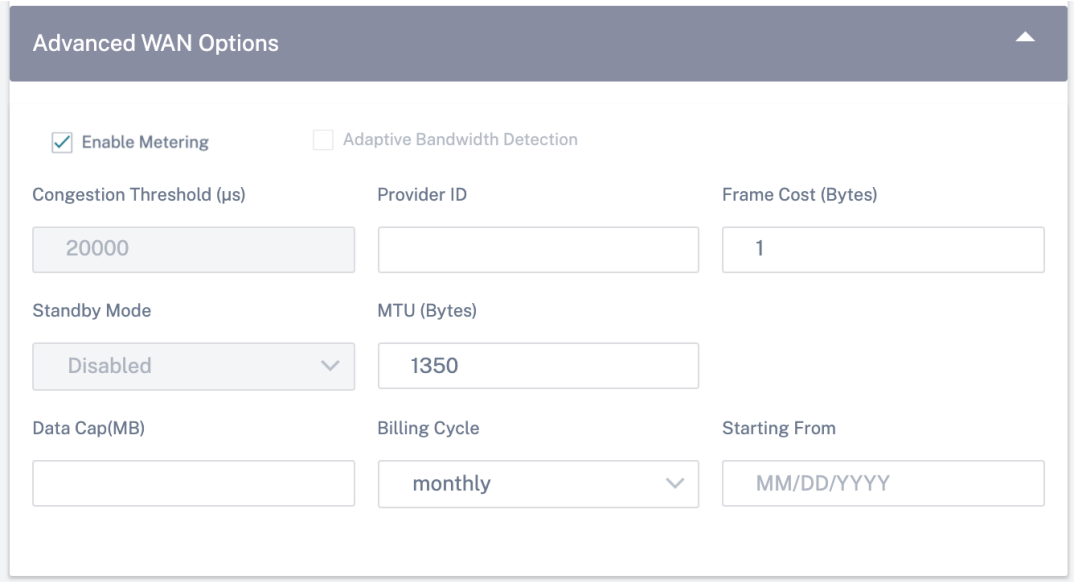

For more information, see Metering and Standby WAN Links.

- **Adaptive Bandwidth Detection**: Uses the WAN link at a reduced bandwidth rate when a loss is detected. When the available bandwidth is below the configured **Minimum Acceptable Bandwidth**, then the path marked as BAD. Use Custom Bad Loss Sensitivity under Path or Autopath group with Adaptive Bandwidth Detection.

  > **Note**
  >
  > Adaptive Bandwidth Detection is available only for Client and not for MCN.

  - **Minimum Acceptable Bandwidth**: When there is varying bandwidth rate, the percentage of WAN to LAN permitted rate below which the path is marked as BAD. The minimum kbps is different on each side of a virtual path. The value can be in the range 10%-50% and the default being 30%.

Routes

The next step in the site configuration workflow is to create routes. You can create application and IP routes based on your site requirements.

> **NOTE**
>
> The routes that were added before introducing the **Application Route** and **IP Route** tabs are listed under the **IP Routes** tab with **Delivery Service** as Internet.

The global routes and site-specific routes that are created at the network level automatically get listed under **Routes > Application Routes** and **Routes > IP routes** tabs. You can only view the global routes at the site level. To edit or delete a global route, navigate to network level configurations.

You can also create, edit, or delete routes at the site level.

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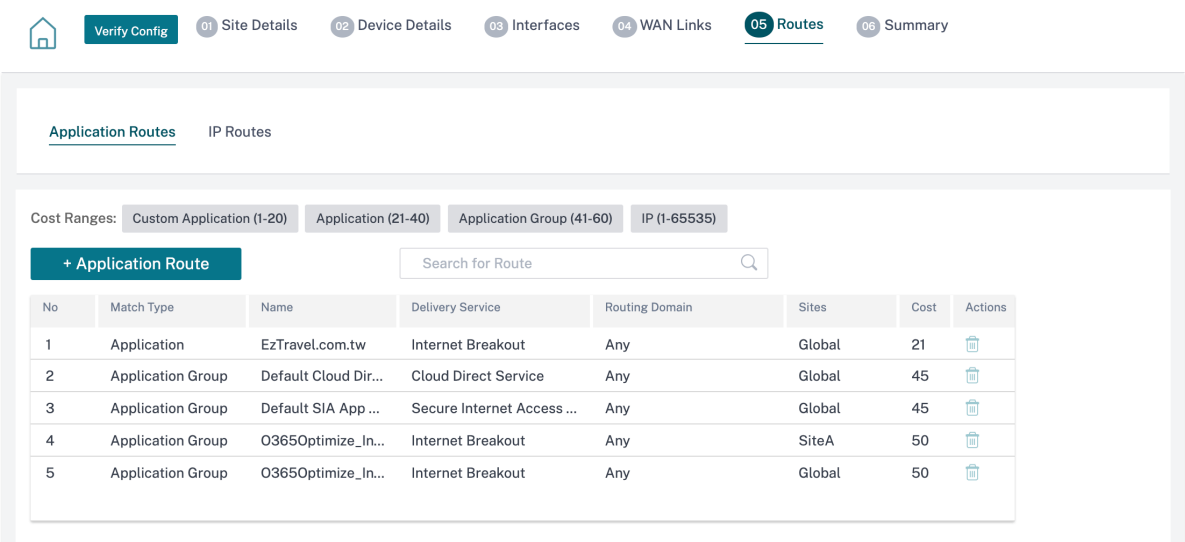

Application routes

Click **+ Application Route** to create an application route.

- **Custom Application Match Criteria**:
  - **Match Type**: Select the match type as **Application**/**Custom Application**/**Application Group** from the drop-down list.
  - **Application**: Choose one application from the drop-down list.
  - **Routing Domain**: Select a routing domain.
- **Traffic Steering**
  - **Delivery Service**: Choose one delivery service from the list.
  - **Cost**: Reflects the relative priority of each route. Lower the cost, the higher the priority.
- **Eligibility Based on Path**:
  - **Add Path**: Choose a site and WAN links, both to and from. If the added path goes down, then the application route does not receive any traffic.

If a new application route gets added, then the route cost must be in the following range:

- Custom application: 1–20
- Application: 21–40
- Application group: 41–60

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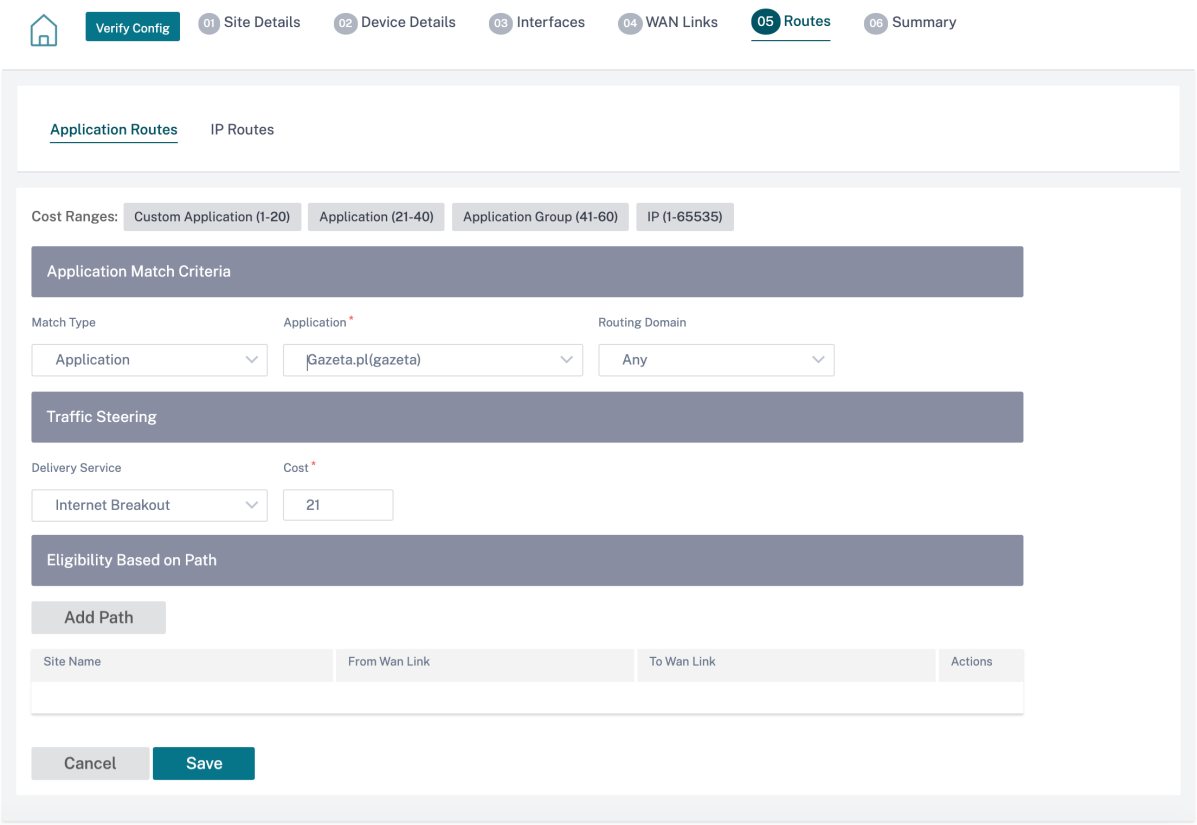

IP routes

Go to **IP Routes** tab and click **+ IP Route** to create the IP Route policy to steer traffic.

- **IP Protocol Match Criteria**:
  - **Destination Network**: Add the destination network that helps to forward the packets.
  - **Use IP Group**: You can add a destination network or enable the Use IP Group check box to select any IP group from the drop-down list.
  - **Routing Domain**: Select a routing domain from the drop-down list.
- **Traffic Steering**
  - **Delivery Service**: Choose one delivery service from the drop-down list.
  - **Cost**: Reflects the relative priority of each route. Lower the cost, the higher the priority.
- **Eligibility Criteria**:
  - **Export Route**: If the Export Route check box is selected and if the route is a local route, then the route is eligible to be exported by default. If the route is an INTRANET/INTERNET based route, then for the export to work, WAN to WAN forwarding has to be enabled. If the Export Route check box is cleared, then the local route is not eligible to be exported to other SD-WAN and has local significance.
- **Eligibility based on Path**:

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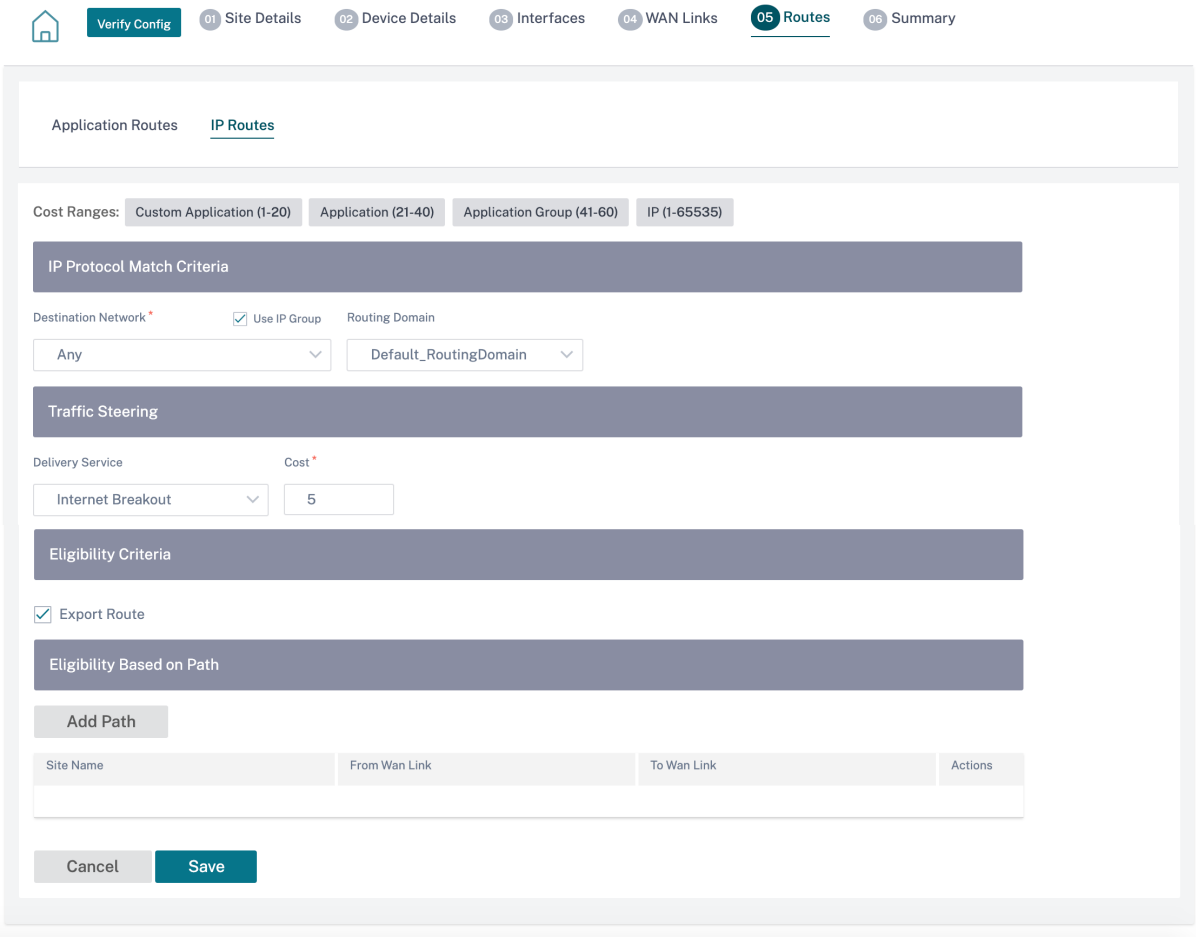
- **Add Path**: Choose a site and WAN links, both to and from. If the added path goes down, then the IP route does not receive any traffic.

If a new IP route gets added, then the route cost must be in the 1–20 range.



Summary

This section provides a summary of the site configuration to enable a quick review before submitting the same.

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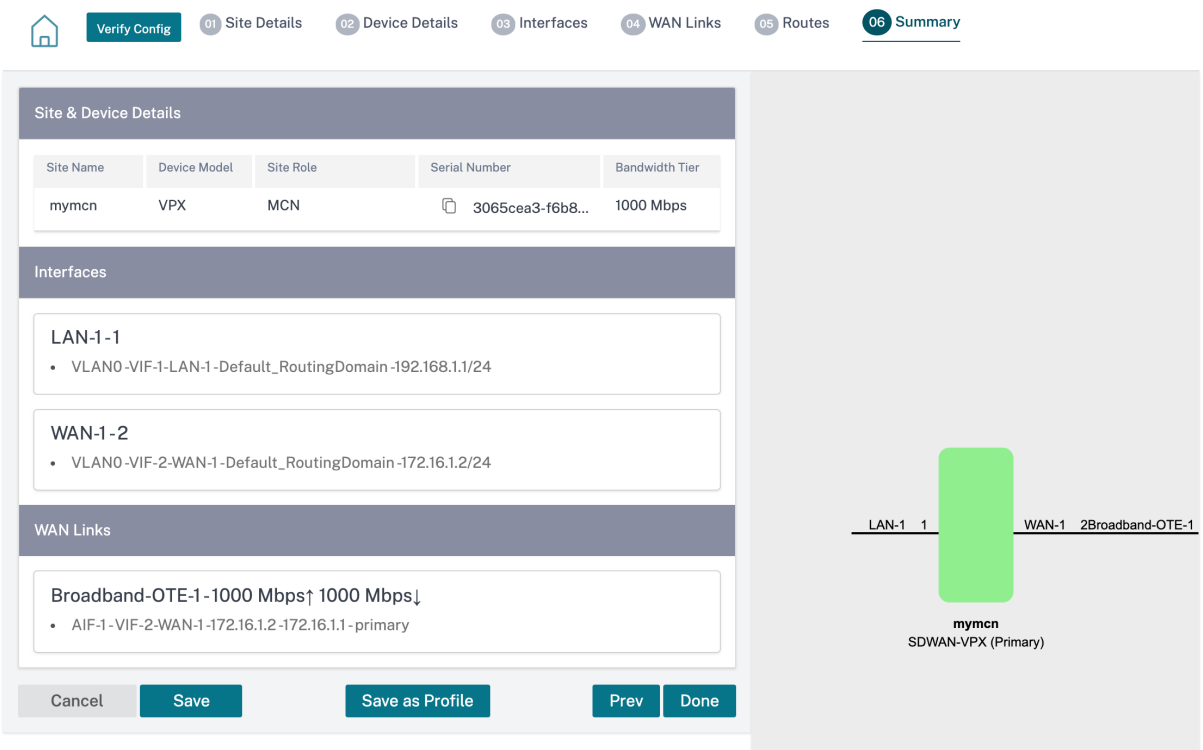

Use the **Save as Template** option to save the site configuration as a template for reuse across other sites. Clicking **Done** marks completion of site configuration, and takes you to the **Network Configuration – Home** page to review all the sites configured. For more information, see Network Configuration.

LTE firmware upgrade

December 16, 2020

Citrix SD-WAN Orchestrator for On-premises allows you to configure and manage all the LTE sites in your network. It includes appliances connected through an internal LTE modem or external USB LTE modem.

To configure the LTE sites in your network:

1. At the site level, navigate to **Configuration > Site Configuration**.

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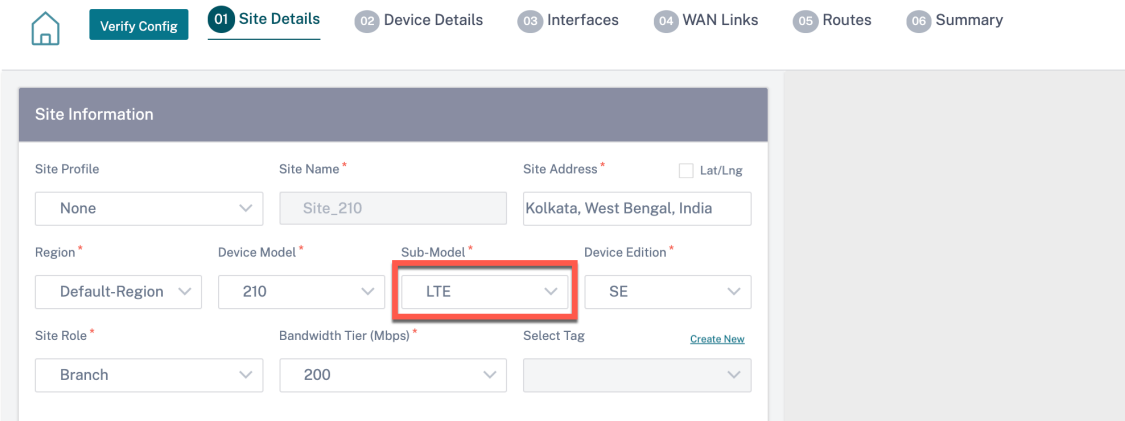
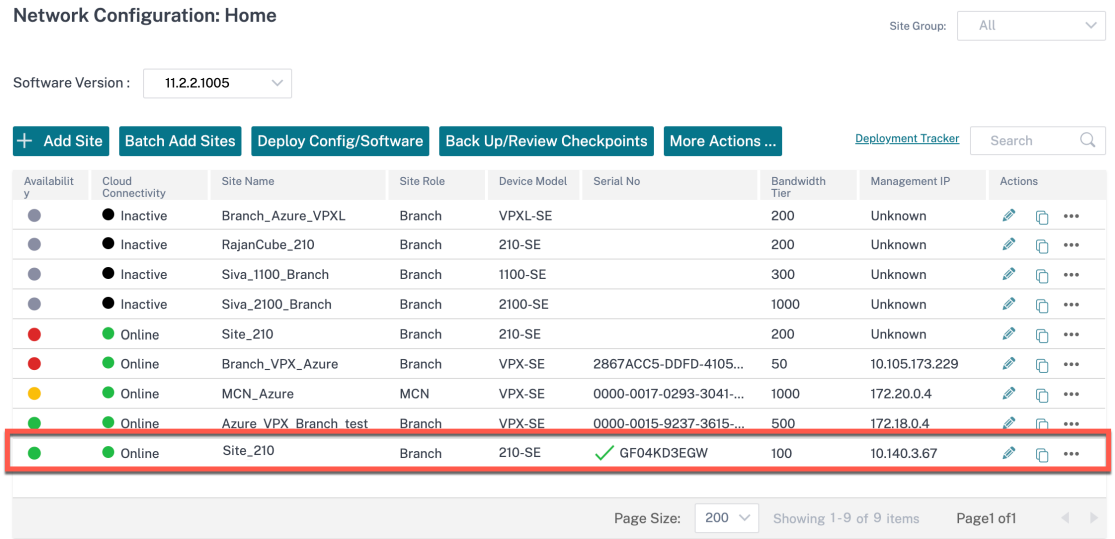


2. Select the submodel as **LTE** along with other necessary details and click Save. For more information on site configuration, see Site configuration.

3. Once the site is created, navigate to the **Network Configuration Home** page and click **Deploy Config/Software** button.



> C
>
> **Note**
>
> Currently, the LTE support is available on Citrix SD-WAN 210 appliances.

4. The **Software Version** field is auto filled with the latest software version package and the filed is non-editable. Once you click **Stage**, it downloads all the appropriate LTE firmware for the selected software version.

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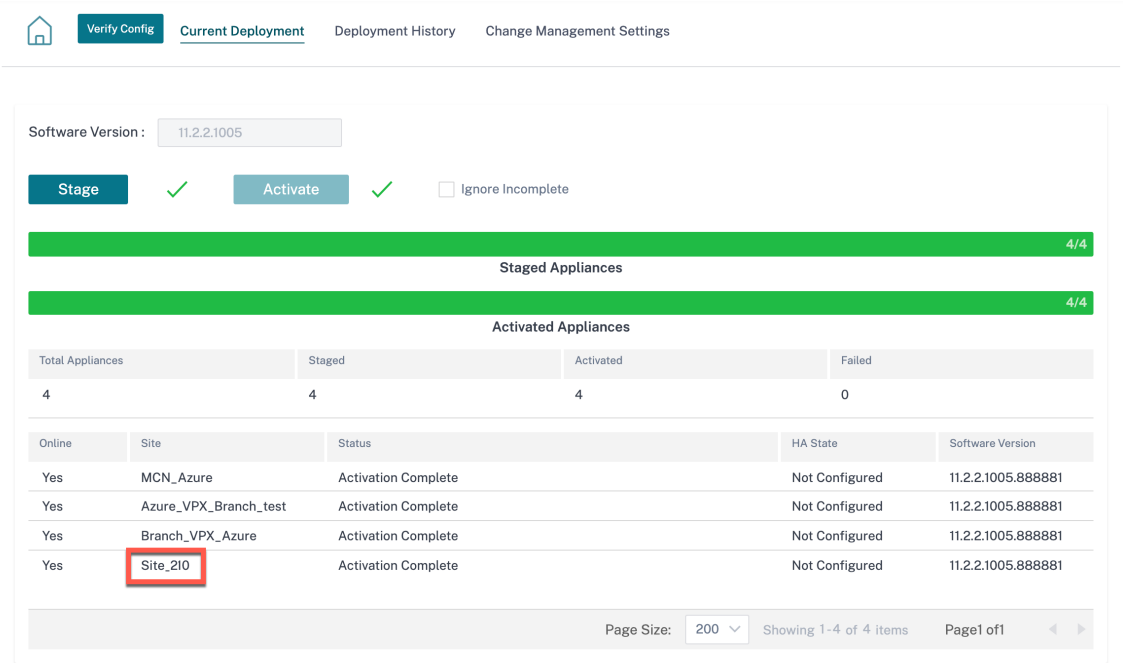
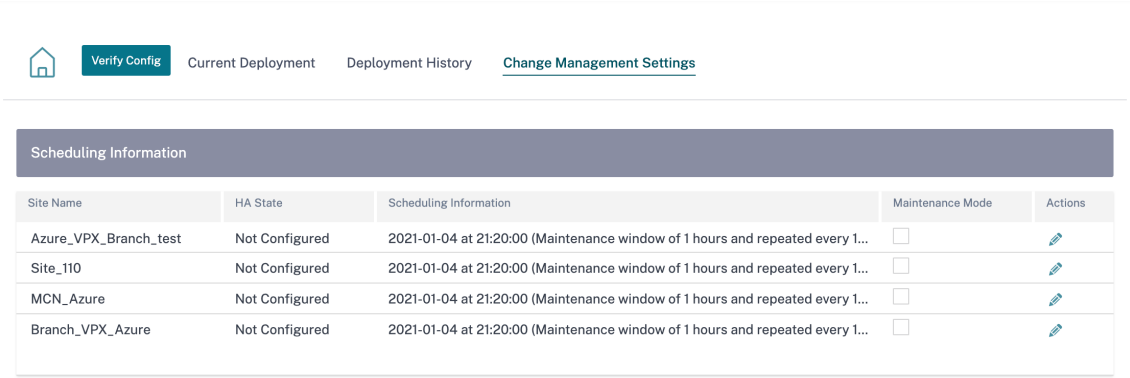


It takes few minutes to complete the staging. You can view the status to track the staging progress. Initially the status shows **Staging Pending**, then **Downloading Appliance Software**, and finally **Staging Complete**. You can cancel the staging anytime by clicking **Cancel Stage** button.

5. Once the staging is completed, click **Activate** button to activate the software.
6. The LTE software activation is part of the scheduling window. To upgrade the LTE software, navigate to **Change Management Settings** tab. You can see a list of site names with scheduling information and an action option.



In the scheduling window, a specific time frame is specified to complete the LTE software upgrade.

7. Click the action symbol and provide the scheduling information - date with time, maintenance window duration in hours, repeat window with unit as days/weeks/months. Click **Save**.

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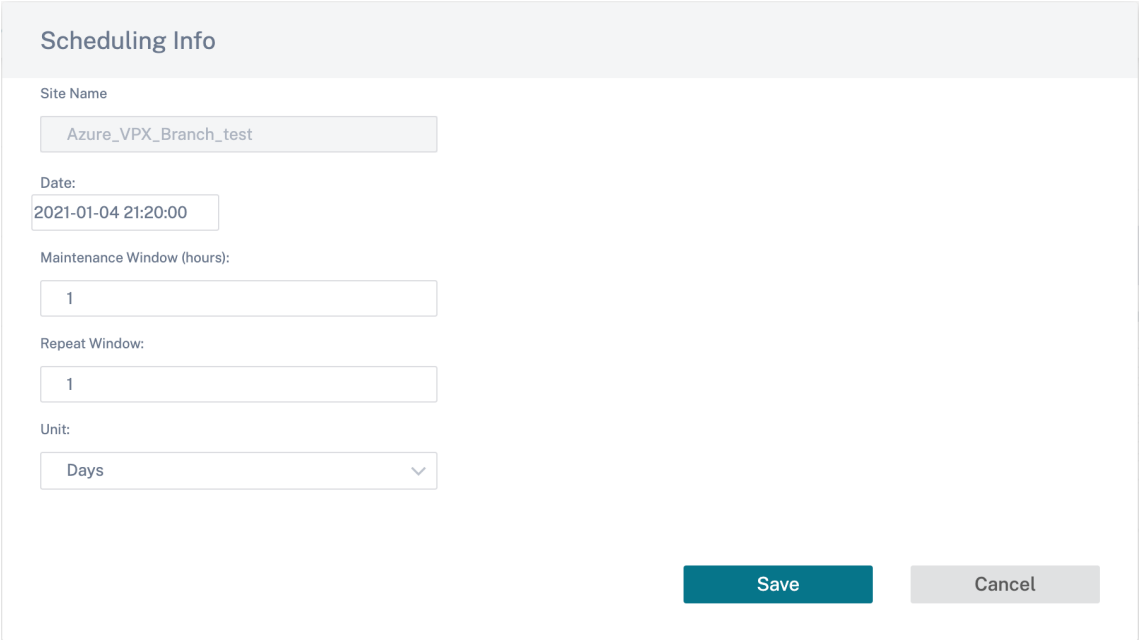

Once the timing is set, it propagates the information to the appliance. LTE firmware upgrades when the time in the appliance matches with the time set in the schedule window. The schedule window lets you configure a specific time to upgrade LTE firmware. LTE firmware upgrade will not start immediately when you set the schedule window.

> **Note**
>
> For all the appliances, the following are the default scheduling information that is already set:
>
> - **Schedule window** - 21:20:00
> - **Maintenance window** - 1 hour
> - **Repeated window** - 1 day
>
> So if you don't configure the change management settings, the scheduling window processes the update automatically. Also, when you set the value of **Maintenance Window (hours)** to **0**, the LTE firmware upgrade happens immediately.

Starting 11.1.0, a new configuration knob is added for in-band management configuration on the site interface group page. This is a mandatory configuration for any appliance that needs to be managed through an inband IP. Missing this configuration in the Citrix SD-WAN Orchestrator for On-premises can cause the appliance to go offline (especially important when the 210 s and 110 s that were managed over LTE upgrade to 11.1.0).

Address resolution protocol

March 8, 2021

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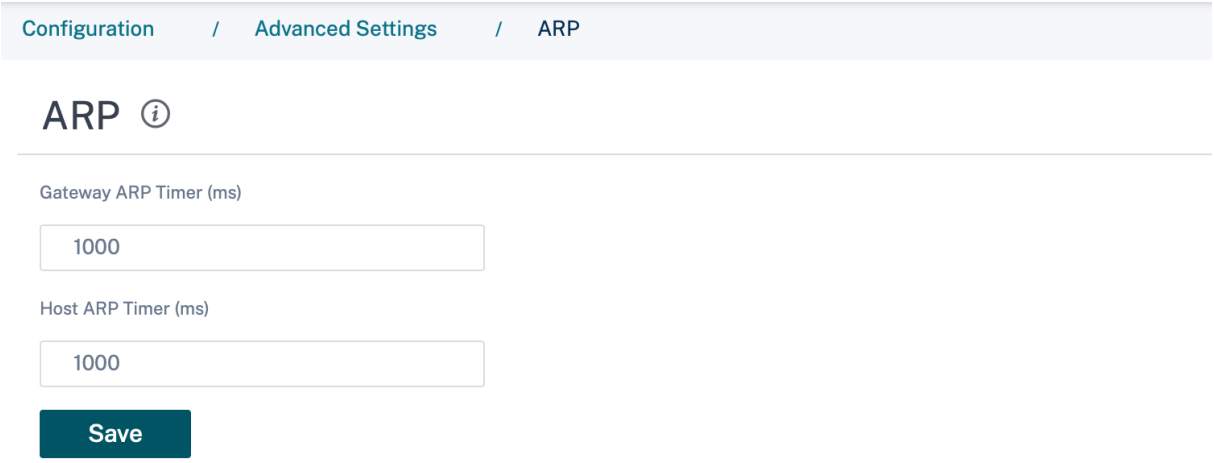
In Citrix SD-WAN deployments such as Gateway and One-arm, when the Address Resolution Protocol (ARP) requests are received frequently, the access points become overloaded affecting traffic flow. To overcome the traffic overload, you can configure the following ARP timers to send the ARP requests with specific interval times.

- **Gateway ARP Timer (ms)**: The time, (range: 100–20000 milliseconds), between ARP requests for configured Gateway IP addresses.
- **Host ARP Timer (ms)**: The time, (range: 1000–180000 milliseconds), between ARP requests for configured Host IP addresses.



Neighbor discovery protocol

April 7, 2021

In an IPv6 network, Citrix SD-WAN appliances periodically multicast router advertisement messages to announce their availability and convey information to the neighboring appliances in the SD-WAN network. The router advertisements include the IPv6 prefix information. Neighbor Discovery protocol (NDP) running on Citrix SD-WAN appliances use these router advertisements to determine the neighboring devices on the same link. NDP also determines each other's link-layer addresses, finds neighbors, and maintains active neighbors reachability information.

To configure the NDP router advertisement, navigate to **Configuration > Advanced Settings > NDP** and click **+ NDP**.

Choose one of the configured virtual interfaces from the **Virtual Interface** drop-down list. Select **Enable Advertisement** to enable sending periodic router advertisements and responding to Router Solicitations for the selected virtual interface.

Specify the maximum, minimum, and router lifetime intervals.

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- **Max Interval**: The maximum time (in seconds) allowed between sending periodic unsolicited multicast router advertisements.
- **Min Interval**: The minimum time (in seconds) allowed between sending periodic unsolicited multicast router advertisements.
- **Router Lifetime**: The time (in seconds) the router is considered valid by the hosts. 0 indicates the router cannot be used as the default router

Select **Managed Flag** if IP addresses are available through the DHCPv6 protocol. Select **Other Flag** if the configuration information (other than the IP addresses) is available through the DHCPv6 protocol.

Specify the following values for the selected interface.

- **Link MTU**: The recommended Maximum Transmission Unit (MTU) for the interface.
- **Reachable Time**: The time (in milliseconds) the NDP protocol stays in the **Reachable** state.
- **Retransmit Timer**: The time (in milliseconds) between retransmission of Neighbor Solicitation messages when resolving an IP address or probing a neighbor.
- **Hop Limit**: The maximum number of hops to be included in the router advertisement.

Click +Prefix List and enter the following values:

- **Prefix**: The prefix and prefix length in Classless Inter-Domain Routing (CIDR) notation.
- **Valid Lifetime**: The time in seconds up to which the prefix is valid. -1 represents infinity which means the prefix remains forever.
- **On-link**: When selected the prefix is considered as local to the network.
- **Autonomous Flag**: When enabled the prefix is used by the host's Stateless Address Autoconfiguration (SLAAC) to generate the IP address.
- **Prefix Lifetime**: The time (in seconds) up to which the prefix is considered as preferred.

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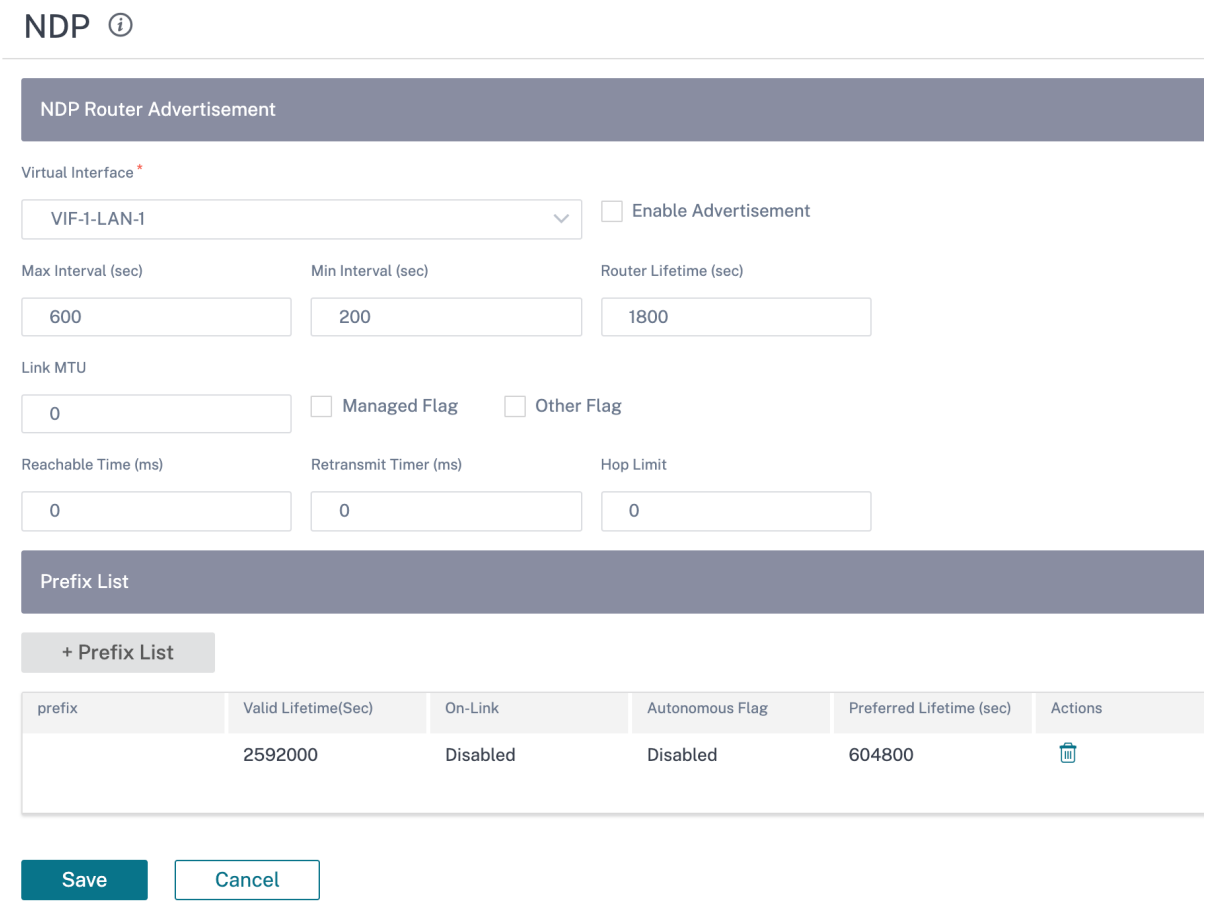

Virtual paths

October 21, 2020

A virtual path is a logical link between two WAN links. It comprises of a collection of WAN paths combined to provide high service-level communication between two SD-WAN nodes. This is done by constantly measuring and adapting to changing application demand and WAN conditions. The SD-WAN appliances measure the network on a per-path basis. A virtual path can be static (always exists) or dynamic (exists only when traffic between two SD-WAN appliances reaches a configured threshold).

Static virtual paths

The virtual path settings are inherited from the global wan link auto-path settings. You can override these configurations and add or remove the member path. You can also filter the virtual paths based on the site and the applied QoS profile. Specify a tracking IP address for the WAN Link that can be pinged to determine the state of the WAN Link. You can also specify a reverse tracking IP for the reverse

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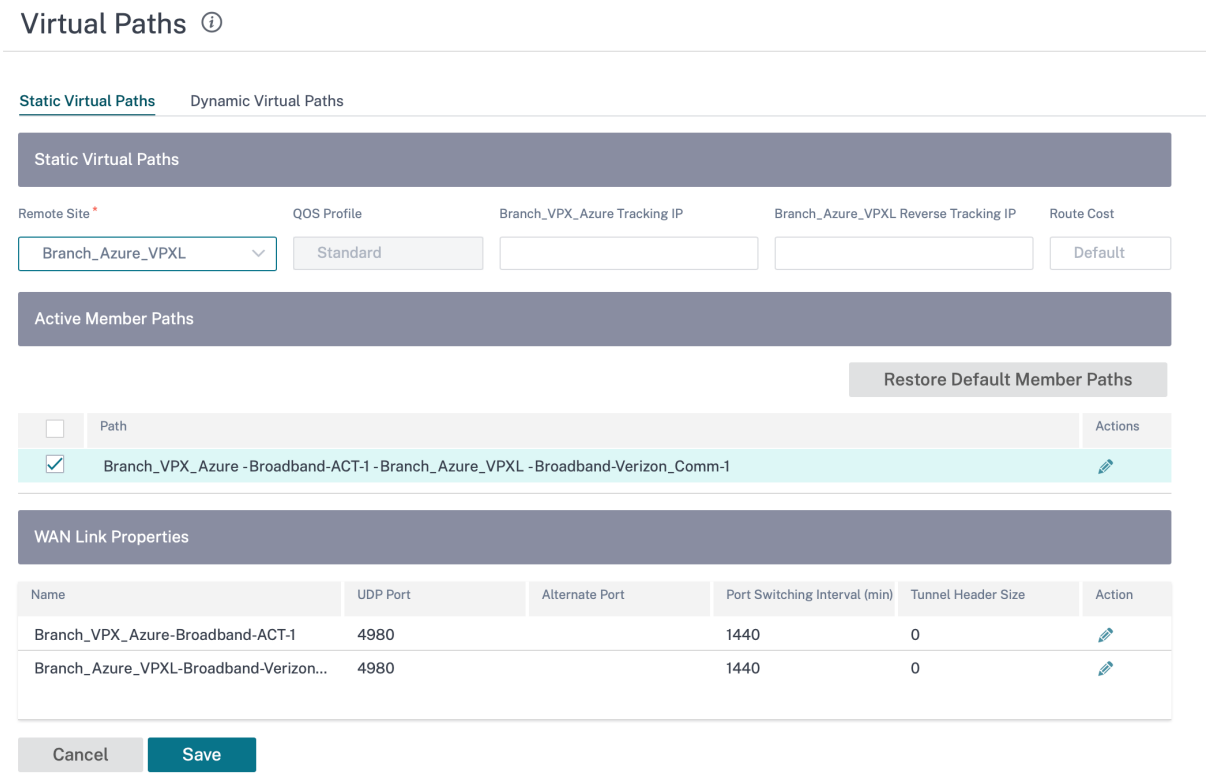
path that can be pinged to determine the state of the reverse path.

To configure static virtual paths, from the site level, navigate to **Configuration** > **Advanced Settings** > **Virtual Paths** > **Static Virtual Paths**.



The active member paths are listed in the **Active Member Paths** section, you can view or edit the member path settings.

- **IP DSCP Tagging**: A tag for the external IP header of the Virtual Path Control Protocol (VPCP) frame.
- **Loss Sensitive**: If enabled, a path might be marked as BAD due to loss and incurs a latency penalty in a path score. Set the percentage of loss over the time required to mark the path as BAD. Disable this option if loss of bandwidth is intolerable.
- **Percent Loss**: If packet loss exceeds the set percentage over the configured time, the GOOD Path state changes to BAD.
- **Over Time**: If packet loss exceeds the set percentage over this configured time, the path state is marked as BAD.
- **Silence Period**: The path state transitions from GOOD to BAD when no packets are received within the specified amount of time.
- **Path Probation Period**: The period to wait before changing the path state from BAD to GOOD.

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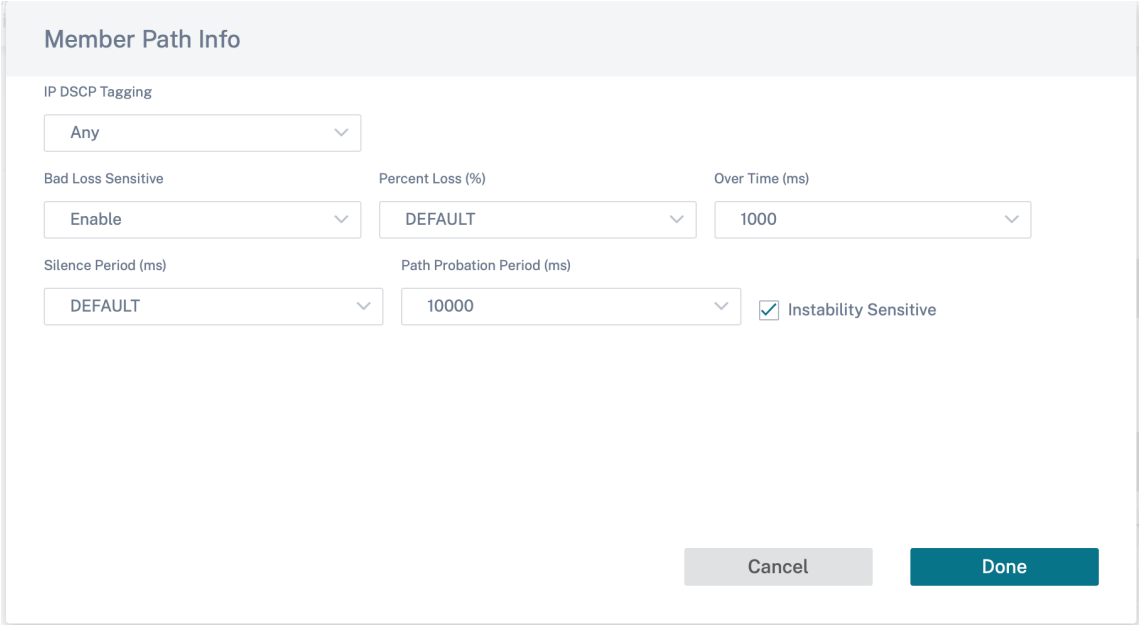
- **Instability Sensitive**: Latency penalties due to BAD state and other spikes in latency are considered.



The WAN link details for the selected active member paths are listed, you can change the settings as required. The **UDP port** settings can be configured for both IPv4 and IPv6.

- **UDP Port**: The port used for LAN to WAN and WAN to LAN packet transfer. You can also specify.
- **Alternate Port**: The alternate UDP Port to be used when UDP port switching is enabled.
- **Port Switch Interval**: The interval, in minutes, that the WAN Link alternates its UDP Port.
- **Tunnel Header Size in Bytes**: The size of the tunnel header, in bytes, if applicable.
- **Active MTU Detect**: The LAN to WAN paths for dynamic virtual paths is actively probed for MTU.
- **Enable UDP Hole Punching**: The MCN assists UDP connectivity between compatible NAT-protected client sites.

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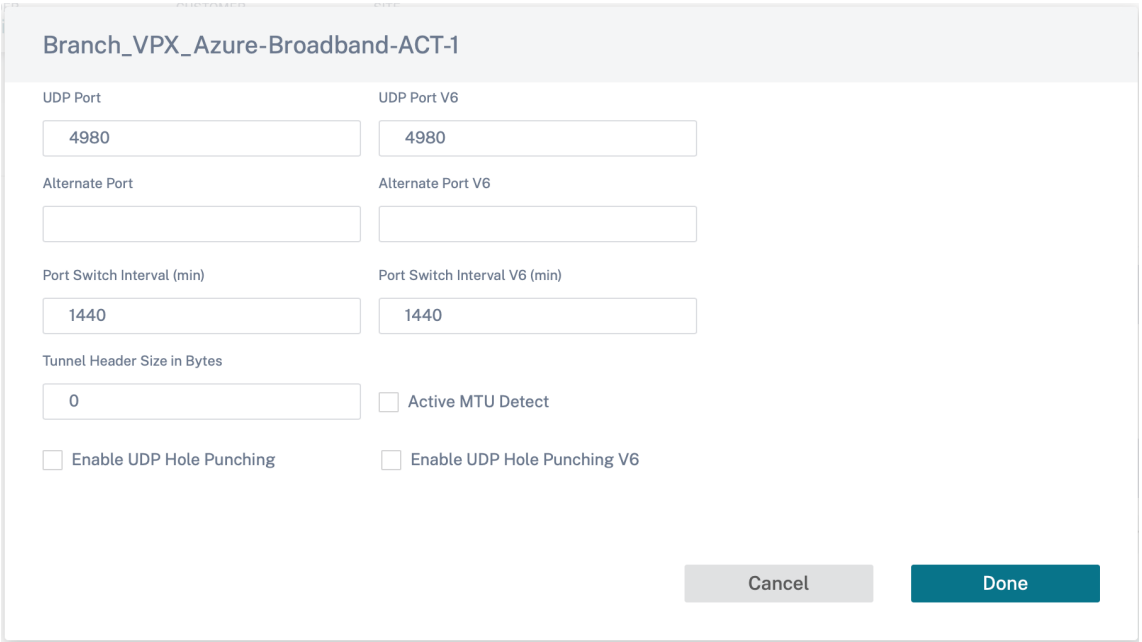

Dynamic virtual paths

With demand for VoIP and video conferencing, the traffic between offices has increased. Setting up full mesh connections through data centers is time consuming and inefficient. With Citrix SD-WAN, you can automatically create paths between offices on demand using the Dynamic Virtual Path feature. The session initially uses an existing fixed path. As the bandwidth and time threshold is met, a new path is created dynamically if that new path has better performance characteristics than the fixed path. The session traffic is transmitted through the new path resulting in efficient usage of resources. The dynamic virtual paths exist only when they are needed and reduce the amount of traffic transmitted to and from the data center.

To configure dynamic virtual paths, from the site level, navigate to **Configuration** > **Advanced Settings** > **Virtual Paths** > **Dynamic Virtual Paths**.

Select **Override Global Defaults** to override the virtual path settings inherited from the global wan link auto-path settings. Select **Enable Dynamic Virtual Paths** to allow dynamic virtual paths between this site and other sites connected through an intermediate node. Set the maximum allowable dynamic virtual paths for the site.

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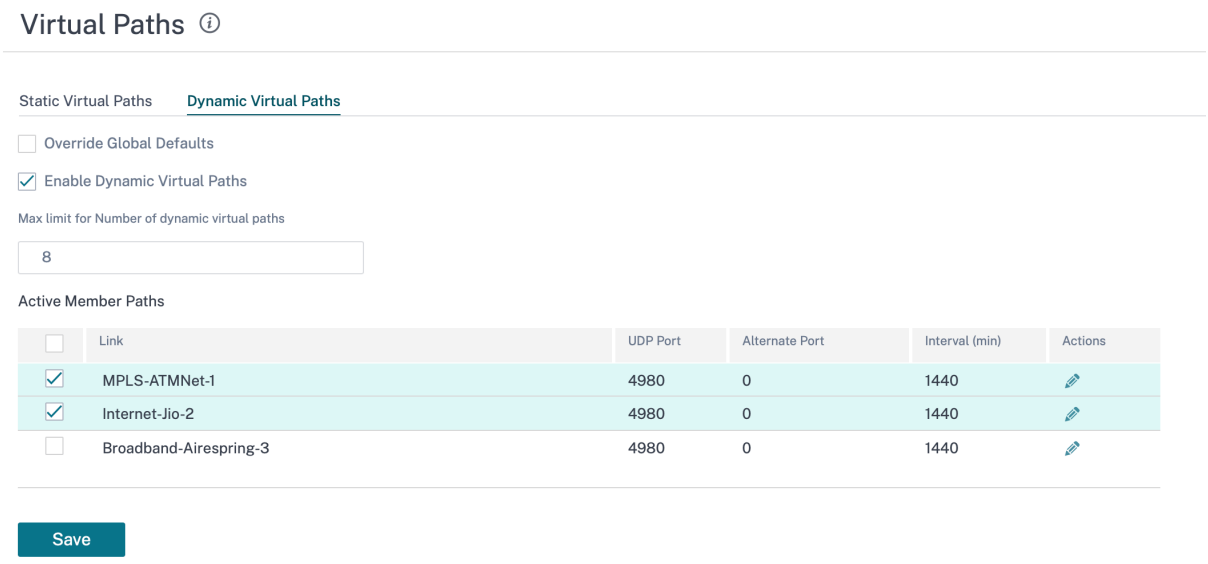
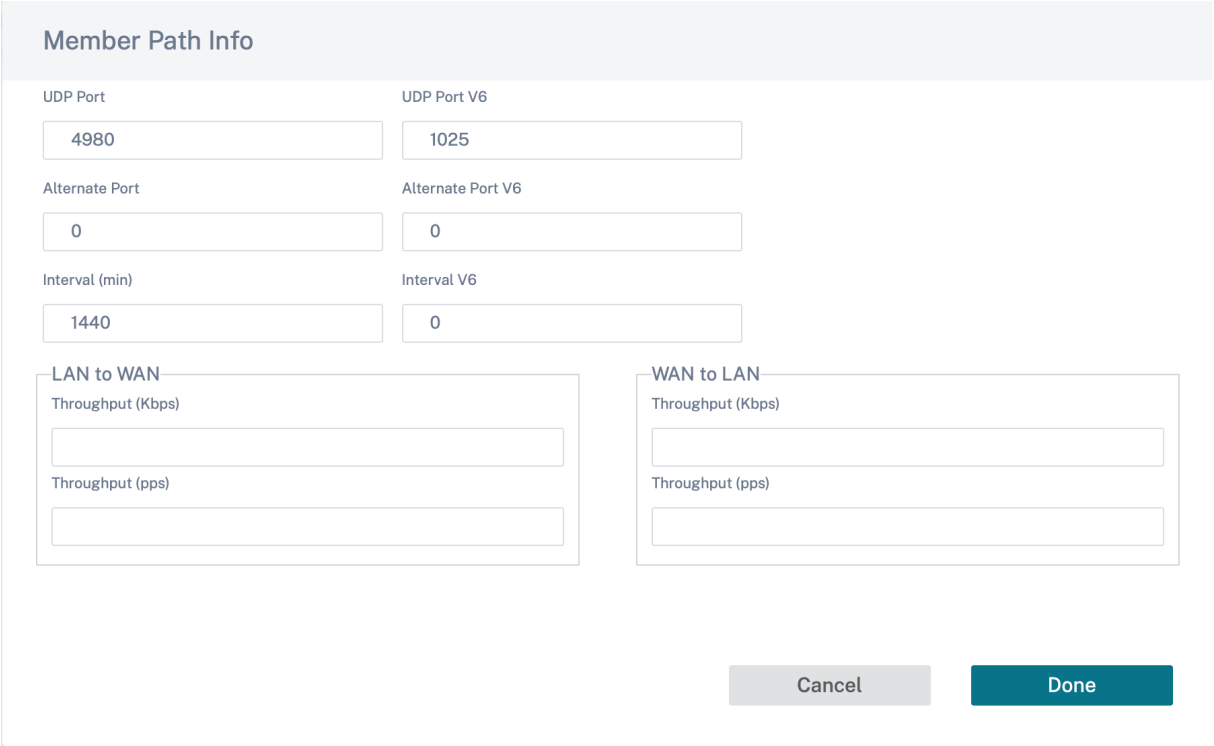


Set the UDP port and dynamic virtual path threshold. Specify the throughput threshold, in kbps or packets per second, on the intermediate site at which the dynamic virtual paths are triggered on LAN to WAN or WAN to LAN.



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Dynamic routing

March 25, 2021

After configuration and deployment of SD-WAN appliances in the network and once the connections are established, it is important to ensure that the traffic is properly redirected through the overlay SD-WAN network. You can check traffic redirection by using ping and traceroute diagnostic tools. If the ping and traceroute tests indicate that connectivity is established through the underlay paths, traffic redirection can be achieved by using the following dynamic routing protocols.

- **Open Shortest Path First (OSPF)**: It is an interior gateway protocol, used to redirect traffic within an autonomous system, like the enterprise network. OSPF uses a link state routing algorithm to detect changes in the network topology and reroute packets by computing the shortest path free for each route. Use this protocol to redirect MPLS traffic. For more information, see **OSPF** section.
- **Border Gateway Protocol (BGP)**: It is an exterior gateway protocol designed to redirect traffic routing and reachability information among different autonomous systems on the internet. It is capable of making routing decisions based on paths determined by ISPs. Use this protocol to redirect Internet traffic. For more information, see **Configure BGP** section.

Earlier, the dynamic routing capability was available only for a single router ID. You were able configure a unique router ID either globally for the entire protocol (one for OSPF and BGP) or provide no router ID. From Citrix SD-WAN 11.3.1 release onwards, you can not only configure a router ID for the entire protocol but also configure a router ID for each routing domain. With this enhancement, you can enable stable dynamic routing across multiple instances with different router ID's converging in a stable manner.

If you configure a router ID for a specific routing domain, the specific router ID overrides the protocol level routing domain.

OSPF

To configure OSFF, navigate to **Configuration > Advanced Settings > Dynamic Routing > OSPF**.

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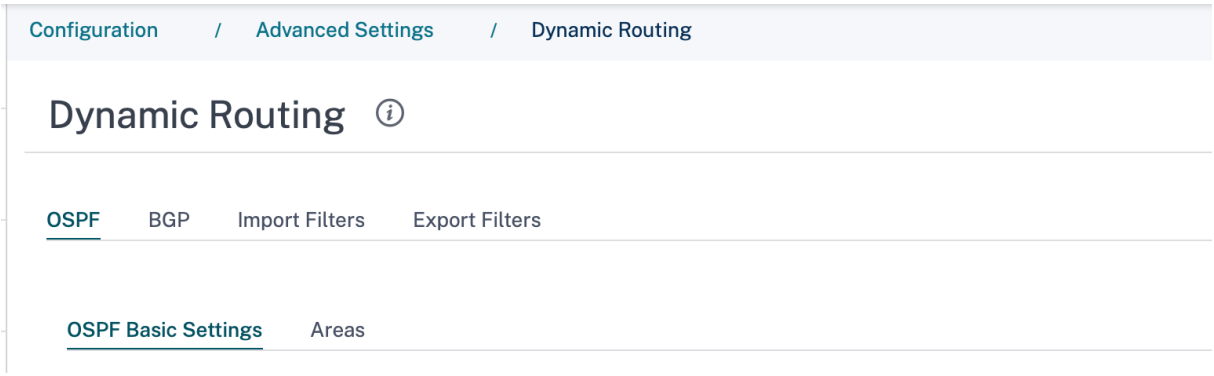

OSPF basic settings

Here are the parameters to be configured:

- **Enable**: Allow the OSPF routing protocol on the SD-WAN appliance to start exchanging Hello packets between neighboring routers.
- **Router ID**: An IPv4 address used for OSPF advertisements. This is optional, if not specified the lowest virtual IP of the virtual interfaces participating in routing is chosen.
- **Export OSPF Route Type**: Advertise the SD-WAN route to OSPF neighbors as type 1 Intra-area route or type 5 External route.
- **Export OSPF Route Weight**: The cost advertised to OSPF neighbors is the original route cost and the weight configured here.
- **Advertise SD-WAN Routes**: To advertise SD-WAN routes to the peer network elements.
- **Advertise BGP Routes**: To enable redistribution of BGP routes into the OSPF domain.

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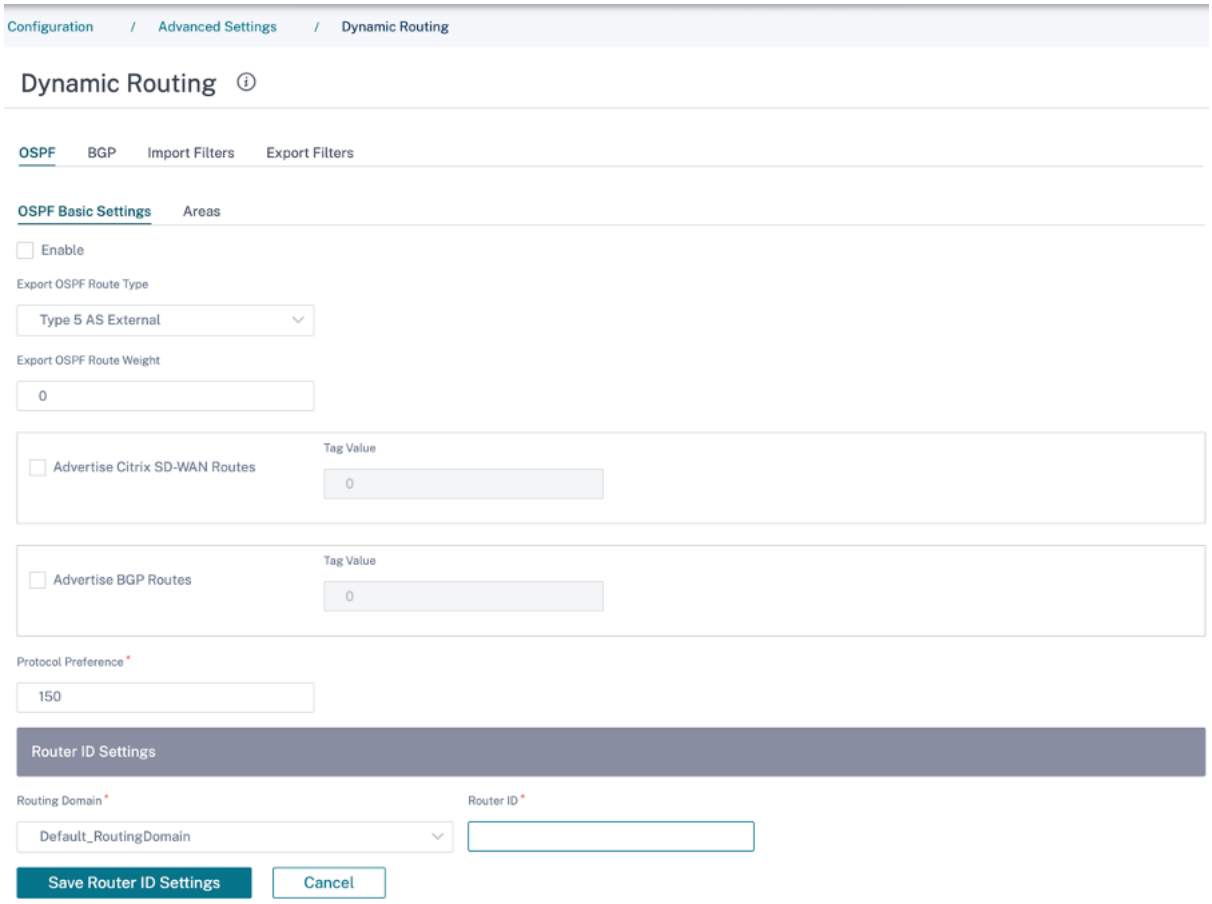

Areas

Click **+ Area** and provide the Area ID of the network that OSPF will learn routes from and advertise routes. Stub area ensures that this area will not receive route advertisements from outside of the designated Autonomous System. Configure the virtual interface settings.

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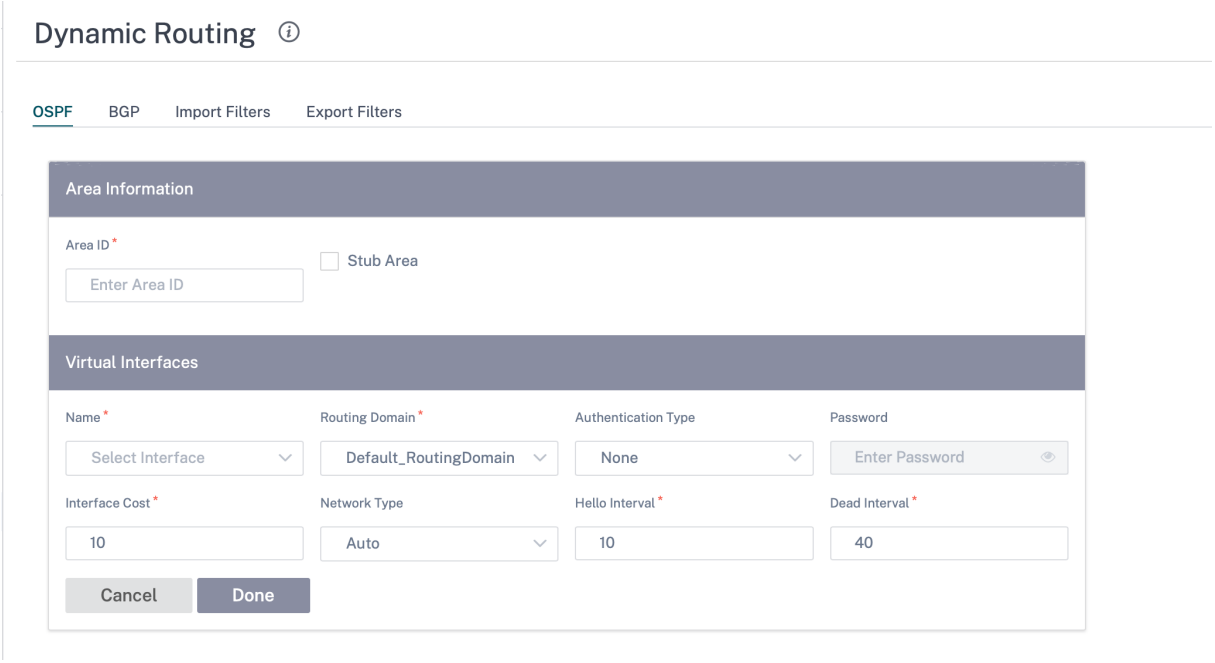
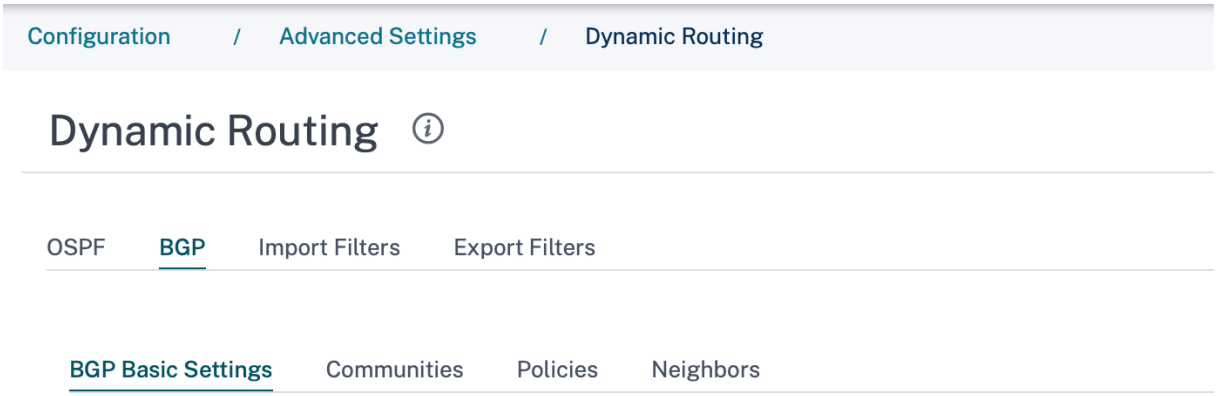


BGP

To configure BGP, navigate to **Configuration > Advanced Settings > Dynamic Routing > BGP**.



BGP basic settings

Here are the parameters to be configured:

- **Enable**: Allow the BGP routing protocol on the SD-WAN appliance to start sending an open message as part of BGP peering.
- **Router ID**: (Optional) IPv4 address used for BGP advertisements. If the router ID is not specified the lowest virtual IP of the virtual interfaces participating in routing is chosen.
- **Local Autonomous System**: Autonomous system number the BGP protocol is running in.

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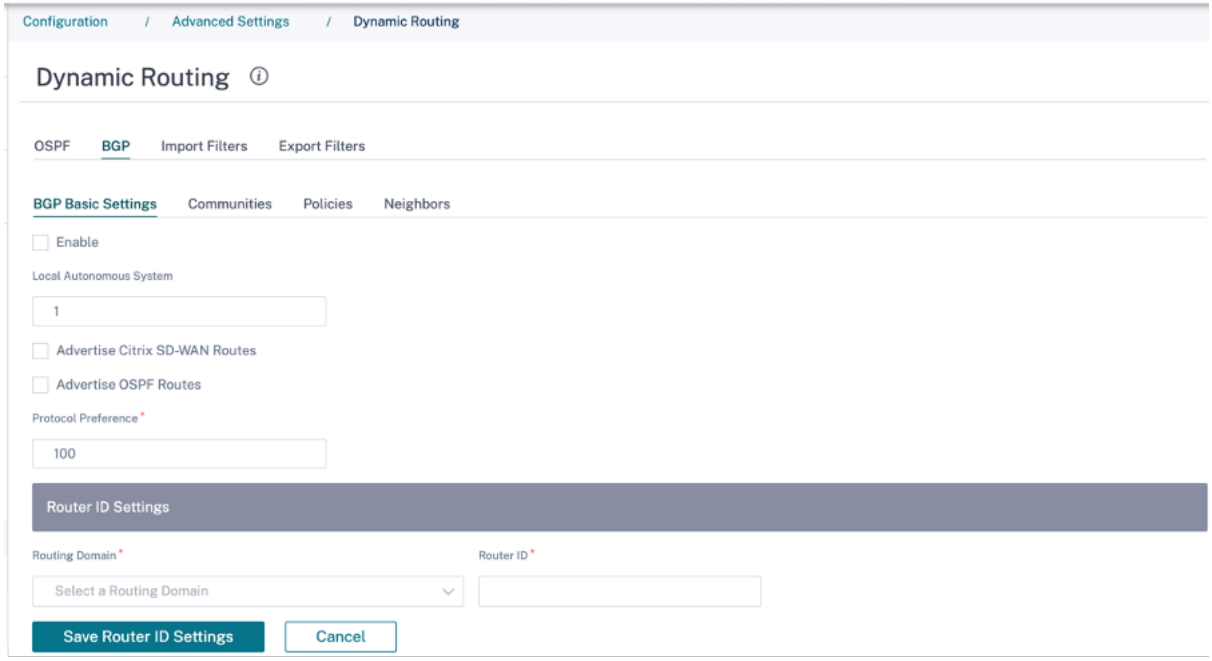
- **Advertise SD-WAN Routes**: To advertise SD-WAN routes to the peer network elements.
- **Advertise OSPF Routes**: To enable redistribution of OSPF routes into the BGP domain.



Communities

Click **+ Community** to add a community. A collection of BGP communities that can be used for route filtering. The community list can also be used to set or modify the communities of a matching route.

For each policy, users can configure multiple community strings, AS-PATH-PREPEND, **MED** attribute. Users can configure up to 10 attributes for each policy.

Specify the name for the community and enter a community string to be advertised.

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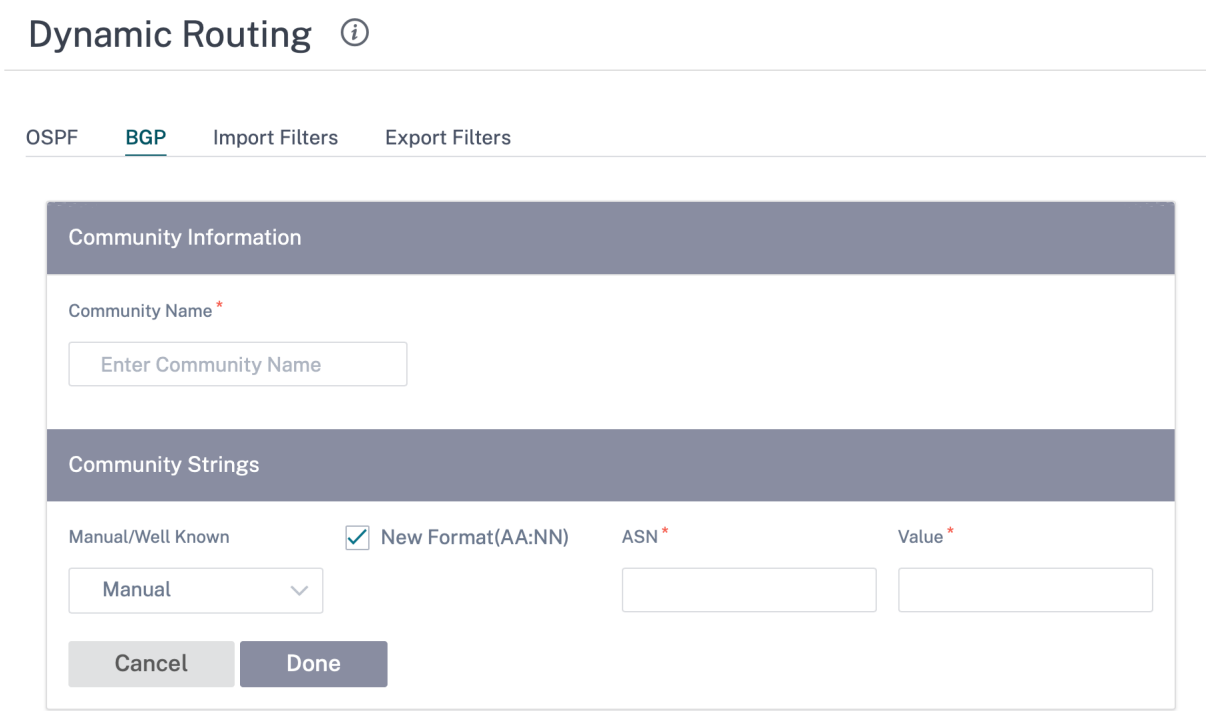

- **Community Name**: Enter a community name.
- **Manual/Well Known**: Configure BGP community manually or select a standard well known BGP community from the list.
- **New Format (AA:NN)**: Select the check box to use the new format for configuring the BGP community.
- **ASN**: The first 16 digit of the BGP community when using the new format for configuration.
- **Value**: Enter the BGP community value.

Policies

A collection of BGP attributes which can be used to set or modify route attributes for each BGP Peer. Create BGP policies to be applied selectively to a set of networks on a per-neighbor basis, in either direction (import or export). An SD-WAN appliance supports eight policies per site, with up to eight network objects (or eight networks) associated with a policy.

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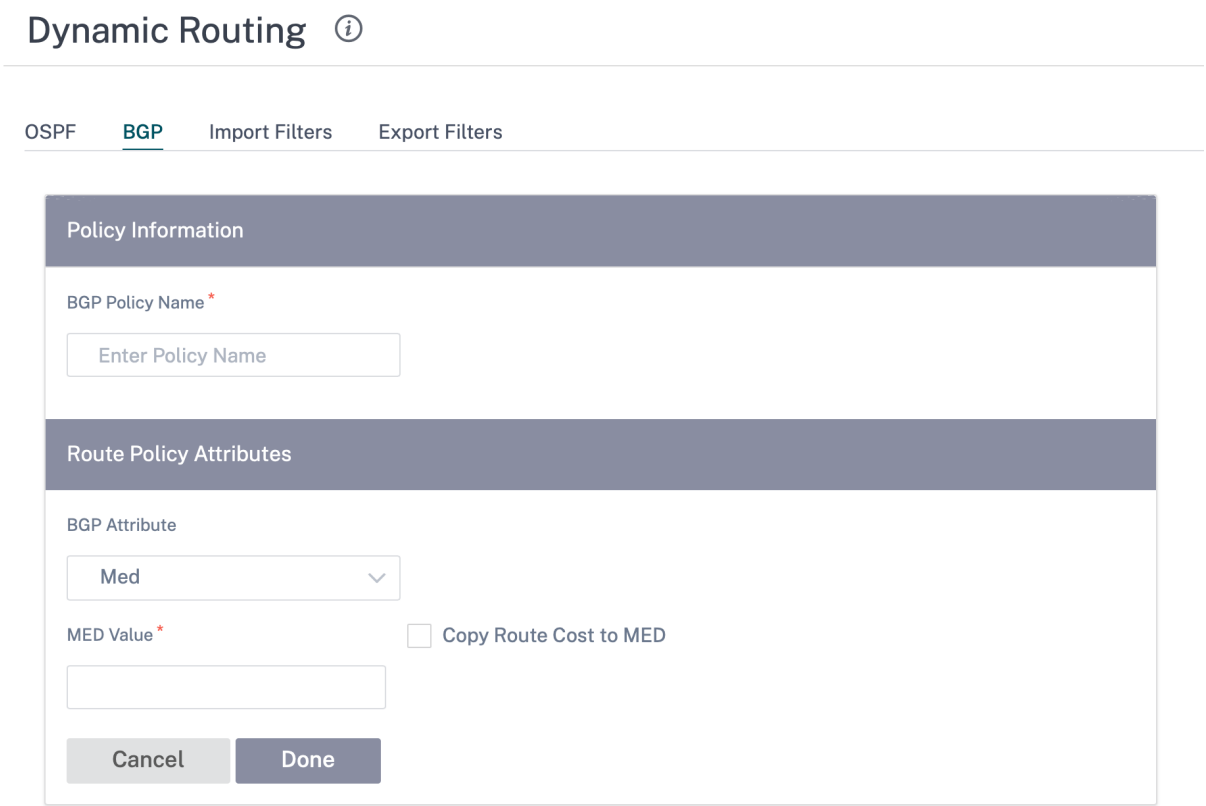

- **BGP Policy Name**: Enter the BGP policy name.
- **BGP Attributes**: Select the BGP attributes from the list and provide the necessary information.

Neighbors

Neighbors are all of the configured BGP peer routers that are checked to find the shortest paths for routing. All the neighbors must be part of the same Autonomous System.

Click **+ Neighbor** to add a configured BGP policy for neighboring routers. You can specify the direction to indicate if this policy is applied for incoming or outgoing routes.

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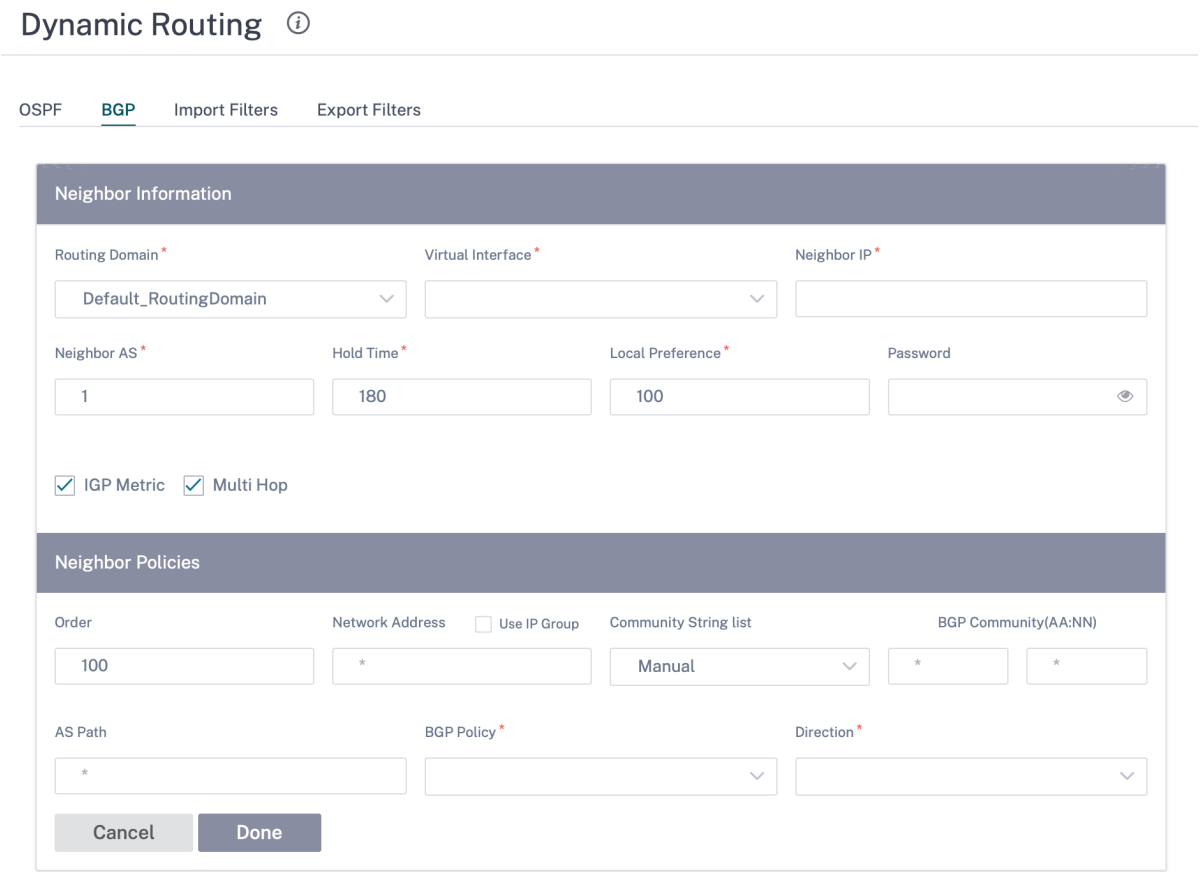

Import filters

You can configure Filters to fine-tune how route-learning takes place.

Import filter rules are rules that have to be met before importing dynamic routes into the SD-WAN route database. By default, no routes are imported.

Click **+ Import Rule**.

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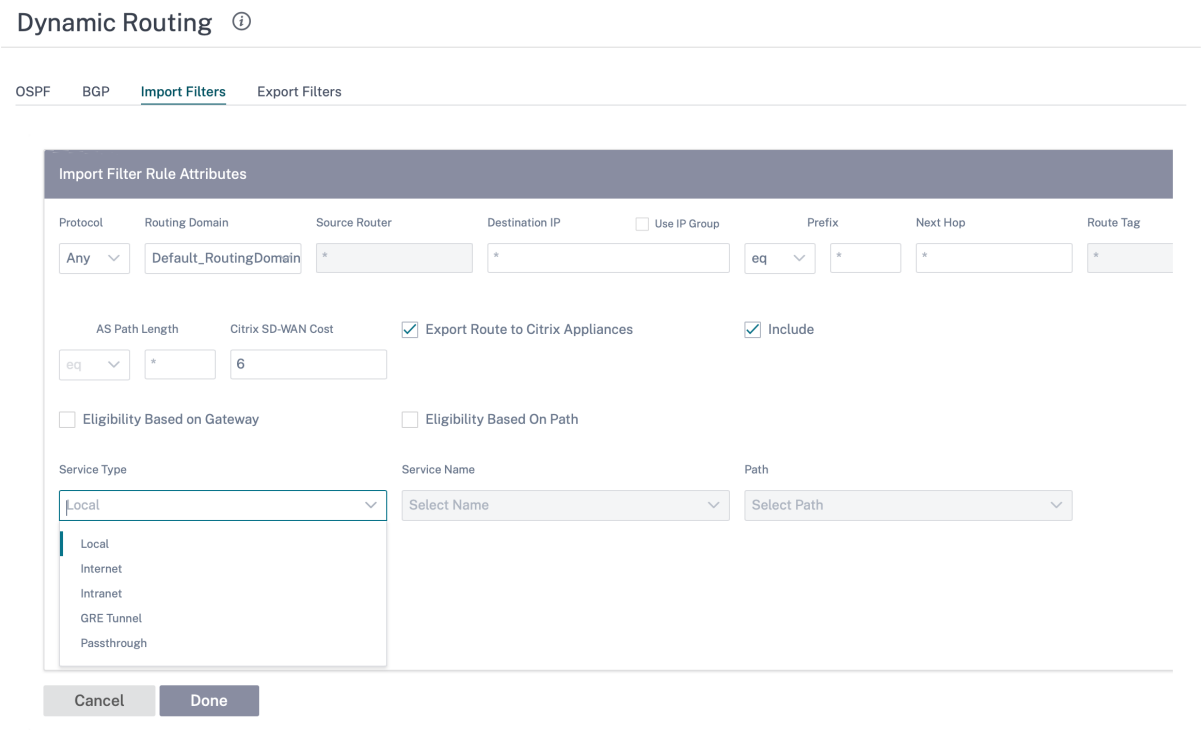
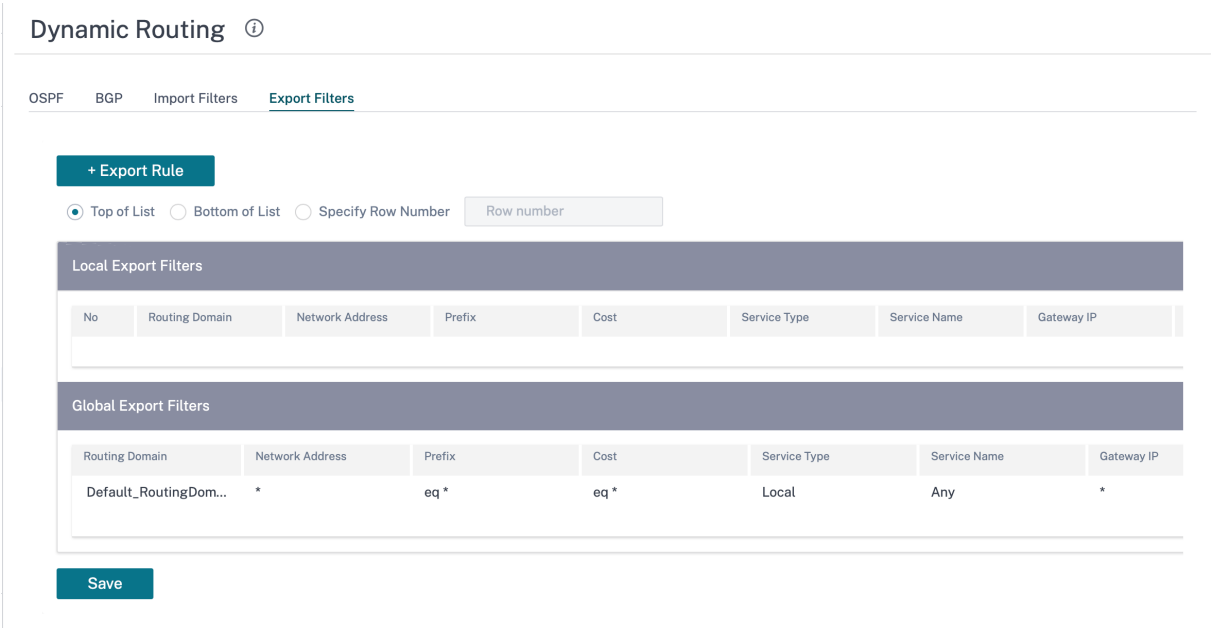


Export filters

Define the rules that have to meet when advertising SD-WAN routes over dynamic routing protocols. By default, all routes are advertised to peers.



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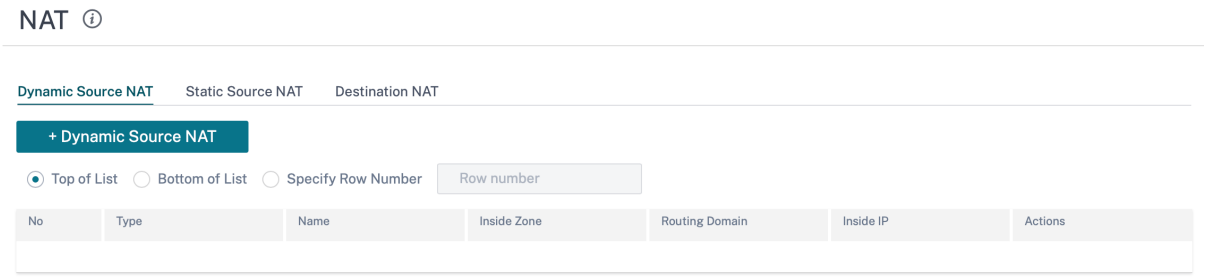
Network address translation

July 29, 2021

Network Address Translation (NAT) on the SD-WAN appliances translates the private IP addresses within your local branch or data center enterprise network to a single Public IP address. The public IP address is used for communication over the internet.

For more information about configuring NAT, see Network Address Translation.

To configure NAT for a site using the Citrix SD-WAN Orchestrator for On-premises, from site level, navigate to **Configuration > Advanced Settings > NAT**.



You can configure the following types of NAT:

- Dynamic source NAT
- Static NAT
- Destination NAT

Dynamic source NAT

Dynamic Source NAT allows multiple hosts to have their source IP addresses translated to the same public IP address with different port numbers. Port restricted NAT uses the same outside port for all translations related to an Inside IP address and port pair. For more information, see Configure Dynamic NAT.

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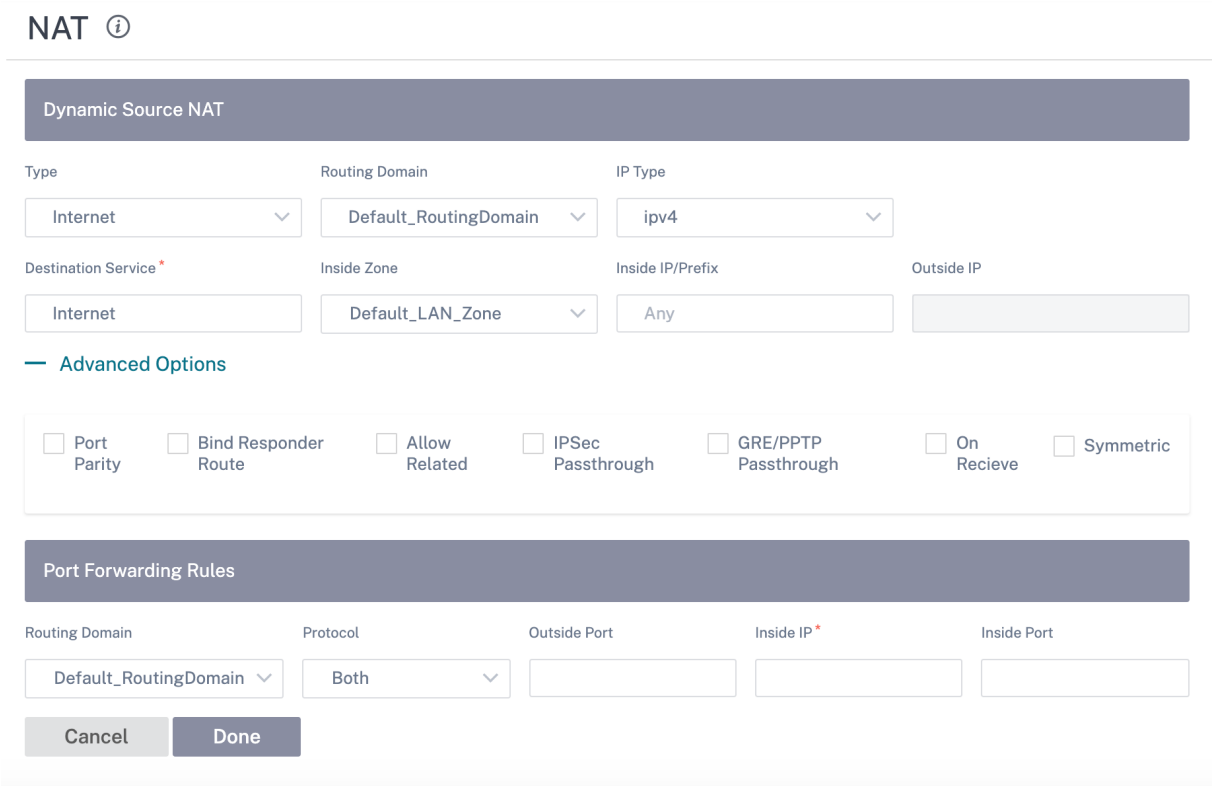
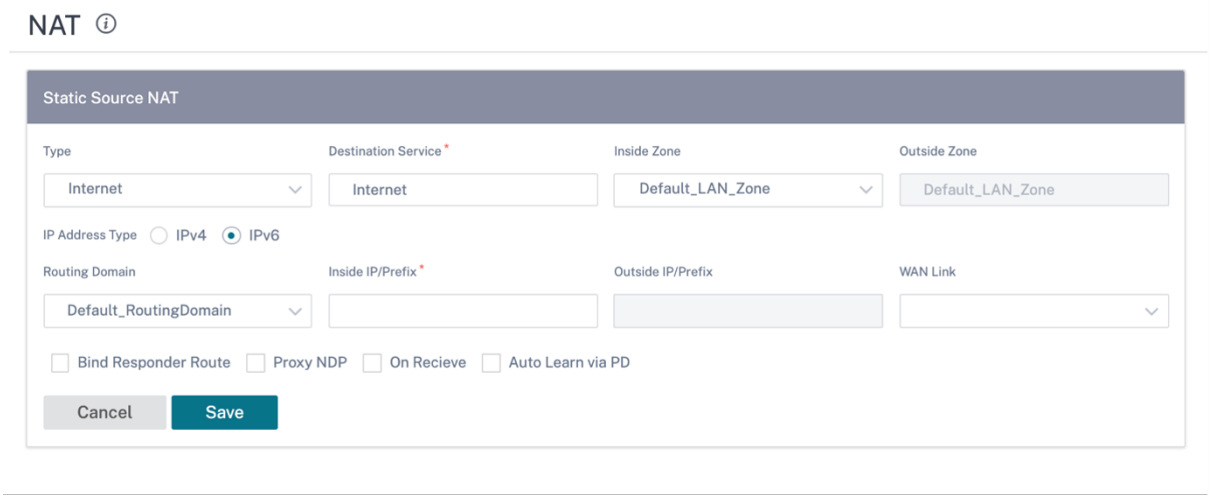


Static NAT

In **Static NAT**, a permanent 1–1 mapping between an internal private address and a public address is done. This type of NAT can be used for allowing traffic into a mail server or web server. For more information, see Configure Static NAT.



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Static NAT Policies for IPv6 Internet service

Citrix SD-WAN supports static NAT policies for IPv6 Internet service from release 11.4.0 onwards. A static NAT policy for IPv6 Internet service specifies the mapping of an inside network prefix to an outside network prefix. The number of static NAT policies required depends on the number of inside networks and the number of outside networks (WAN links). If there are **M** number of inside networks and **N** number of WAN links, then the number of static NAT policies required is **M x N**.

From Citrix SD-WAN release 11.4.0 onwards, while creating a static NAT policy, you can either enter the outside IP address manually or enable **Auto Learn via PD**. When **Auto Learn via PD** is enabled, the SD-WAN appliance receives delegated prefixes from the upstream delegating router through DHCPv6 Prefix Delegation. Before Citrix SD-WAN release 11.4.0, the outside IP address was derived from the service automatically and there was no option to enter the outside IP address manually. If you are upgrading an appliance to 11.4.0 or a later release and have static NAT policies configured for IPv6 Internet service, then you must manually update the policies.

Configuration example

In the following topology, the Citrix SD-WAN appliance is configured with 2 inside networks and 2 WAN links:

- Inside network 1 resides in the CORPORATE routing domain with network prefix FD01:0203:6561::/64
- Inside network 2 resides in the Wi-Fi routing domain with network prefix FD01:0203:1265::/64
- Through WAN Link 1, the SD-WAN appliance receives from the upstream delegating router through DHCPv6 Prefix Delegation, 2 delegated prefixes 2001:0D88:1261::/64 and 2001:0D88:1265::/64. These 2 delegated prefixes are used as the outside network prefixes when the traffic from the inside networks transits WAN link 1.
- Through WAN Link 2, the SD-WAN appliance receives from the upstream delegating router through DHCPv6 Prefix Delegation, 2 delegated prefixes 2001:DB8:8585::/64 and 2001:DB8:8599::/64. These 2 delegated prefixes are used as the outside network prefixes when the traffic from the inside networks transits WAN link 2.

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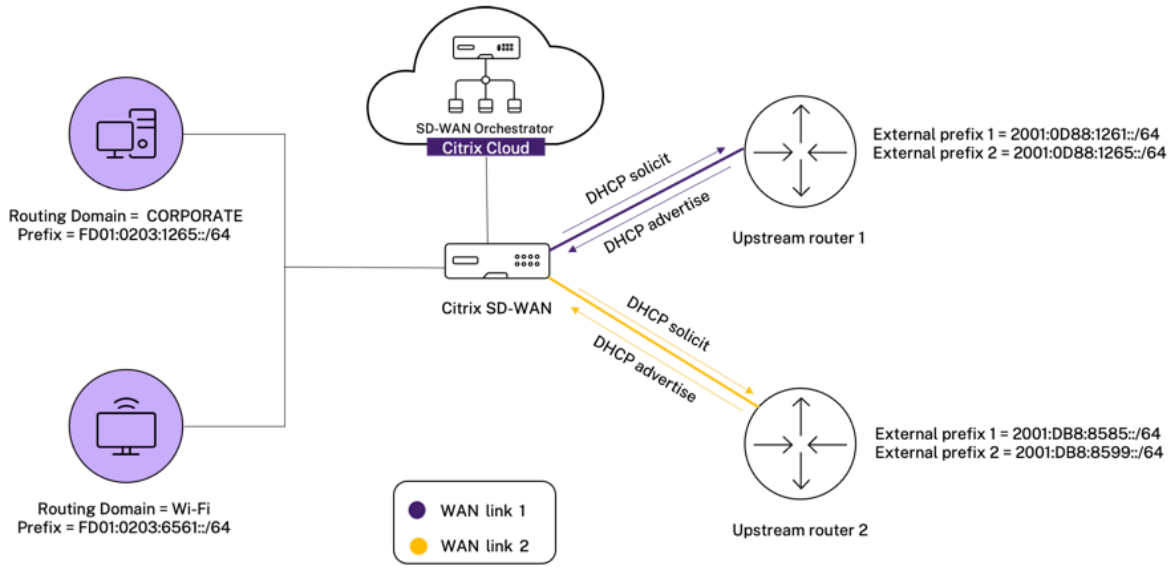

In this scenario, there are M=2 inside networks and N=2 WAN links. Therefore, the number of static NAT policies required for proper deployment of IPv6 Internet service is 2 x 2 = 4. These 4 static NAT policies specify the address translation for:

- Inside network 1 through WAN link 1
- Inside network 1 through WAN link 2
- Inside network 2 through WAN link 1
- Inside network 2 through WAN link 2

To configure these static NAT policies, from site level, navigate to **Configuration > Advanced Settings > NAT > Static Source NAT**. Click **+Static Source NAT**.

While creating NAT policies, ensure that you select the **Type** as **Internet** and **IP Address Type** as **IPv6**. Select the WAN link and in the **Inside IP/Prefix** field, enter the inside network prefix (only /64 prefixes are allowed). In the **Outside IP/Prefix** field, you can either manually enter the outside network prefix or select the **Auto Learn via PD** check box.

The following is an example where the outside IP address is entered manually in the static NAT policy.

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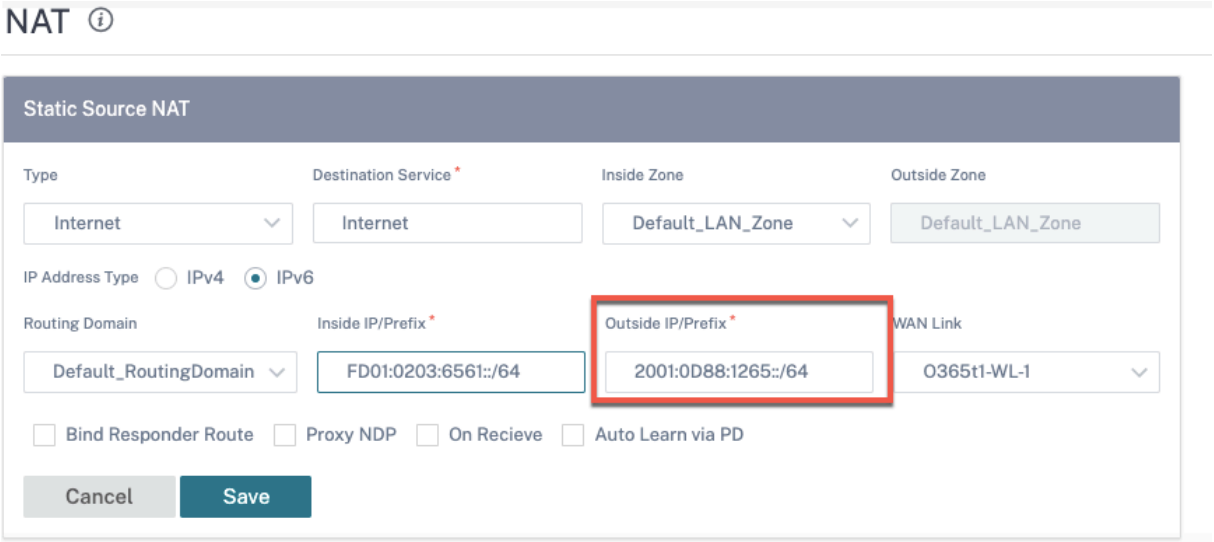
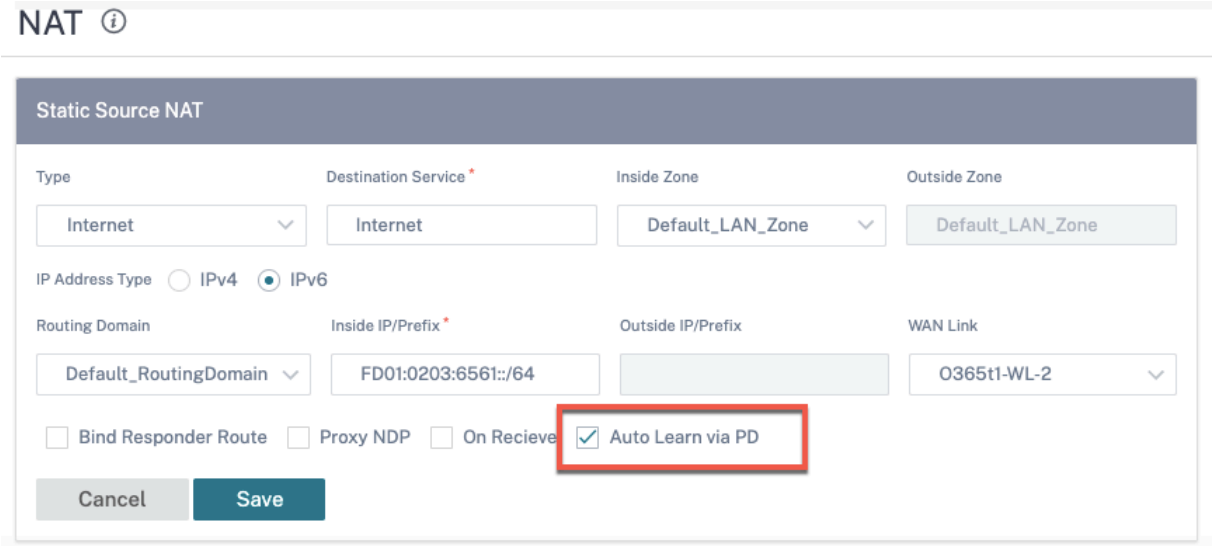


If you select the **Auto Learn via PD** check box, ensure that the upstream router supports DHCPv6 Prefix Delegation. Citrix SD-WAN requests a prefix from the upstream delegating router and the delegating router responds with a prefix to Citrix SD-WAN. Citrix SD-WAN uses this delegated prefix to translate the inside IP address to the outside IP address.

The following is an example where **Auto Learn via PD** is enabled, so that the outside network prefix is obtained through DHCPv6 Prefix Delegation.



Destination NAT

Destination NAT is performed on incoming packets when the SD-WAN appliance translates a public destination address to a private address. It also allows port forwarding.

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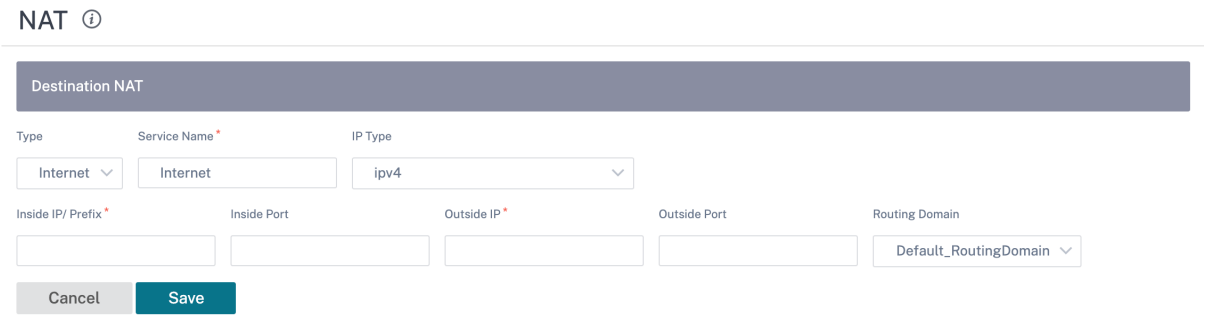
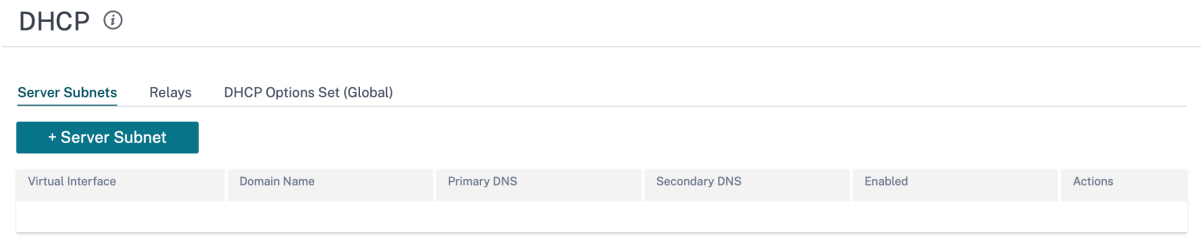


Dynamic host configuration protocol

April 14, 2021

You can configure your SD-WAN appliances as either **DHCP Servers** or **DHCP Relay agent**. The DHCP server feature allows devices on the same network as the SD-WAN appliance's LAN/WAN interface to obtain their IP configuration from the SD-WAN appliance. The DHCP relay feature allows your SD-WAN appliances to forward DHCP packets between DHCP client and server.



DHCP server

Citrix SD-WAN appliances can be configured as a DHCP server. It can assign and manage IP addresses from specified address pools within the network to DHCP clients.

The DHCP server can be configured to assign other parameters such as the DNS IP address and default gateway. DHCP server accepts address assignment requests and renewals. The DHCP server also accepts broadcasts from locally attached LAN segments or from DHCP requests forwarded by other DHCP relay agents within the network.

To configure the DHCP server, in the Site configuration page, from site level, navigate to **Configuration > Advanced Settings > DHCP > Server Subnets** > click **+ Server Subnet**.

Select the **Virtual interface** to be used to receive the DHCP requests. The IP Subnet to which the DHCP server provides the IP addresses is auto-populated.

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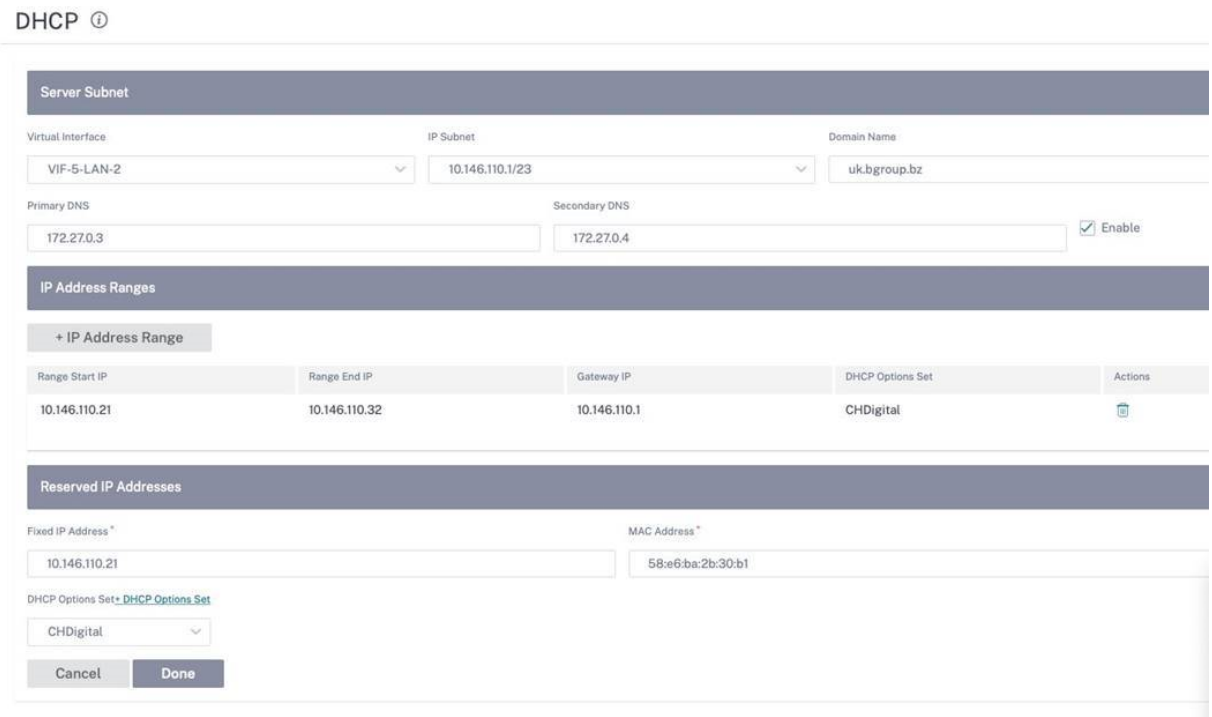

Enter the **Domain Name**, **Primary DNS**, and **Secondary DNS**. The DHCP Server forwards this information to the DHCP clients.

Configure dynamic IP address pools that is used to allocate IP addresses to clients. Specify the range starting and ending IP address and select the **DHCP Option Set**.

> **Note**
>
> The DHCP Option Set are groups of DHCP settings that can be applied to individual IP address ranges. For more information, see DHCP Option Set.

Set the reserved IP address by mapping individual hosts that require a fixed IP address to it's MAC address. Enter the **Fixed IP Address**, **MAC Address**, and select a **DHCP Option Set**.

> **Note**
>
> For reserved IP addresses, the **Gateway IP** is set by configuring the **Router** option in the **DHCP Option Set**.

DHCP relay

Citrix SD-WAN appliance can be configured as a DHCP relay. It relays DHCP requests and replies between the local DHCP Clients and a remote DHCP Server.

It allows local hosts to acquire dynamic IP addresses from the remote DHCP Server. Relay agent receives DHCP messages and generates a new DHCP message to send out on another interface.

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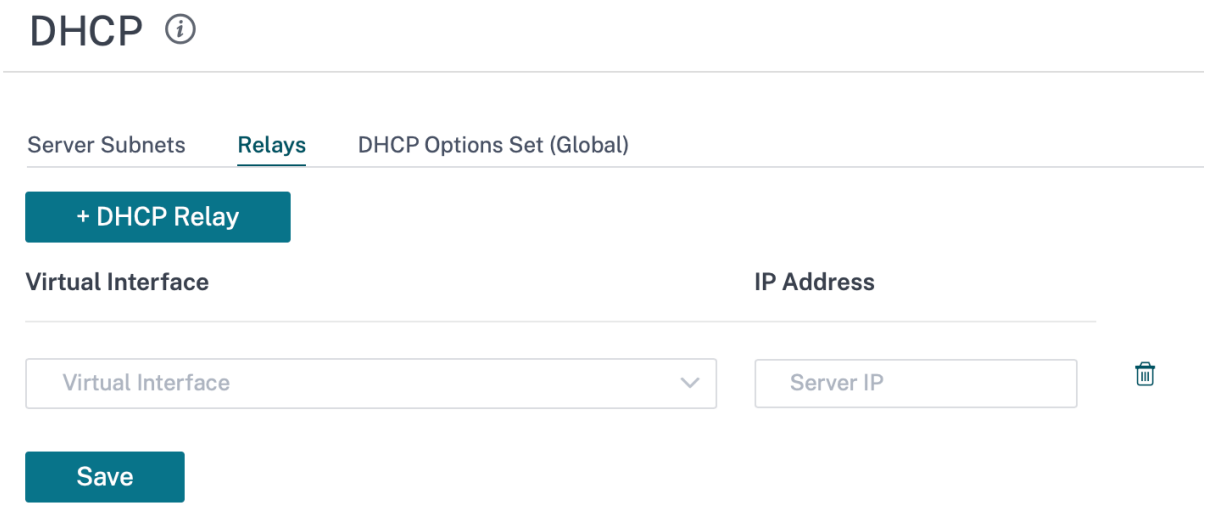
To configure the DHCP server, in the Site configuration page, navigate to **Configuration > Advanced Settings > DHCP > Relays** > click **+ DHCP Relay**.



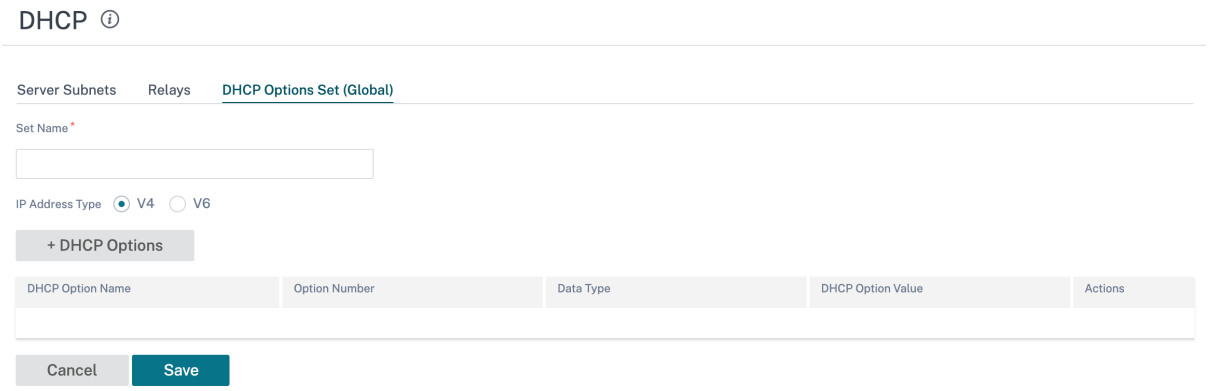
Select a **Virtual Interface** that communicates to a remote DHCP Server. Enter the **DHCP Server IP** that the relay uses to forward the request and response from the clients.

You can configure a single **DHCP Relay** using a common Virtual Network Interface and point it to multiple DHCP Servers.

DHCP options set

DHCP Options are a group of DHCP configurations that can be applied to individual IP address ranges or a single host.

Set a name for the DHCP option profile and choose the **IP Address Type**. Click **+ DHCP Options Set** and select a DHCP option name from the list. The option number is pre-configured. For custom options, the range is 224–254. Select a **Data Type** and enter a **Value** for the option.



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Multicast routing

April 8, 2021

Multicast routing enables efficient distribution of one-to-many traffic. A multicast source, sends multicast traffic in a single stream to a multicast group. The multicast group contains receivers such as hosts and adjacent routers that use the IGMP protocol for multicast communication. Voice over IP, Video on demand, IP television, and Video conferencing are some of the common technologies that use multicast routing. When you enable multicast routing on the Citrix SD-WAN appliance, the appliance acts as a multicast router.

Source specific multicast

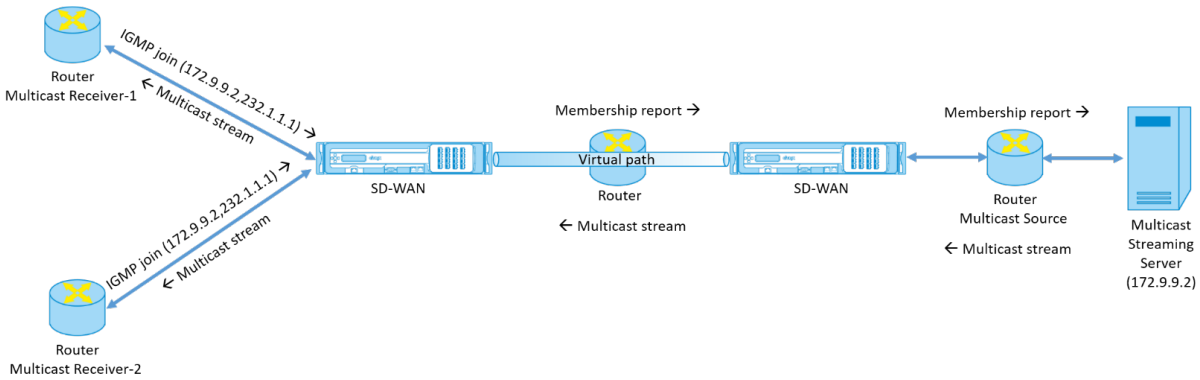
Multicast protocols typically allow multicast receivers to receive multicast traffic from any source.

With the source specific multicast (SSM), you can specify the source from which the receivers receive the multicast traffic. It ensures that the receivers are not open listeners to every source that is sending multicast streams but rather listen to a particular multicast source.

The SSM reduces the cost of resources used in consuming traffic from every possible source. The SSM also provides a layer of security by ensuring that the receivers receive traffic from a known sender.

The following topology shows two multicast receivers at a branch site and a multicast server (172.9.9.2) at the Data Center. The multicast server streams traffic over a particular group (232.1.1.1), the receivers join the group. Any traffic streamed on the multicast group is relayed to all the receivers that joined the group.

> **Note**
>
> For SSM to work, the multicast group IP must fall within the range 232.0.0.0/8.



1. The multicast receivers send an IP IGMP join request indicating that the receivers want to join the multicast group and want to receive the multicast stream from the source.

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The IGMP join includes 2 attributes the multicast source and group (S, G). IGMP Version 3 is used for SSM on the multicast source and the receiver to relay some INCLUDE specific source addresses.

The SSM allows the receivers to explicitly receive streams from specific Multicast servers, whose source address is explicitly provided by the receivers as part of the JOIN request. In this example, an IGMP v3 join request is triggered with an explicit include source list, which contains the source 172.9.9.2, to be the address that sends the multicast stream over the group 232.1.1.1.

2. The Citrix SD-WAN at the branch listens to all the IGMP requests from these receivers and converts it into a membership report and sends it over the Virtual Path to the SD-WAN appliance at the data center.
3. The Citrix SD-WAN appliance at the data center receives the membership report over the Virtual Path and forwards it to the Multicast Source, establishing a control channel.
4. The Multicast source transmits the multicast stream over the Virtual path to the multicast receivers.

The control channel traffic and the multicast stream flow through the established virtual path between the branch and the data center. The Citrix SD-WAN overlay path insures and insulates multicast traffic from WAN degradation or link brownouts.

Configure multicast

To configure multicast, perform the following on the SD-WAN appliance at both the source and destination.

1. Create a multicast group - Provide a name and IP address for the multicast group. The multicast group IP must fall within the range 232.0.0.0/8 for source specific multicast.
2. Enable IGMP proxy – You can configure the Citrix SD-WAN appliance as an IGMP proxy to carry the IGMP control channel information for multicast routing. IGMP V3 is required for single source multicast.
3. Define the upstream and downstream services - An upstream interface enables the IGMP PROXY to connect to the SD-WAN appliance closer to the actual multicast source that streams the traffic. A downstream interface enables the IGMP Proxy to connect to the hosts that are farther away from the actual multicast source that streams the traffic.
   The upstream and downstream services are different for the appliance at the source and the appliance at the destination

To configure multicast, at the site level, navigate to **Configuration** > **Advanced Settings** > **Multicast Groups**. Create a multicast group by providing a name and IP address for the multicast group. Click **Enable IGMP Proxy**.

Configure the upstream and downstream paths for the Branch and data center appliances.

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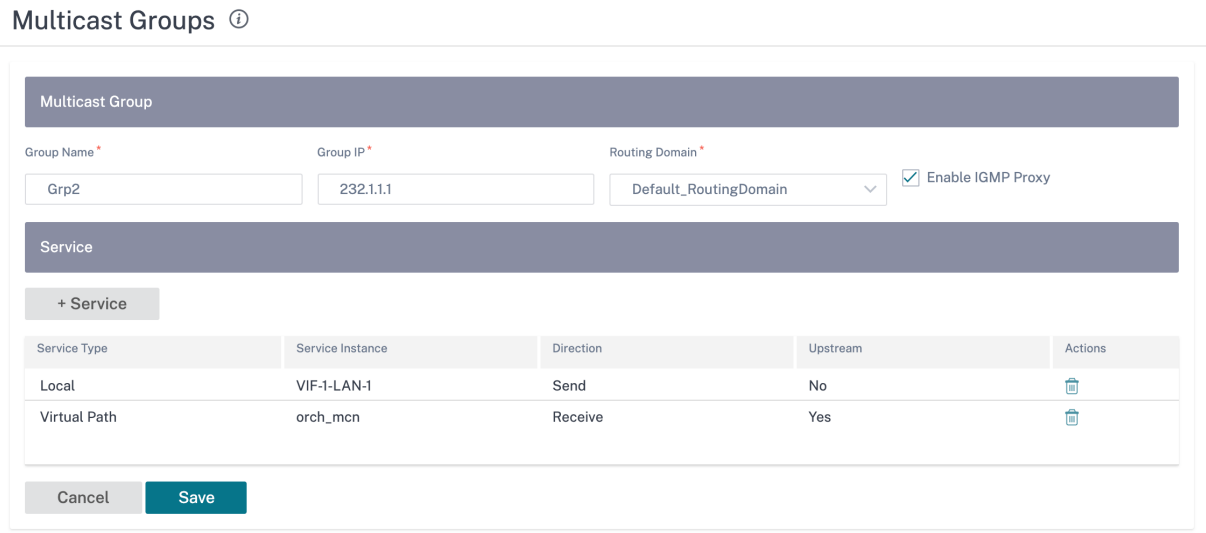
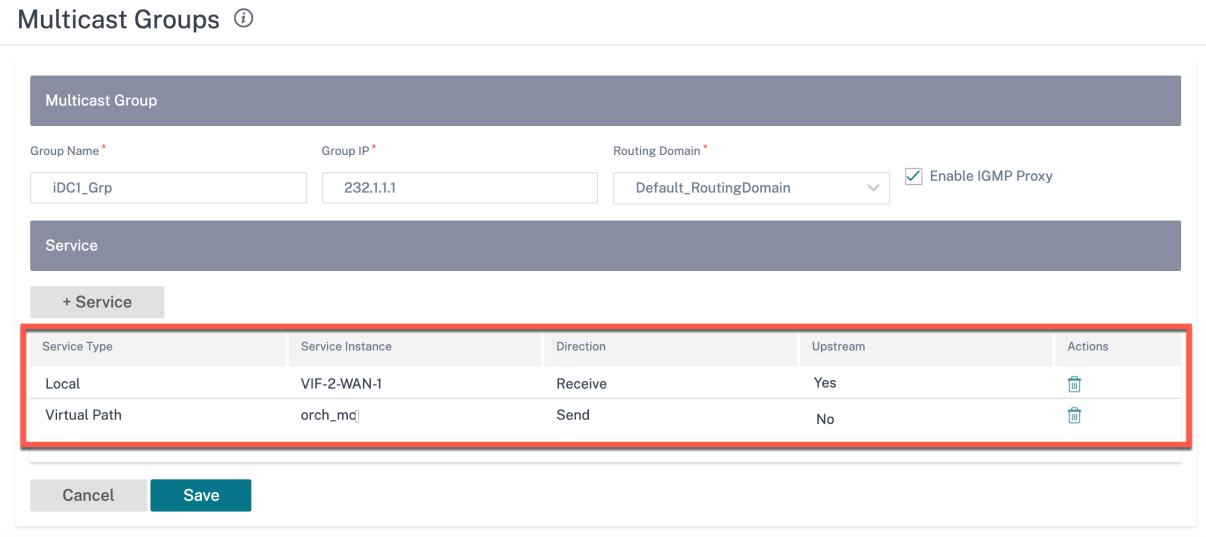
For the appliance closer to the multicast receiver (Branch), the appliance receives the multicast traffic on the Virtual Path Interface and sends the traffic on the Local Interface towards the receiver.



For the appliance closer to the multicast source (Data center), the appliance receives the multicast traffic on the Local Interface and sends the traffic on the Virtual Path Interface.



Monitoring

Flows statistics

After the multicast control channel is established and the multicast source begins streaming, you can view the multicast flows statistics. You can see that Multicast UDP traffic was sent on the virtual path service from a receiver to the multicast group 232.1.1.1.

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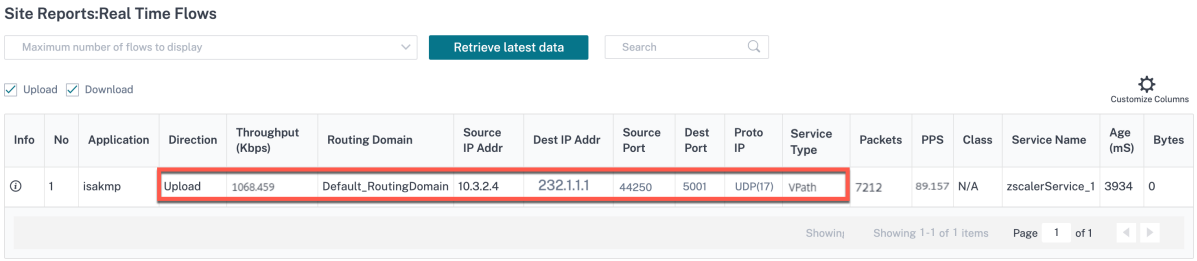
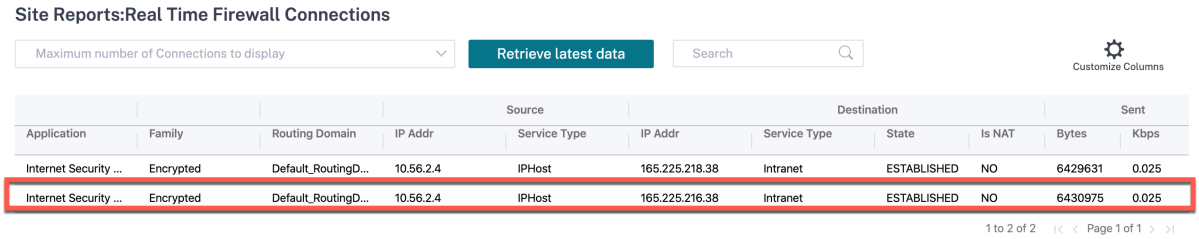
> **Note**:
>
> If SSM is enabled and if the traffic is received from a different server that is not part of the expected list of source senders the SD-WAN appliance will not have any reporting data.



Info	No	Application	Direction	Throughput (Kbps)	Routing Domain	Source IP Addr	Dest IP Addr	Source Port	Dest Port	Proto IP	Service Type	Packets	PPS	Class	Service Name	Age (mS)	Bytes
	1	isakmp	Upload	1068.459	Default_RoutingDomain	10.3.2.4	232.1.1.1	44250	5001	UDP(17)	VPath	7212	89.157	N/A	zscalerService_1	3934	0

Firewall statistics

The firewall table shows the multicast traffic coming over the LAN interface over the Multicast group IP address and is sent over the virtual path.



			Source		Destination				Sent	
Application	Family	Routing Domain	IP Addr	Service Type	IP Addr	Service Type	State	Is NAT	Bytes	Kbps
Internet Security ...	Encrypted	Default_RoutingD...	10.56.2.4	IPHost	165.225.218.38	Intranet	ESTABLISHED	NO	6429631	0.025
Internet Security ...	Encrypted	Default_RoutingD...	10.56.2.4	IPHost	165.225.216.38	Intranet	ESTABLISHED	NO	6430975	0.025

Multicast group statistics

The multicast group table provides details about multicast traffic such as packets sent and received over source, destination, and the aggregation of both.

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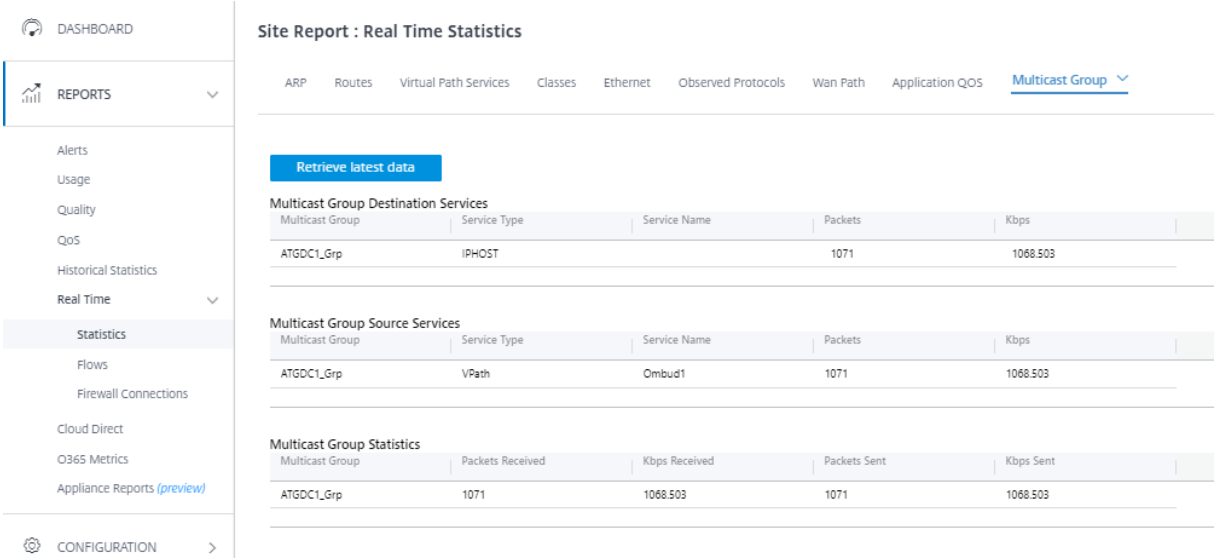

Virtual router redundancy protocol

January 4, 2021

Virtual Router Redundancy Protocol (VRRP) is a widely used protocol that provides device redundancy to eliminate the single point of failure inherent in the static default-routed environment. VRRP allows you to configure two or more routers to form a group. This group appears as a single default gateway with one virtual IP address and one virtual MAC address.

Citrix SD-WAN supports VRRP version 2 and version 3 to inter-operate with any third party routers. The SD-WAN appliance acts as a master router and direct the traffic to use the Virtual Path Service between sites. You can configure the SD-WAN appliance as the VRRP master by configuring the Virtual Interface IP as the VRRP IP and by manually setting the priority to a higher value than the peer routers. You can configure the advertisement interval and the preempt options.

To configure VRRP, in the Site configuration page, navigate to **Configuration** > **Advanced Settings** > **VRRP** > click **+ Add VRRP**.

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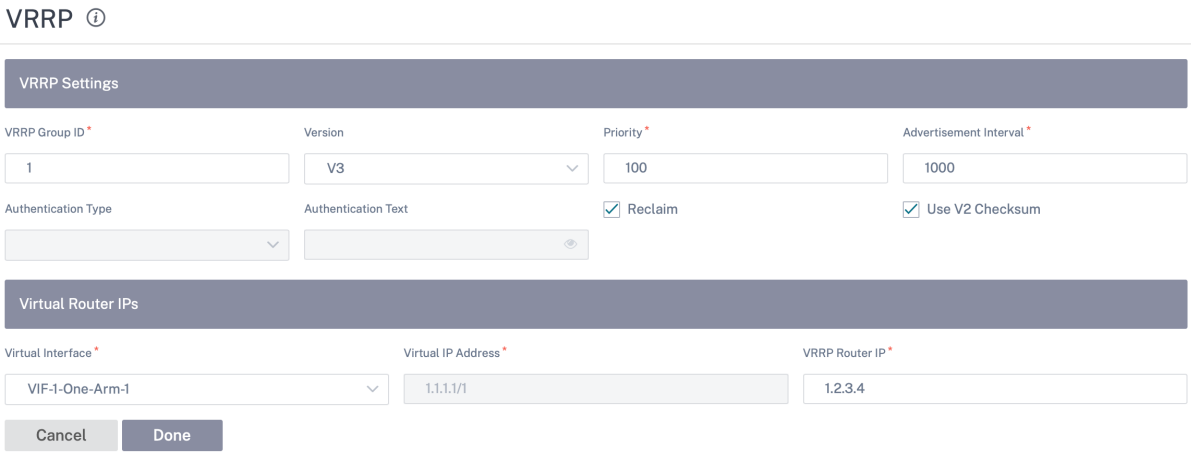

You can edit the following member path parameters:

- **VRRP group ID**: The VRRP group ID. The group ID must be a value range is 1–255. The same group ID must be configured on the back-up routers too.
- **Version**: The VRRP protocol version. You can choose between VRRP protocol V2 and V3.
- **Priority**: The priority of the Citrix SD-WAN appliance for the VRRP group. The priority range is 1–254. Set this value to maximum (254) to make the SD-WAN appliance the master.

  > **Note**
  >
  > If the router is the owner of the VRRP IP address, the priority is set to 255 by default.

- **Advertisement Interval**: The frequency in milliseconds, with which the VRRP advertisements are sent when the SD-WAN appliance is the master. The default advertisement interval is one second.
- **Authentication Type**: You can choose **Plain Text** to enter an authentication string. The authentication string is sent as a plain text without any encryption in the VRRP Advertisements. Choose **None**, if you do not want to set up authentication.
- **Authentication Text**: The authentication string to be sent in the VRRP Advertisement. This option is enabled if the **Authentication Type** is **Plain Text**.

  > **Note**
  >
  > The **Authentication Type** and **Authentication Text** parameters are enabled only for VRRP protocol version 2.

- **Use V2 Checksum**: Enables compatibility with third party network devices for VRRPv3. By default, VRRPv3 uses the v3 checksum computation method. Certain third party devices might only support VRRPv2 checksum computation. In such cases, enable this option.
- **Virtual Interface**: The virtual interface to be used for VRRP. Choose one of the configured virtual interfaces.

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- **Virtual IP Address**: The virtual IP address assigned to the virtual interface. Choose one of the configured virtual IP addresses for the virtual interface.
- **VRRP Router IP**: The virtual router IP address for the VRRP group. By default, the Virtual IP address of the SD-WAN appliance is assigned as the virtual router IP address.

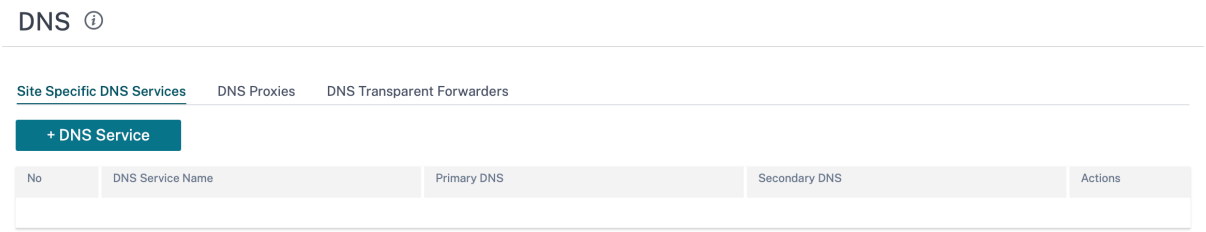
Domain Name System settings

April 7, 2021

Domain Name System (DNS) translates human readable domain names to machine-readable IP addresses, and the opposite way. Citrix SD-WAN provides the following DNS features:

- DNS Proxy
- DNS Transparent Forwarding

To configure DNS settings, in the Site configuration page, navigate to **Configuration > Advanced Settings** > **DNS Settings**.



Site specific DNS servers

On the **Site specific DNS servers** tab, click **+ DNS Server** to configure site-specific DNS servers to which the DNS requests are routed. Provide a name for the DNS server. Choose one of the following service types:

- **Static**: Intercepts the DNS requests destined to the Citrix SD-WAN IP address and forwards it to the specified IPv4 DNS servers. You can create internal, ISP, google or any other open source DNS service.
- **Dynamic**: Intercepts the DNS requests destined to the Citrix SD-WAN IP address and redirects it to one of the IPv4 DNS servers learned from the DHCP based WAN links. If the WAN link goes down, another DHCP based WAN links DNS server is chosen. This feature is useful in the deployment where ISPs allow DNS requests only to DNS servers hosted by them. Dynamic DNS service can be configured at site level only. Only one dynamic DNS service is permitted per site.

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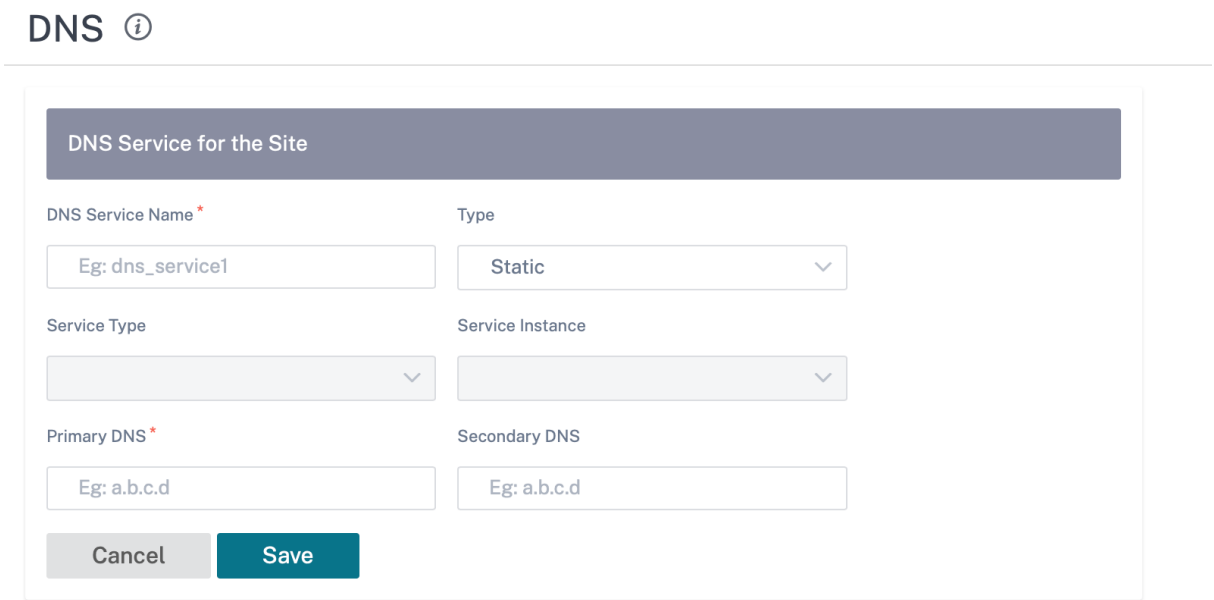
- **StaticV6**: Intercepts the DNS requests destined to the Citrix SD-WAN IP address and forwards it to the specified IPv6 DNS servers. You can create internal, ISP, google or any other open source DNS service.
- **DynamicV6**: Intercepts the DNS requests destined to the Citrix SD-WAN IP address and redirects it to one of the IPv6 DNS servers learned from the DHCP based WAN links. If the WAN link goes down, another DHCP based WAN links DNS server is chosen. This feature is useful in the deployment where ISPs allow DNS requests only to DNS servers hosted by them. Dynamic DNS service can be configured at site level only. Only one dynamic DNS service is permitted per site.

To configure the Static DNS service, select the **Type** as **Static** (for IPv4 address) or **StaticV6** (for IPv6 address) and enter a pair of **Primary DNS** and **Secondary DNS** server IP addresses.

To configure Dynamic DNS service, select the **Type** as **Dynamic** (for IPv4 address) or **DynamicV6** (for IPv6 address)and select **Internet** for **Service Type** and **Service Instance**.

The corresponding DNS proxy services get listed in the **InBand Management DNS** drop-down list under **Site Configuration > Interfaces**.



DNS proxy

DNS proxy intercepts the DNS requests destined to the SD-WAN IP address and forwards it to the selected DNS servers. You can configure a proxy with multiple forwarders that helps steering DNS requests based on application domain names.

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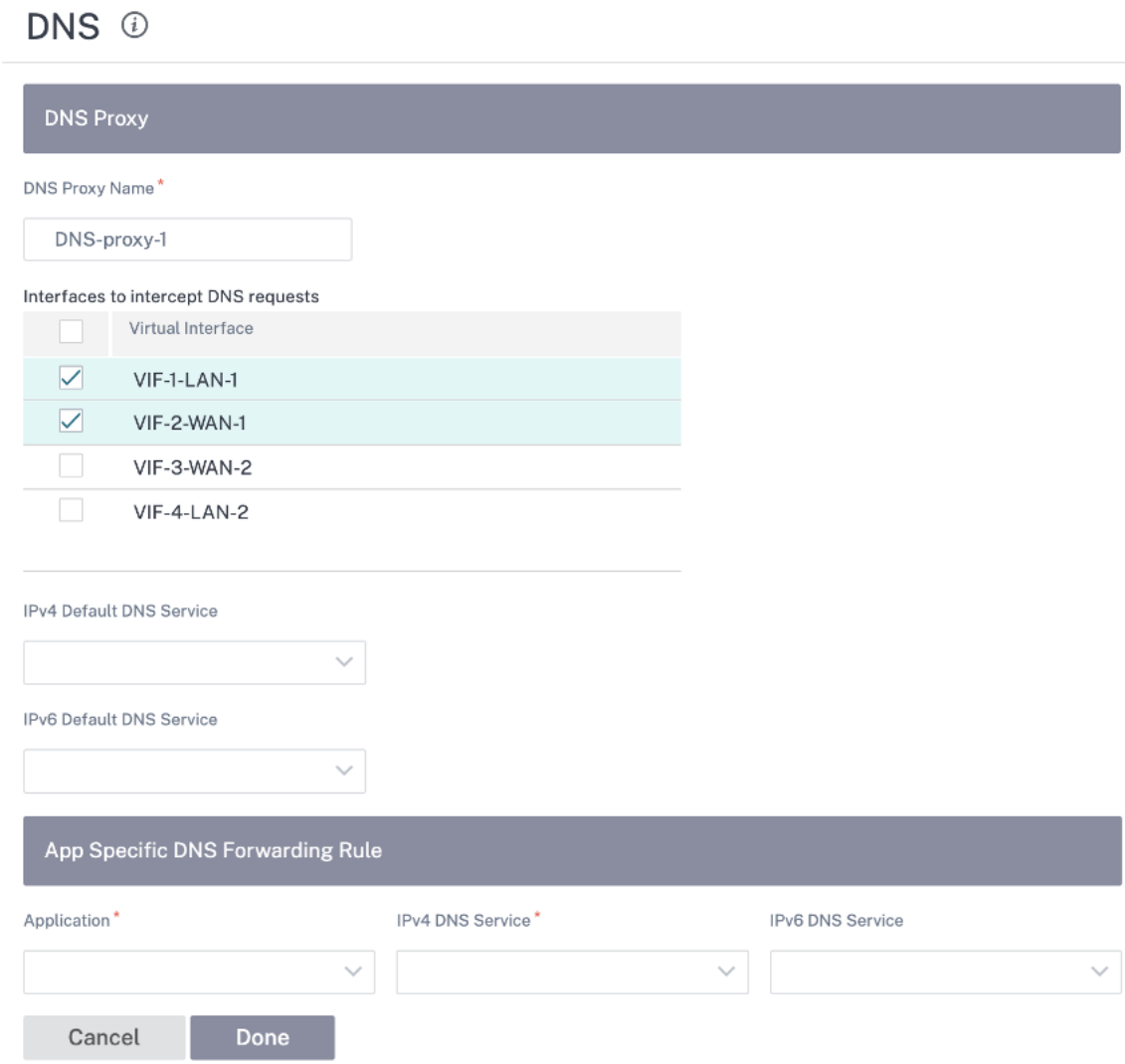

- DNS proxy settings:
  - **DNS Proxy Name**: Name of the DNS Proxy.
  - **Interfaces to intercept DNS requests**: The interfaces on which the DNS requests are intercepted. Only trusted interfaces are allowed.
  - **Default DNS Server for all traffic**: The default DNS server to which the DNS requests is forwarded, if none of the applications match in the DNS forwarder look-up.
  - **IPv4 Default DNS Service**: The IPv4 default DNS service to which the DNS requests are forwarded, if none of the applications match in the DNS forwarder look-up.
  - **IPv6 Default DNS Service**: The IPv6 default DNS service to which the DNS requests are forwarded, if none of the applications match in the DNS forwarder look-up.
- App specific DNS Forwarding rules:
  - **Application**: Applications for which DNS requests have to be forwarded to the selected DNS server.
  - **IPv4 DNS Service**: The IPv4 DNS service that the DNS request is forwarded to for the spec-

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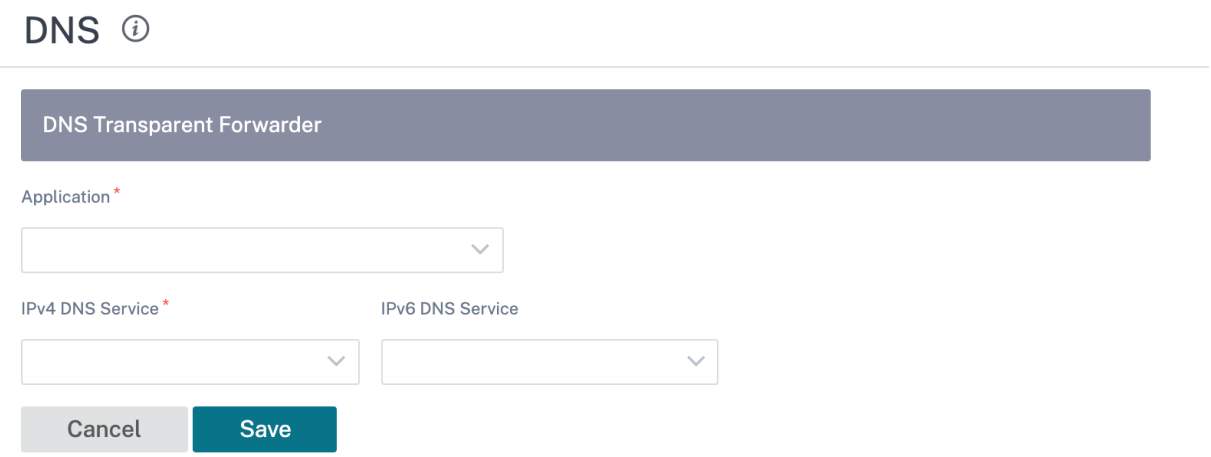
ified application.
  - **IPv6 DNS Service**: The IPv6 DNS service that the DNS request is forwarded to for the specified application.

DNS transparent forwarders

Citrix SD-WAN can be configured as a transparent DNS forwarder. In this mode, SD-WAN can intercept DNS requests that are not destined to its IP address and forward them to the specified DNS servers. Only the DNS requests coming from the local service on trusted interfaces are intercepted. If the DNS requests match any applications in the DNS forwarder list, then it is forwarded to the configured DNS service.



- **Application**: Applications for which DNS requests have to be forwarded to the selected DNS server.
- **IPv4 DNS Service**: The IPv4 DNS service that the DNS request is forwarded to for the specified application.
- **IPv6 DNS Service**: The IPv6 DNS service that the DNS request is forwarded to for the specified application.

Prefix delegation groups

April 7, 2021

Citrix SD-WAN appliances can be configured as a DHCPv6 client to request a prefix from the ISP using the configured WAN port. Once the Citrix SD-WAN appliance receives the prefix, it uses the prefix to create a pool of IP addresses to cater to the LAN clients. The Citrix SD-WAN appliance then behaves as a DHCP server and advertise the prefix on the LAN ports to the LAN side clients.

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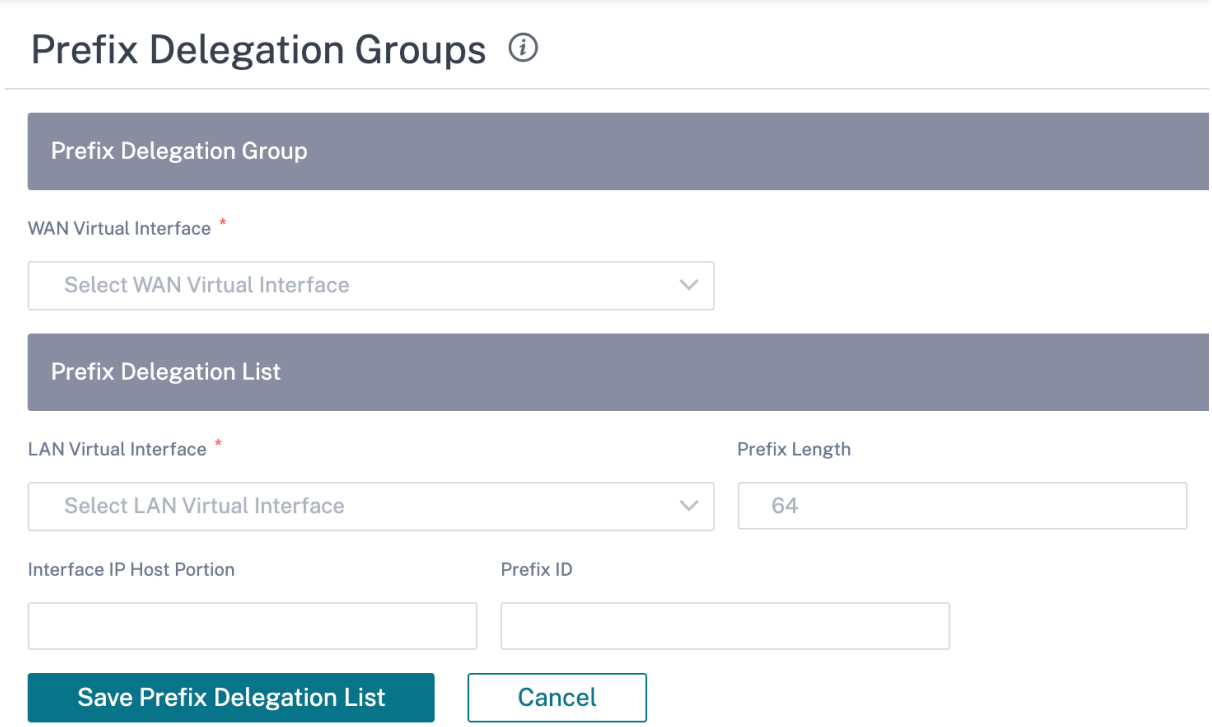
To configure prefix delegation, navigate to **Configuration > Advanced Settings > Prefix Delegation Groups** and click **+ Prefix Delegation Groups**.

Choose a configured WAN Virtual Interface on which the prefix is requested from the ISP and provide the following details:

- **LAN Virtual Interface**: Select one of the configured LAN virtual interfaces for which the prefix is requested.
- **Prefix Length**: The number of bits of a Global Unicast IPv6 address that are part of the prefix.
- **Interface IP Host Portion**: The host portion to be used for the interface IP address.
- **Prefix ID**: A unique identifier to identify the prefix delegation requests for the LAN interface.



June 14, 2021

Link aggregation groups

The Link Aggregation Groups (LAG) functionality allows you to group two or more ports on your SD-WAN appliance to work together as a single port. This ensures increased availability, link redundancy, and enhanced performance.

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Citrix SD-WAN Orchestrator for On-premises supports simple Link Aggregation Group (ACTIVE-BACKUP). The 802.3ad LACP protocol based negotiations are not supported in the current release. At any time only one port is active and the other ports are in backup mode. The active and backup supports rely on the Data Plane Development Kit (DPDK) package for LAG functionality. The LAG functionality is available only on the following DPDK supported platforms:

- Citrix SD-WAN 110 SE
- Citrix SD-WAN 210 SE
- Citrix SD-WAN 410 SE
- Citrix SD-WAN 1100 SE/PE
- Citrix SD-WAN 2100 SE/PE
- Citrix SD-WAN 4000, 4100, and 5100 SE
- Citrix SD-WAN 6100 SE

> **Note**
>
> The LAG functionality is not supported on VPX/VPXL platforms.

To configure link aggregation groups, at the site level, navigate to **Configuration > Advanced Settings > LAG** and select the member Ethernet interfaces to form a link aggregation group.

You can create a maximum of four LAGs with a maximum of four ports grouped in each LAG on the Citrix SD-WAN appliances. For Citrix SD-WAN 110, 210, and 410 appliances, you can create only one LAG.

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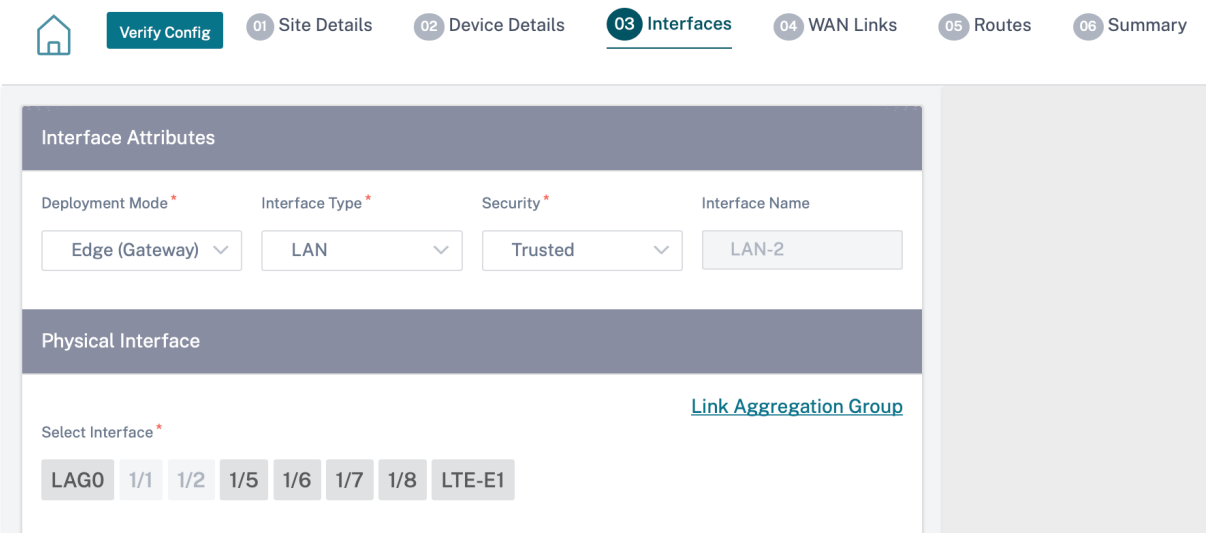
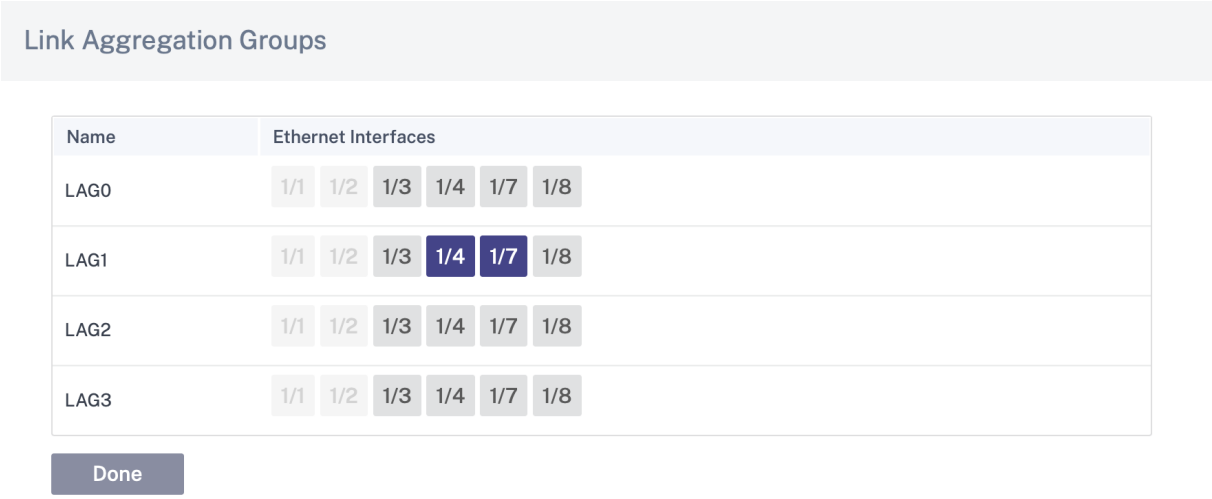
Once the ports are added to the LAG, you can select the LAGs to configure interfaces under **Site Configuration**. These interfaces are further used to configure LAN/WAN links and HA. You cannot change settings for individual member ports, any configuration changes made to the LAG, is automatically pushed to the member ports.



In the **Interfaces** section, click **Link Aggregation Group** to quickly change the LAG configuration if necessary.



Appliance settings

August 19, 2021

Citrix SD-WAN Orchestrator for On-premises allows you to configure the appliance settings, at the site

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level and push it to the remote appliances.

You can configure the user, network adapters, NetFlow, AppFlow, SNMP, Fallback configuration, and Purge flow settings.

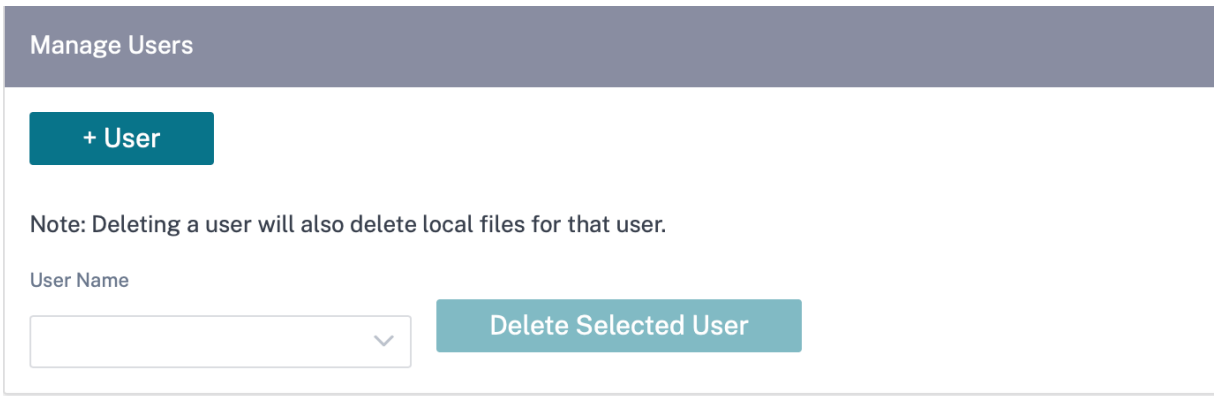
If HA is configured, select the primary or secondary appliance for which you want to change the appliance settings.

Administrative interface

The administrative interface allows you to add and manage the local and remote user accounts. The remote user accounts are authenticated through the RADIUS or TACACS+ authentication servers.

Manage users

You can add new user accounts for the site. To add a new user, navigate to **Configuration** > **Appliance Settings** > **Administrator Interface** > **Manage Users**, and click **+User**.



Provide the following details:

- **User Name**: The user name for the user account.
- **New Password**: The password for the user account.
- **Confirm Password**: Reenter the password to confirm it.
- **User level**: Select one of the following account privileges:
  - **Admin**: An Admin account has read-write access to all the settings. An admin can perform configuration and software update to the network.
  - **Viewer**: A Viewer account is a read-only account with access to Dashboard, Reporting, and Monitoring sections.

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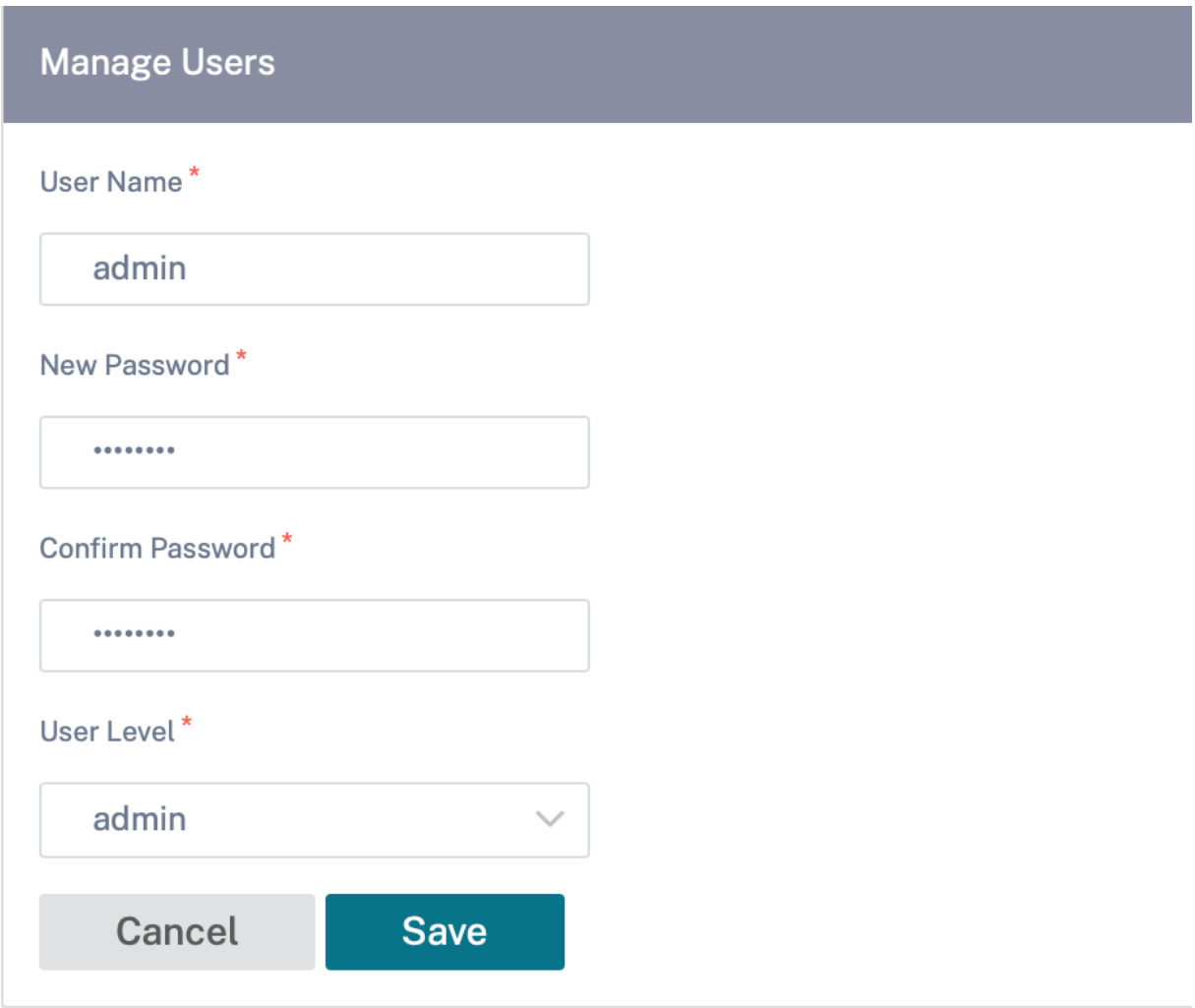
- **Network Admin**: A Network Administrator has read-write access to the Network setting and read-only access for other settings.
- **Security Admin**: A Security Administrator has read-write access for the Firewall / Security related settings read-only access for other settings.

> **Note**
> Security administrator has the authority to disable the write access to the firewall for other users (Admin/Viewer).



To delete a user, select a user name and click **Delete Selected User**. The user account and the local files are deleted.

Change local user password

To change the local user password, navigate to **Configuration** > **Appliance Settings** > **Administrative Interface** > **User Accounts** > **Change Local User Password** and provide the following values:

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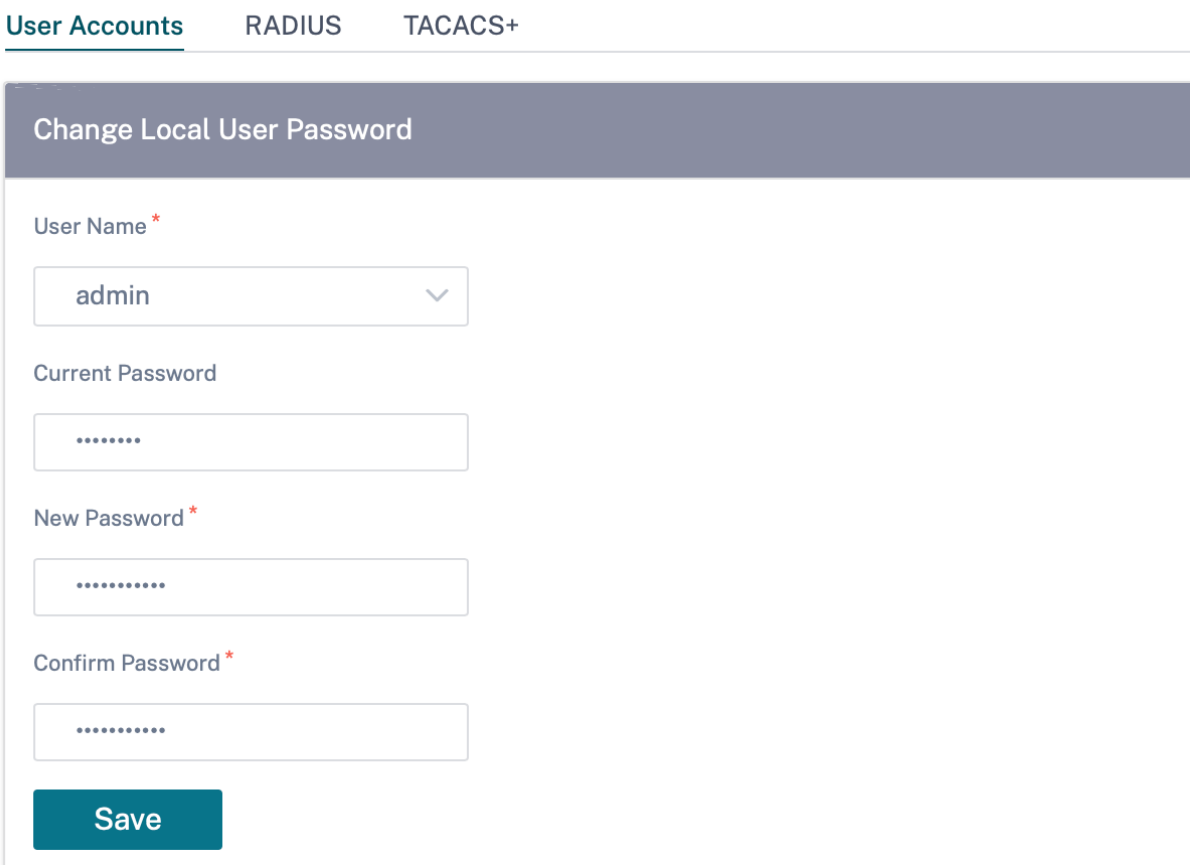
- **User Name**: Select a user name for which you want to change the password from the list of users configured at the site.
- **Current Password**: Enter the current password. This field is optional for admin users.
- **New Password**: Enter a new password of your choice.
- **Confirm Password**: Reenter the password to confirm it.



RADIUS authentication server

RADIUS enables remote user authentication on the appliance. To use RADIUS authentication, you must specify and configure at least one RADIUS server. Optionally, you can configure redundant backup RADIUS servers, up to a maximum of three. The servers are checked sequentially. Ensure that the required user accounts are created on the RADIUS authentication server.

To configure RADIUS authentication, navigate to **Configuration** > **Appliance Settings** > **Administrative Interface** > **RADIUS**, and click **Enable RADIUS**.

> **Note**
>
> You can either enable RADIUS or TACACS+ authentication on a site. You cannot enable both at

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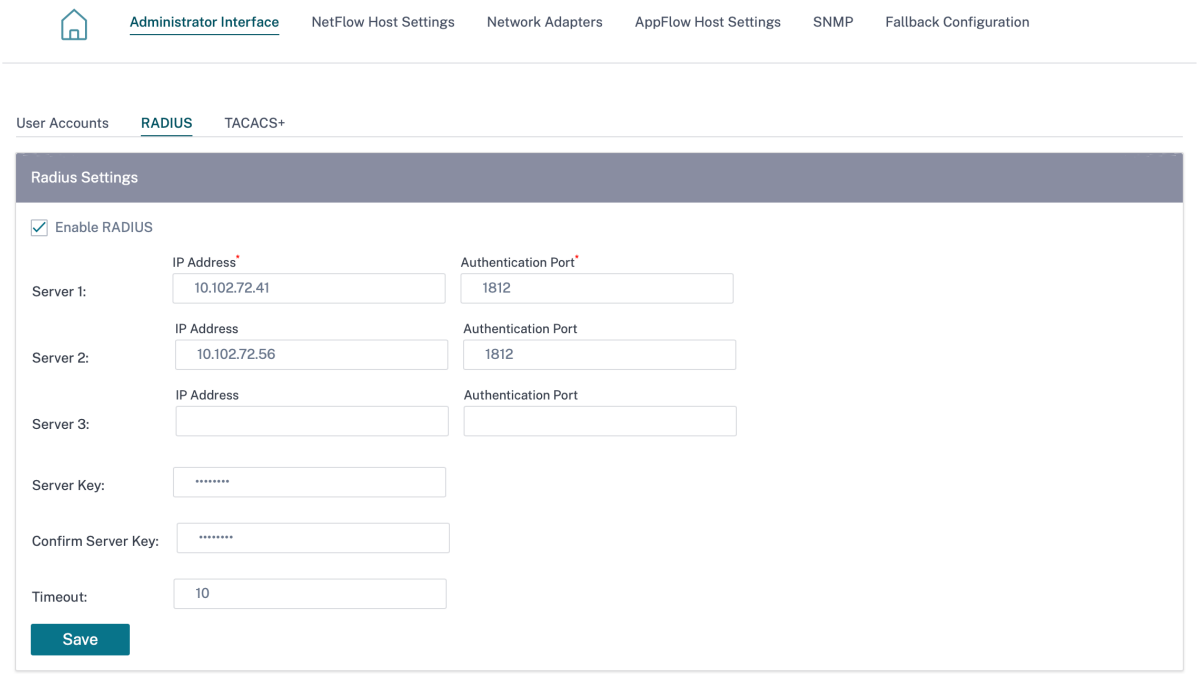
> the same time.

Provide the host IP address of the RADIUS server and the authentication port number. The default port number is 1812. Enter a Server key and confirm it, it is a secret key used to connect to the RADIUS server. Specify the time interval to wait for an authentication response from the RADIUS server. The timeout value must be less than or equal to 60 seconds.

> **Note**
>
> The **Server Key** and **Timeout** settings are applied to all the configured servers.



TACACS+ authentication server

TACACS+ enables remote user authentication on the appliance. To use TACACS+ authentication, you must specify and configure at least one TACACS+ server. Optionally, you can configure redundant backup TACACS+ servers, up to a maximum of three. The servers are checked sequentially. Ensure that the required user accounts are created on the TACACS+ authentication server.

To configure TACACS+ authentication, navigate to **Configuration** > **Appliance Settings** > **Administrative Interface** > **TACACS+** and click **Enable TACACS+**.

> **Note**
>
> You can either enable RADIUS or TACACS+ authentication on a site. You cannot enable both at the same time.

1. Select the encryption method to send the user name and password to the TACACS+ server.

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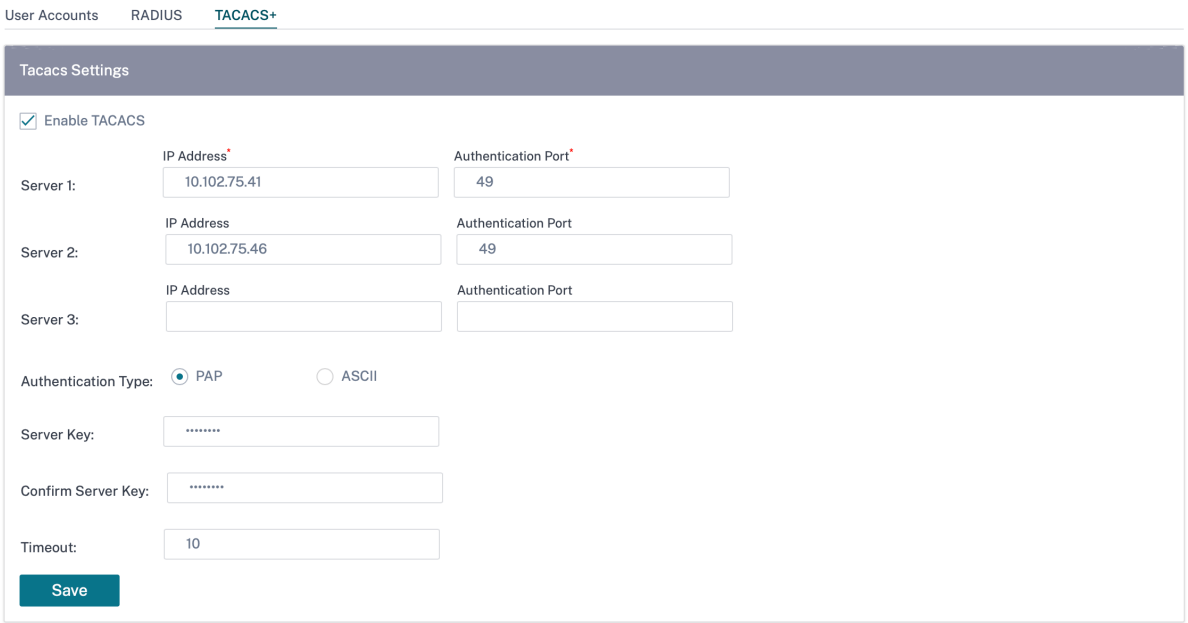
2. Provide the host IP address of the TACACS+ server and the authentication port number. The default port number is 49.
3. Enter a Server key and confirm it. It is a secret key used to connect to the TACACS+ server.
4. Specify the time interval to wait for an authentication response from the TACACS+ server. The timeout value must be less than or equal to 60 seconds.

> **Note**
>
> The **Authentication type**, **Server Key**, and **Timeout settings** are applied to all the configured servers.



NetFlow host settings

NetFlow Collectors collect IP network traffic as it enters or exits an SD-WAN interface. You can determine the source and destination of traffic, class of service, and the causes for traffic congestion using NetFlow data. For more information, see Multiple NetFlow Collector.

You can configure up to three NetFlow hosts. To configure NetFlow host settings, navigate to **Configuration** > **Appliance Settings** > **NetFlow Host Settings**. Select **Enable NetFlow** and provide the IP Address, and Port number of the NetFlow host.

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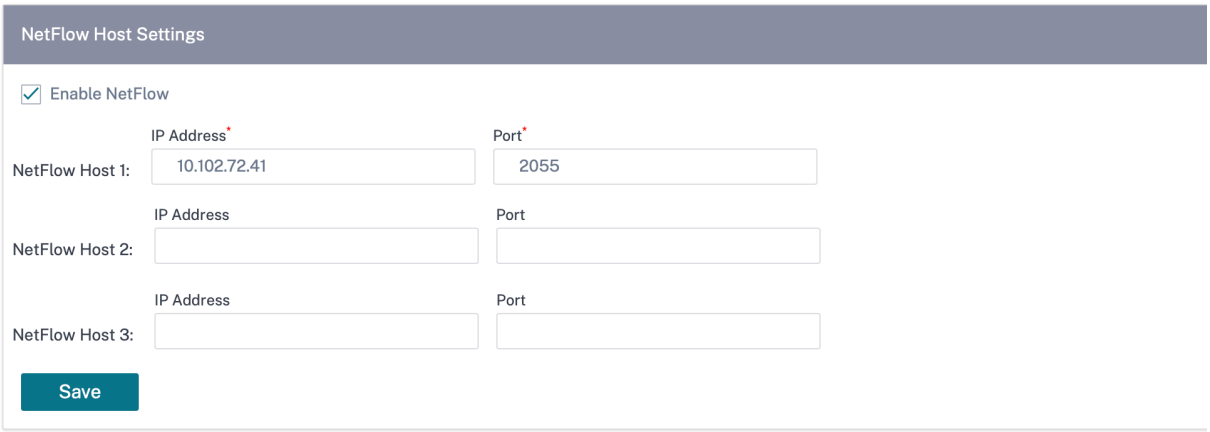

Network adapters

For Citrix SD-WAN appliances, you can manually change the management IP address and other network parameters. You can change the IPv4 address, subnet mask, gateway IP address, IPv6 address, and prefix of the appliance or obtain the IP address automatically by enabling DHCP or SLAAC (only for IPv6 addresses). For more information, see Dynamic host configuration protocol.

> **Note**
>
> You cannot change the IP address, if the interface is used for in-band management. For more information on in-band management, see In-band management.

To configure the network adapter settings, navigate to **Configuration** > **Appliance Settings** > **Network Adapter**.

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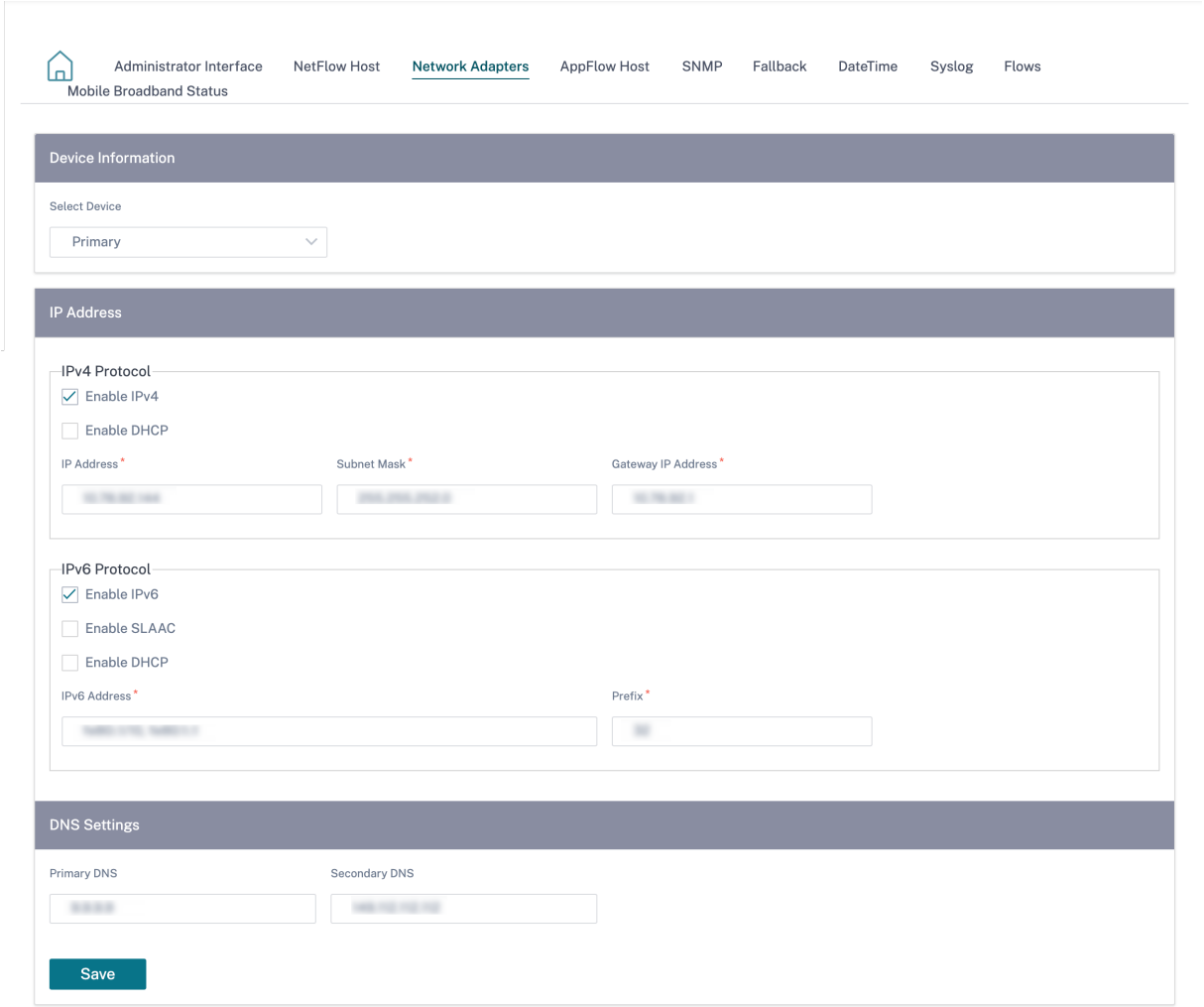

AppFlow host settings

AppFlow and IPFIX are flow export standards used to identify and collect application and transaction data in the network infrastructure. This data gives better visibility into application traffic utilization and performance.

The collected data, called flow records are transmitted to one or more IPv4 collectors. The collectors aggregate the flow records and generate real-time or historical reports. For more information, see AppFlow and IPFIX.

To configure AppFlow Host Settings, navigate to **Configuration** > **Appliance Settings** > **AppFlow Host Settings** and click **Enable**. Specify the data update interval, in minutes, at which the AppFlow reports are exported to the AppFlow / IPFIX collector.

Choose one of the following AppFlow dataset templates:

- **TCP only for HDX**: Collects and sends multi-hop data of ICA connections to the AppFlow collec-

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tor.
- **HDX**: Collects and sends HDX insight data of ICA connections to the AppFlow collector.

You can configure up to four AppFlow / IPFIX collectors. For each collector specify the following parameters:

- **IP Address**: The IP address of the external AppFlow / IPFIX collector system.
- **Port**: The port number on which the external AppFlow / IPFIX collector system listens. The default value is 4739. You can change the port number depending on the collector used.
- **AppFlow**: Sends flow records, as per IPFIX template 613, to IPFIX collectors.
- **Application Flow Info**: Sends flow records, as per IPFIX templates 611 and 612, to IPFIX collectors.
- **Citrix ADM**: Use Citrix ADM as the AppFlow collector. Provide the user name and password to seamlessly log in into Citrix ADM and store flow data.

> **Note**
>
> Citrix ADM currently does not support IPFIX collection.

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AppFlow Host Settings

Enable

Data Update Interval (minutes) :

5

Appflow Data Set: TCP only for HDX HDX

AppFlow / IPFIX Collector 1

IP Address: 10.102.76.35 Port: 4730

Data Set: Appflow Application Flow Info (IPFIX) Basic Properties (IPFIX)

Citrix ADM Citrix ADM user* Password*

AppFlow / IPFIX Collector 2

IP Address: 10.102.36.89 Port: 4736

Data Set: Appflow Application Flow Info (IPFIX) Basic Properties (IPFIX)

Citrix ADM Citrix ADM: admin Password: ••••••••

AppFlow / IPFIX Collector 3

IP Address: 10.29.30.45 Port: 4735

Data Set: Appflow Application Flow Info (IPFIX) Basic Properties (IPFIX)

Citrix ADM Citrix ADM Password

AppFlow / IPFIX Collector 4

IP Address: 10.102.89.46 Port: 4732

Data Set: Appflow Application Flow Info (IPFIX) Basic Properties (IPFIX)

Citrix ADM Citrix ADM Password

Save

SNMP

SNMP is used for exchanging management information between network devices. SNMPv1 is the first version of the SNMP protocol. SNMPv2 is the revised protocol, which includes enhancements in protocol packet types, transport mappings and MIB structure elements. SNMPv3 defines the secure version

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of the SNMP. SNMPv3 protocol also facilitates remote configuration of the SNMP entities.

The SNMP agent collects the management information from the appliance locally and sends it to the SNMP manager whenever it is queried. If the agent detects an emergency event on the appliance, it sends out a warning message to the manager without waiting to be queried for data. This emergency message is called a trap. Enable the required SNMP version agents, the corresponding traps, and provide the required information. For more details see, SNMP.

To configure SNMP settings, navigate to **Configuration** > **Appliance Settings** > **SNMP**

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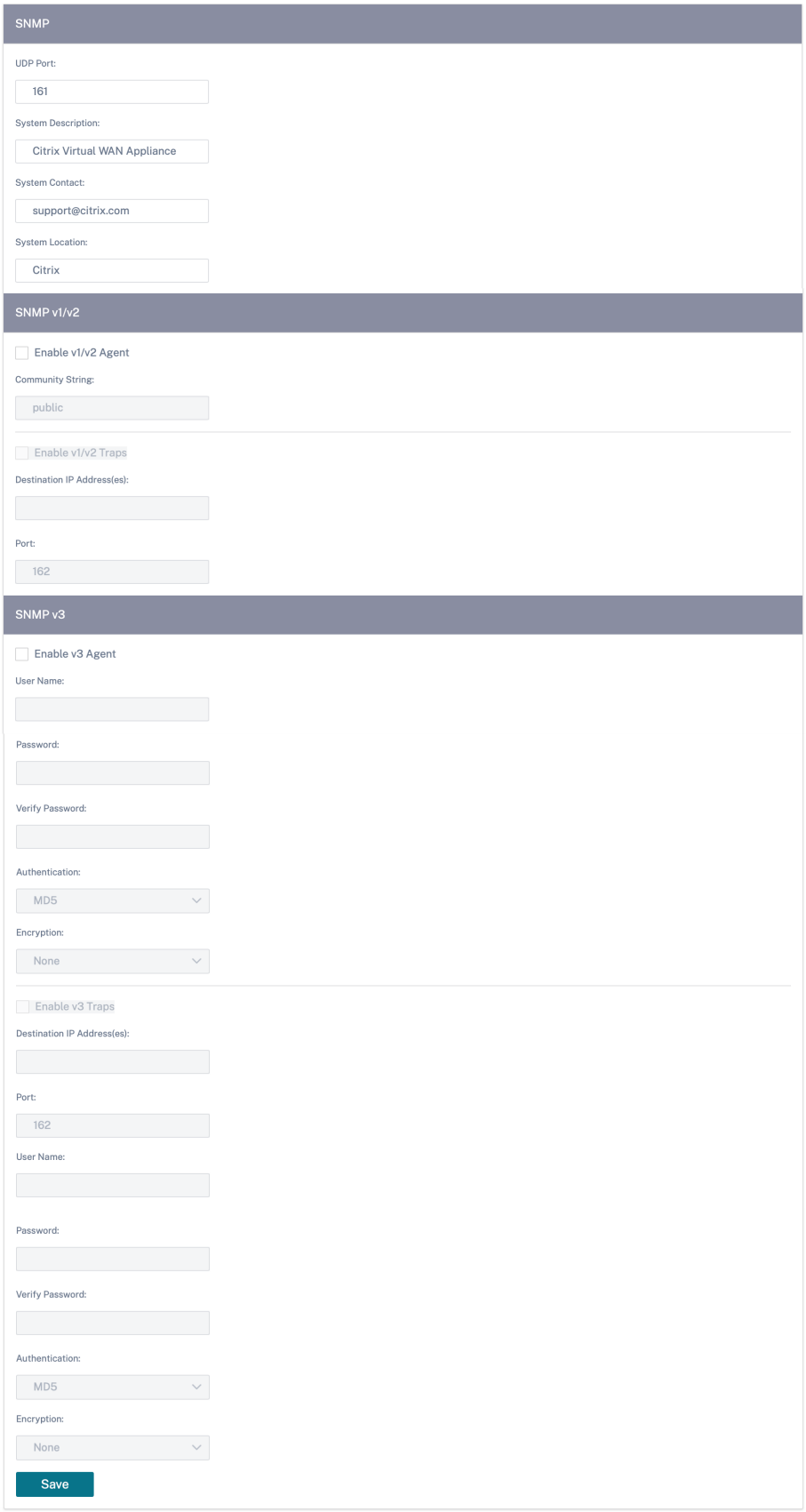

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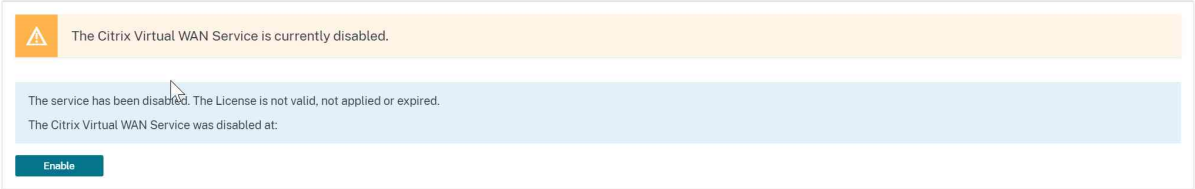
Fallback configuration

Fallback configuration ensures that the appliance remains connected to the zero-touch deployment service if there is a link failure, configuration mismatch, or software mismatch. Fallback configuration is enabled by default on the appliances that have a default configuration profile. You can also edit the fallback configuration as per your existing LAN network settings. For more information, see Fallback configuration.

Flows

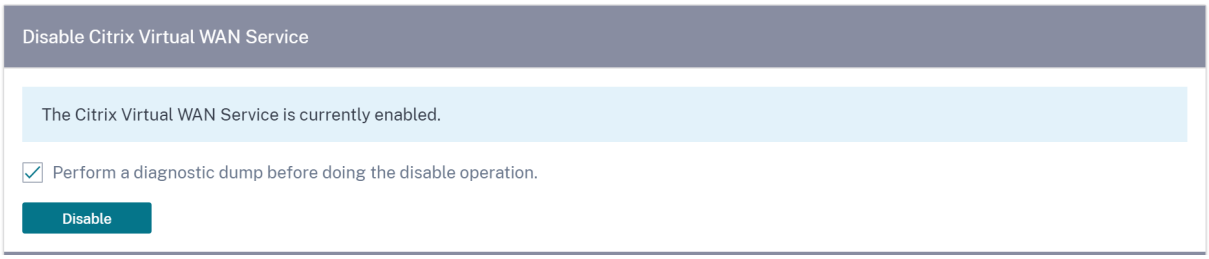
The flows section allows you to enable or disable Citrix Virtual WAN service on the appliance. Enabling the service enables and starts the Virtual WAN daemon. An option to enable Citrix Virtual Wan Service is available if the service is disabled.



Disable Citrix Virtual WAN service

The **Disable Citrix Virtual WAN Service** option is available if the service is enabled. Disabling the service stops the Virtual WAN daemon on the appliance.

You can choose to collect a diagnostic dump of the Virtual WAN network before disabling the Citrix Virtual WAN service.



Restart dynamic routing

You can restart the dynamic route learning process through OSPF and BGP routing protocols. The restart dynamic routing option is provided for troubleshooting only.

> **Warning**
>
> Restarting dynamic routing might result in network outage.

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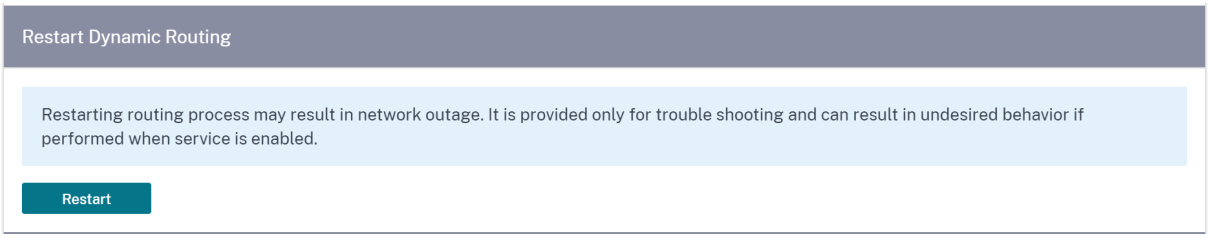
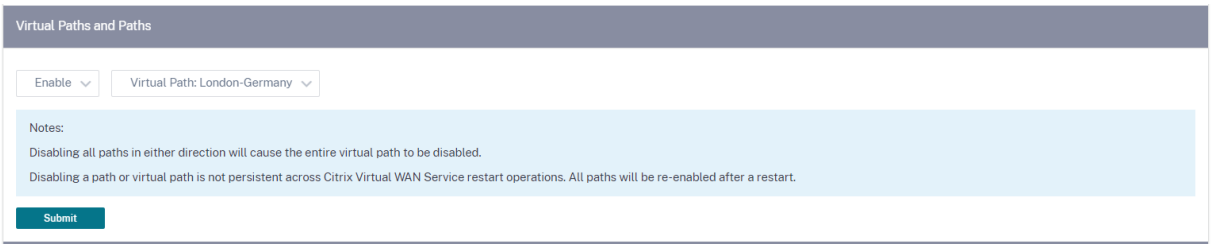


Virtual paths

You can choose to enable or disable the virtual path between 2 sites. You can either choose the underlying individual paths, in either directions, or the overlay virtual path. Disabling individual paths, disables the entire virtual path.

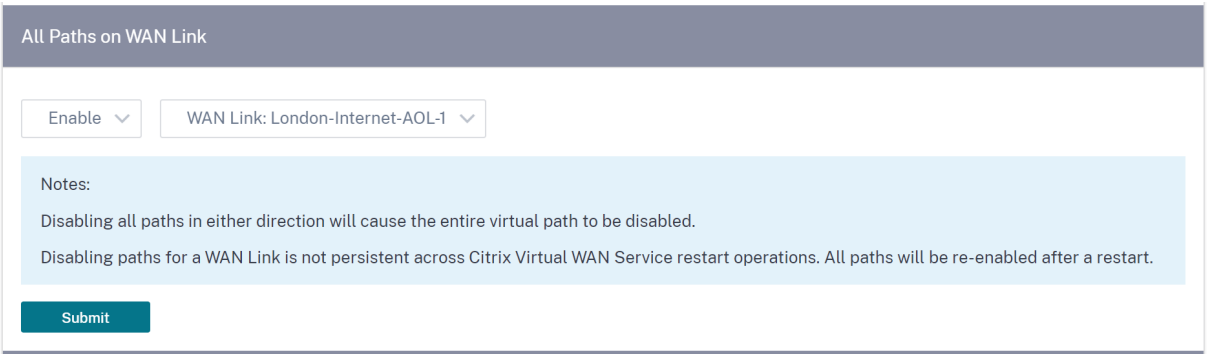
> **Note**
>
> All paths are re-enabled after restarting the Citrix Virtual WAN Service.



All paths on WAN link

You can choose to enable or disable WAN links between 2 sites Disabling all WAN links, disables the Virtual path.

> **Note**
>
> All the WAN links are re-enabled after restarting the Citrix Virtual WAN Service.



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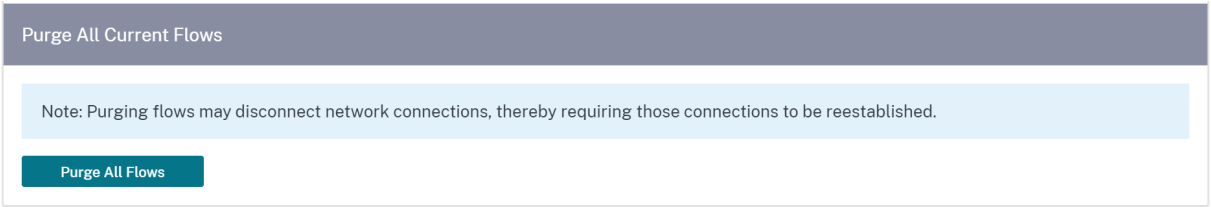
Purge all current flows

Purging flows ends all the current flows, clears the flow tables, re-establishes flow connections, and repopulates the flow table.



Date and time

You can change the date and time of the appliance either manually or by using an NTP server. To configure date and time manually, ensure that the **Use NTP server** option is not selected and provide the date and time.

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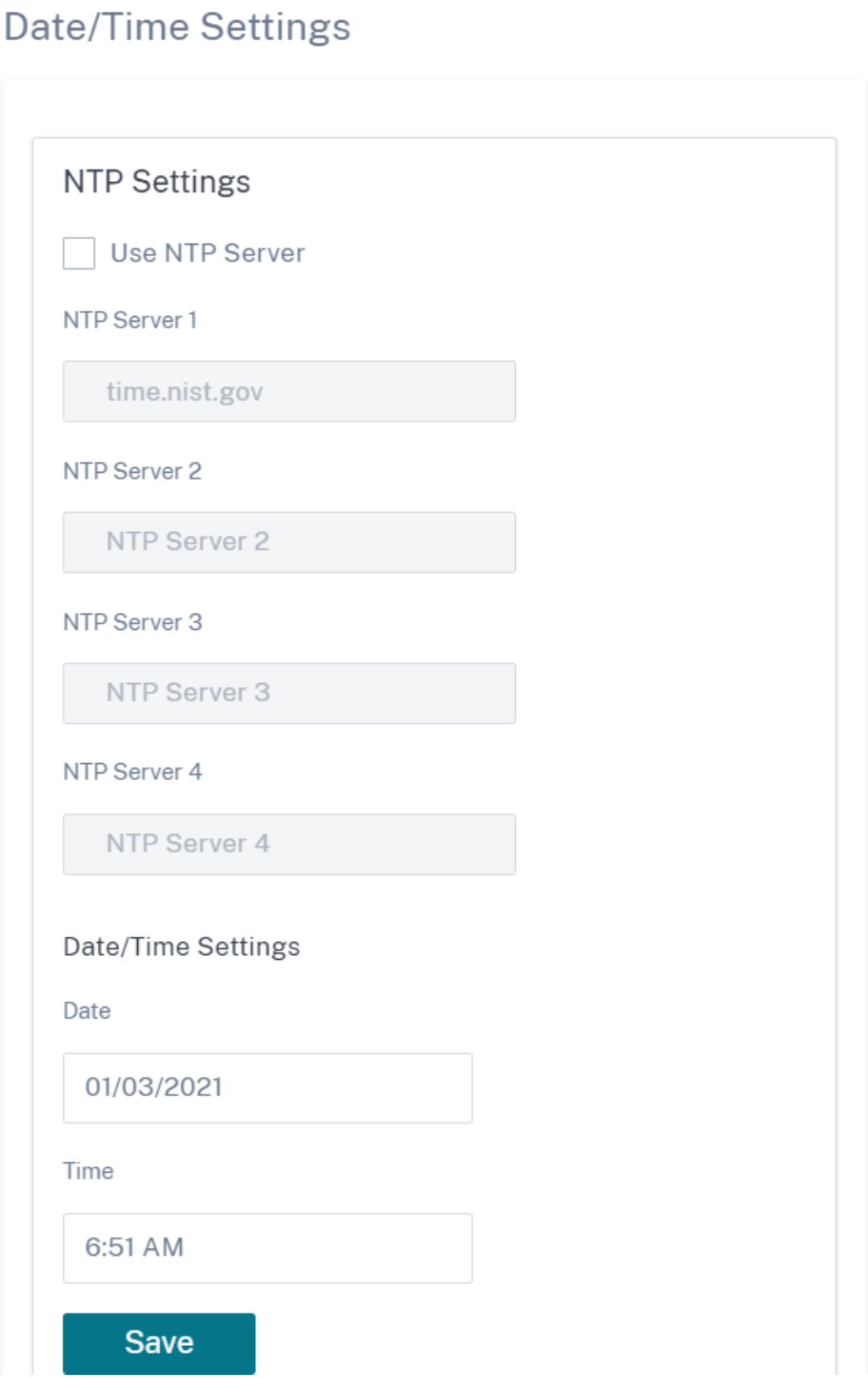

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If you select the **Use NTP server** option, then you cannot manually enter a current date and time. You can specify up to 4 NTP servers, but you must specify at least one. These act as backup NTP servers, if one server is down the appliance automatically synchronizes with the other NTP server. If you specify a domain name for an NTP server, you must also configure a DNS server unless you have already done so.

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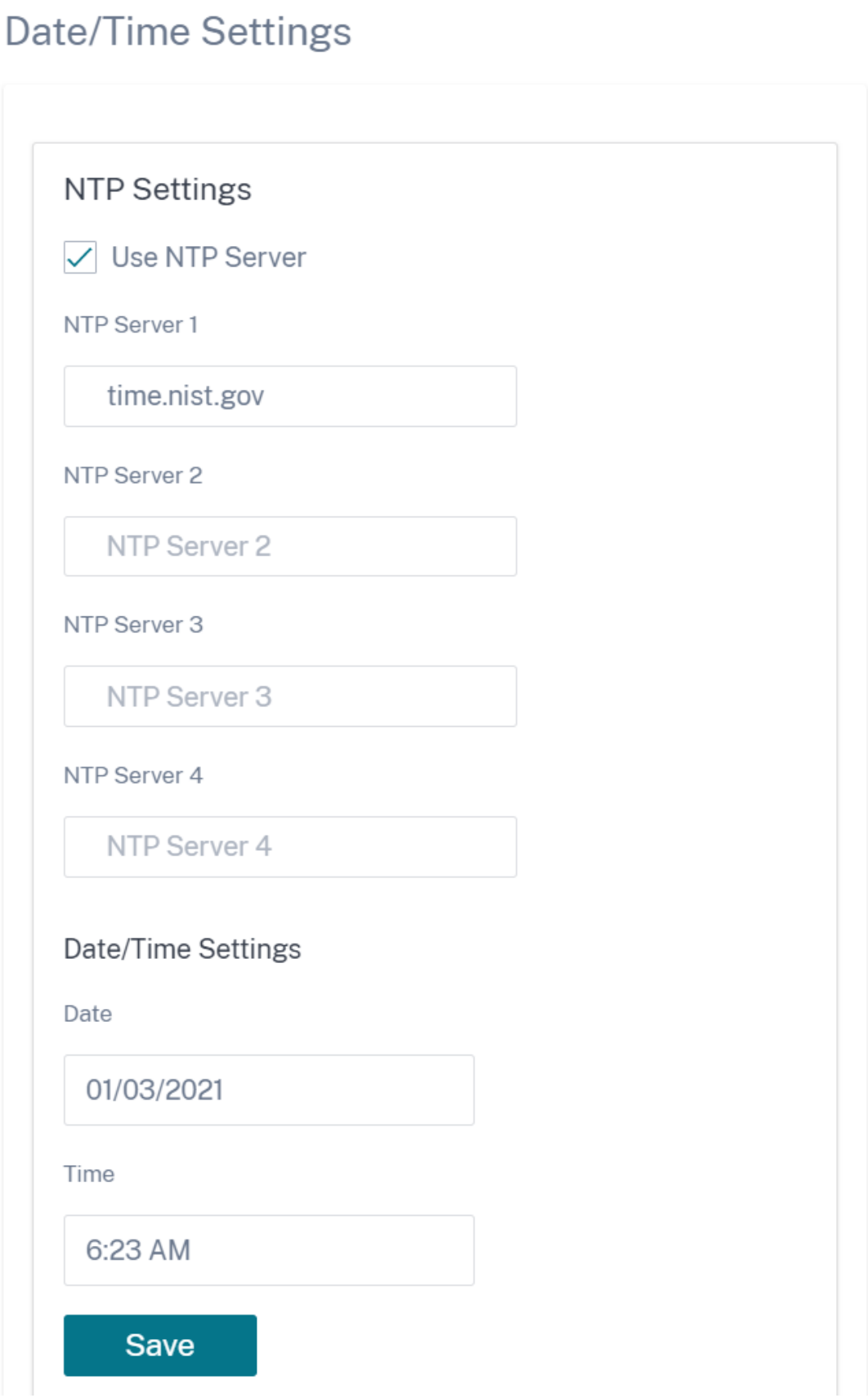

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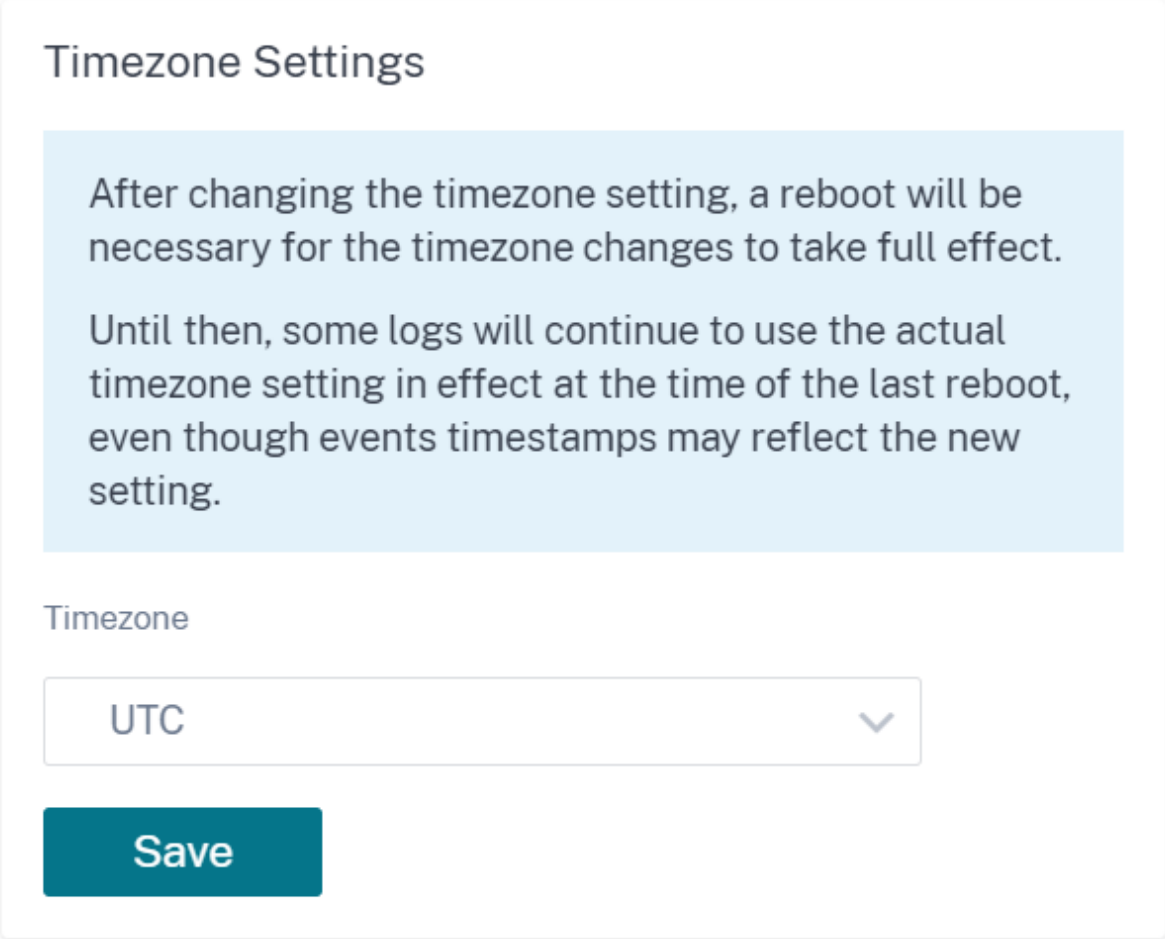
If the time zone has to be changed, change it before setting the date and time, or else your settings do not persist. Reboot the appliance after changing the time zone.



Syslog server settings

You can configure Syslog server settings of SD-WAN appliances using Citrix SD-WAN Orchestrator for On-premises. By enabling Syslog settings, you can send system alerts and event details of SD-WAN appliances to an external Syslog server. However, you must select the event type on the SD-WAN appliance UI by navigating to **Configuration** > **Appliance Settings** > **Logging/Monitoring** > **Alarm Options**. For more information, see Configure Alarms.

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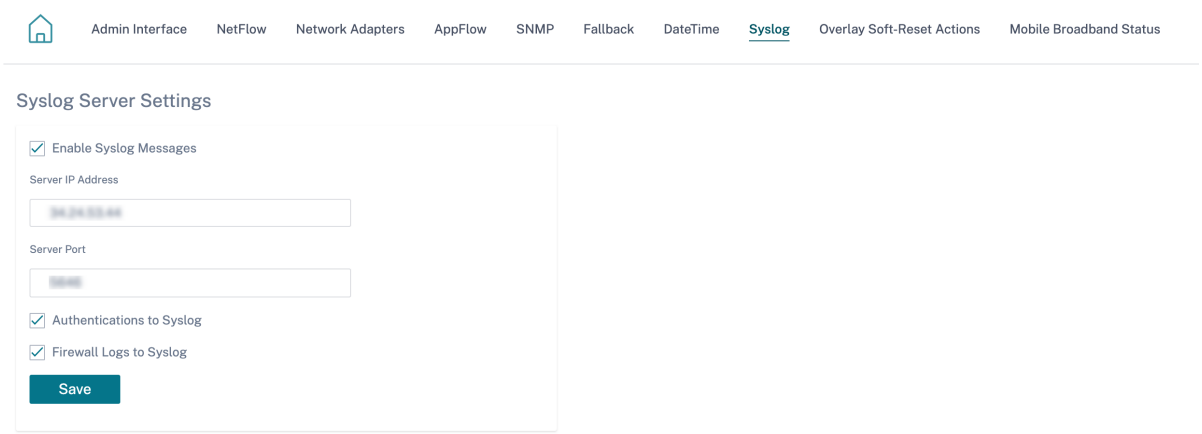

The following Syslog server settings are configurable through Citrix SD-WAN Orchestrator for On-premises:

- **Enable Syslog Messages**: Enable or disable sending logs or event messages to Syslog server.
- **Server IP Address**: IP address of the Syslog server.
- **Server Port**: Port number of the Syslog server.
- **Authentication to Syslog**: Enable or disable sending authentication logs or event messages to the Syslog server.
- **Firewall Logs to Syslog**: Enable or disable sending firewall logs to the Syslog server.

In-band management

April 7, 2021

Citrix SD-WAN Orchestrator for On-premises allows you to manage the SD-WAN appliance in two ways, out-of-band management and in-band management. Out-of-band management allows you to create a management IP using a port reserved for management, which carries management traffic only. In-band management allows you to use the SD-WAN data ports for management. It carries both data and management traffic, without having to configure an addition management path.

In-band management allows virtual IP addresses to connect to management services such as web UI and SSH. You can enable in-band management on a trusted interface that is enabled to be used for IP services. You can access the web UI and SSH using the management IP and in-band virtual IPs.

> **Note**
>
> In-band management in Citrix SD-WAN Orchestrator for On-premises is supported for Citrix SD-WAN 11.1.1 and higher.

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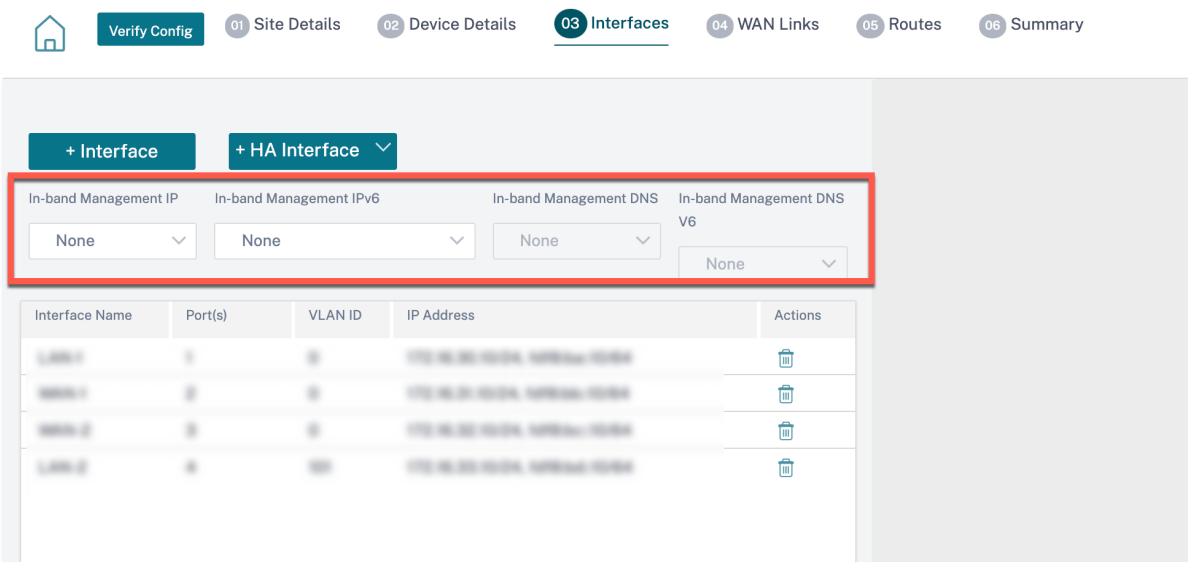
To enable in-band management on a virtual IP, at the site level, navigate to **Configuration** > **Site Configuration** > **Interfaces**. Select the virtual IP to be used as the In-band management port. You can use the **InBand Management IP** or **InBand Management IPv6** to access the web UI and SSH.

> **Note**
>
> In-band management is supported on LAN ports only.



For detailed procedure on configuring a virtual IP address, see Interfaces.

The In-band management IP also acts as a back-up management IP. It is used as the management IP address if the management port is not configured with a default gateway. Select the DNS proxy to which all DNS requests over the in-band management plane is forwarded to. For information on configuring DNS, see DNS settings.

For use cases where the appliance connectivity to Citrix SD-WAN Orchestrator for On-premises toggles between management and in-band ports, configure **InBand Management DNS** or **InBand Management DNS V6** to ensure uninterrupted Citrix SD-WAN Orchestrator for On-premises connectivity.

In-band provisioning

The need to deploy SD-WAN appliances in simpler environments like home or small branches has increased significantly. Configuring separate management access for simpler deployments is an added overhead. Zero-touch deployment along with the in-band management feature enables provisioning and configuration management through designated data ports. Zero-touch deployment is supported on the designated data ports and there is no need to use a separate management port for Zero-touch deployment.

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You can provision an appliance in the factory shipped state, that supports in-band provisioning by connecting the data or management port to the internet. The appliances that support in-band provisioning have specific ports for LAN and WAN. The appliance in the factory reset state has a default configuration that allows to establish a connection with the zero-touch deployment service. The LAN port acts as the DHCP server and assigns a dynamic IP to the WAN port that acts as a DHCP client. The WAN links monitor the Quad 9 DNS service to determine WAN connectivity.

Once the IP address is obtained and a connection is established with the zero-touch deployment service the configuration packages are downloaded and installed on the appliance. For information on zero-touch deployment through the Citrix SD-WAN Orchestrator for On-premises, see Zero Touch Deployment.

> **Note**
>
> - In-band provisioning is applicable to all the platforms. However, default configuration is enabled only on Citrix SD-WAN 110 and VPX platforms because the other platforms are shipped with an older software version.
> - For day-0 provisioning of SD-WAN appliances through the data ports, the appliance software version must be Citrix SD-WAN 11.1.1 or higher.

The default configuration of an appliance in factory reset state includes the following configurations:

- DHCP Server on LAN port
- DHCP client on WAN port
- QUAD9 configuration for DNS
- Default LAN IP is 192.168.101.1/24 for Citrix SD-WAN appliances with factory image 11.1.1.39.
- Default LAN IP is 192.168.0.1/24 for Citrix SD-WAN 110 appliance with factory image 11.0.4.
- Grace License of 35 days.
- Interface 1/1 as LAN port.
- Interface 1/2 and LTE as WAN port

Once the appliance is provisioned, the default configuration is disabled and overridden by the configuration received from the zero-touch deployment service. If an appliance license or grace license expires, the default configuration is activated, ensuring that the appliance remains connected to the zero-touch deployment service and receives the license managed service.

Fallback configuration

Fallback configuration ensures that the appliance remains connected to the zero-touch deployment service if there is a link failure, configuration mismatch, or software mismatch. Fallback configuration is enabled by default on the appliances that have a default configuration profile. You can also edit the fallback configuration as per your existing LAN network settings.

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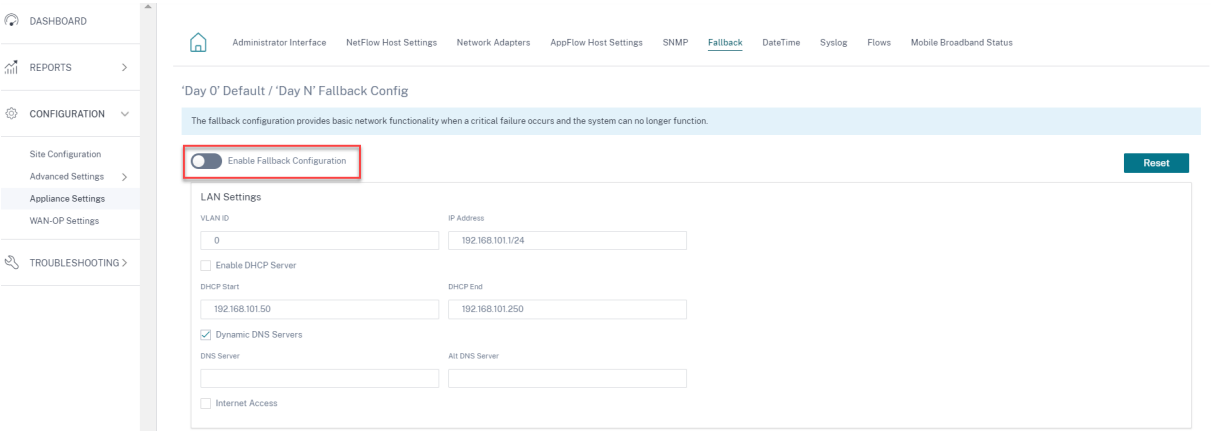
> **Note**
>
> After the initial appliance provisioning, ensure that the fallback configuration is enabled for zero-touch deployment service connectivity.

If the fallback configuration is disabled, you can enable it through Citrix SD-WAN Orchestrator service at the site level by navigating to **Configuration** > **Appliance Settings** > **Fallback** and click **Enable Fallback** Configuration.



To customize the fallback configuration as per your LAN network, edit the values for the following LAN settings as per your network requirements. This is the minimum configuration required to establish a connection with the zero-touch deployment service.

- **VLAN ID**: The VLAN ID to which the LAN port must be grouped.
- **IP Address**: The virtual IP address assigned to the LAN port.
- **Enable DHCP Server**: Enables the LAN port as the DHCP server. The DHCP server assigns dynamic IP addresses to the WAN port.
- **DHCP Start and DHCP End**: The range of IP addresses which DHCP uses to assign an IP to the WAN port dynamically.
- **Dynamic DNS Server**: Enables the LAN port as the domain name server.
- **DNS Server**: The IP address of the primary DNS server.
- **Alt DNS Server**: The IP address of the secondary DNS server.
- **Internet Access**: Permit internet access to all LAN clients without other filtering.

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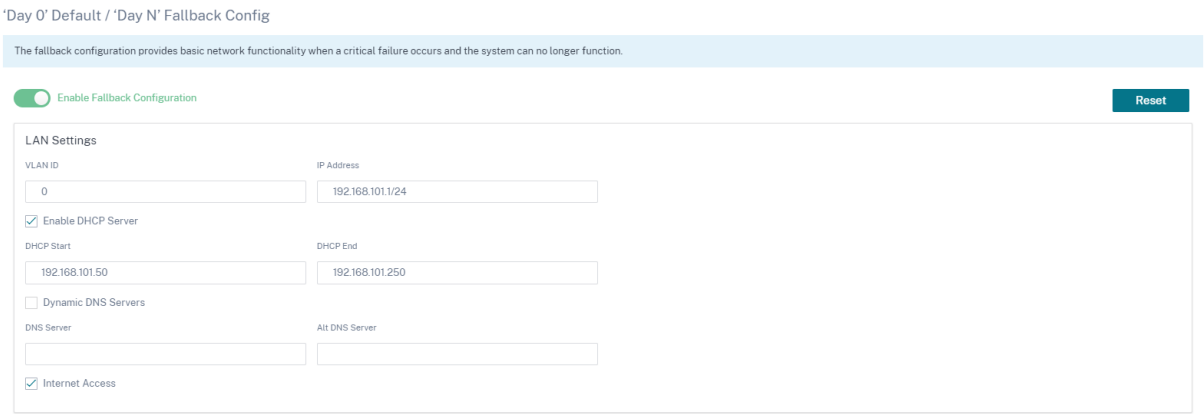

Configure the mode for each port. The port can be a LAN port or a WAN port or can be disabled. The ports displayed depend on the appliance model. Also, set the port bypass mode to **Fail-to-Block** or **Fail-to-wire**.

The following table provides the details of pre-designated WAN and LAN ports for fallback configuration on different platforms:

Platform	WAN Ports	LAN Ports
110	1/2	1/1
110-LTE	1/2, LTE-1	1/1
210	1/4, 1/5	1/3
210-LTE	1/4, 1/5, LTE-1	1/3
VPX	2	1
410	1/4, 1/5, 1/6	1/3 (FTB)
1100	1/4, 1/5, 1/6	1/3 (FTB)

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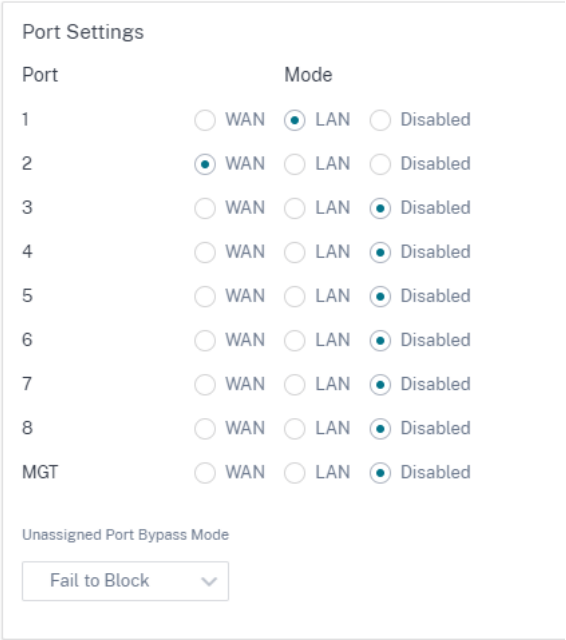
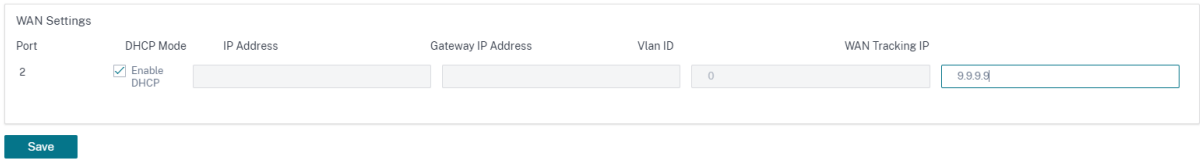


The WAN ports can be configured as independent WAN Links using the DHCP client and monitor the Quad9 DNS service to determine WAN connectivity. You can configure WAN IPs/static IPs for the WAN ports in the absence of DHCP to use In-band management for initial provisioning.

> **Note**
>
> You can only configure the Ethernet ports with the static IPs. The static IPs are not configurable with LTE-1 and LTE-E1 ports. Though you can add the LTE-1 and LTE-E1 port as WAN, the configuration fields remain non-editable.

When you add a WAN port, it is added under the **WAN Settings (Port: 2)** section with the **Enable DHCP** check box selected by default. If the **DHCP Mode** check box is selected, the **IP Address**, **Gateway IP Address**, and the **VLAN ID** text fields are grayed out. Clear the **Enable DHCP** check box, if you want to configure static IP.



By default, the **WAN Tracking IP Address** field is auto filled with the 9.9.9.9. You can change the address as needed.

> **Note**
>
> If you are selecting the **Dynamic DNS Servers** check box, ensure to add/configure at least one WAN port with the **DHCP Mode** selected.

To reset the fallback configuration to default configuration at any time, click **Reset**.

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> **Note**
>
> It is recommended to enable fallback configuration on all appliances that are connected to Orchestrator through the In-band/Management Port connected to LAN subnet. Ensure that the default fall-back configuration is set up as per your network subnet requirements.

Port failover

Citrix SD-WAN Orchestrator for On-premises also allows to fail over management traffic seamlessly to the management port when the data port goes down and conversely. If an appliance can connect to the internet through both the management and in-band ports, the management port is chosen for zero-touch deployment.

On rebooting the appliance, if internet is available over the in-band port and not the management port, the appliance is connected to the Citrix SD-WAN Orchestrator for On-premises immediately.

Once the connection is established, a service agent running on the appliance sends the heartbeat information to the Citrix SD-WAN Orchestrator for On-premises every 10 seconds. If the Citrix SD-WAN Orchestrator for On-premises does not receive the heartbeat for 5 minutes, the In-band port failover is activated. Citrix SD-WAN Orchestrator for On-premises reports the appliance as offline during this period.

On rebooting the appliance, if internet is not available over both the management and in-band port and once internet connection is re-established, the service agent takes about 5 minutes to restart and establish a connection.

Ensure that the **Preserve route to internet from link even if all associated paths are down** option is enabled at the network level, **Configuration** > **Delivery Services** > **Internet**. Ensuring that the connectivity to the Citrix SD-WAN Orchestrator for On-premises is maintained even if the virtual path is down.

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Configurable management or data port

In-band management allows the data ports to carry both data and management traffic, eliminating the need for a dedicated management port. It leaves the management port unused on the low end appliances, which already have low port density. Citrix SD-WAN allows you to configure the management port to operate as either a data port or a management port.

> **Note**
>
> You can convert the management port to data port only on the following platforms.
>
> - Citrix SD-WAN 110 SE/LTE
> - Citrix SD-WAN 210 SE/LTE

While configuring a site, use the management port in your configuration. After the configuration is activated, the management port is converted to a data port.

> **Note**
>
> You can configure a management port only when in-band management is enabled on other trusted interfaces on the appliance.

To configure a management interface, at the site level, navigate to **Configuration** > **Site Configuration** > **Interfaces** and select the MGMT interface. For more information on configuring interface groups, see Interfaces.

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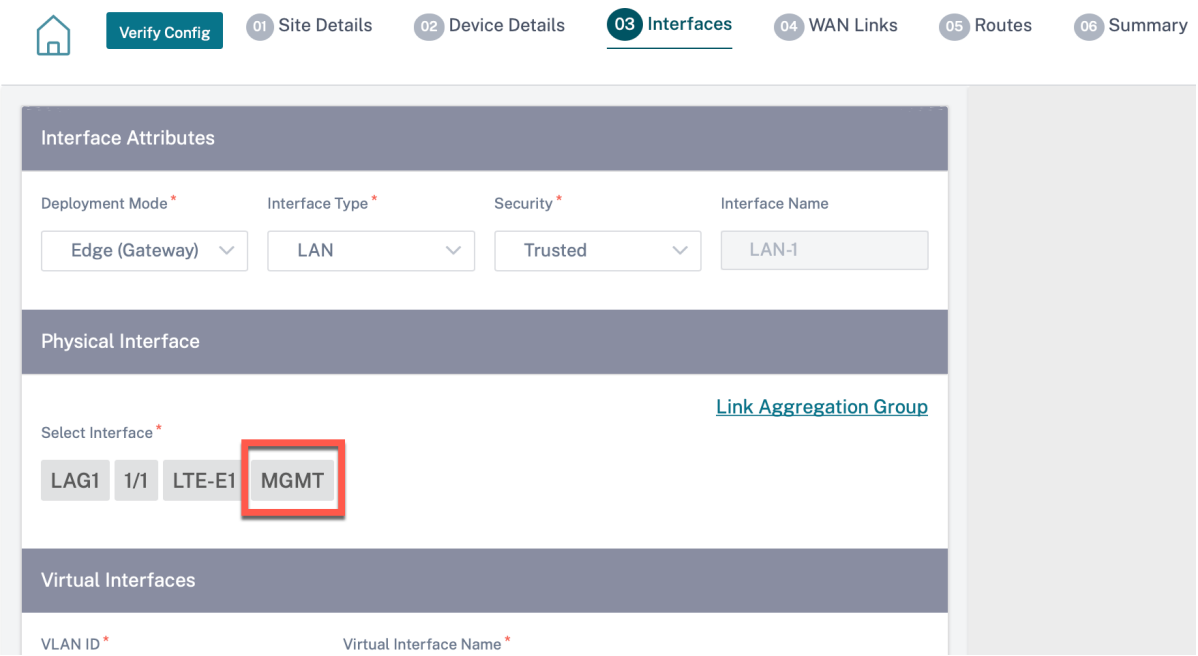
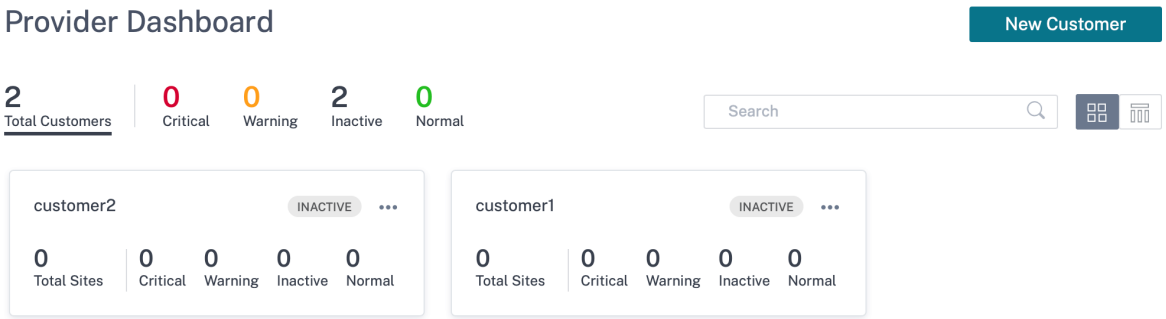


To reconfigure the management port to perform management functionality, remove the configuration. Create a configuration without using the management port and activate it.

Provider dashboard

October 21, 2020

When you log in as a Citrix partner, the **Provider Dashboard** appears. It offers a bird's eye view of all the SD-WAN customers managed by a service provider.



A color-coded health snapshot of each customer's SD-WAN network is provided, with a provision to drill down into any of them for customer specific details. The dashboard is available in both **Tile View** and **List View**.

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The color-coding criteria used for the customer's network are:

- Critical (Red): One or more sites are down
- Warning (Orange): No sites are down but there are one or more critical alerts.
- Normal (Green): No sites are down and there are no critical alerts.
- Inactive (Gray): The network is being configured, but has not been deployed yet.

The color-coding criteria allows administrators to focus on the customers that need their attention.

Customer/Network dashboard

July 29, 2021

The Network Dashboard provides a bird's eye view of an organization's SD-WAN network in terms of health and usage across all the sites. The dashboard captures a summary of the network-wide alerts, uptime of the overlay and underlay paths, highlights usage trends, and provides a global view of the network.

The dashboard summarizes the following aspects of a network, with a provision to drill down for more details.

- **Critical Alerts**: Running count of the critical health alerts, if any, popping up on the network.
- **Uptime**: Side-by-side comparison of the average uptime offered by the SD-WAN virtual overlay network v/s the physical underlay network
- **Usage Trends**: Top Apps - based on traffic volume and Top Sites - based on capacity utilization.
- **Network View**: A visual representation of all the sites across a network, available in both Map View and List View.

The dashboard lists the total number sites in the network and also segregates the sites based on their connectivity status. Select the numbered links to view the sites based on the following status categories:

- **Critical** – Sites that have all the associated virtual paths down.
- **Warning** - Sites that have at least one virtual path down.
- **Normal** - All virtual paths and associated member paths of the site are up.
- **Inactive** - Sites that are in the undeployed and inactive state.
- **Unknown** - Status of the site is unknown.

Clicking the status filters the sites based on their status and displays the details. You can also use the **Search** bar to view the details of a site based on the site name, role, overlay connectivity, model, bandwidth tier, and the serial number parameters.

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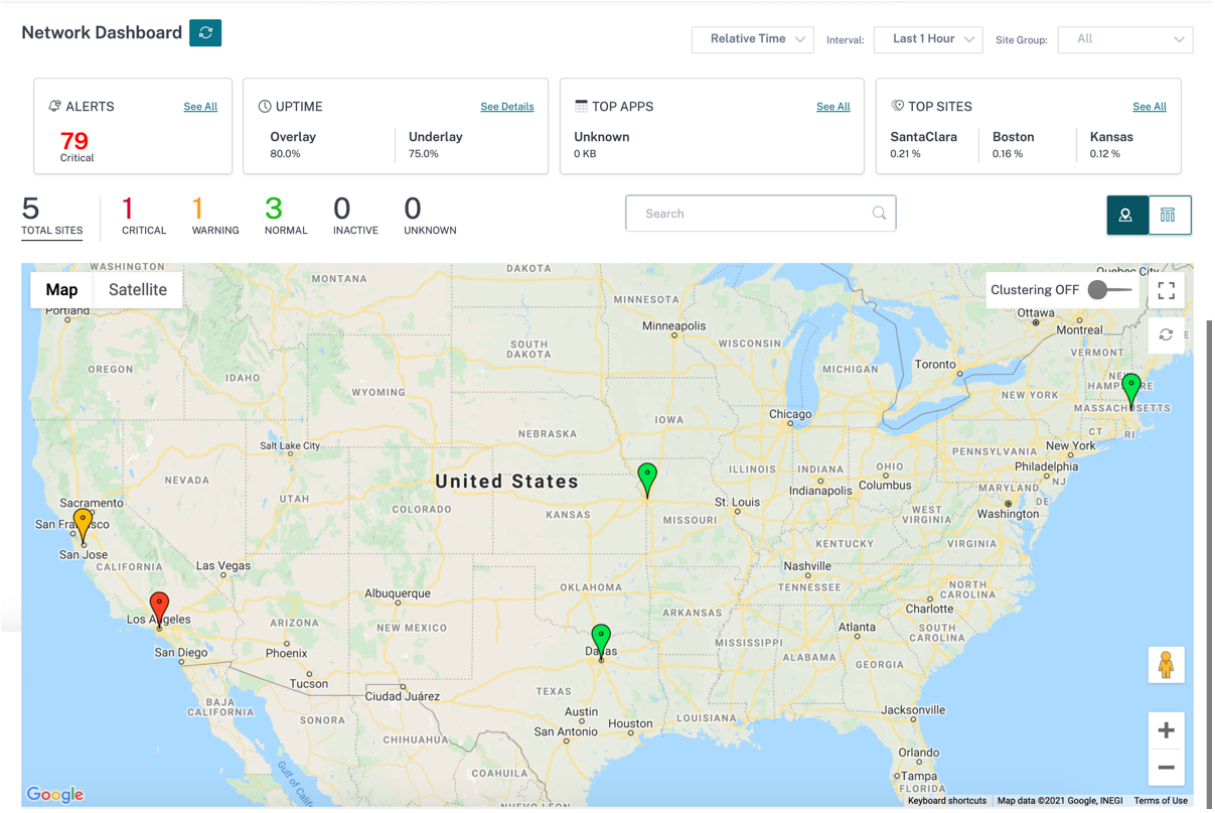

The map provides a real-time view of the global network with all the organization's sites depicted on a world map, based on their locations. The color of each site reflects its current health.

Following are the color-coding criteria used for each site:

- **Critical (Red)**: At least one overlay virtual path associated with a site is DOWN.
- **Warning (Orange)**: At least one underlay member path is DOWN, but all the overlay virtual paths are UP.
- **Normal (Green)**: All overlay virtual paths and the associated underlay member paths are UP.
- **Inactive (Grey)**: Site is under-configuration and has not been deployed yet.

On hovering over any site, some of the key site-specific details such as the site role, device model, bandwidth tier is displayed. The virtual paths associated with a site show up with suitable color codes that reflect their health. The **List View** provides the same details for each site, summarized as entries in a table.

Clustering

The **Clustering ON** feature monitors the consistency, status, and health of various sites of a cluster or a combination of clusters. The Clustering ON service provides a real-time view of sites that help to monitor the failover and the current state of the site.

This **Clustering ON** feature is introduced to manage the high density of sites. It is not recommended

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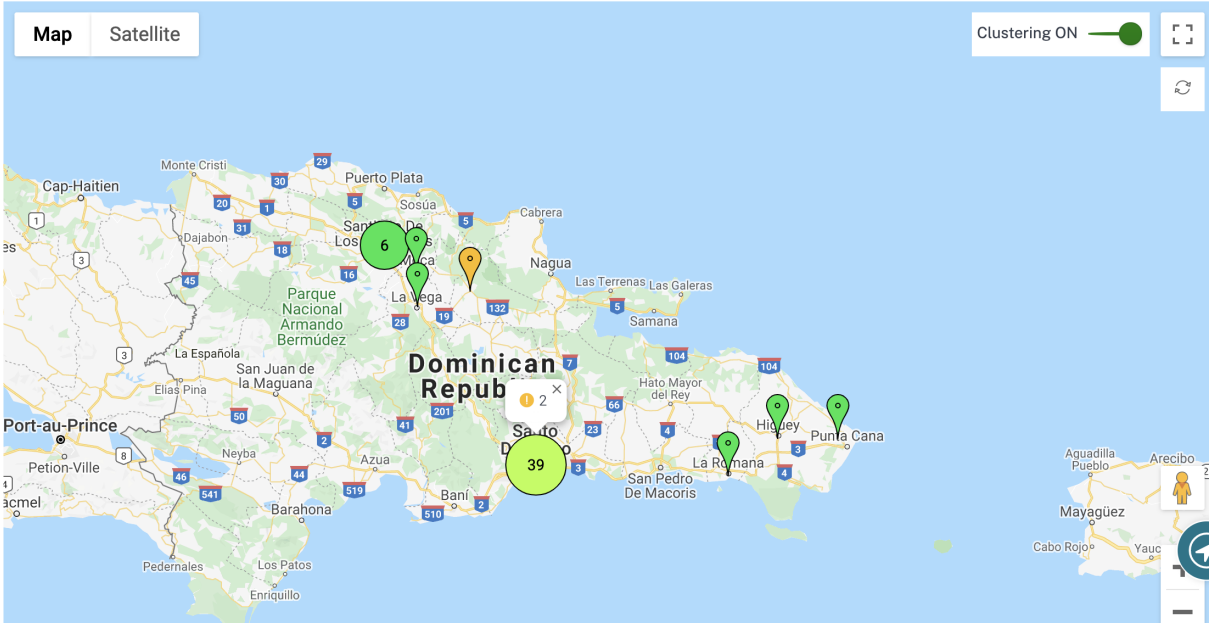
to use the clustering off option when there are thousands of sites and it also brings down the performance.



The following table describes the five colors shade that is used for clusters to represent the health of sites:

Color Legends	Description
	All sites in the cluster are green. That means each site has all the virtual paths, and the associated member paths UP
	All sites in the cluster are orange. That means each site has at least one member path DOWN, but all virtual paths UP
	All sites in the cluster are red. That means each site has at least one virtual path DOWN
	The cluster has a combination of green and orange sites
	The cluster has a combination of red and non-red sites

You can also verify the network aspect by hovering your mouse on any cluster. The critical or warning alerts are visible on top of the cluster as a pop-up.

If you click the cluster, it zooms into that cluster and shows other clusters. You can see a view bar with

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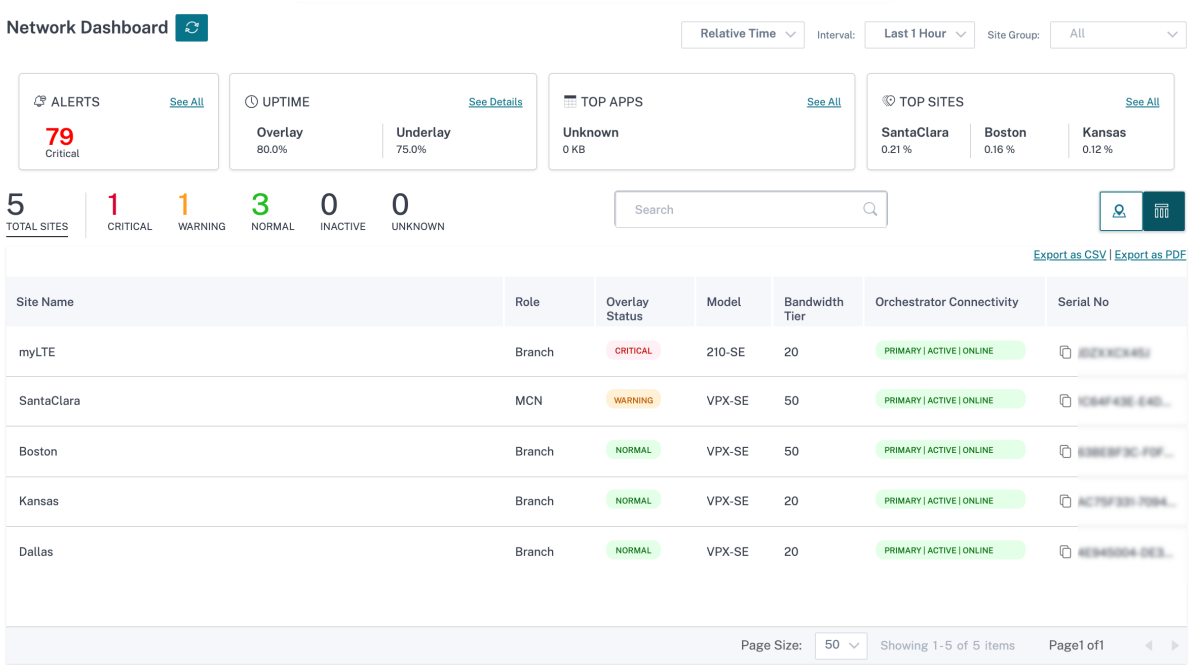
the number of clusters. The arrow option helps to bring you back one step. Click the **Close (X)** button to resume to the original page.

Alternatively, you can view the network summary in **List View**.



- Clicking any inactive “under-configuration” site that is yet to be deployed, would take you to the site configuration workflow.
- Clicking any active site, which has already been deployed, would take you to the **Site Dashboard**.

> **Note**
>
> Citrix SD-WAN overlay tunnels are called Virtual Paths. You would typically have one virtual path tunnel between each site and the Master Control Node (MCN), and extra site-site virtual paths as needed. Virtual paths are formed by bonding together the underlay WAN links / paths. So, each virtual path comprises multiple member paths.
>
> This can be shown when a user hovers over the term virtual path or member path.

You can drag the **Pegman** onto the map to open the street view.

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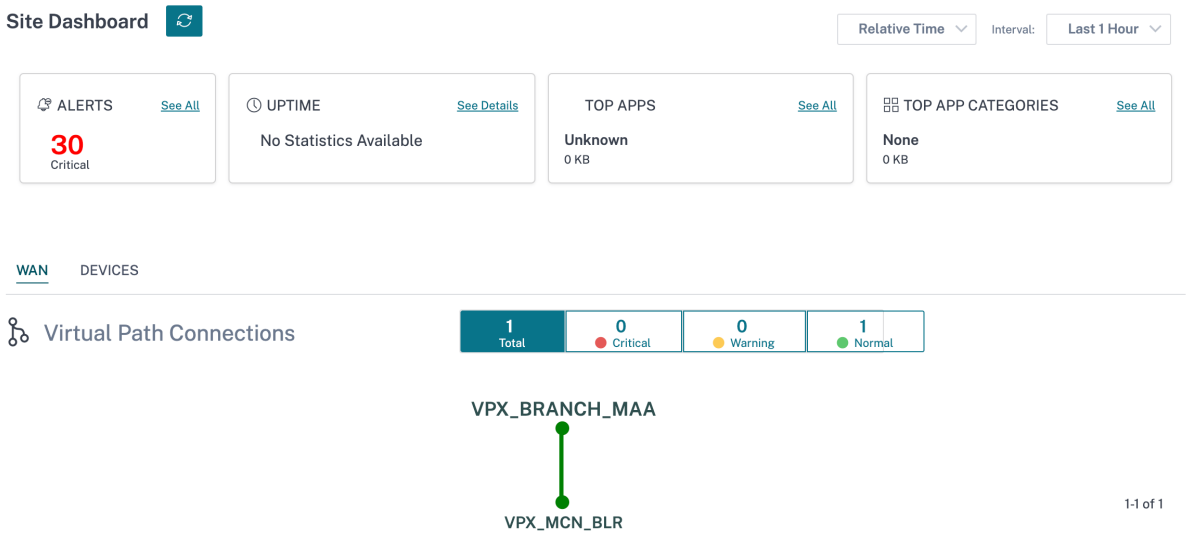
Site dashboard

October 21, 2020

The Site Dashboard provides an overview of a site's health and usage trends.

The dashboard summarizes the following aspects of a site, with a provision to drill down for more details.

- **Critical Alerts**: Running count of the critical health alerts, if any, popping up on the site.
- **Uptime**: Side-by-side comparison of the average uptime offered by the SD-WAN virtual overlay paths v/s the physical underlay paths, associated with a site
- **Usage Trends**: Top Apps and App Categories associated with a site, based on traffic volume
- **Site Details**: WAN Connections, and Devices associated with a site



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> **Tip**
>
> Click **See All** or **See Details** to view statistics that are more detailed.

All the overlay virtual path connections associated with a site are displayed with suitable color-coding to reflect the health of each connection.

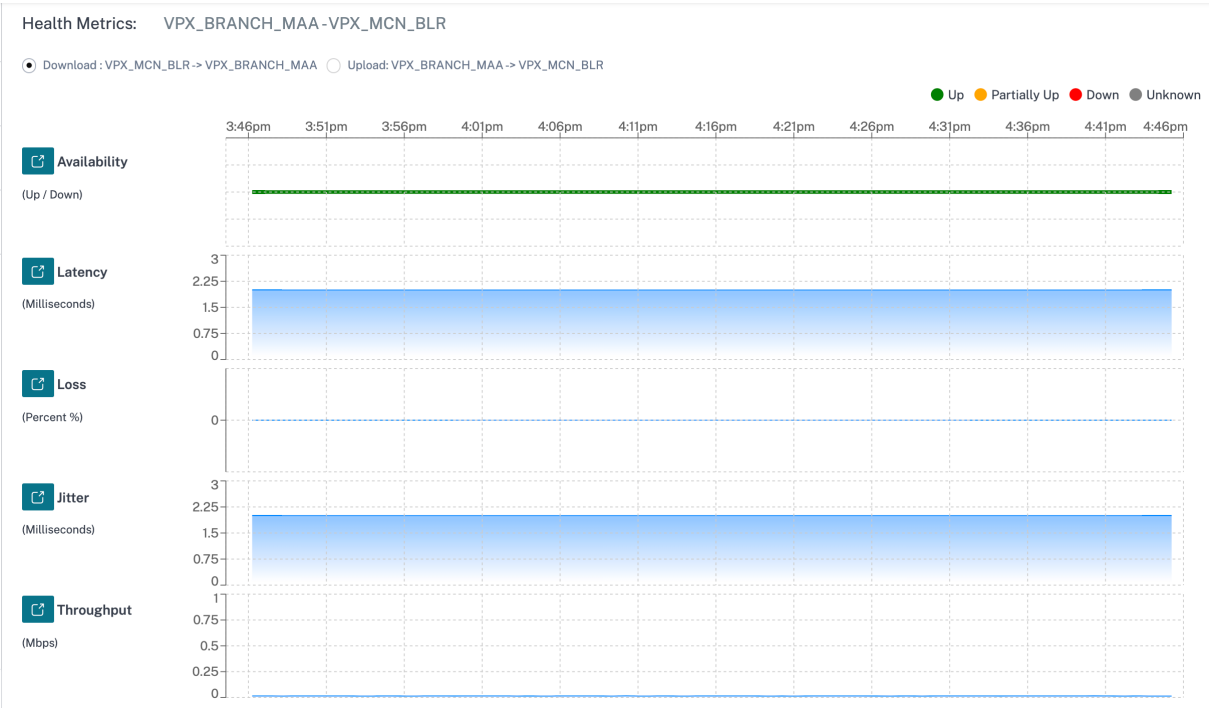
You can select any virtual path connection, to review the corresponding health metrics and trends.

The color-coding criteria used for virtual path connections are:

- **Critical (Red)**: Virtual path is DOWN.
- **Warning (Orange)**: Virtual path is UP, but at least one member path is DOWN.
- **Normal (Green)**: Virtual path and all member paths are UP.

Health metrics

Health metrics and graphical trends around availability, latency, loss, jitter, and throughput are displayed for the selected virtual path connection. These statistics are available in both the directions: **WAN to LAN** and **LAN to WAN**. All the metrics can be reviewed against a common timeline, to help quickly narrow down the problem domain while troubleshooting.



You can further drill down into each health metric to get a comparative view of the overlay virtual path and the underlay member paths for the same metric. This would aid in troubleshooting overlay versus underlay issues.

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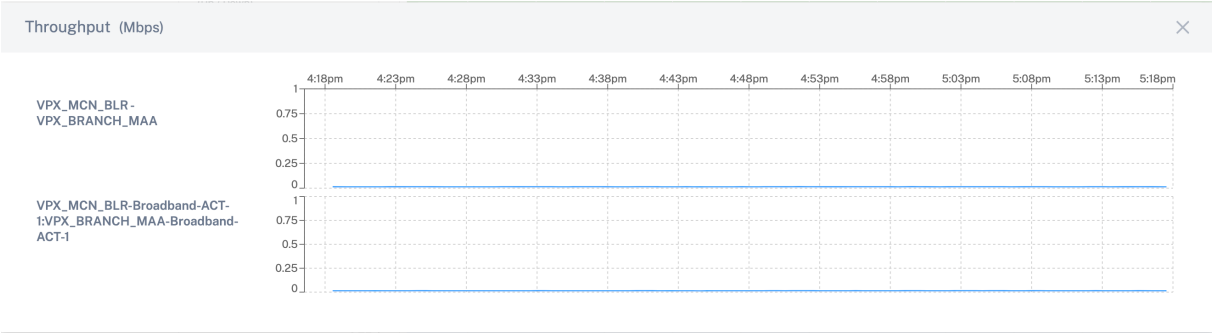
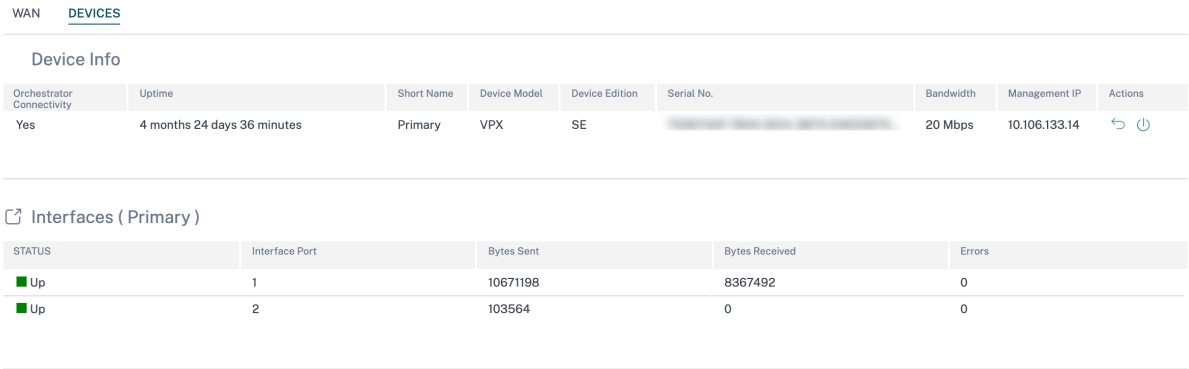


Devices

The **Devices** section displays details associated with the site's devices and interfaces. You can also reboot the appliance, reset the appliance configuration or download device logs.



March 8, 2021

Network Troubleshooting

Customers can view logs of all the network appliances from a single pane of glass, enabling quick troubleshooting. You can view audit and device logs.

Audit logs

Audit logs capture the action, time, and result of the action performed by users in the customer network.

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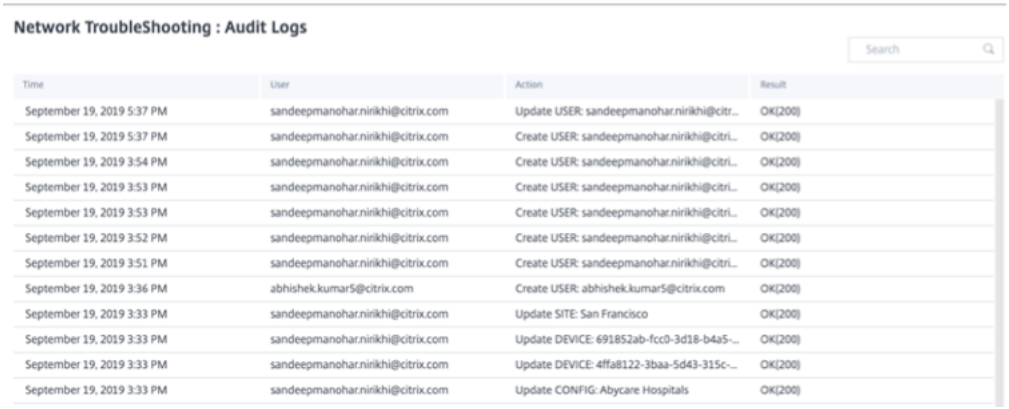
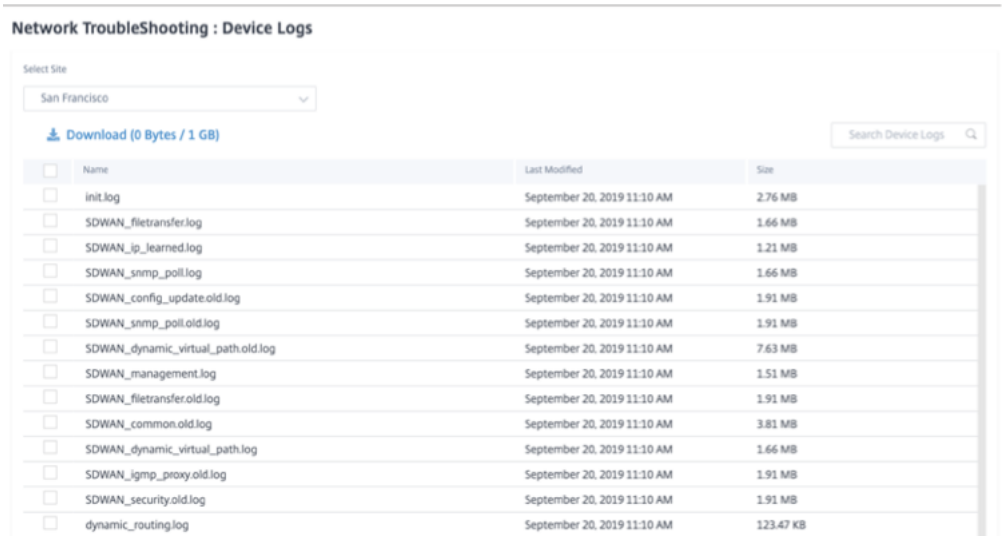


Device logs

Customers can view the device logs that are specific to sites.

You can select specific device logs, download it, and share it with site admins if necessary.



Site troubleshooting

October 21, 2020

Device logs

Logs are useful to troubleshoot issues. The site administrator can view a list of all the logs that are captured across all the devices at the site. You can also download logs for further verification.

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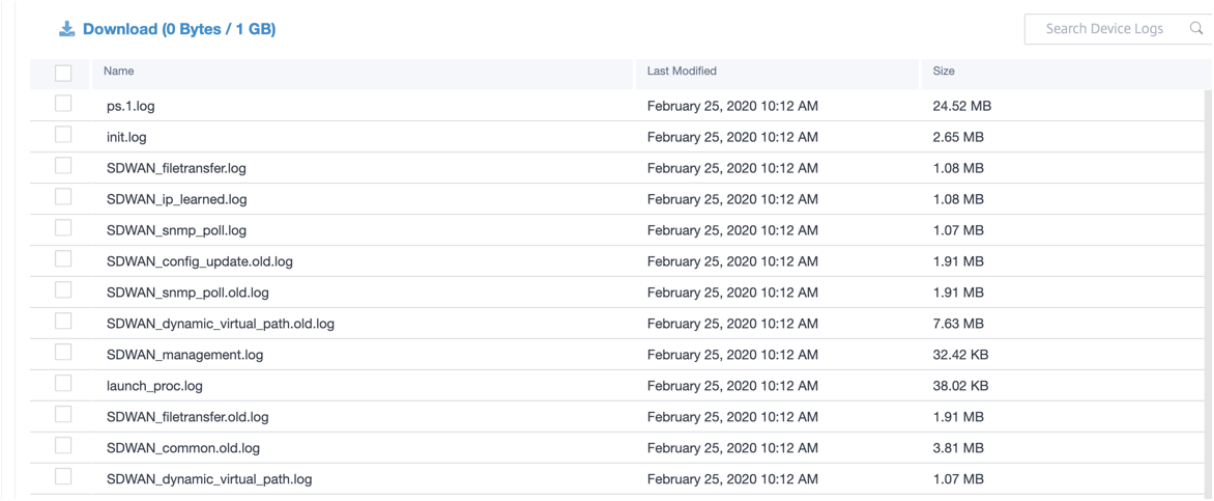
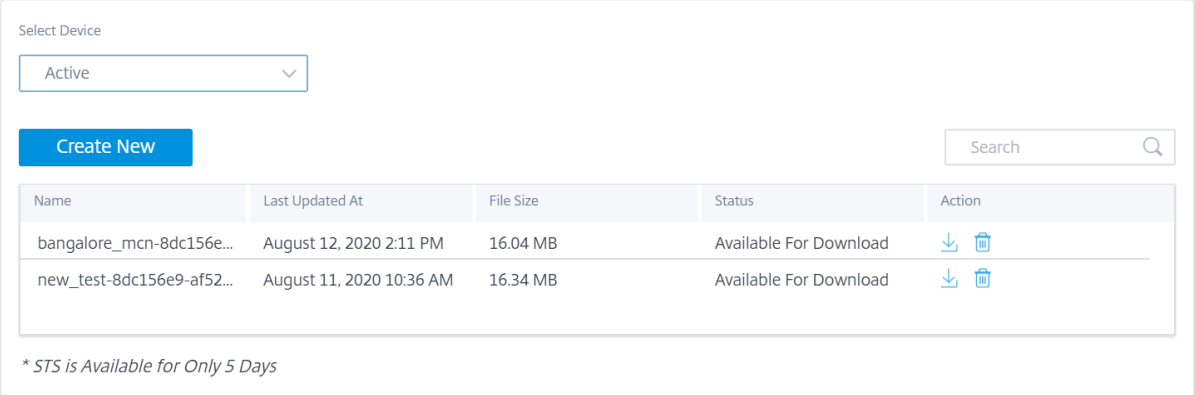


Show Tech Support Bundle

The Show Tech Support (STS) Bundle contains important real-time system information such as access logs, diagnostics logs, firewall logs. The STS bundle is used to troubleshoot issues in the SD-WAN appliances. You can create, download the STS bundle, and share it with Citrix Support Representatives.

If a site is configured in HA deployment mode, you can select the **Active or Standby appliance** for which to create or download the STS bundle.

To create a new STS bundle for a site appliance, at the site level, navigate to **Troubleshooting** > **STS bundle** and click **Create New**.



Provide a name for the STS bundle. The name must begin with a letter and can contain letters, numbers, dashes, and under-scores. The maximum length of the name is 32 characters. The user provided name is used as a prefix in the final name. The service generates a full name to ensure unique names (timestamp) and to help recognize the device from the STS package (serial number). If no name is provided a name is auto-generated while creating the bundle.

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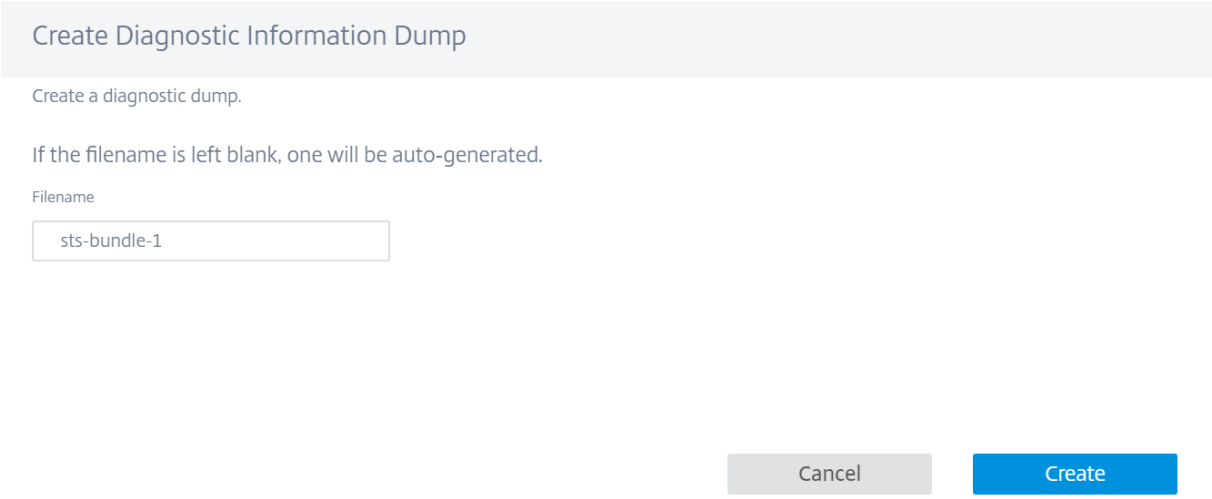

At any given time, the STS process is in one of the following states:

STS Status	Description
Requested	A new STS bundle is requested. This takes a few minutes. You can choose to cancel the STS creation process, if necessary.
Uploading	The created STS package is uploaded to the cloud service. The duration depends on the size of the package. The status is updated every 5 seconds. You cannot cancel the STS upload process.
Failure	The STS process has failed during creation or upload. You can delete the entries of failed STS operations.
Available for download	The STS creation and upload process are successful. You can now download or delete the STS packages.

The STS bundles and failure records are maintained for 7 days, post which it is auto-deleted.

Provider reports

April 23, 2021

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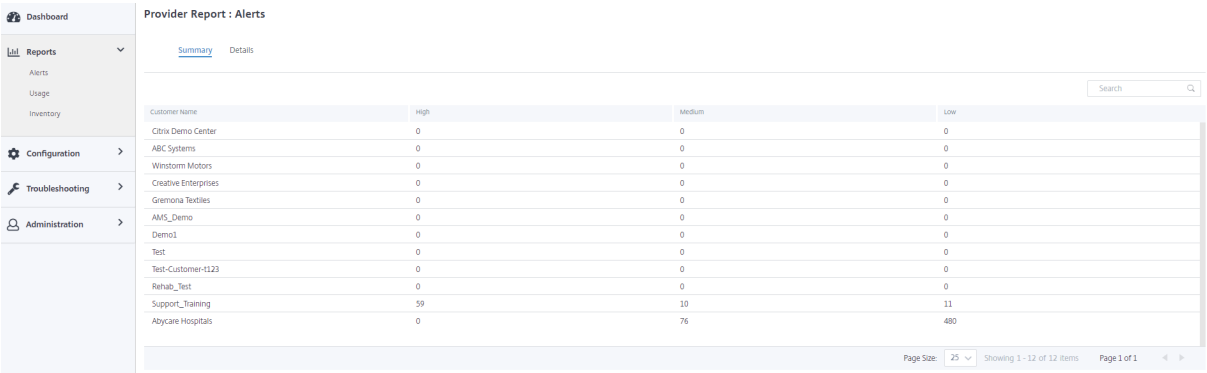
The **Provider Reports** provide visibility into alerts, usage trends, and inventory aggregated across all the customers managed by a Provider.

In the Citrix SD-WAN Orchestrator for On-premises provider level UI, navigate to **Reports**.

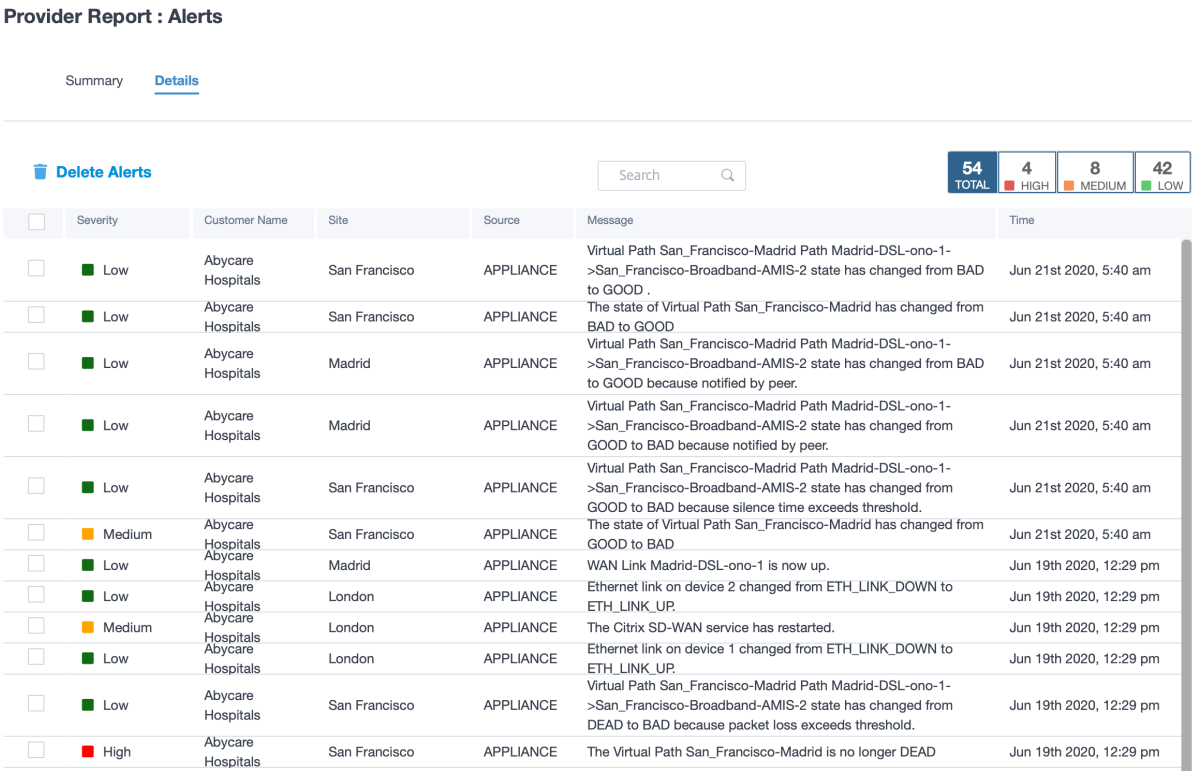
Alerts

The provider can review all the events and alerts generated across all the customer networks.

The **Summary** view displays the number of high, medium, and low alerts for each customer.



You can also view the severity, site at which the alert originated, alert message, time, and other information under **Details**.



Severity	Customer Name	Site	Source	Message	Time
Low	Abycare Hospitals	San Francisco	APPLIANCE	Virtual Path San_Francisco-Madrid Path Madrid-DSL-ono-1->San_Francisco-Broadband-AMIS-2 state has changed from BAD to GOOD .	Jun 21st 2020, 5:40 am
Low	Abycare Hospitals	San Francisco	APPLIANCE	The state of Virtual Path San_Francisco-Madrid has changed from BAD to GOOD	Jun 21st 2020, 5:40 am
Low	Abycare Hospitals	Madrid	APPLIANCE	Virtual Path San_Francisco-Madrid Path Madrid-DSL-ono-1->San_Francisco-Broadband-AMIS-2 state has changed from BAD to GOOD because notified by peer.	Jun 21st 2020, 5:40 am
Low	Abycare Hospitals	Madrid	APPLIANCE	Virtual Path San_Francisco-Madrid Path Madrid-DSL-ono-1->San_Francisco-Broadband-AMIS-2 state has changed from GOOD to BAD because notified by peer.	Jun 21st 2020, 5:40 am
Low	Abycare Hospitals	San Francisco	APPLIANCE	Virtual Path San_Francisco-Madrid Path Madrid-DSL-ono-1->San_Francisco-Broadband-AMIS-2 state has changed from GOOD to BAD because silence time exceeds threshold.	Jun 21st 2020, 5:40 am
Medium	Abycare Hospitals	San Francisco	APPLIANCE	The state of Virtual Path San_Francisco-Madrid has changed from GOOD to BAD	Jun 21st 2020, 5:40 am
Low	Abycare Hospitals	Madrid	APPLIANCE	WAN Link Madrid-DSL-ono-1 is now up.	Jun 19th 2020, 12:29 pm
Low	Abycare Hospitals	London	APPLIANCE	Ethernet link on device 2 changed from ETH_LINK_DOWN to ETH_LINK_UP.	Jun 19th 2020, 12:29 pm
Medium	Abycare Hospitals	London	APPLIANCE	The Citrix SD-WAN service has restarted.	Jun 19th 2020, 12:29 pm
Low	Abycare Hospitals	London	APPLIANCE	Ethernet link on device 1 changed from ETH_LINK_DOWN to ETH_LINK_UP.	Jun 19th 2020, 12:29 pm
Low	Abycare Hospitals	San Francisco	APPLIANCE	Virtual Path San_Francisco-Madrid Path Madrid-DSL-ono-1->San_Francisco-Broadband-AMIS-2 state has changed from DEAD to BAD because packet loss exceeds threshold.	Jun 19th 2020, 12:29 pm
High	Abycare Hospitals	San Francisco	APPLIANCE	The Virtual Path San_Francisco-Madrid is no longer DEAD	Jun 19th 2020, 12:29 pm

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Suitable filtering options can be used as needed for example: Look for the high severity alerts across all the customers, or the alerts for a given customer and so on.

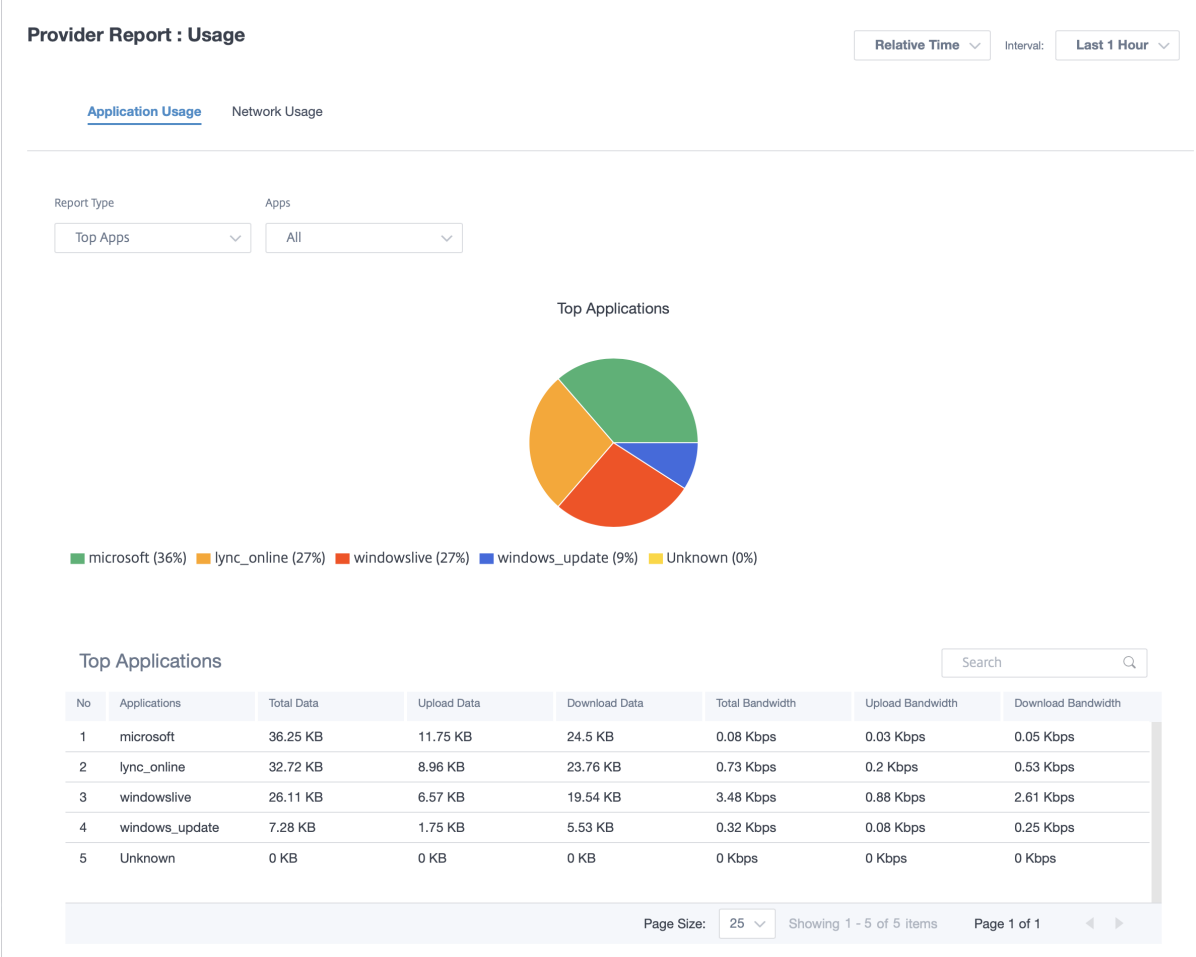
You can also select and delete alerts.

Usage

The provider can review cross-customer usage trends such as **Top Applications**, **Top Application Categories**, **Application Bandwidth**, and **Top Sites**.

Top application and application categories

The **Top Applications** and **Top Application Categories** chart shows the applications and application families that are widely used across all customer networks. This allows you to analyze the data consumption pattern and reassign the bandwidth limit for each class of data, if necessary.



No	Applications	Total Data	Upload Data	Download Data	Total Bandwidth	Upload Bandwidth	Download Bandwidth
1	microsoft	36.25 KB	11.75 KB	24.5 KB	0.08 Kbps	0.03 Kbps	0.05 Kbps
2	lync_online	32.72 KB	8.96 KB	23.76 KB	0.73 Kbps	0.2 Kbps	0.53 Kbps
3	windowslive	26.11 KB	6.57 KB	19.54 KB	3.48 Kbps	0.88 Kbps	2.61 Kbps
4	windows_update	7.28 KB	1.75 KB	5.53 KB	0.32 Kbps	0.08 Kbps	0.25 Kbps
5	Unknown	0 KB	0 KB	0 KB	0 Kbps	0 Kbps	0 Kbps

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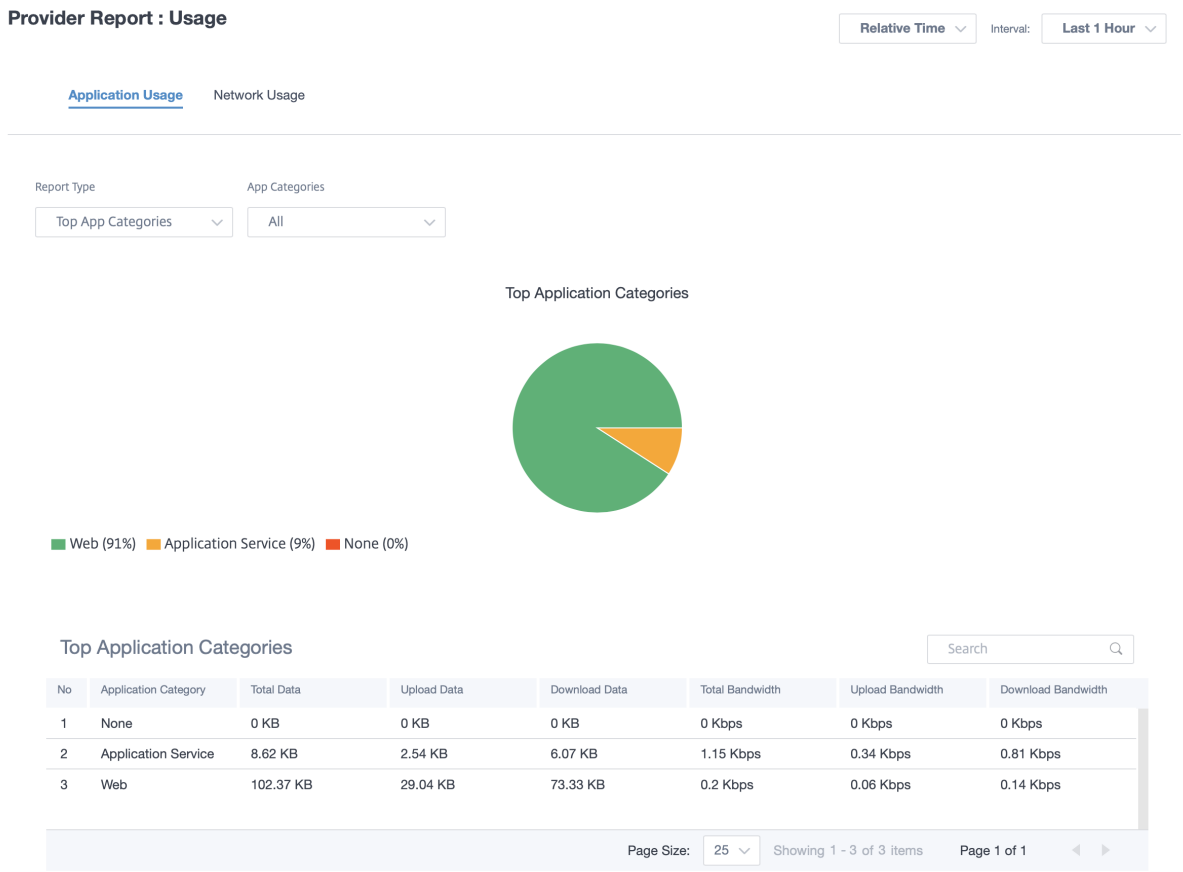
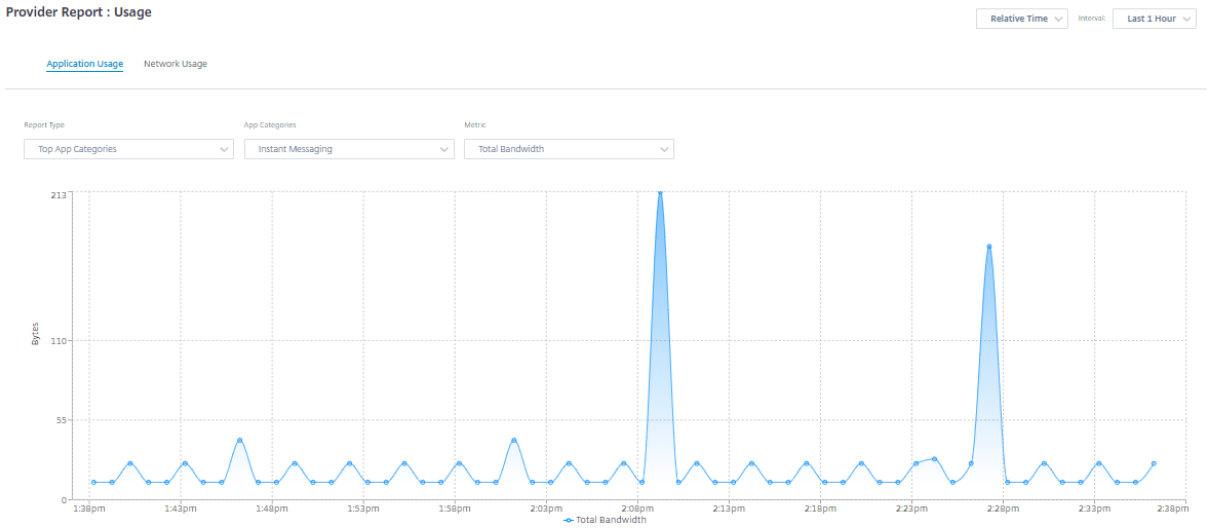


You can view the bandwidth usage statistics. The bandwidth statistics are collected for the selected time interval. You can filter the statistics report based on the **Report Type, Apps or Apps Categories,** and **Metrics**.



- **Report Type:** Select **Top App or App Categories** from the list.
- **Apps/App Categories:** Select top application or categories from the list.

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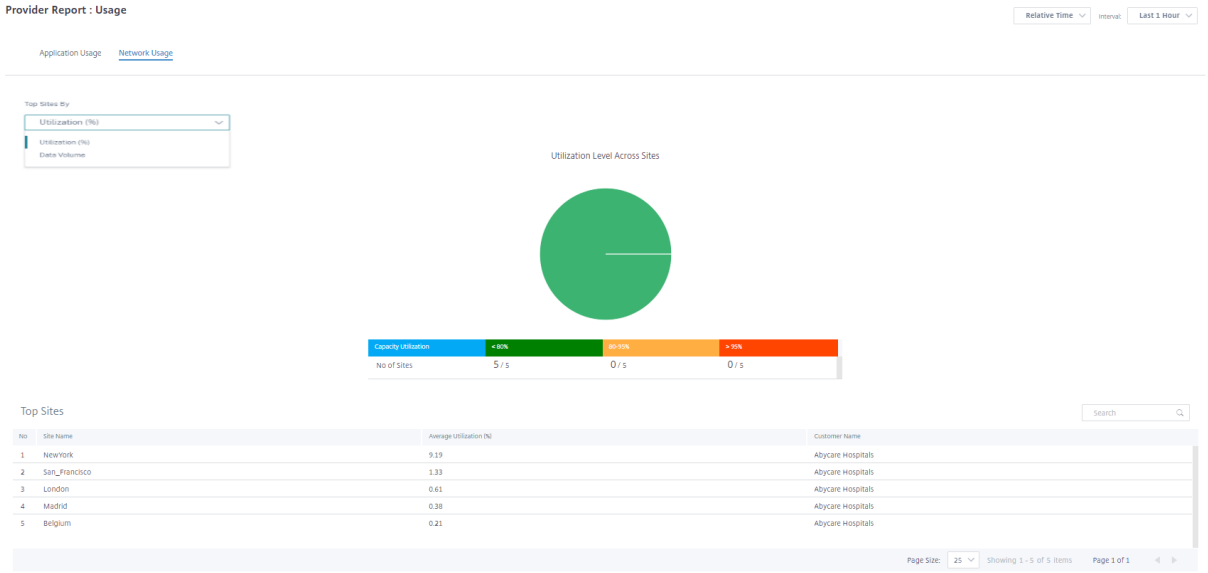
- **Metric:** Select the bandwidth metric (such as Total Data, Incoming Data, Total Bandwidth) from the list.

Network usage

The network usage chart depicts the top 10 sites across all the customers that have the highest bandwidth usage. You can view the Sites by Utilization (%) or Data Volume (MB).



Inventory

The provider can view the entire device inventory across all the customers. You can choose to view an inventory summary or a detailed view.

The inventory summary view provides a chart of the inventory spread, depicting the various appliance models and the number of each type of appliances used across customer networks.

Suitable filtering options can be used as needed for example: Look for all appliances belonging to a specific customer, or all appliances with a certain device model and so on

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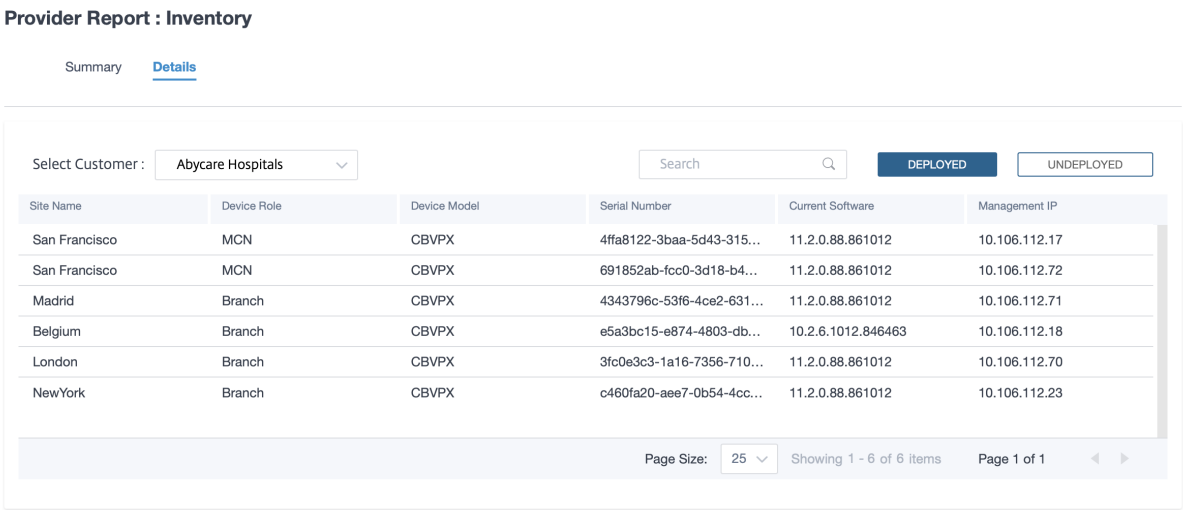
The inventory detailed view provides a list of all the appliances that are deployed and those appliances that are configured but not deployed yet. Choose a customer from the **Select Customer** drop-down list. You can view the site name, device role, device model, device serial number, current software, and device management IP address.



May 17, 2021

Customer/Network reports

The **Customer Reports** provide visibility into network-wide alerts, usage trends, inventory, quality, diagnostics, and firewall status aggregated across all the sites in a customer network.

Alerts

The customer can review a detailed report of all the events and alerts generated across all the sites in this network.

It includes the severity, site at which the alert originated, alert message, time, and other details.

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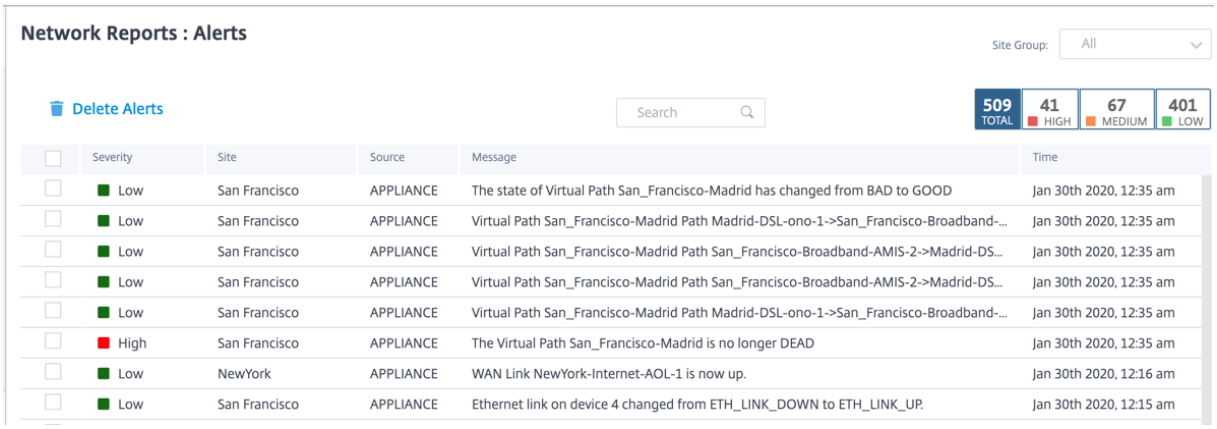

Suitable filtering options can be used as needed for example: Look for all the high severity alerts across all the sites, or all the alerts for a particular site and so on.

You can also select and clear alerts.

Usage

Customers can review usage trends such as **Top Applications**, **Top Application Categories**, **App Bandwidth**, and **Top Sites** across all the sites in their network.

Top application and application categories

The **Top Applications** and **Top Application Categories** chart shows the top applications and top application families that are widely used across all the sites. This allows you to analyze the data consumption pattern and reassign the bandwidth limit for each class of data within the network.

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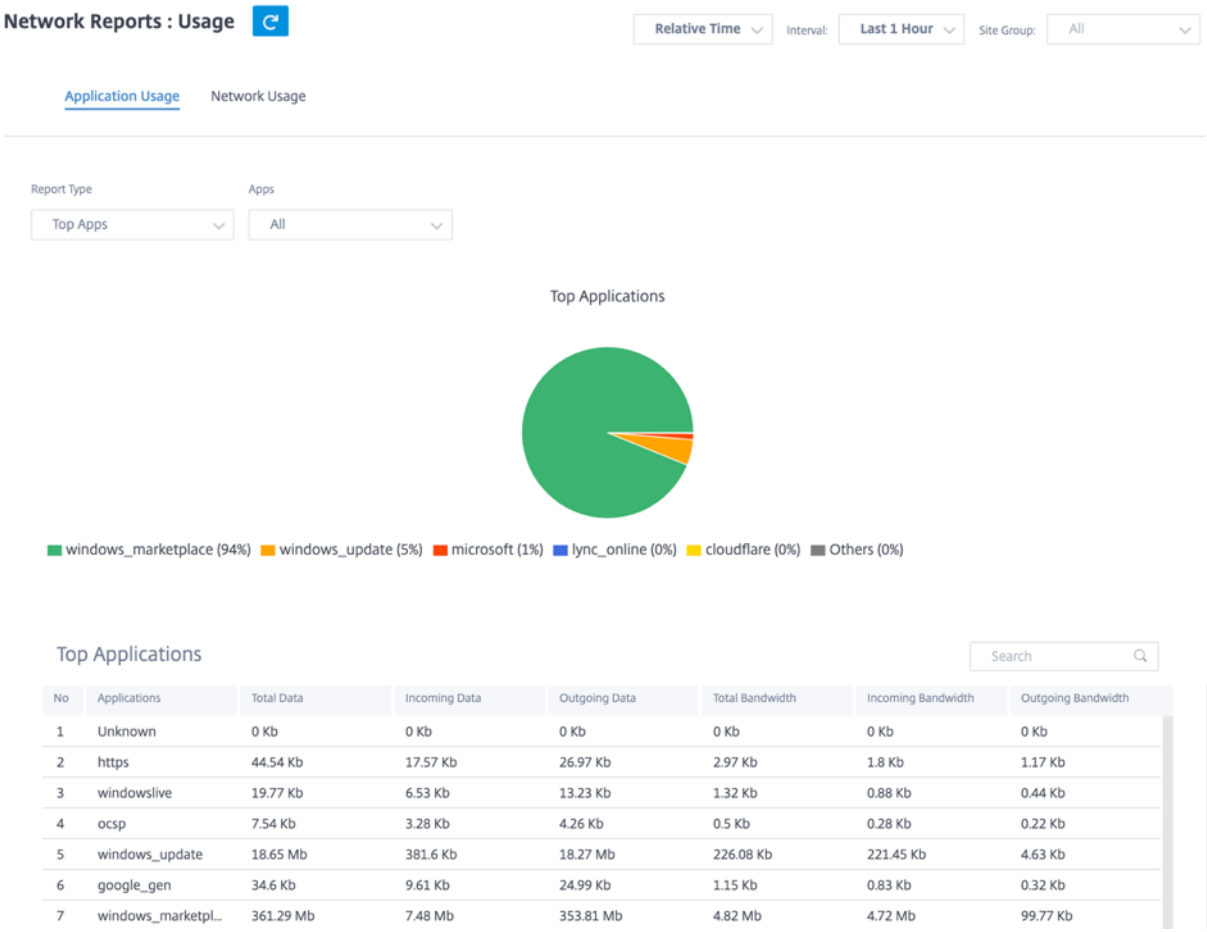

No	Applications	Total Data	Incoming Data	Outgoing Data	Total Bandwidth	Incoming Bandwidth	Outgoing Bandwidth
1	Unknown	0 Kb	0 Kb	0 Kb	0 Kb	0 Kb	0 Kb
2	https	44.54 Kb	17.57 Kb	26.97 Kb	2.97 Kb	1.8 Kb	1.17 Kb
3	windowslive	19.77 Kb	6.53 Kb	13.23 Kb	1.32 Kb	0.88 Kb	0.44 Kb
4	ocsp	7.54 Kb	3.28 Kb	4.26 Kb	0.5 Kb	0.28 Kb	0.22 Kb
5	windows_update	18.65 Mb	381.6 Kb	18.27 Mb	226.08 Kb	221.45 Kb	4.63 Kb
6	google_gen	34.6 Kb	9.61 Kb	24.99 Kb	1.15 Kb	0.83 Kb	0.32 Kb
7	windows_marketpl...	361.29 Mb	7.48 Mb	353.81 Mb	4.82 Mb	4.72 Mb	99.77 Kb

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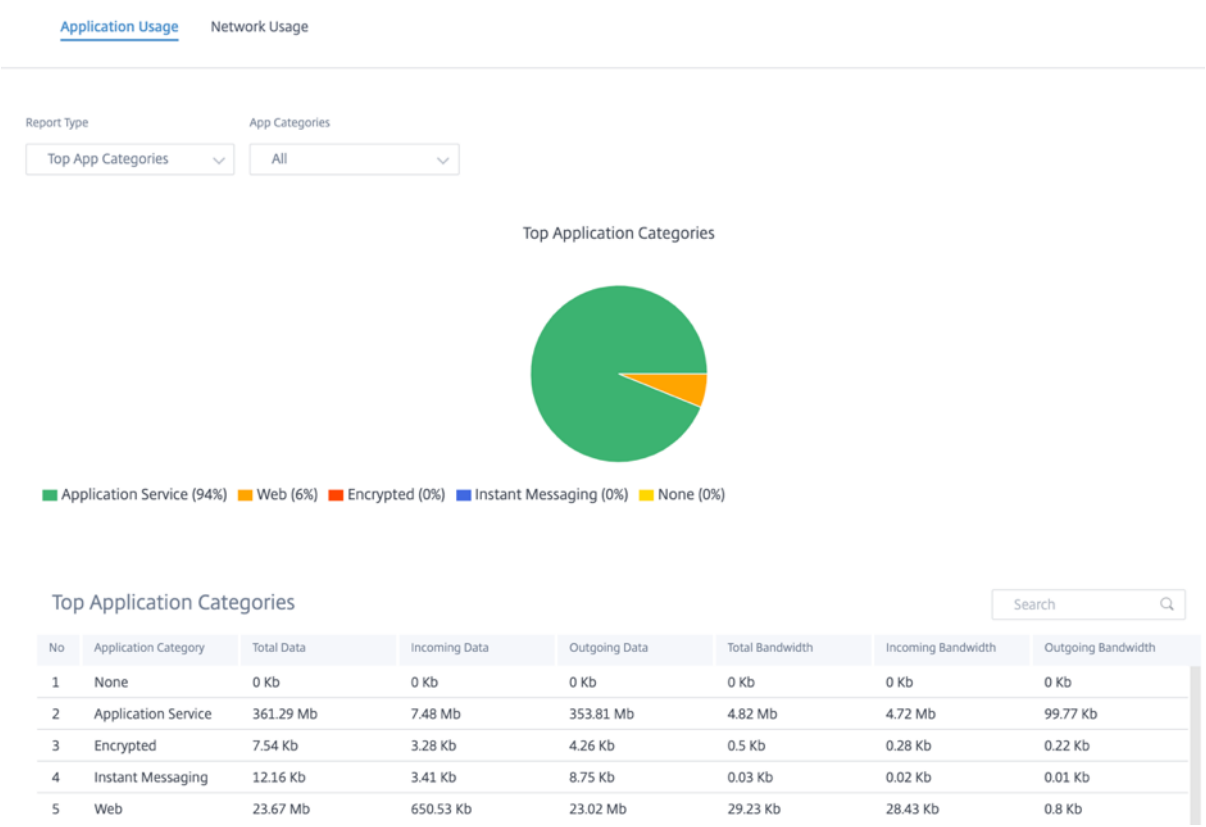

No	Application Category	Total Data	Incoming Data	Outgoing Data	Total Bandwidth	Incoming Bandwidth	Outgoing Bandwidth
1	None	0 Kb	0 Kb	0 Kb	0 Kb	0 Kb	0 Kb
2	Application Service	361.29 Mb	7.48 Mb	353.81 Mb	4.82 Mb	4.72 Mb	99.77 Kb
3	Encrypted	7.54 Kb	3.28 Kb	4.26 Kb	0.5 Kb	0.28 Kb	0.22 Kb
4	Instant Messaging	12.16 Kb	3.41 Kb	8.75 Kb	0.03 Kb	0.02 Kb	0.01 Kb
5	Web	23.67 Mb	650.53 Kb	23.02 Mb	29.23 Kb	28.43 Kb	0.8 Kb

Application bandwidth

You can view the bandwidth usage statistics for the selected site group or for all sites. The bandwidth statistics are collected for the selected time interval. You can filter the statistics report based on the **Report Type, Apps or Apps Categories,** and **Metrics**.

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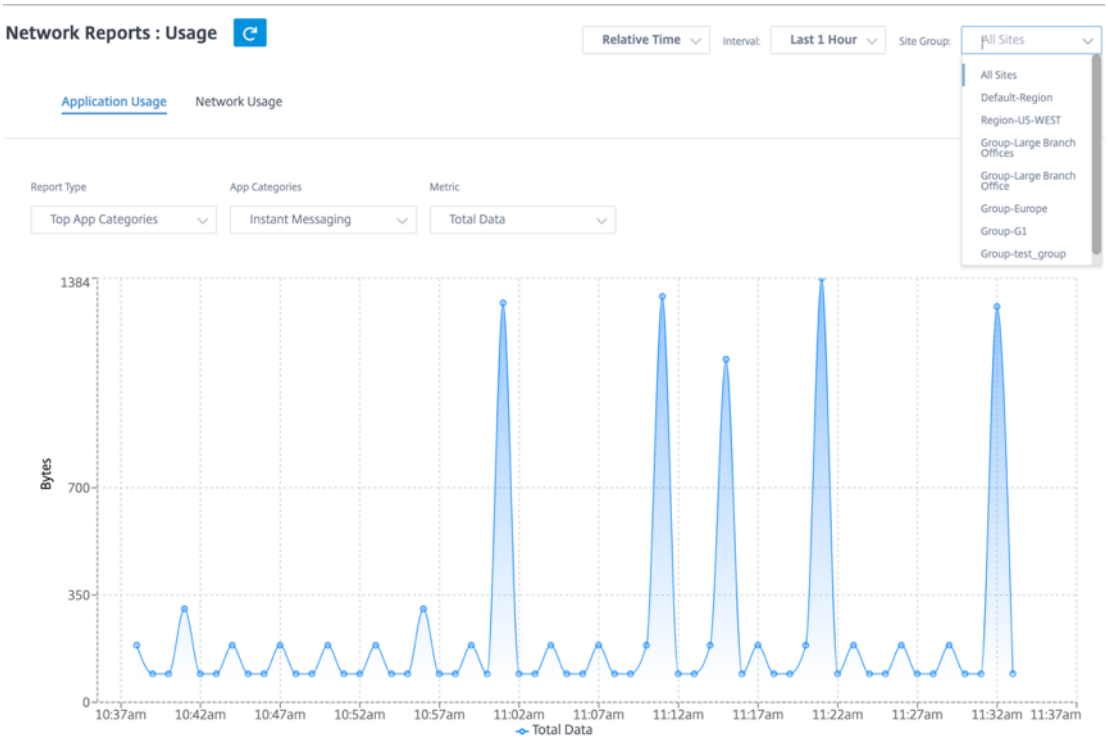

- **Report Type:** Select **Top App or App Categories** from the list.
- **Apps/App Categories:** Select top application or categories (such as network service) from the list.
- **Metric:** Select the bandwidth metric (such as Total Data, Incoming Data, Total Bandwidth) from the list.

Network usage

The **Top Sites** chart depicts the top sites in the customer network that have the highest bandwidth usage. You can view the Sites by Utilization (%) or Traffic Volume (MB).

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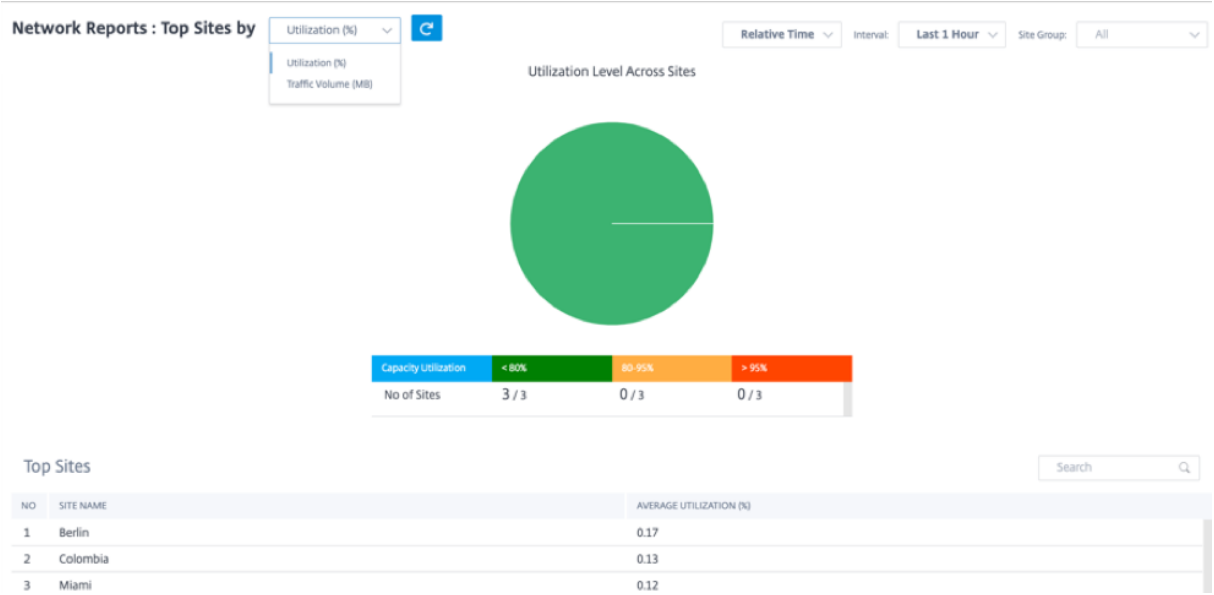
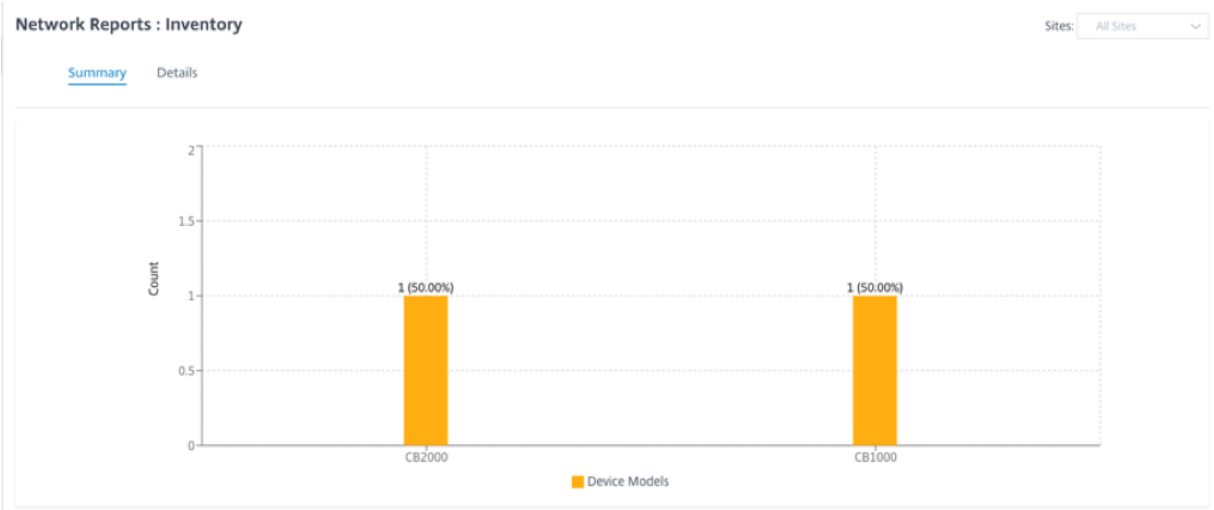


Inventory

The customer can view the entire device inventory across all the sites in the network. You can choose to view an inventory summary or a detailed view.

The inventory summary view provides a chart of the inventory spread, depicting the various appliance models and the number of each type of appliances used across all sites in the customer network.



Suitable filtering options can be used as needed for example: Look for all appliances belonging to a specific site, or all appliances with a certain device model and so on.

The inventory detailed view provides a list of all the appliances that are deployed and those appliances that are configured but not deployed yet. Along with the customer, site name, device role, device serial number, current software, and device management IP address.

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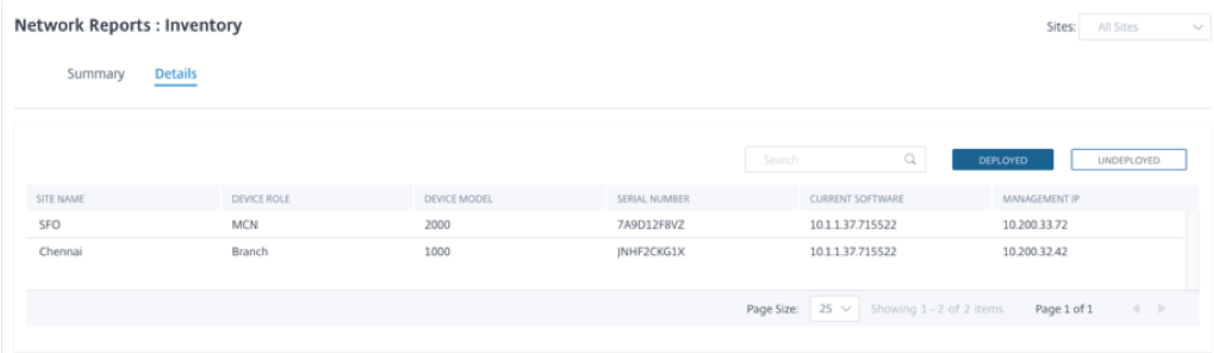

HDX dashboard and reports

For details on HDX dashboard and reports, see HDX dashboard and reports.

Quality

The **Network Quality Report** enables a network-level comparison between the virtual overlay and the physical underlay in terms of uptime, loss, latency, and jitter. This helps effectively monitor how the overlay is faring relative to the underlay network, and also aids troubleshooting.

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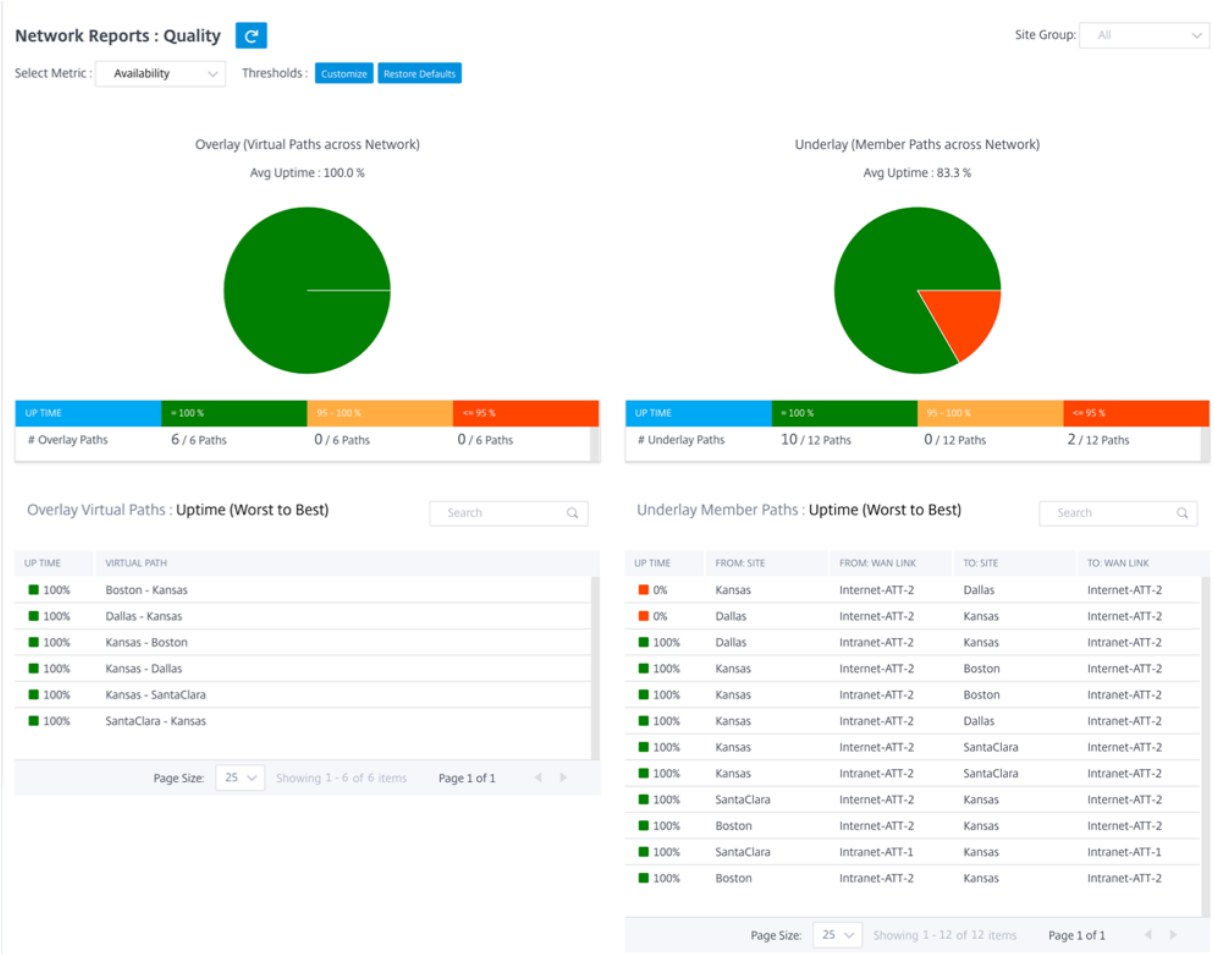

Quality of Service

Quality of Service (QoS) manages data traffic to reduce packet loss, latency, and jitter on the network. For more information, see Quality of Service. The following are two ways to view the Quality-of-Service (QoS) report:

- **Summary View:** Summary view provides an overview of bandwidth consumption across all types of traffic - real-time, interactive, bulk, and control across the network and per site.

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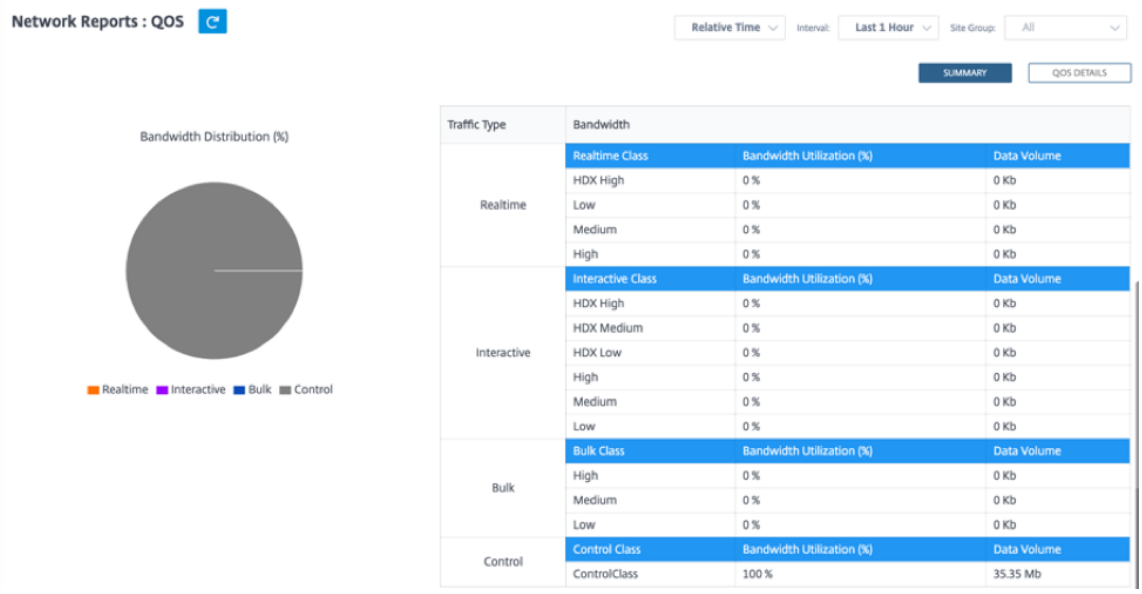
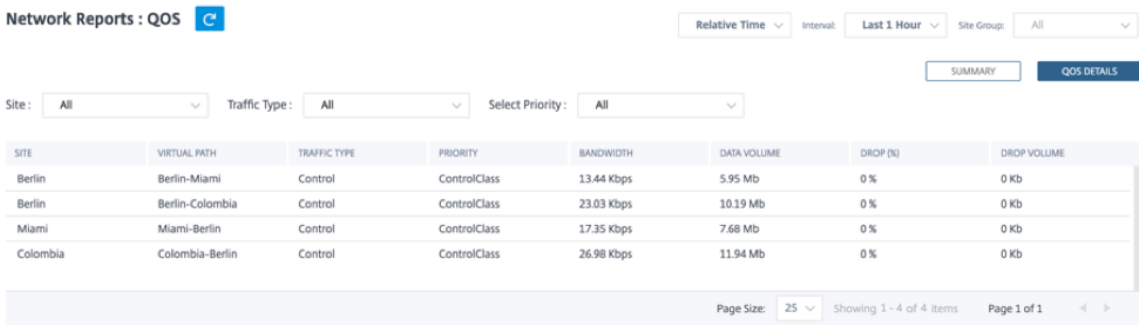


- **Real-time:** Used for low latency, low bandwidth, time-sensitive traffic. Real-time applications are time sensitive but don't really need high bandwidth (for example voice over IP). Real-time applications are sensitive to latency and jitter, but can tolerate some loss.
- **Interactive:** Used for interactive traffic with low to medium latency requirements and low to medium bandwidth requirements. Interactive applications involve human input in the form of mouse clicks or cursor moves. The interaction is typically between a client and a server. The communication might not need high bandwidth but is sensitive to loss and latency. However, server to client does need high bandwidth to transfer graphical information, which might not be sensitive to loss.
- **Bulk:** Used for high bandwidth traffic that can tolerate high latency. Applications that handle file transfer and need high bandwidth are categorized as bulk class. These applications involve little human interference and are mostly handled by the systems themselves.
- **Control:** Used to transfer control packets that contain routing, scheduling, and link statistics information.

• **Detailed View:** The detailed view captures trends around bandwidth consumption, traffic volume, packets dropped and so on for each QoS class associated with an overlay virtual path.



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This report is available at the site level where the user can view QoS statistics based on the virtual path between the two sites. For more information see Site reports.

Historical statistics

For each site, you can view the statistics as graphs for the following network parameters:

- Sites
- Virtual Paths
- Paths
- WAN Links
- Interfaces
- Classes
- GRE Tunnels
- IPsec Tunnels

The statistics are collected as graphs. These graphs are plotted as timeline versus usage, allowing you to understand the usage trends of various network object properties. You can view graphs for network-wide application statistics.

You can view or hide the graphs and customize the columns as needed.

Sites

To view the Site statistics, navigate to **Reports > Historical Statistics > Sites** tab.

Select the site name from the list.

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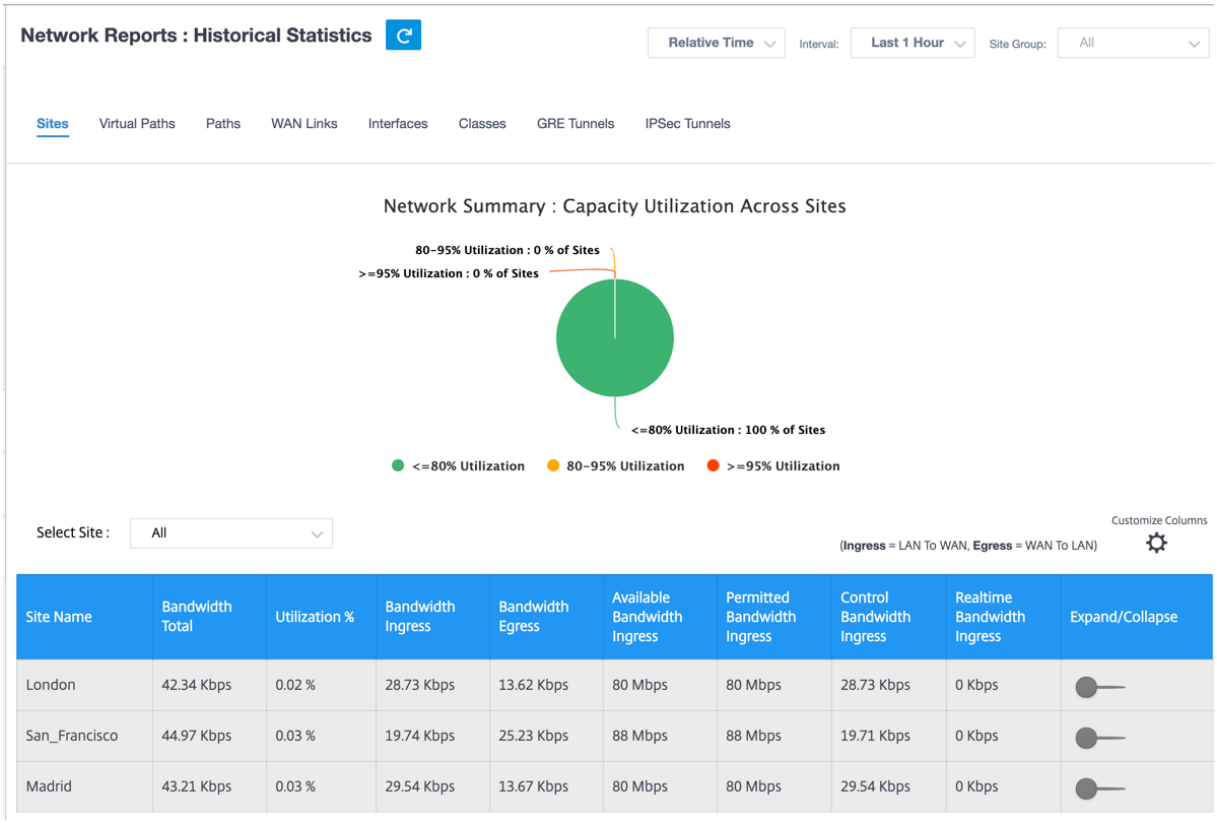

Site Name	Bandwidth Total	Utilization %	Bandwidth Ingress	Bandwidth Egress	Available Bandwidth Ingress	Permitted Bandwidth Ingress	Control Bandwidth Ingress	Realtime Bandwidth Ingress	Expand/Collapse
London	42.34 Kbps	0.02 %	28.73 Kbps	13.62 Kbps	80 Mbps	80 Mbps	28.73 Kbps	0 Kbps	
San_Francisco	44.97 Kbps	0.03 %	19.74 Kbps	25.23 Kbps	88 Mbps	88 Mbps	19.71 Kbps	0 Kbps	
Madrid	43.21 Kbps	0.03 %	29.54 Kbps	13.67 Kbps	80 Mbps	80 Mbps	29.54 Kbps	0 Kbps	

You can view the following metrics:

- **Site Name**: The site name.
- **Bandwidth Total**: Total bandwidth consumed by all packet types. Bandwidth = Control Bandwidth + Real-time Bandwidth + Interactive Bandwidth + Bulk Bandwidth.
- **Utilization**: You can view the site statistics by Utilization (%).
- **Bandwidth Ingress**: The max and the min download speed through the WAN port.
- **Bandwidth Egress**: The max and the min upload speed through the WAN port.
- **Available Bandwidth Ingress**: Total bandwidth allocated to all the WAN links of a site.
- **Permitted Bandwidth Ingress**: Bandwidth available for transmitting information.
- **Control Bandwidth Ingress**: Bandwidth used to transfer control packets that contain routing, scheduling, and link statistics information.
- **Realtime Bandwidth Ingress**: Bandwidth consumed by applications that belong to the real-time class type in the NetScaler SD-WAN configuration. The performance of such applications depends on a great extent upon network latency. A delayed packet is worse than a lost packet (for example, VoIP, Skype for Business).
- **Expand/Collapse**: You can expand or collapse the data as needed.

Virtual paths

To view the **Virtual Paths** statistics, navigate to **Reports > Statistics > Virtual Paths** tab.

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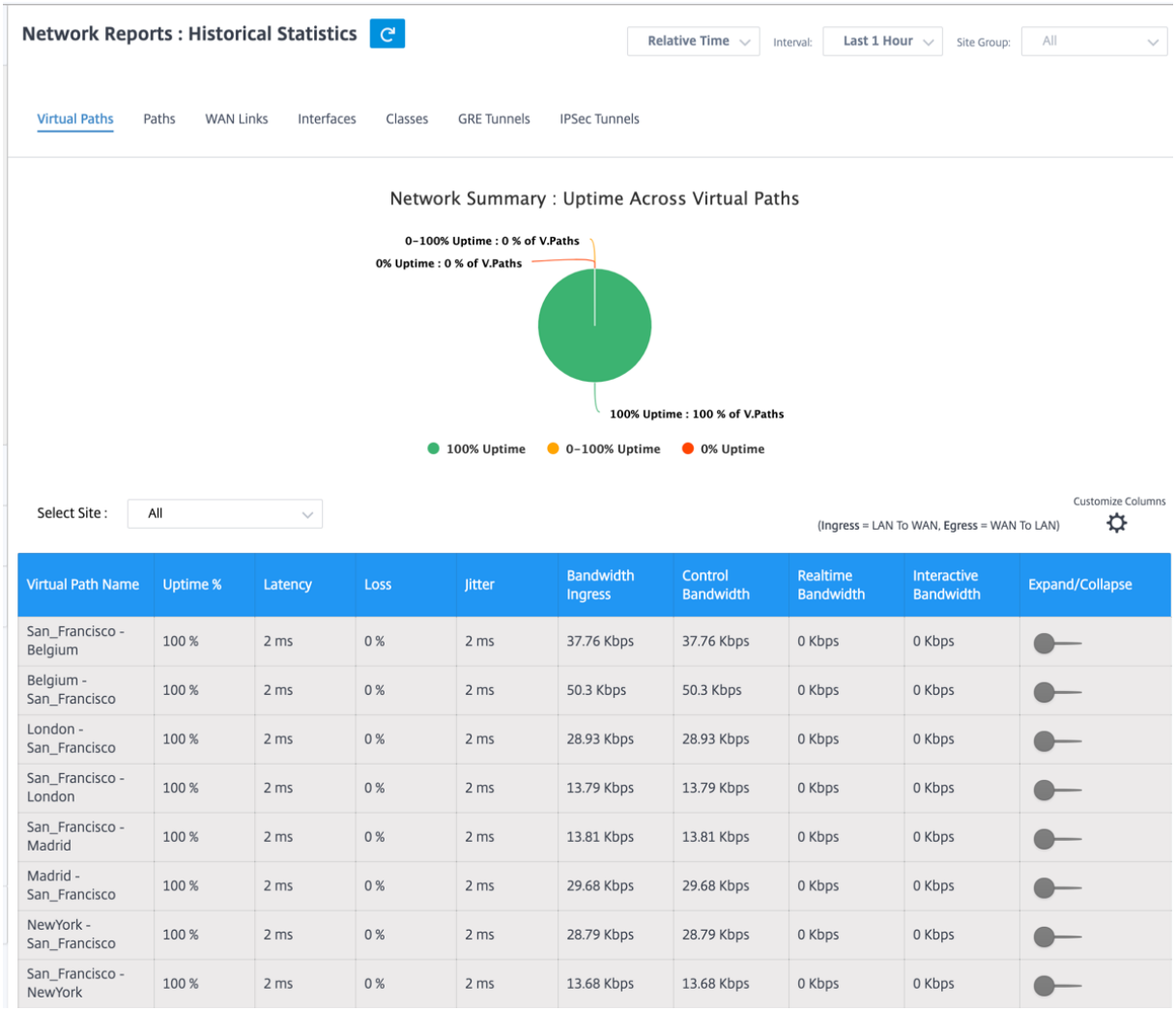

Virtual Path Name	Uptime %	Latency	Loss	Jitter	Bandwidth Ingress	Control Bandwidth	Realtime Bandwidth	Interactive Bandwidth	Expand/Collapse
San_Francisco - Belgium	100 %	2 ms	0 %	2 ms	37.76 Kbps	37.76 Kbps	0 Kbps	0 Kbps	
Belgium - San_Francisco	100 %	2 ms	0 %	2 ms	50.3 Kbps	50.3 Kbps	0 Kbps	0 Kbps	
London - San_Francisco	100 %	2 ms	0 %	2 ms	28.93 Kbps	28.93 Kbps	0 Kbps	0 Kbps	
San_Francisco - London	100 %	2 ms	0 %	2 ms	13.79 Kbps	13.79 Kbps	0 Kbps	0 Kbps	
San_Francisco - Madrid	100 %	2 ms	0 %	2 ms	13.81 Kbps	13.81 Kbps	0 Kbps	0 Kbps	
Madrid - San_Francisco	100 %	2 ms	0 %	2 ms	29.68 Kbps	29.68 Kbps	0 Kbps	0 Kbps	
NewYork - San_Francisco	100 %	2 ms	0 %	2 ms	28.79 Kbps	28.79 Kbps	0 Kbps	0 Kbps	
San_Francisco - NewYork	100 %	2 ms	0 %	2 ms	13.68 Kbps	13.68 Kbps	0 Kbps	0 Kbps	

You can view the following metrics:

- **Virtual Path Name**: The virtual path name.
- **Latency**: The latency in milliseconds for real-time traffic.
- **Loss**: Percentage of packets lost.
- **Jitter**: Variation in the delay of received packets, in milliseconds.
- **Bandwidth Ingress**: Ingress (LAN to WAN) Bandwidth usage for the selected time period.
- **Control Bandwidth**: Bandwidth used to transfer control packets that contain routing, scheduling, and link statistics information.
- **Real-time Bandwidth**: Bandwidth consumed by applications that belong to the real-time class type in the SD-WAN configuration. The performance of such applications depends on a great extent upon network latency. A delayed packet is worse than a lost packet (for example, VoIP, Skype for Business).
- **Interactive Bandwidth**: Bandwidth consumed by applications that belong to the interactive class type in the SD-WAN configuration. The performance of such applications depends on a great extent upon network latency, and packet loss (for example, XenDesktop, XenApp).

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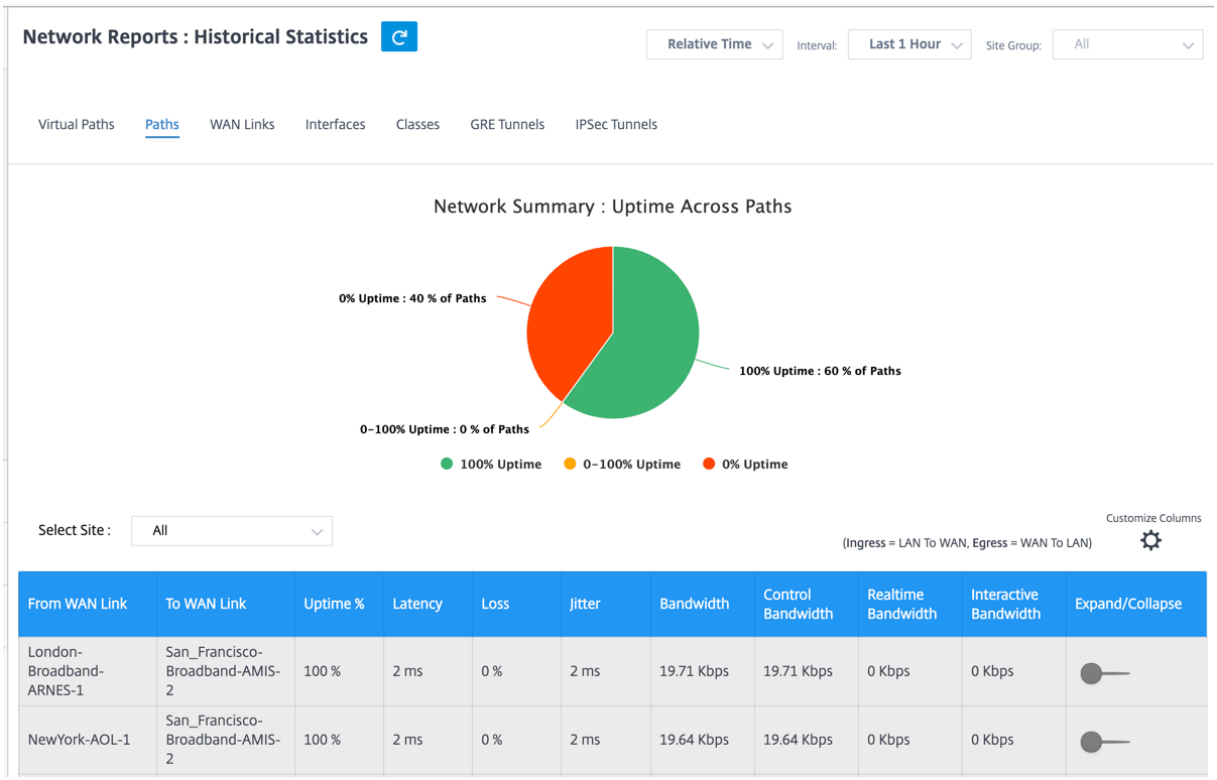
- **Bulk Bandwidth**: Bandwidth consumed by applications that belong to the bulk class type in the SD-WAN configuration. These applications involve little human intervention and are handled by the systems themselves (for example, FTP, backup operations).
- **Expand/Collapse**: You can expand or collapse the data as needed.

Paths

To view the **Paths** statistics, navigate to **Reports > Statistics > Paths** tab.



From WAN Link	To WAN Link	Uptime %	Latency	Loss	Jitter	Bandwidth	Control Bandwidth	Realtime Bandwidth	Interactive Bandwidth	Expand/Collapse
London-Broadband-ARNES-1	San_Francisco-Broadband-AMIS-2	100 %	2 ms	0 %	2 ms	19.71 Kbps	19.71 Kbps	0 Kbps	0 Kbps	
NewYork-AOL-1	San_Francisco-Broadband-AMIS-2	100 %	2 ms	0 %	2 ms	19.64 Kbps	19.64 Kbps	0 Kbps	0 Kbps	

You can view the following metrics:

- **From WAN Link**: The source WAN link.
- **To WAN Link**: The destination WAN link.
- **Latency**: The latency in milliseconds for real time traffic.
- **Loss**: Percentage of packets lost.
- **Jitter**: Variation in the delay of received packets, in milliseconds.
- **Bandwidth**: Total bandwidth consumed by all packet types. Bandwidth= Control Bandwidth + Real-time Bandwidth + Interactive Bandwidth + Bulk Bandwidth.
- **Control Bandwidth**: Bandwidth used to transfer control packets that contain routing, scheduling, and link statistics information.
- **Real-time Bandwidth**: Bandwidth consumed by applications that belong to the real-time class type in the SD-WAN configuration. The performance of such applications depends on a great

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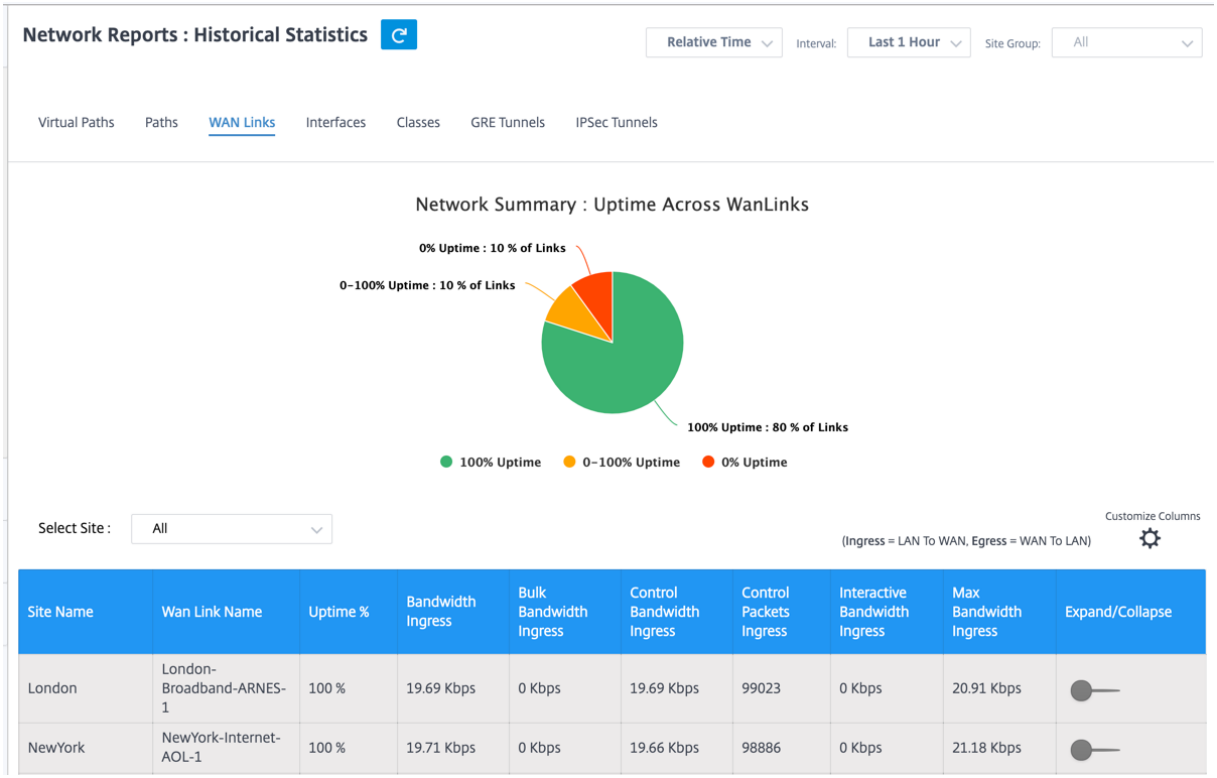
extent upon network latency. A delayed packet is worse than a lost packet (for example, VoIP, Skype for Business).

- **Interactive Bandwidth**: Bandwidth consumed by applications that belong to the interactive class type in the SD-WAN configuration. The performance of such applications depends on a great extent upon network latency, and packet loss (for example, XenDesktop, XenApp).
- **Bulk Bandwidth**: Bandwidth consumed by applications that belong to the bulk class type in the SD-WAN configuration. These applications involve little human intervention and are handled by the systems themselves (for example, FTP, backup operations).
- **Expand/Collapse**: You can expand or collapse the data as needed.

WAN links

To view the statistics at **WAN Link** level, navigate to **Reports > Statistics > WAN Links** tab.



Site Name	Wan Link Name	Uptime %	Bandwidth Ingress	Bulk Bandwidth Ingress	Control Bandwidth Ingress	Control Packets Ingress	Interactive Bandwidth Ingress	Max Bandwidth Ingress	Expand/Collapse
London	London-Broadband-ARNES-1	100 %	19.69 Kbps	0 Kbps	19.69 Kbps	99023	0 Kbps	20.91 Kbps	
NewYork	NewYork-Internet-AOL-1	100 %	19.71 Kbps	0 Kbps	19.66 Kbps	98886	0 Kbps	21.18 Kbps	

You can view the following metrics:

- **WAN Link Name**: The path name.
- **Bandwidth Ingress**: Ingress (LAN to WAN) Bandwidth usage for the selected time period.
- **Bulk Bandwidth Ingress**: Ingress (LAN to WAN) Virtual Path Bandwidth used by Bulk traffic for the selected time period.
- **Control Bandwidth Ingress**: Ingress (LAN to WAN) Virtual Path Bandwidth used by Control traffic for the selected time period.

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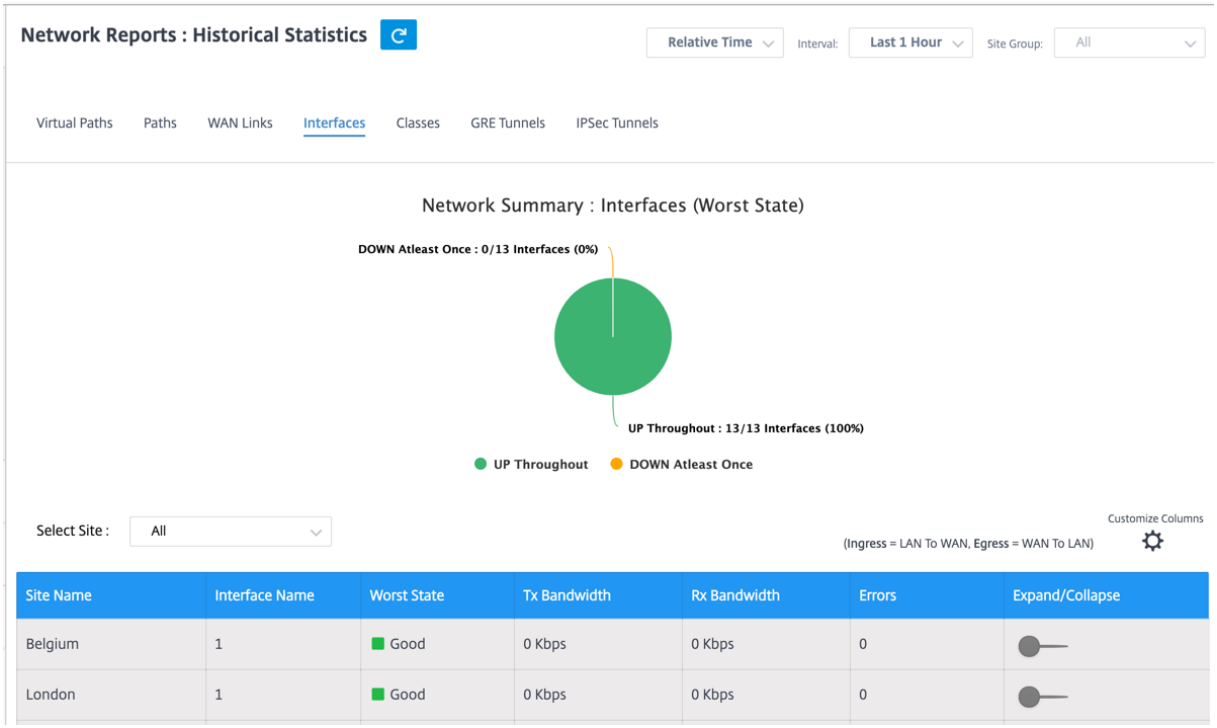
- **Control Packet Ingress**: Ingress (LAN to WAN) Virtual Path Control packets for the selected time period.
- **Interactive Bandwidth Ingress**: Ingress (LAN to WAN) Virtual Path Bandwidth used by Interactive traffic for the selected time period.
- **Max Bandwidth Ingress**: Max Ingress (LAN to WAN) Bandwidth used in a minute for the selected time period.
- **Min Bandwidth Ingress**: Min Ingress (LAN to WAN) Bandwidth used in a minute for the selected time period.
- **Expand/Collapse**: You can expand or collapse the data as needed.

Interfaces

The Interfaces statistic report helps you during troubleshooting to quickly see whether any of the ports are down. You can also view the transmitted and received bandwidth, or packet details at each port. You can also view the number of errors that occurred on these interfaces during a certain time period.

To view **Interface** statistics, navigate to **Reports > Statistics > Interfaces** tab.



You can view the following metrics:

- **Interface Name**: The name of the Ethernet interface.
- **Tx Bandwidth**: Bandwidth transmitted.
- **Rx Bandwidth**: Bandwidth received.
- **Errors**: Number of errors observed during the selected time period.

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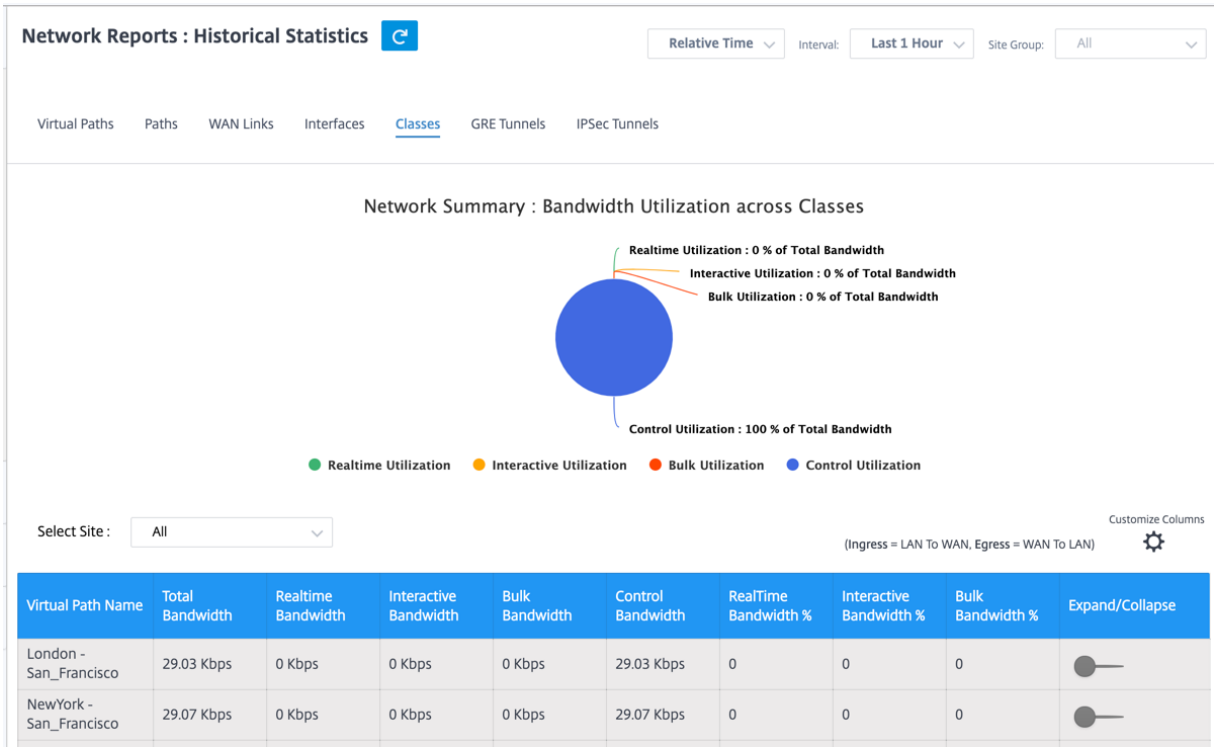
- **Expand/Collapse**: You can expand or collapse the data as needed.

Classes

The virtual services can be assigned to particular QoS classes, and different bandwidth restraints can be applied to different classes.

To view **Class** statistics, navigate to **Reports > Statistics > Classes** tab.



You can view the following metrics:

- **QoS Class**: The class name.
- **Bandwidth**: Transmitted bandwidth.
- **Data Volume**: Data sent, in Kbps.
- **Drop Volume**: Percentage of data dropped.
- **Drop Percent**: Percentage of data dropped.
- **Expand/Collapse**: You can expand or collapse the data as needed.

GRE tunnels

You can use a tunneling mechanism to transport packets of one protocol within another protocol. The protocol that carries the other protocol is called the transport protocol, and the carried protocol is called the passenger protocol. Generic Routing Encapsulation (GRE) is a tunneling mechanism that uses IP as the transport protocol and can carry many different passenger protocols.

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The tunnel source address and destination address are used to identify the two endpoints of the virtual point-to-point links in the tunnel. For more information about configuring GRE tunnels on Citrix SD-WAN appliances, see GRE Tunnel.

To view **GRE Tunnel** statistics, navigate to **Reports > Statistics > GRE Tunnels** tab.

You can view the following metrics:

- **Site Name**: The site name.
- **Tx Bandwidth**: Bandwidth transmitted.
- **Rx Bandwidth**: Bandwidth received.
- **Packet Dropped**: Number of packets dropped, because of network congestion.
- **Packets Fragmented**: Number of packets fragmented. Packets are fragmented to create smaller packets that can pass through a link with an MTU that is smaller than the original datagram. The fragments are reassembled by the receiving host.
- **Expand/Collapse**: You can expand or collapse the data as needed.

IPsec tunnels

IP Security (IPsec) protocols provide security services such as encrypting sensitive data, authentication, protection against replay, and data confidentiality for IP packets. Encapsulating Security Payload (ESP), and Authentication Header (AH) are the two IPsec security protocols used to provide these security services.

In IPsec tunnel mode, the entire original IP packet is protected by IPsec. The original IP packet is wrapped and encrypted, and a new IP header is added before transmitting the packet through the VPN tunnel.
For more information about configuring IPsec tunnels on Citrix SD-WAN appliances, see IPsec Tunnel Termination.

To view **IPsec Tunnel** statistics, navigate to **Reporting > statistics > IPsec Tunnels** tab.

You can view the following metrics:

- **Tunnel Name**: The tunnel name.
- **Tunnel State**: IPsec tunnel state.
- **MTU**: Maximum transmission unit—size of the largest IP datagram that can be transferred through a specific link.
- **Packet Received**: Number of packets received.
- **Packets Sent**: Number of packets Sent.
- **Packet Dropped**: Number of packets dropped, because of network congestion.
- **Bytes Dropped**: Number of bytes dropped.
- **Expand/Collapse**: You can expand or collapse the data as needed.

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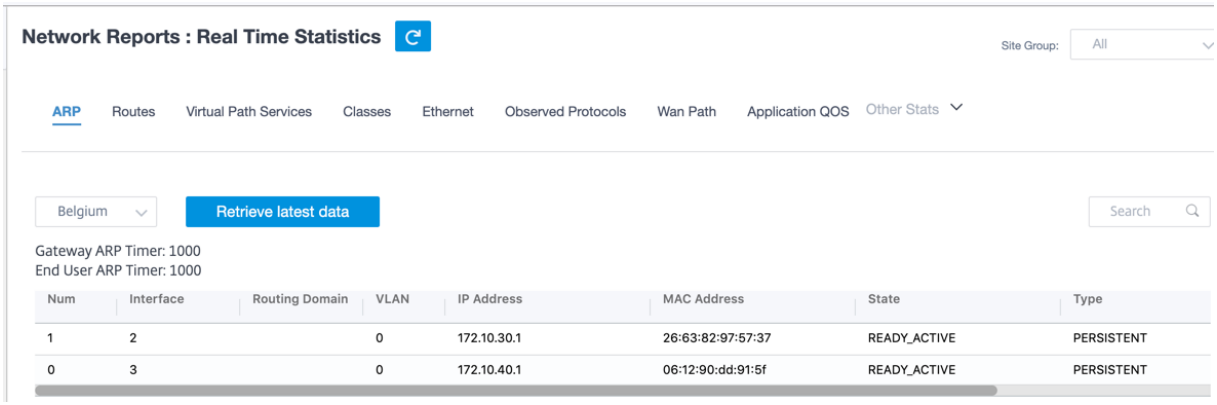
Real time statistics

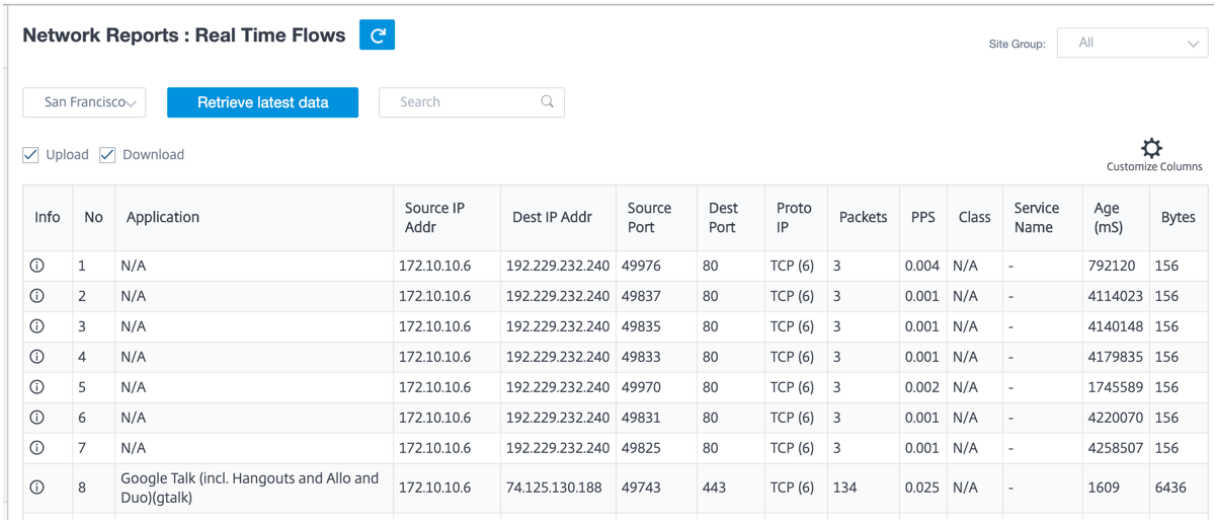
You can also get the following real time statistics information under **Troubleshooting > Statistics**:

- ARP
- Routes
- Ethernet
- Observed Protocols
- Application
- Rules



Flows

At the network level, select the site from the drop-down list before you can fetch the statistics. The **Flows** feature provides unidirectional flow information related to a particular session going through the appliance. This provides information on the destination service type the flow is falling into and also the information related to the rule and class type and also the transmission mode.



Info	No	Application	Source IP Addr	Dest IP Addr	Source Port	Dest Port	Proto IP	Packets	PPS	Class	Service Name	Age (mS)	Bytes
ⓘ	1	N/A	172.10.10.6	192.229.232.240	49976	80	TCP (6)	3	0.004	N/A	-	792120	156
ⓘ	2	N/A	172.10.10.6	192.229.232.240	49837	80	TCP (6)	3	0.001	N/A	-	4114023	156
ⓘ	3	N/A	172.10.10.6	192.229.232.240	49835	80	TCP (6)	3	0.001	N/A	-	4140148	156
ⓘ	4	N/A	172.10.10.6	192.229.232.240	49833	80	TCP (6)	3	0.001	N/A	-	4179835	156
ⓘ	5	N/A	172.10.10.6	192.229.232.240	49970	80	TCP (6)	3	0.002	N/A	-	1745589	156
ⓘ	6	N/A	172.10.10.6	192.229.232.240	49831	80	TCP (6)	3	0.001	N/A	-	4220070	156
ⓘ	7	N/A	172.10.10.6	192.229.232.240	49825	80	TCP (6)	3	0.001	N/A	-	4258507	156
ⓘ	8	Google Talk (incl. Hangouts and Allo and Duo)(gtalk)	172.10.10.6	74.125.130.188	49743	443	TCP (6)	134	0.025	N/A	-	1609	6436

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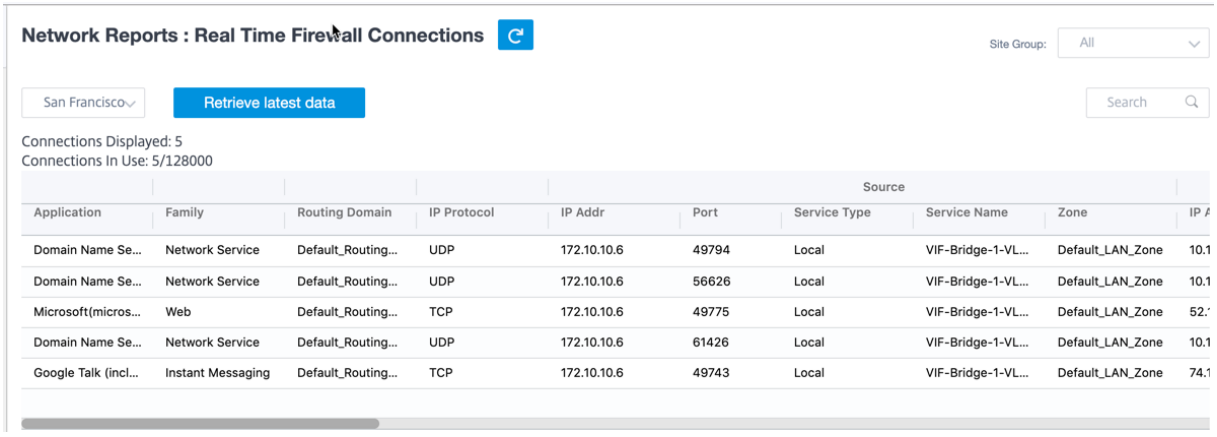
Firewall connections

At the network level, select the site from the drop-down list before you can fetch the statistics. The **Firewall connections** provide the state of the connection related to a particular session based on the firewall action configured. Firewall connections also provide complete details about the source and destination of the connection.



Application Quality

Application QoE is a measure of Quality of Experience of applications in the SD-WAN network. It measures the quality of applications that flow through the virtual paths between two SD-WAN appliances. The Application QoE score is a value between 0 and 10. The score range that it falls in determines the quality of an application. Application QoE enables network administrators to review the quality of experience of applications and take proactive measures when the quality goes below the acceptable threshold.

Quality	Range	Color Coding
Good	8–10	Green
Fair	4–8	Orange
Poor	0–4	Red

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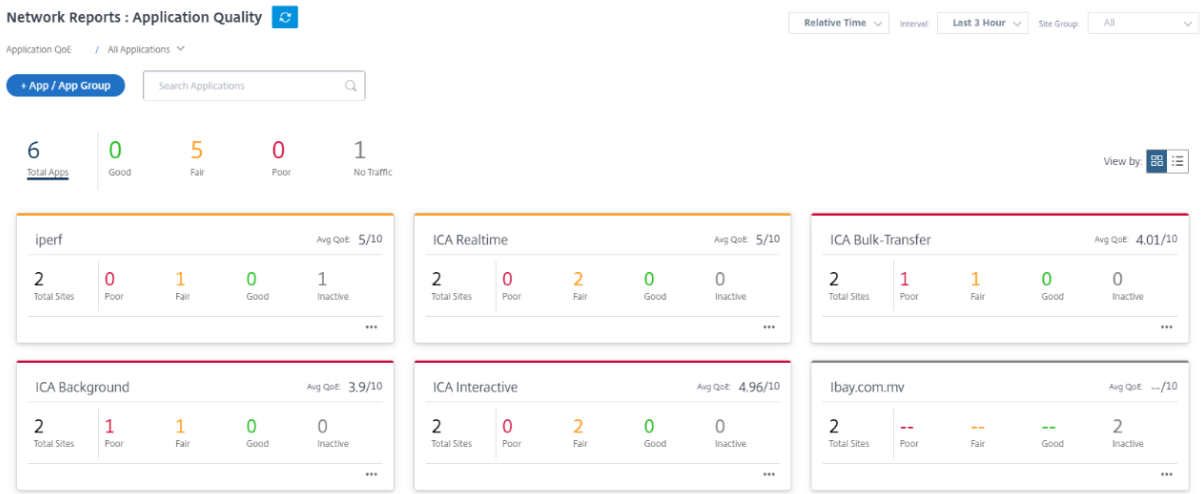
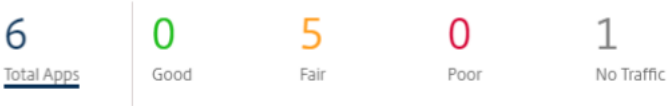
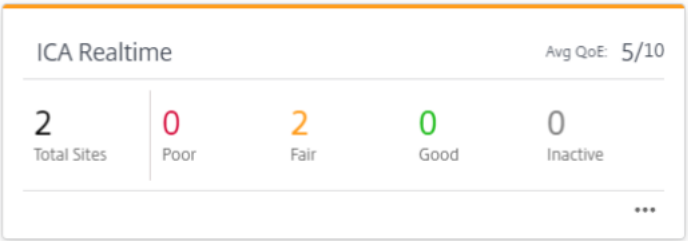


The top of the dashboard displays the overall number of applications and the number of applications that have good, fair, or poor Application QoE in the network. It also displays the number of applications that do not have any traffic.



The individual application card displays the number of sites that have poor, fair, or good Application QoE for the specific application. It also displays the number of sites that are not actively using the application. The Avg QoE is the average QoE score of the application across all the sites in the network.



Click an individual application card to view the details on the number of sites that have good, fair, or poor application QoE for the selected application. A map view of all the sites that is running the selected application is displayed. Click a site in the map to further drill down and view the Application QoE statistics of the various virtual paths at the site.

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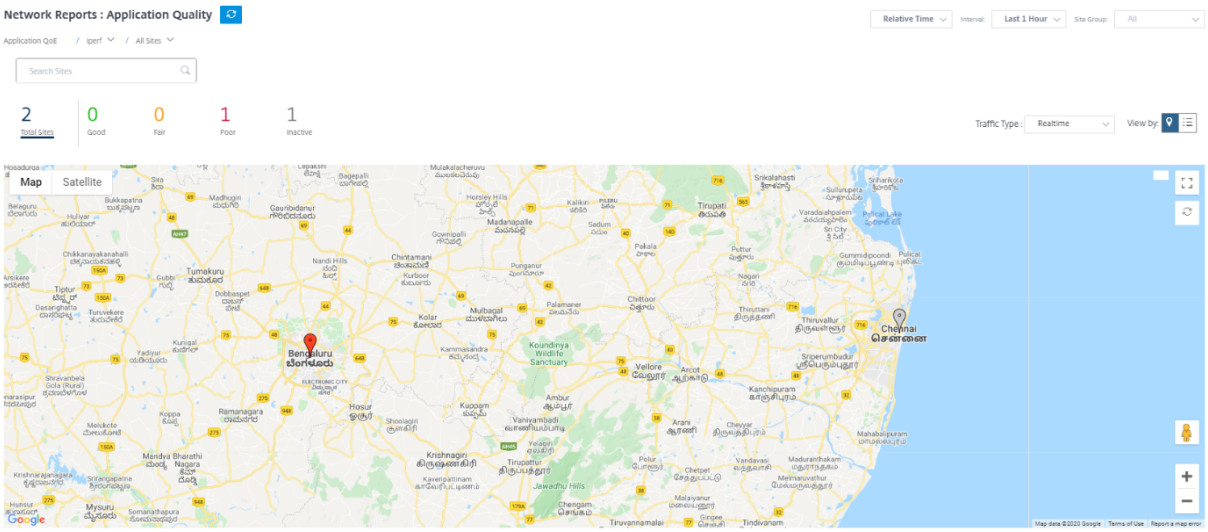
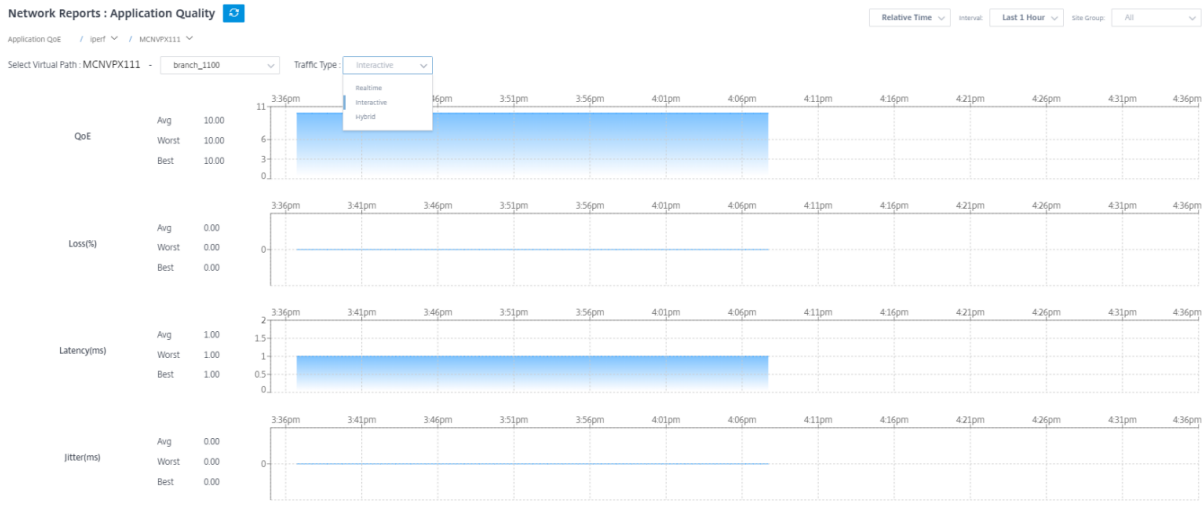


You can view the following metrics for Real-time, Interactive, and Hybrid traffic for the selected time-frame:

- **QoE**: The QoE score for the traffic.
- **Loss**: The loss percentage for the traffic.
- **Latency**: The latency in milliseconds for the traffic.
- **Jitter**: The jitter observed in milliseconds for the traffic.



Application QoE profiles

Click **+ App / App Group** to map applications, custom applications, or application groups to the default or custom QoE profiles.

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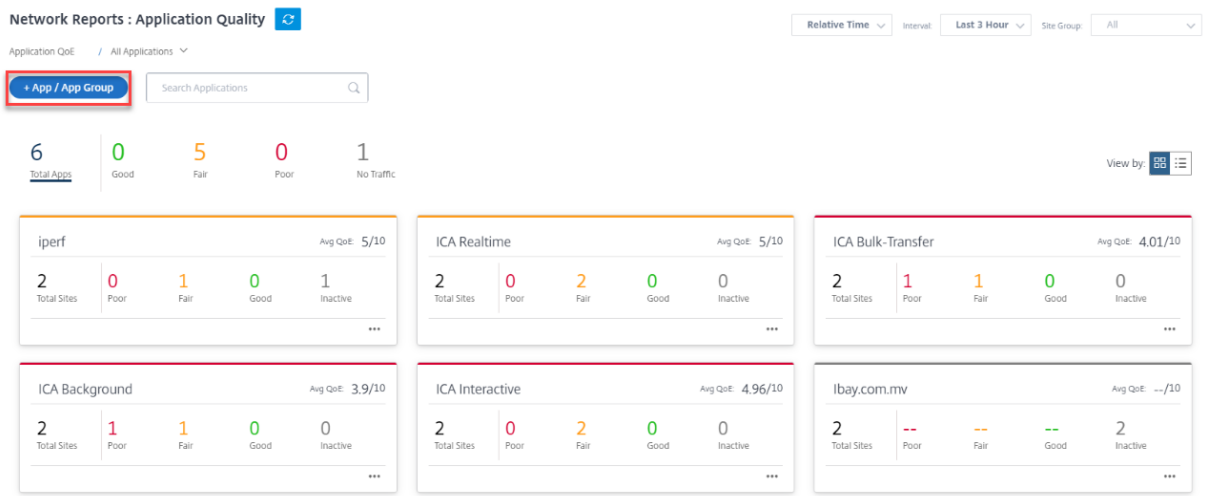
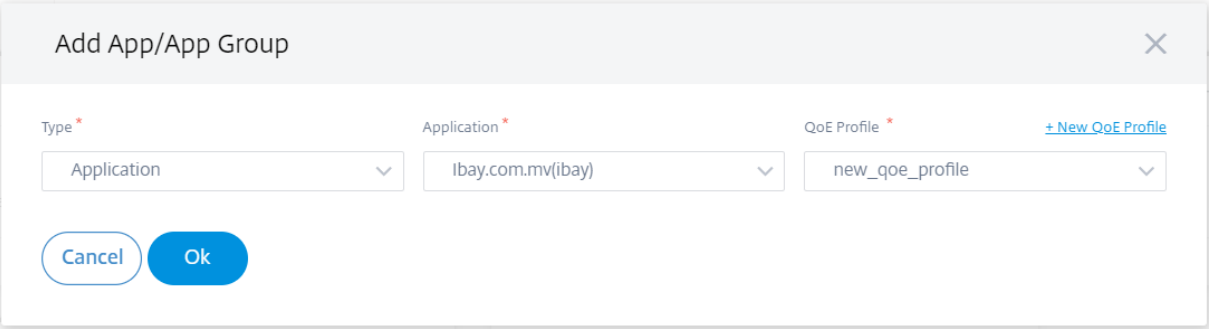


The QoE profiles define the threshold for real-time, interactive, and hybrid traffic. The QoE thresholds as per the QoE profiles are applied to the selected application or application group.



Click **+ New QoE Profile** to create a new application QoE profile and enter the value for the following parameters:

- **Profile Name**: A name to identify the profile that sets thresholds for real-time and interactive traffic.
- **Traffic Type**: Choose the type of traffic – Real-time, Interactive, or Hybrid. If the traffic type is Hybrid, you can configure both Real-time and Interactive QoE profile thresholds.
- **Realtime Configuration**: Configure thresholds for traffic flows that select the real-time QoS policy. A flow of a real-time application that meets the following thresholds for latency, loss, and jitter is considered to be of good quality.
  - **One Way latency**: The latency threshold in milliseconds. The default QoE profile value is 160 ms.
  - **Jitter**: The jitter threshold in milliseconds. The default QoE profile value is 30 ms.
  - **Packet Loss**: The percentage of packet loss. The default QoE profile value is 2%.
- **Interactive Configuration**: Configure thresholds for traffic flows that select the interactive QoS policy. A flow of an interactive application that meets the following threshold for burst ratio and

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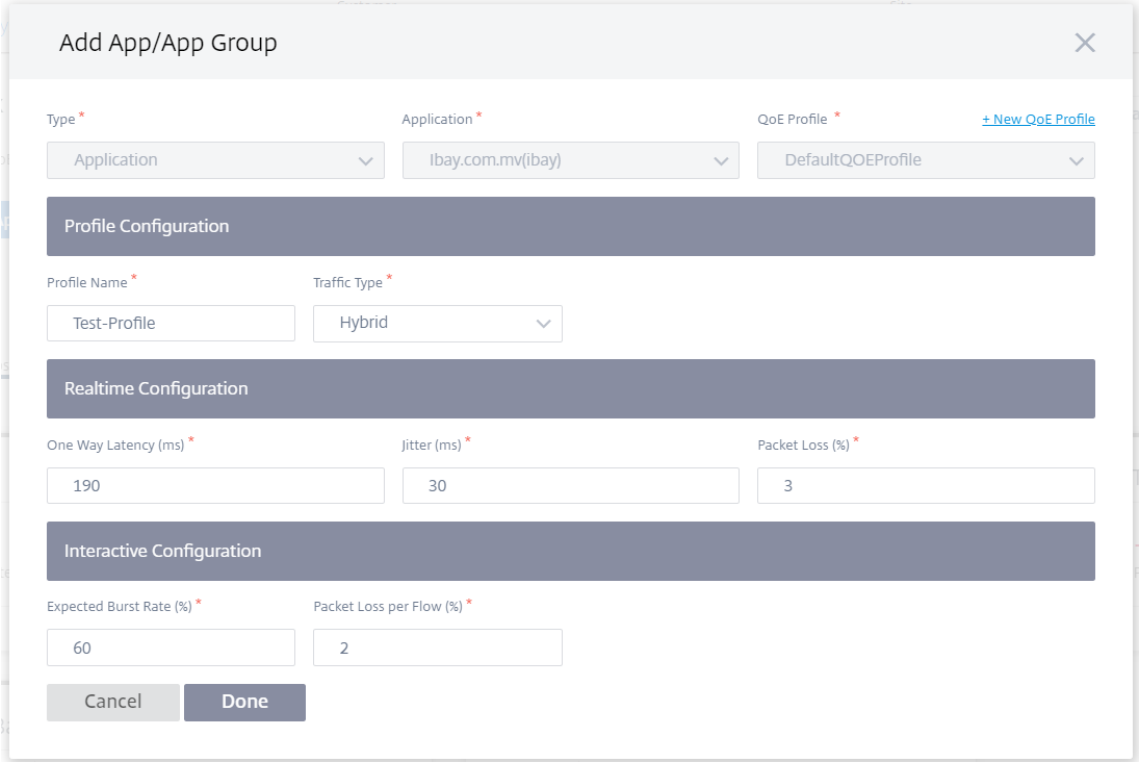
packet loss is considered to be of good quality.

- **Expected Burst Rate**: The percentage of expected burst rate. The egress burst rate must be at least the configured percentage of ingress burst rate. The default QoE profile value is 60%.
- **Packet loss per flow**: The percentage of packet loss. The default QoE profile value is 1%.



The newly added application is displayed in the Application Quality dashboard.

You can also define and configure application QoE from App & DNS Settings for more information see, Application quality profiles and Application quality configuration.

June 25, 2021

Site reports

The **Site Reports** provide visibility into site-level alerts, usage trends, quality, device information, and firewall statistics.

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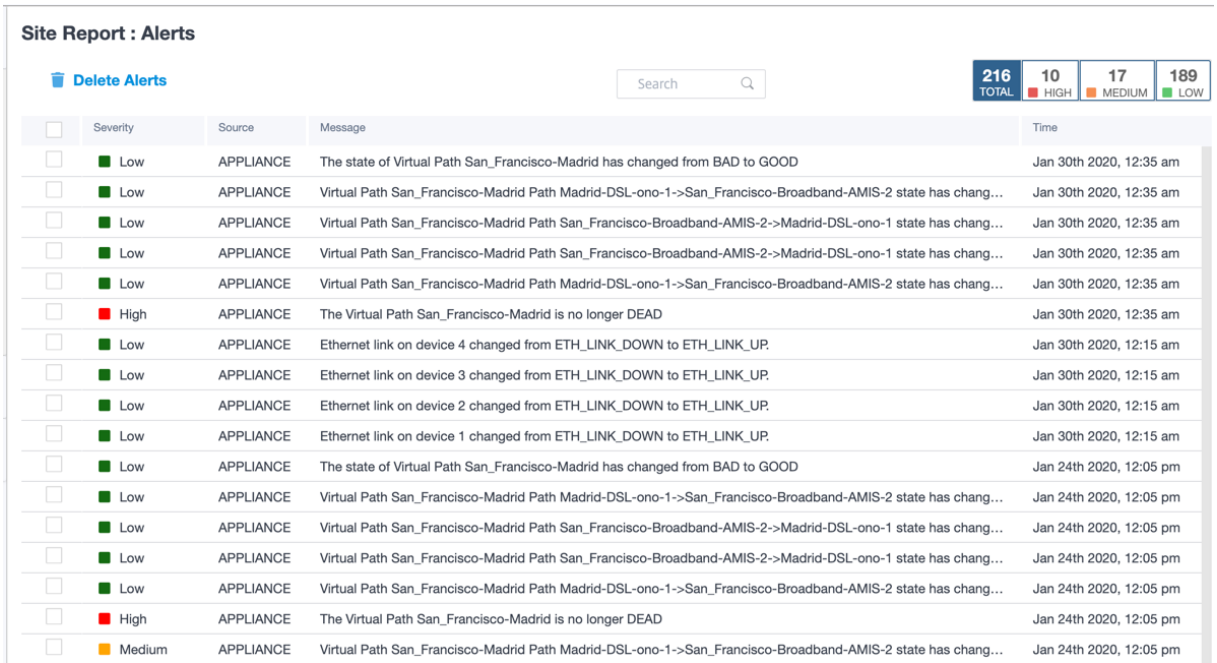
Alerts

The site administrator can review a detailed report of all the events and alerts generated at a site.

It includes the severity, site at which the alert originated, alert message, time, and other details.



Severity	Source	Message	Time
Low	APPLIANCE	The state of Virtual Path San_Francisco-Madrid has changed from BAD to GOOD	Jan 30th 2020, 12:35 am
Low	APPLIANCE	Virtual Path San_Francisco-Madrid Path Madrid-DSL-ono-1->San_Francisco-Broadband-AMIS-2 state has chang...	Jan 30th 2020, 12:35 am
Low	APPLIANCE	Virtual Path San_Francisco-Madrid Path San_Francisco-Broadband-AMIS-2->Madrid-DSL-ono-1 state has chang...	Jan 30th 2020, 12:35 am
Low	APPLIANCE	Virtual Path San_Francisco-Madrid Path San_Francisco-Broadband-AMIS-2->Madrid-DSL-ono-1 state has chang...	Jan 30th 2020, 12:35 am
Low	APPLIANCE	Virtual Path San_Francisco-Madrid Path Madrid-DSL-ono-1->San_Francisco-Broadband-AMIS-2 state has chang...	Jan 30th 2020, 12:35 am
High	APPLIANCE	The Virtual Path San_Francisco-Madrid is no longer DEAD	Jan 30th 2020, 12:35 am
Low	APPLIANCE	Ethernet link on device 4 changed from ETH_LINK_DOWN to ETH_LINK_UP.	Jan 30th 2020, 12:15 am
Low	APPLIANCE	Ethernet link on device 3 changed from ETH_LINK_DOWN to ETH_LINK_UP.	Jan 30th 2020, 12:15 am
Low	APPLIANCE	Ethernet link on device 2 changed from ETH_LINK_DOWN to ETH_LINK_UP.	Jan 30th 2020, 12:15 am
Low	APPLIANCE	Ethernet link on device 1 changed from ETH_LINK_DOWN to ETH_LINK_UP.	Jan 30th 2020, 12:15 am
Low	APPLIANCE	The state of Virtual Path San_Francisco-Madrid has changed from BAD to GOOD	Jan 24th 2020, 12:05 pm
Low	APPLIANCE	Virtual Path San_Francisco-Madrid Path Madrid-DSL-ono-1->San_Francisco-Broadband-AMIS-2 state has chang...	Jan 24th 2020, 12:05 pm
Low	APPLIANCE	Virtual Path San_Francisco-Madrid Path San_Francisco-Broadband-AMIS-2->Madrid-DSL-ono-1 state has chang...	Jan 24th 2020, 12:05 pm
Low	APPLIANCE	Virtual Path San_Francisco-Madrid Path San_Francisco-Broadband-AMIS-2->Madrid-DSL-ono-1 state has chang...	Jan 24th 2020, 12:05 pm
Low	APPLIANCE	Virtual Path San_Francisco-Madrid Path Madrid-DSL-ono-1->San_Francisco-Broadband-AMIS-2 state has chang...	Jan 24th 2020, 12:05 pm
High	APPLIANCE	The Virtual Path San_Francisco-Madrid is no longer DEAD	Jan 24th 2020, 12:05 pm
Medium	APPLIANCE	Virtual Path San_Francisco-Madrid Path Madrid-DSL-ono-1->San_Francisco-Broadband-AMIS-2 state has chang...	Jan 24th 2020, 12:05 pm

Suitable filtering options can be used as needed for example: Look for all the high severity alerts at the site or the alerts that occurred during a particular period.

You can also select and clear alerts.

Usage

Site administrators can review usage trends such as **Top Applications, Top Application Categories**, and **App Bandwidth** in a particular site.

Top applications and application categories

The **Top Applications** and **Top Application Categories** chart shows the top applications and top application families that are widely used in the site. This allows you to analyze the data consumption pattern and reassign the bandwidth limit for each class of data within the site.

You can also view the bandwidth usage statistics. The bandwidth statistics are collected for the selected time interval. You can filter the statistics report based on the **Report Type, Apps or Apps Categories,** and **Metrics**.

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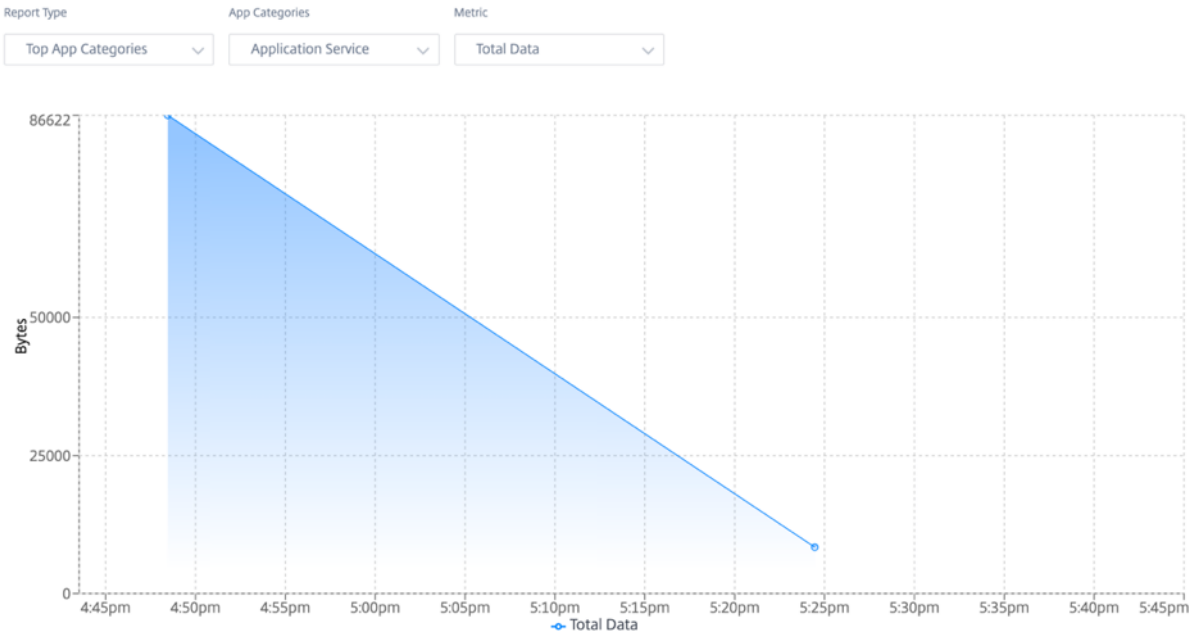

- **Report Type:** Select **Top App or App Categories** from the list.
- **Apps/App Categories:** Select top application or categories (such as network service) from the list.
- **Metric:** Select the bandwidth metric (such as Total Data, Incoming Data, Total Bandwidth) from the list.

Quality

Site administrators can use the Quality reports to analyze the Quality of Experience (QoE) at the site for each QoS metric such as availability, loss, latency, and jitter. The quality metric is displayed for both the overlay virtual paths and its underlying member paths.

- **Availability**

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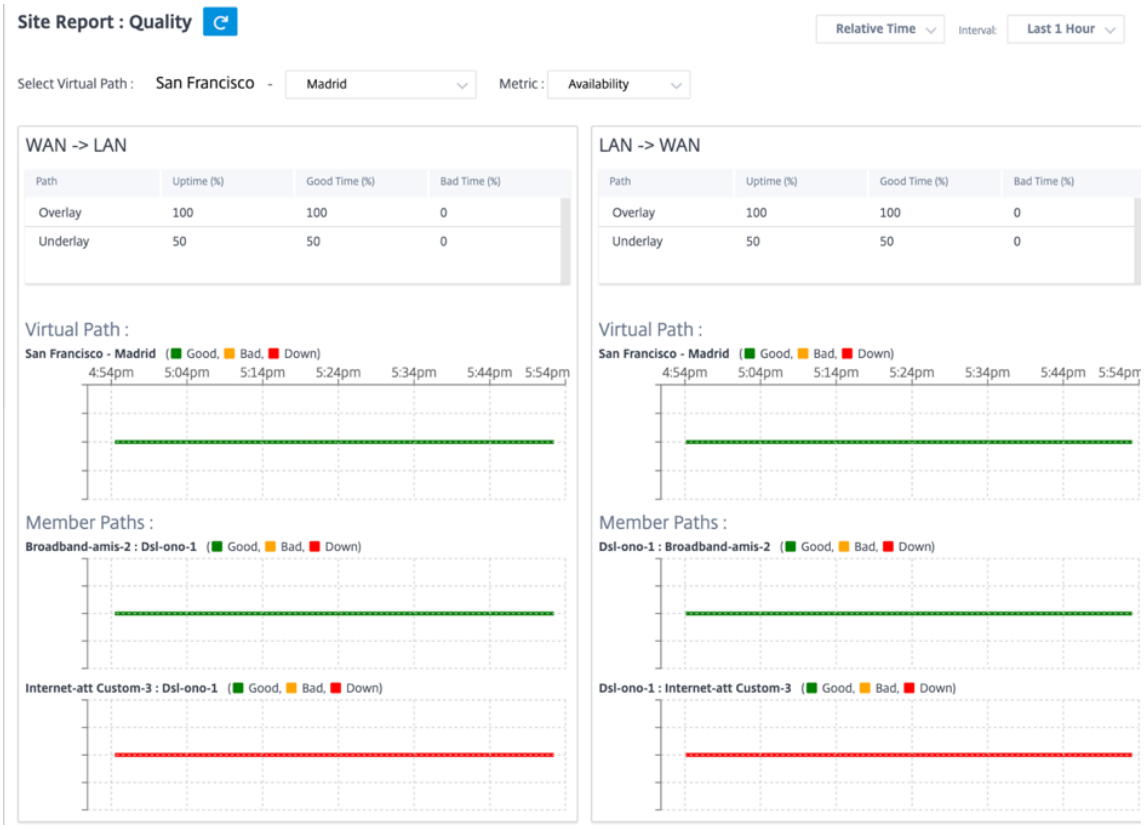
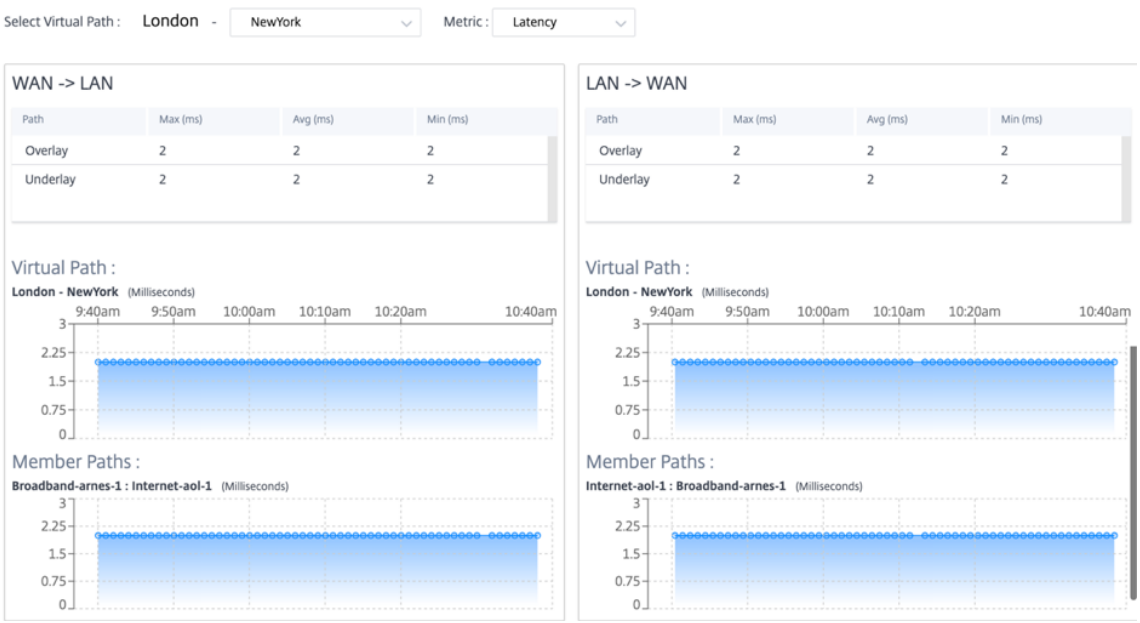


- **Latency**



- **Loss**

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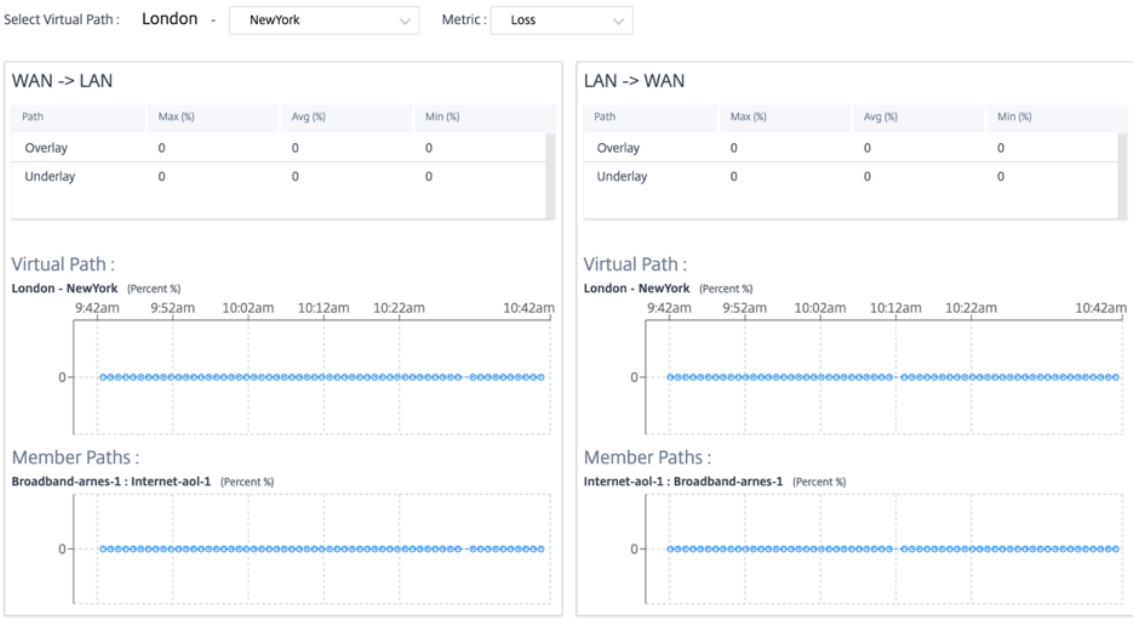
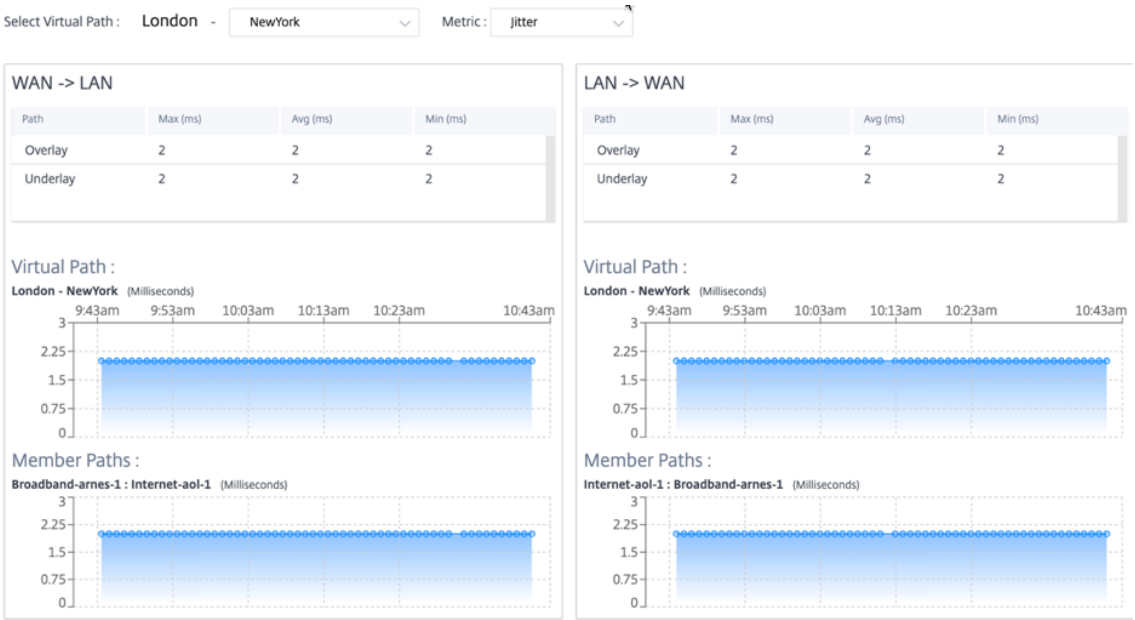


- **Jitter**



- **Throughput**

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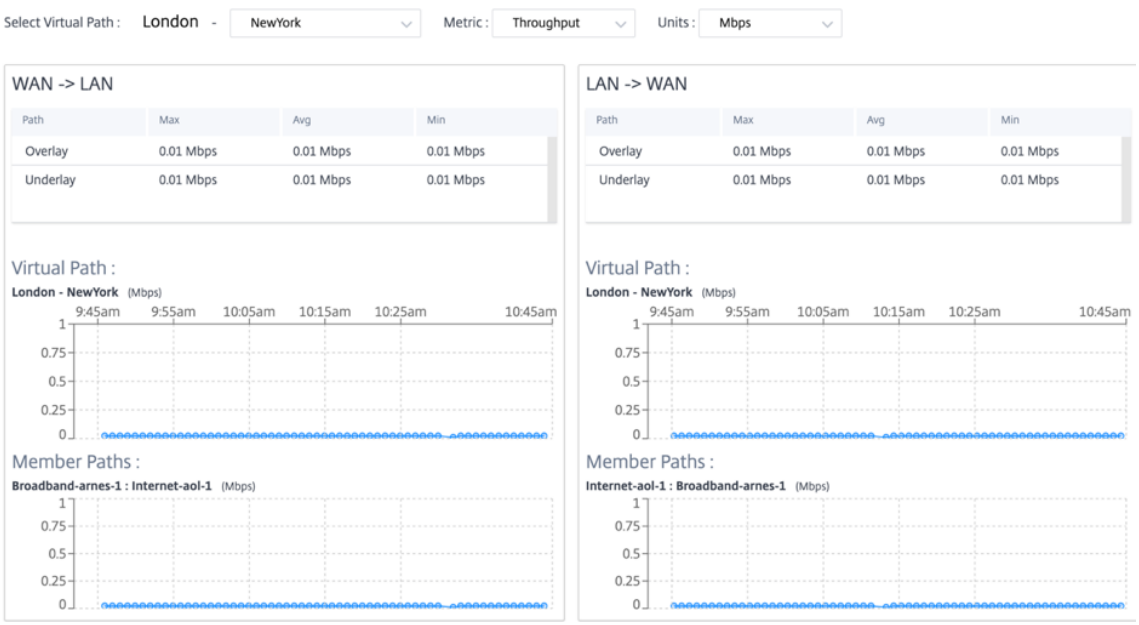
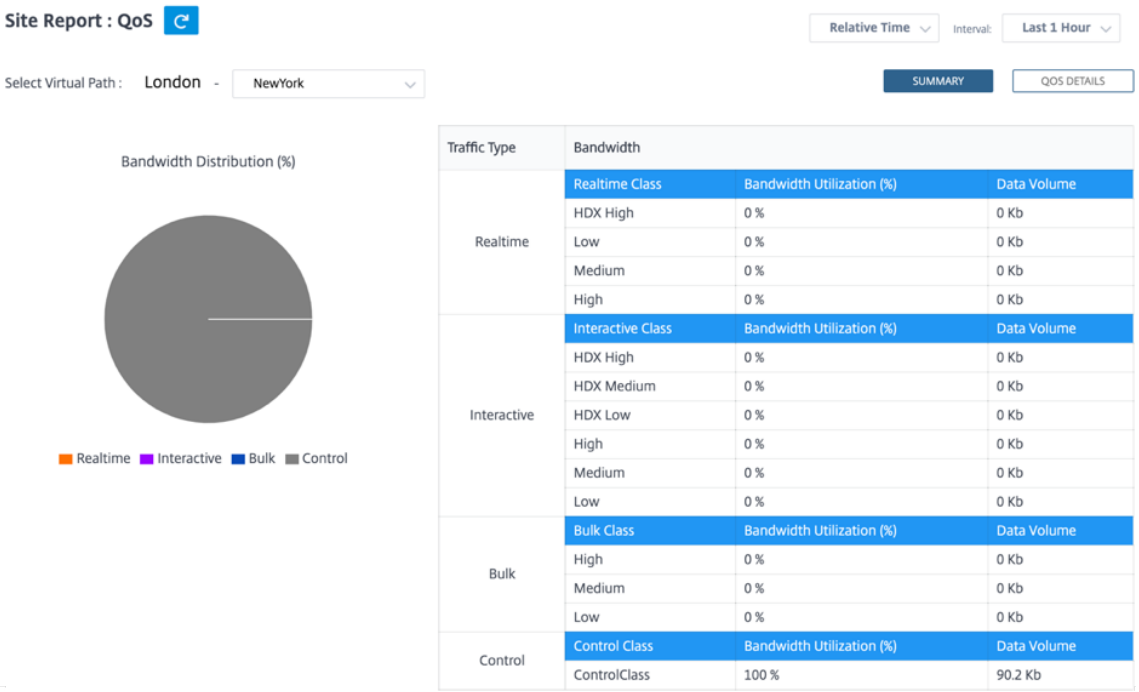


Quality of Service

Quality of Service (QoS) manages data traffic to reduce packet loss, latency, and jitter on the network. For more information, see Quality of Service. The following are two ways to view the Quality-of-Service (QoS) report:

- **Summary View:** Summary view provides an overview of bandwidth consumption across all types of traffic - real-time, interactive, bulk, and control across the network and per site.



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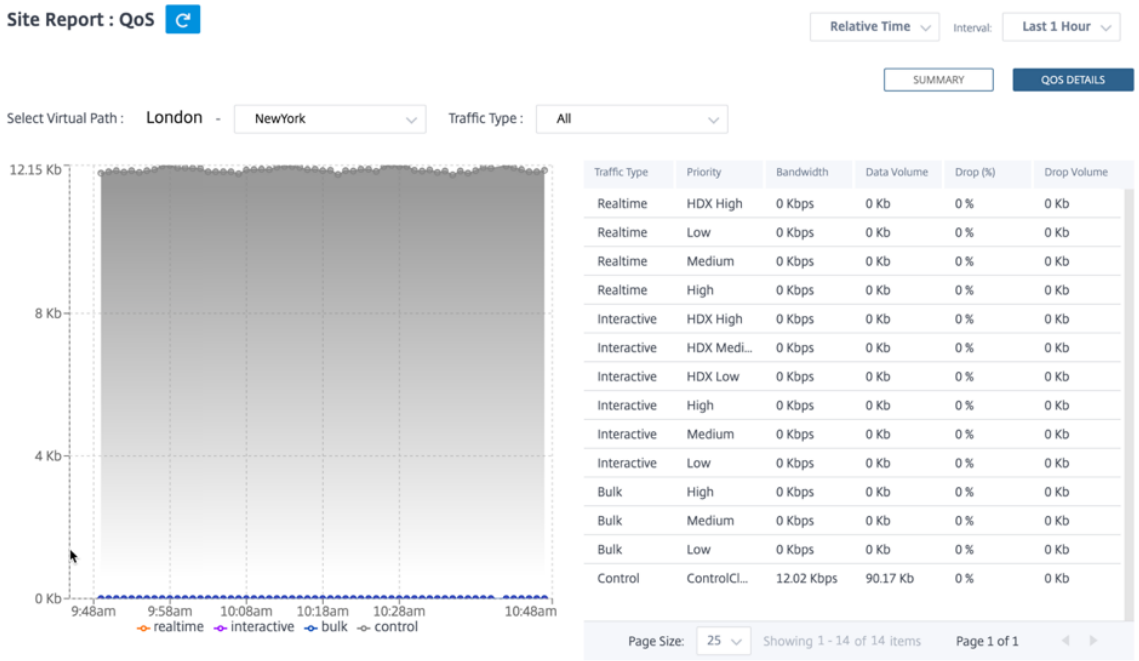
  - **Real-time:** Used for low latency, low bandwidth, time-sensitive traffic. Real-time applications are time sensitive but don't really need high bandwidth (for example voice over IP). Real-time applications are sensitive to latency and jitter, but can tolerate some loss.
  - **Interactive:** Used for interactive traffic with low to medium latency requirements and low to medium bandwidth requirements. Interactive applications involve human input in the form of mouse clicks or cursor moves. The interaction is typically between a client and a server. The communication might not need high bandwidth but is sensitive to loss and latency. However, server to client does need high bandwidth to transfer graphical information, which might not be sensitive to loss.
  - **Bulk:** Used for high bandwidth traffic that can tolerate high latency. Applications that handle file transfer and need high bandwidth are categorized as bulk class. These applications involve little human interference and are mostly handled by the systems themselves.
  - **Control:** Used to transfer control packets that contain routing, scheduling, and link statistics information.

- **Detailed View:** The detailed view captures trends around bandwidth consumption, traffic volume, packets dropped and so on For each QoS class associated with an overlay virtual path. You can view QoS statistics based on the virtual path between two sites.



Historical statistics

For each site, you can view the statistics as graphs for the following network parameters:

- Virtual Paths

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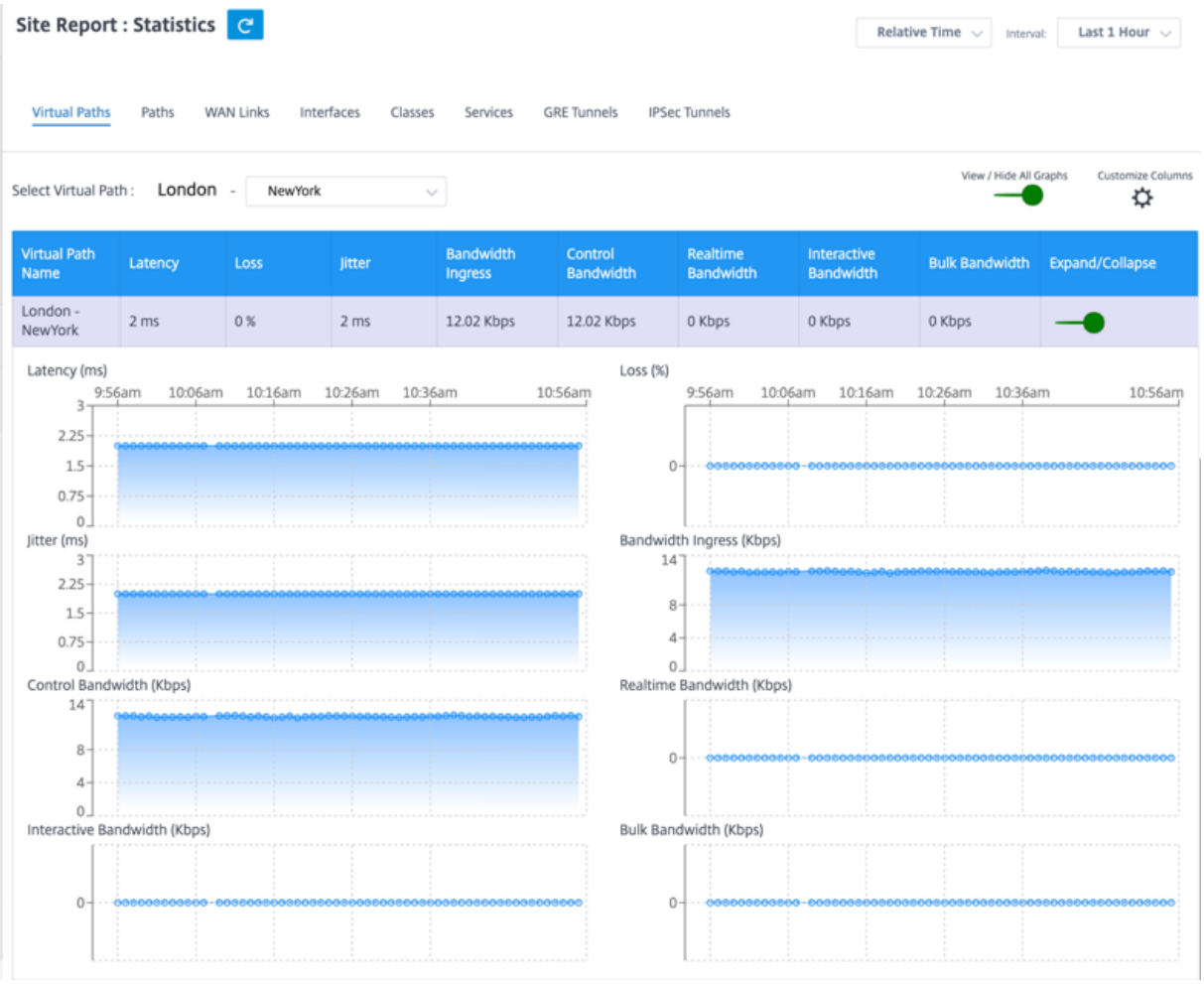
- Paths
- WAN Links
- Interfaces
- Classes
- Services
- GRE Tunnels
- IPsec Tunnels

The statistics are collected as graphs. These graphs are plotted as timeline versus usage, allowing you to understand the usage trends of various network object properties. You can view graphs for network-wide application statistics.

You can view or hide the graphs and customize the columns as needed.

Virtual paths

To view the **Virtual Paths** statistics, navigate to **Reports > Statistics > Virtual Paths** tab.



You can view the following metrics:

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- **Virtual Path Name**: The virtual path name.
- **Latency**: The latency in milliseconds for real time traffic.
- **Loss**: Percentage of packets lost.
- **Jitter**: Variation in the delay of received packets, in milliseconds.
- **Bandwidth Ingress**: **Ingress (LAN > WAN) Bandwidth** usage for the selected time period.
- **Control Bandwidth**: Bandwidth used to transfer control packets that contain routing, scheduling, and link statistics information.
- **Real-time Bandwidth**: Bandwidth consumed by applications that belong to the real-time class type in the SD-WAN configuration. The performance of such applications depends on a great extent upon network latency. A delayed packet is worse than a lost packet (for example, VoIP, Skype for Business).
- **Interactive Bandwidth**: Bandwidth consumed by applications that belong to the interactive class type in the SD-WAN configuration. The performance of such applications depends on a great extent upon network latency, and packet loss (for example, XenDesktop, XenApp).
- **Bulk Bandwidth**: Bandwidth consumed by applications that belong to the bulk class type in the SD-WAN configuration. These applications involve little human intervention and are mostly handled by the systems themselves (for example, FTP, backup operations).
- **Expand/Collapse**: You can expand or collapse the data as needed.

Paths

To view the **Paths** statistics, navigate to **Reports > Statistics > Paths** tab.

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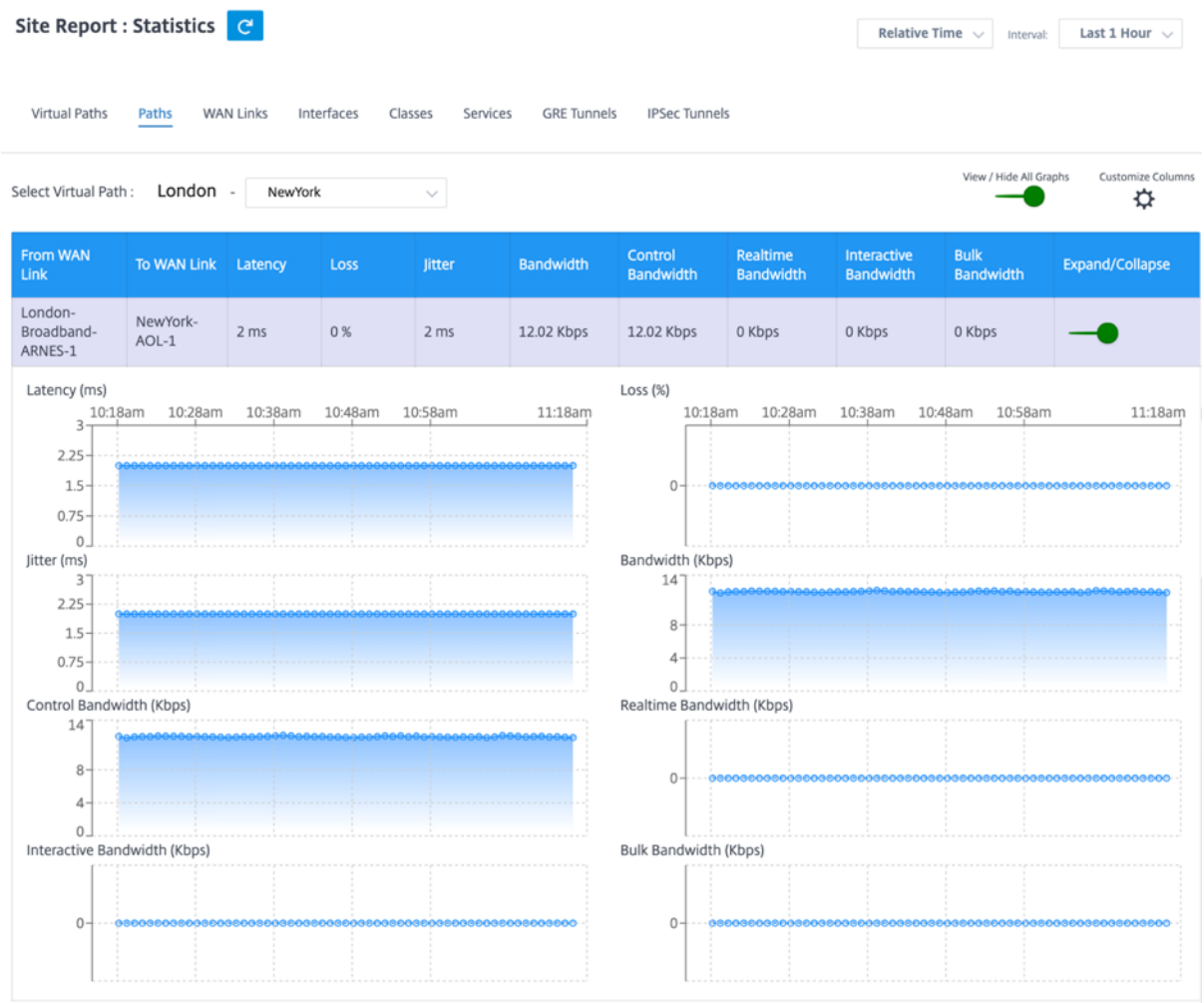

You can view the following metrics:

- **From WAN Link**: The source WAN link.
- **To WAN Link**: The destination WAN link.
- **Latency**: The latency in milliseconds for real time traffic.
- **Loss**: Percentage of packets lost.
- **Jitter**: Variation in the delay of received packets, in milliseconds.
- **Bandwidth**: Total bandwidth consumed by all packet types. Bandwidth= Control Bandwidth + Real-time Bandwidth + Interactive Bandwidth + Bulk Bandwidth.
- **Control Bandwidth**: Bandwidth used to transfer control packets that contain routing, scheduling, and link statistics information.
- **Real-time Bandwidth**: Bandwidth consumed by applications that belong to the real-time class type in the SD-WAN configuration. The performance of such applications depends on a great extent upon network latency. A delayed packet is worse than a lost packet (for example, VoIP, Skype for Business).
- **Interactive Bandwidth**: Bandwidth consumed by applications that belong to the interactive

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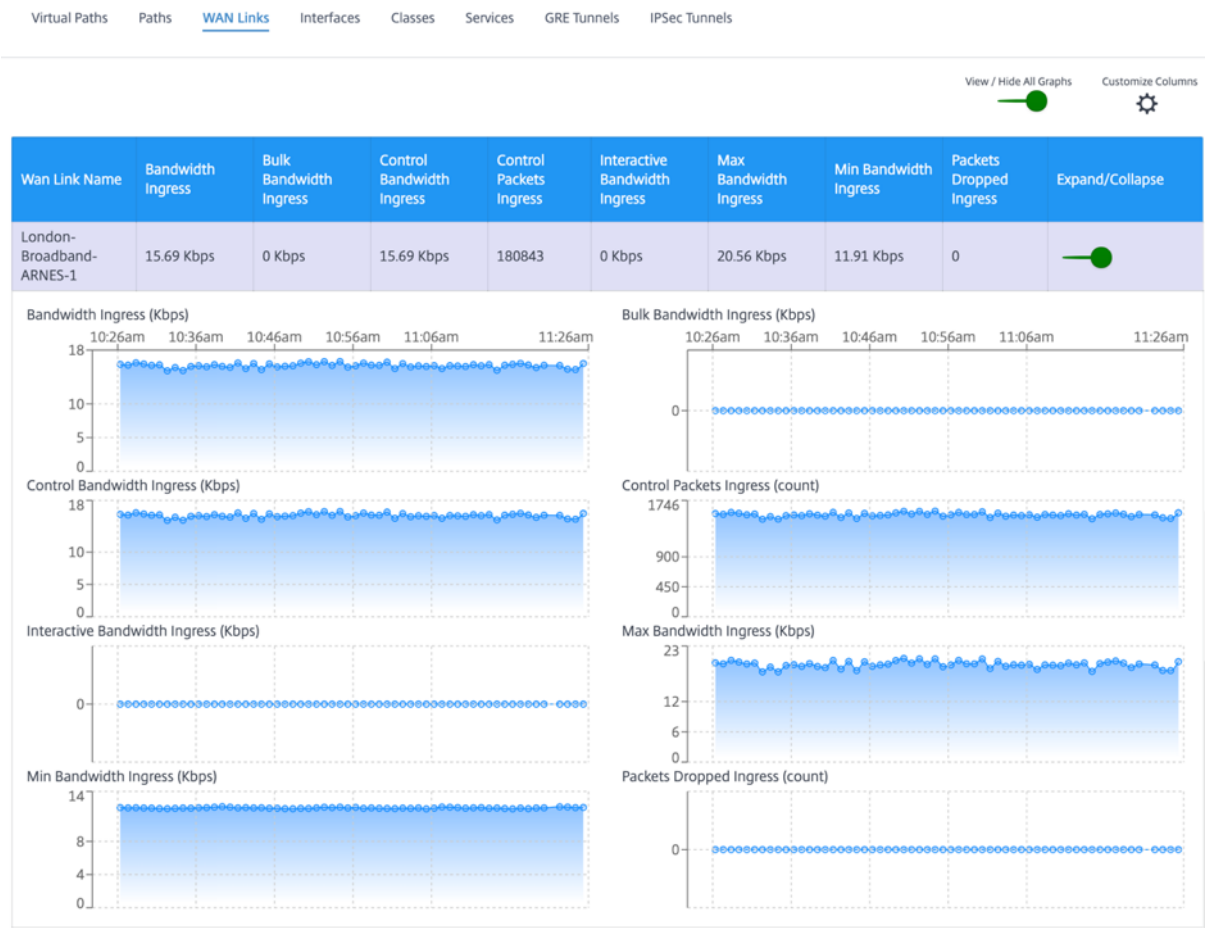
class type in the SD-WAN configuration. The performance of such applications depends on a great extent upon network latency, and packet loss (for example, XenDesktop, XenApp).

- **Bulk Bandwidth**: Bandwidth consumed by applications that belong to the bulk class type in the SD-WAN configuration. These applications involve little human intervention and are mostly handled by the systems themselves (for example, FTP, backup operations).
- **Expand/Collapse**: You can expand or collapse the data as needed.

WAN links

To view the statistics at **WAN Link** level, navigate to **Reports > Statistics > WAN Links** tab.



You can view the following metrics:

- **WAN Link Name**: The path name.
- **Bandwidth Ingress**: **Ingress (LAN > WAN) Bandwidth** usage for the selected time period.
- **Bulk Bandwidth Ingress**: **Ingress (LAN > WAN) virtual path bandwidth** used by Bulk traffic for the selected time period.
- **Control Bandwidth Ingress**: **Ingress (LAN > WAN) virtual path bandwidth** used by Control traffic for the selected time period.

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- **Control Packet Ingress**: **Ingress (LAN > WAN) Virtual Path Control packets** for the selected time period.
- **Interactive Bandwidth Ingress**: **Ingress (LAN > WAN) virtual path bandwidth** used by Interactive traffic for the selected time period.
- **Max Bandwidth Ingress**: **Maximum ingress (LAN > WAN) bandwidth** used in a minute for the selected time period.
- **Min Bandwidth Ingress**: **Minimum ingress (LAN > WAN) bandwidth** used in a minute for the selected time period.
- **Expand/Collapse**: You can expand or collapse the data as needed.

Interfaces

The Interfaces statistic report helps you during troubleshooting to quickly see whether any of the ports are down. You can also view the transmitted and received bandwidth, or packet details at each port. You can also view the number of errors that occurred on these interfaces during a certain time period.

To view **Interface** statistics, navigate to **Reports > Statistics > Interfaces** tab.

You can view the following metrics:

- **Interface Name**: The name of the Ethernet interface.
- **Tx Bandwidth**: Bandwidth transmitted.
- **Rx Bandwidth**: Bandwidth received.
- **Errors**: Number of errors observed during the selected time period.
- **Expand/Collapse**: You can expand or collapse the data as needed.

Classes

The virtual services can be assigned to particular QoS classes, and different bandwidth restraints can be applied to different classes.

To view **Class** statistics, navigate to **Reports > Statistics > Classes** tab.

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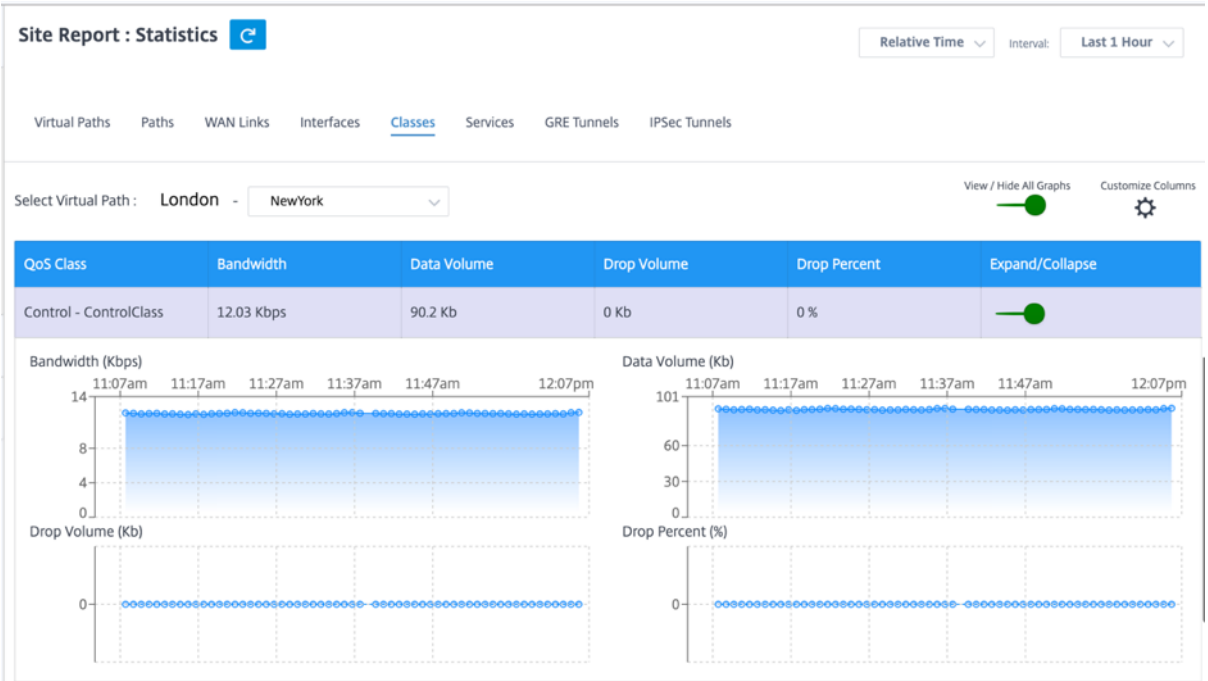

You can view the following metrics:

- **QoS Class**: The class name.
- **Bandwidth**: Transmitted bandwidth.
- **Data Volume**: Data sent, in Kbps.
- **Drop Volume**: Percentage of data dropped.
- **Drop Percent**: Percentage of data dropped.
- **Expand/Collapse**: You can expand or collapse the data as needed.

Services

To view the **Services** statistics, navigate to **Reports > Statistics > Services** tab.

Select the service type from the list. The options are as follows:

- **Passthrough** – This service manages traffic that is not intercepted, delayed, shaped, or changed by the SD-WAN. Traffic directed to the Passthrough Service includes broadcasts, ARPs, and other non-IPv4 traffic, and traffic on the Virtual WAN Appliance local subnet, configured subnets, or Rules applied by the Network Administrator. This traffic is not delayed, shaped, or changed by the SD-WAN. Therefore, you must ensure that Passthrough traffic does not consume substantial resources on the WAN links that the SD-WAN Appliance is configured to use for other services.
- **Intranet** – This service manages Enterprise Intranet traffic that has not been defined for transmission across a Virtual Path. As with Internet traffic, it remains unencapsulated, and the SD-WAN manages bandwidth by rate-limiting this traffic relative to other service types during times of congestion. Under certain conditions, and if configured for Intranet Fallback on the Virtual

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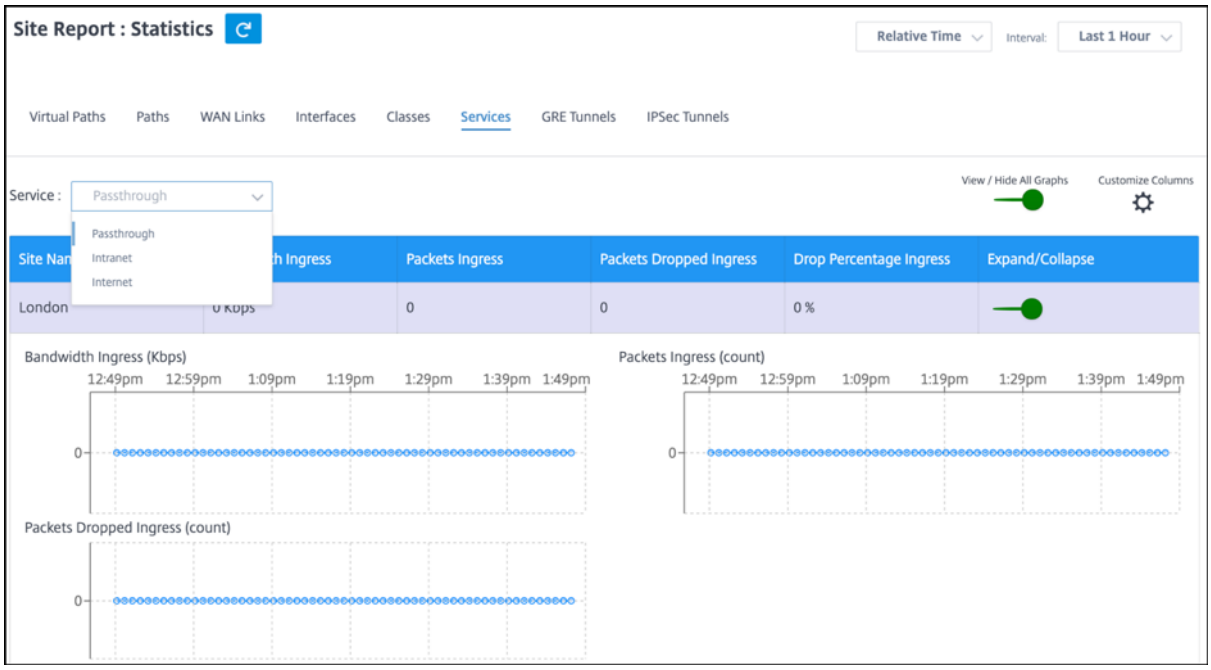
Path, traffic that ordinarily travels with a Virtual Path can instead be treated as Intranet traffic, to maintain network reliability.

- **Internet** – This service manages traffic between an Enterprise site and sites on the public Internet. Traffic of this type is not encapsulated. During times of congestion, the SD-WAN actively manages bandwidth by rate-limiting Internet traffic relative to the Virtual Path, and Intranet traffic according to the SD-WAN configuration established by the Administrator.



You can view the following metrics:

- **Site Name**: The site name.
- **Bandwidth Ingress**: **Ingress (LAN > WAN) Bandwidth** usage for the selected time period.
- **Packet Ingress**: **(LAN > WAN) Packets** sent for the selected time interval.
- **Expand/Collapse**: You can expand or collapse the data as needed.

GRE tunnels

You can use a tunneling mechanism to transport packets of one protocol within another protocol. The protocol that carries the other protocol is called the transport protocol, and the carried protocol is called the passenger protocol. Generic Routing Encapsulation (GRE) is a tunneling mechanism that uses IP as the transport protocol and can carry many different passenger protocols.

The tunnel source address and destination address are used to identify the two endpoints of the virtual point-to-point links in the tunnel. For more information about configuring GRE tunnels on Citrix SD-WAN appliances, see GRE Tunnel.

To view **GRE Tunnel** statistics, navigate to **Reports > Statistics > GRE Tunnels** tab.

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You can view the following metrics:

- **Site Name**: The site name.
- **Tx Bandwidth**: Bandwidth transmitted.
- **Rx Bandwidth**: Bandwidth received.
- **Packet Dropped**: Number of packets dropped, because of network congestion.
- **Packets Fragmented**: Number of packets fragmented. Packets are fragmented to create smaller packets that can pass through a link with an MTU that is smaller than the original datagram. The fragments are reassembled by the receiving host.
- **Expand/Collapse**: You can expand or collapse the data as needed.

IPsec tunnels

IP Security (IPsec) protocols provide security services such as encrypting sensitive data, authentication, protection against replay, and data confidentiality for IP packets. Encapsulating Security Payload (ESP), and Authentication Header (AH) are the two IPsec security protocols used to provide these security services.

In IPsec tunnel mode, the entire original IP packet is protected by IPsec. The original IP packet is wrapped and encrypted, and a new IP header is added before transmitting the packet through the VPN tunnel.
For more information about configuring IPsec tunnels on Citrix SD-WAN appliances, see IPsec Tunnel Termination.

To view **IPsec Tunnel** statistics, navigate to **Reporting > statistics > IPsec Tunnels** tab.

You can view the following metrics:

- **Tunnel Name**: The tunnel name.
- **Tunnel State**: IPsec tunnel state.
- **MTU**: Maximum transmission unit—size of the largest IP datagram that can be transferred through a specific link.
- **Packet Received**: Number of packets received.
- **Packets Sent**: Number of packets Sent.
- **Packet Dropped**: Number of packets dropped, because of network congestion.
- **Bytes Dropped**: Number of bytes dropped.
- **Expand/Collapse**: You can expand or collapse the data as needed.

Real time statistics

You can also get the following real time statistics information under **Troubleshooting > Statistics**:

- Address Resolution Protocol (ARP)
- Routes

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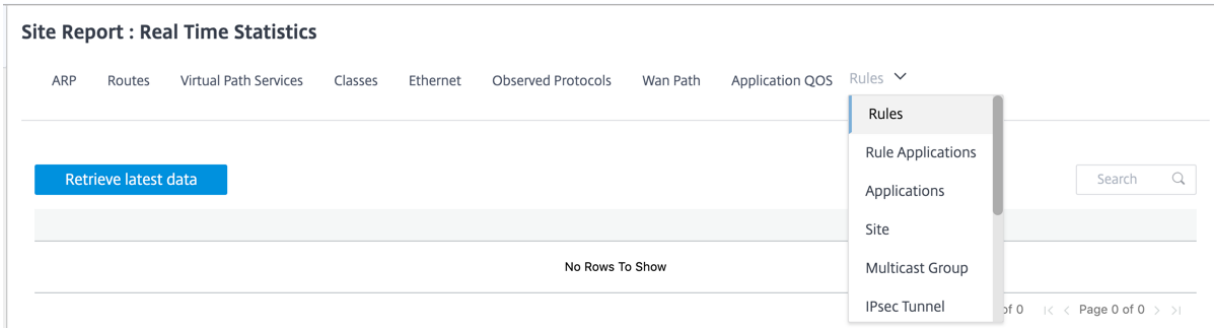
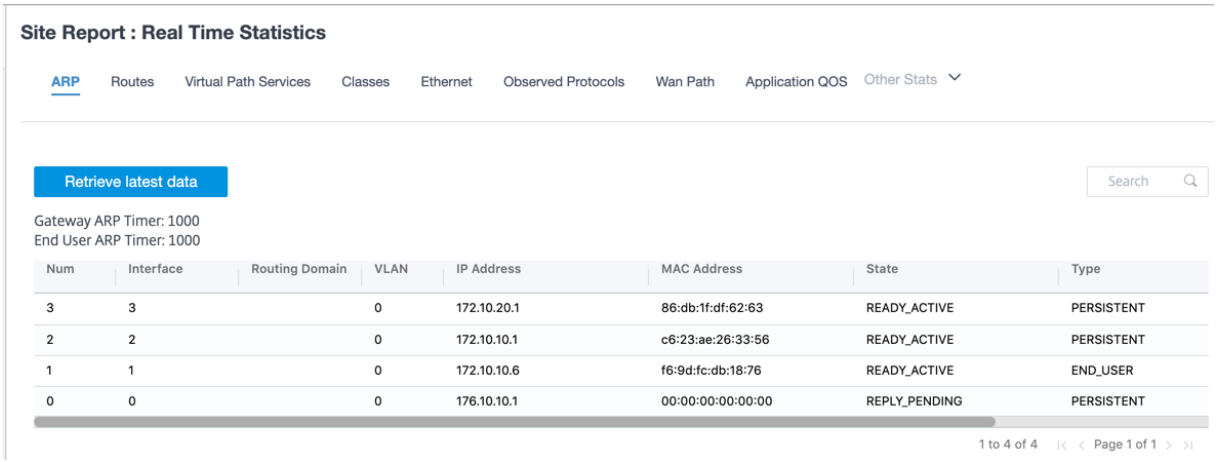
- Virtual Path Services
- Classes
- Ethernet
- Observed Protocols
- WAN Path
- Application QoS
- Other Statistics (Rules, Rule Applications, Applications, Site, Multicast Group, IPsec Tunnel, GRE Tunnel, WAN Link Usage, Intranet, Access Interfaces, WAN Links, and MPLS Queues)



Address Resolution Protocol

To view ARP statistics, navigate to **Reports > Real Time > ARP** tab.

Click **Retrieve latest data** to get the current data.



Routes

To view Route statistics, navigate to **Reports > Real Time > Routes** tab.

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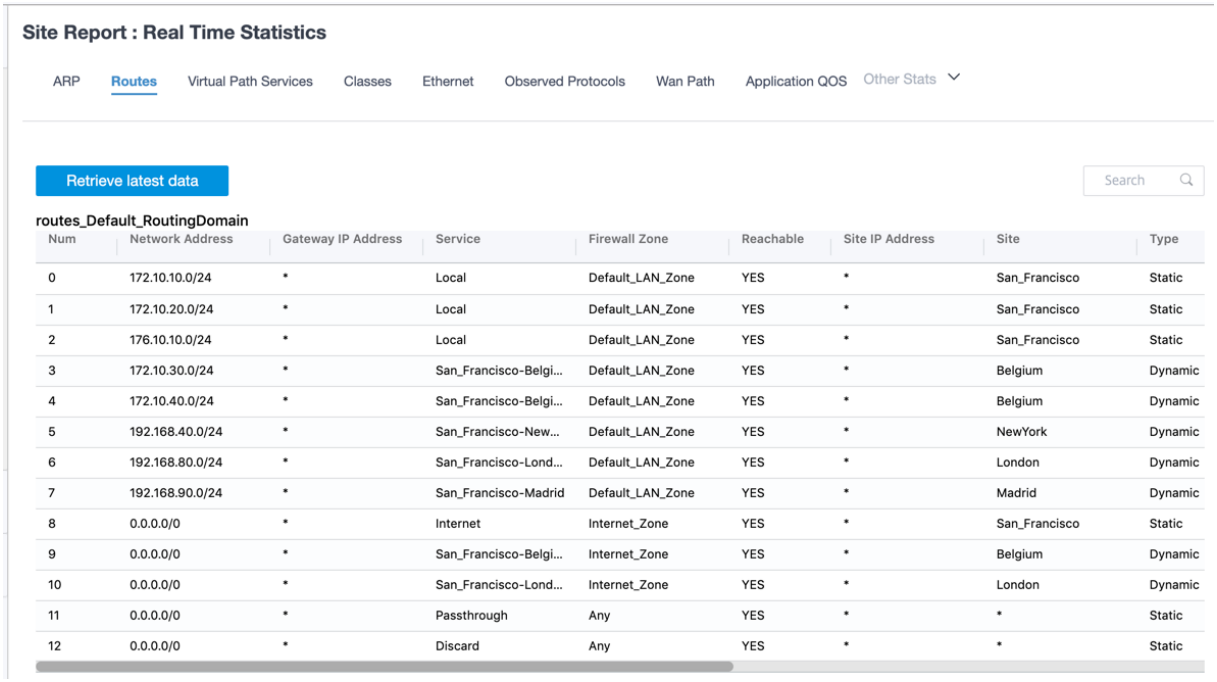
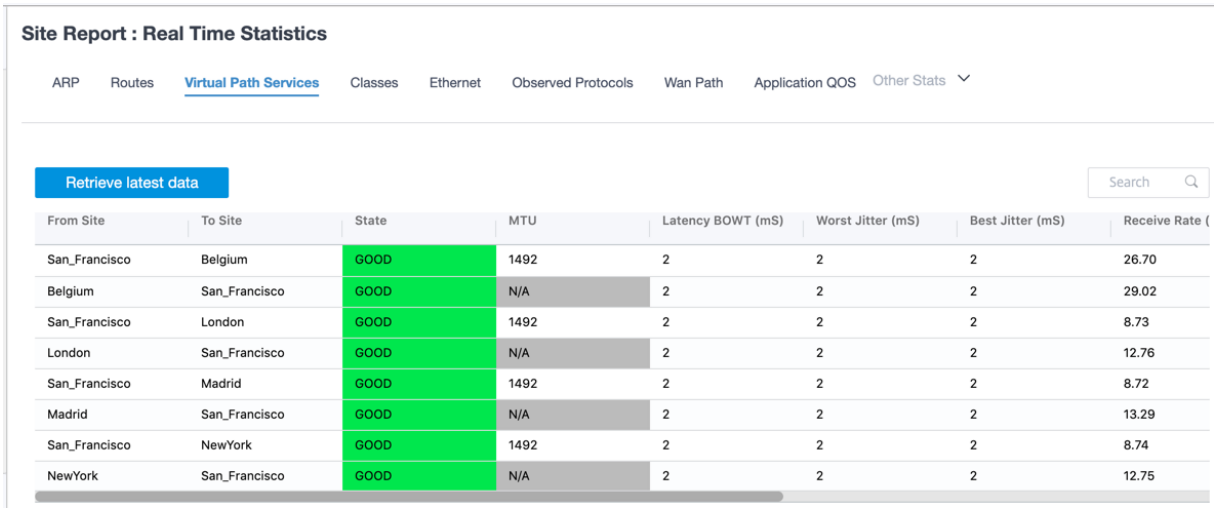


Num	Network Address	Gateway IP Address	Service	Firewall Zone	Reachable	Site IP Address	Site	Type
0	172.10.10.0/24	*	Local	Default_LAN_Zone	YES	*	San_Francisco	Static
1	172.10.20.0/24	*	Local	Default_LAN_Zone	YES	*	San_Francisco	Static
2	176.10.10.0/24	*	Local	Default_LAN_Zone	YES	*	San_Francisco	Static
3	172.10.30.0/24	*	San_Francisco-Belgi...	Default_LAN_Zone	YES	*	Belgium	Dynamic
4	172.10.40.0/24	*	San_Francisco-Belgi...	Default_LAN_Zone	YES	*	Belgium	Dynamic
5	192.168.40.0/24	*	San_Francisco-New...	Default_LAN_Zone	YES	*	NewYork	Dynamic
6	192.168.80.0/24	*	San_Francisco-Lond...	Default_LAN_Zone	YES	*	London	Dynamic
7	192.168.90.0/24	*	San_Francisco-Madrid	Default_LAN_Zone	YES	*	Madrid	Dynamic
8	0.0.0.0/0	*	Internet	Internet_Zone	YES	*	San_Francisco	Static
9	0.0.0.0/0	*	San_Francisco-Belgi...	Internet_Zone	YES	*	Belgium	Dynamic
10	0.0.0.0/0	*	San_Francisco-Lond...	Internet_Zone	YES	*	London	Dynamic
11	0.0.0.0/0	*	Passthrough	Any	YES	*	*	Static
12	0.0.0.0/0	*	Discard	Any	YES	*	*	Static

Virtual Path Services

To view virtual path service statistics, navigate to **Reports > Real Time > Virtual Path Services** tab.



From Site	To Site	State	MTU	Latency BOWT (mS)	Worst Jitter (mS)	Best Jitter (mS)	Receive Rate (
San_Francisco	Belgium	GOOD	1492	2	2	2	26.70
Belgium	San_Francisco	GOOD	N/A	2	2	2	29.02
San_Francisco	London	GOOD	1492	2	2	2	8.73
London	San_Francisco	GOOD	N/A	2	2	2	12.76
San_Francisco	Madrid	GOOD	1492	2	2	2	8.72
Madrid	San_Francisco	GOOD	N/A	2	2	2	13.29
San_Francisco	NewYork	GOOD	1492	2	2	2	8.74
NewYork	San_Francisco	GOOD	N/A	2	2	2	12.75

Classes

To view Class statistics, navigate to **Reports > Real Time > Classes** tab.

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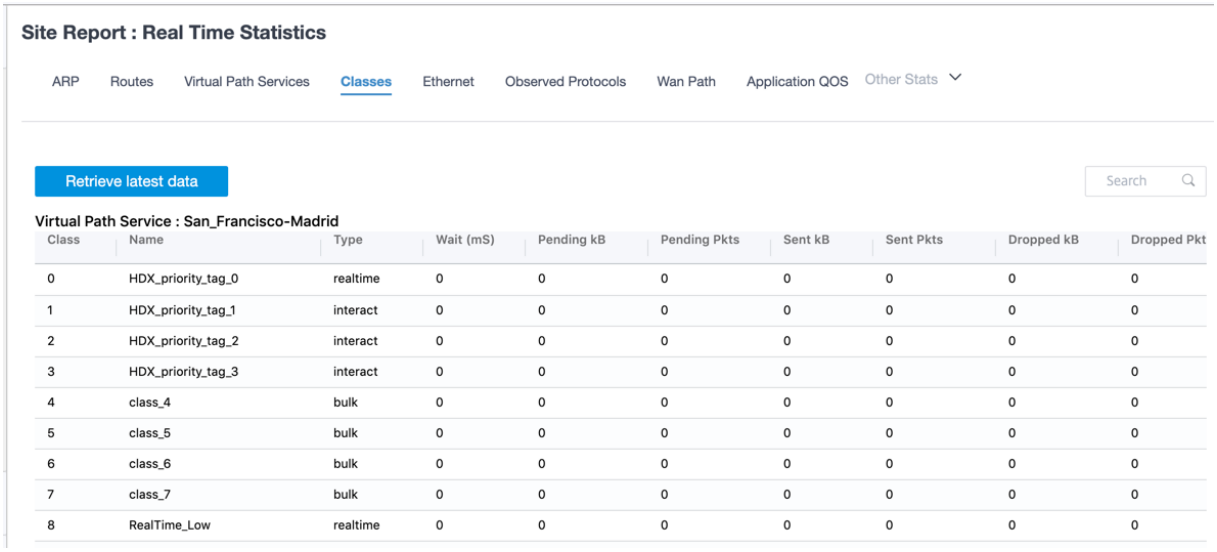
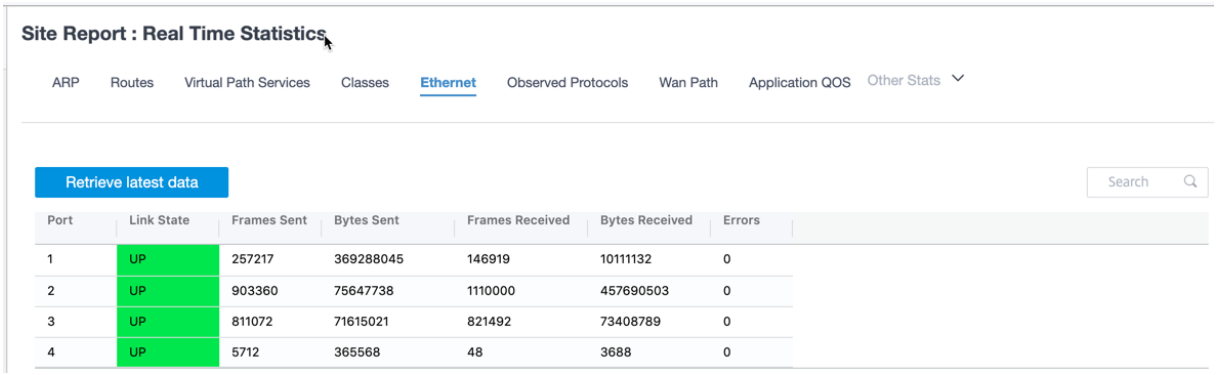


Class	Name	Type	Wait (mS)	Pending kB	Pending Pkts	Sent kB	Sent Pkts	Dropped kB	Dropped Pkt
0	HDX_priority_tag_0	realtime	0	0	0	0	0	0	0
1	HDX_priority_tag_1	interact	0	0	0	0	0	0	0
2	HDX_priority_tag_2	interact	0	0	0	0	0	0	0
3	HDX_priority_tag_3	interact	0	0	0	0	0	0	0
4	class_4	bulk	0	0	0	0	0	0	0
5	class_5	bulk	0	0	0	0	0	0	0
6	class_6	bulk	0	0	0	0	0	0	0
7	class_7	bulk	0	0	0	0	0	0	0
8	RealTime_Low	realtime	0	0	0	0	0	0	0

Ethernet

To view Ethernet statistics, navigate to **Reports > Real Time > Ethernet** tab.



Port	Link State	Frames Sent	Bytes Sent	Frames Received	Bytes Received	Errors
1	UP	257217	369288045	146919	10111132	0
2	UP	903360	75647738	1110000	457690503	0
3	UP	811072	71615021	821492	73408789	0
4	UP	5712	365568	48	3688	0

Observed Protocols

To view observed protocol statistics, navigate to **Reports > Real Time > Observed Protocols** tab.

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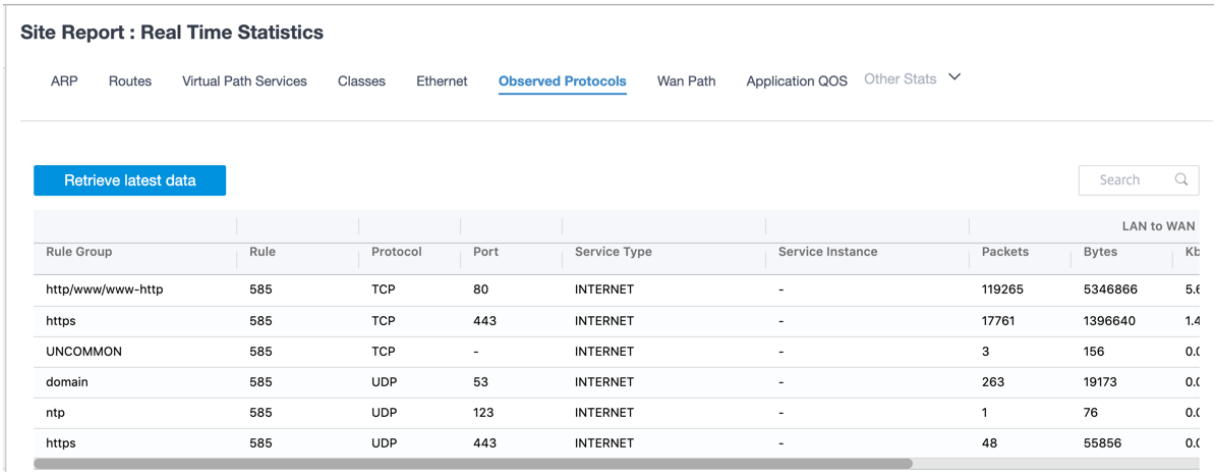
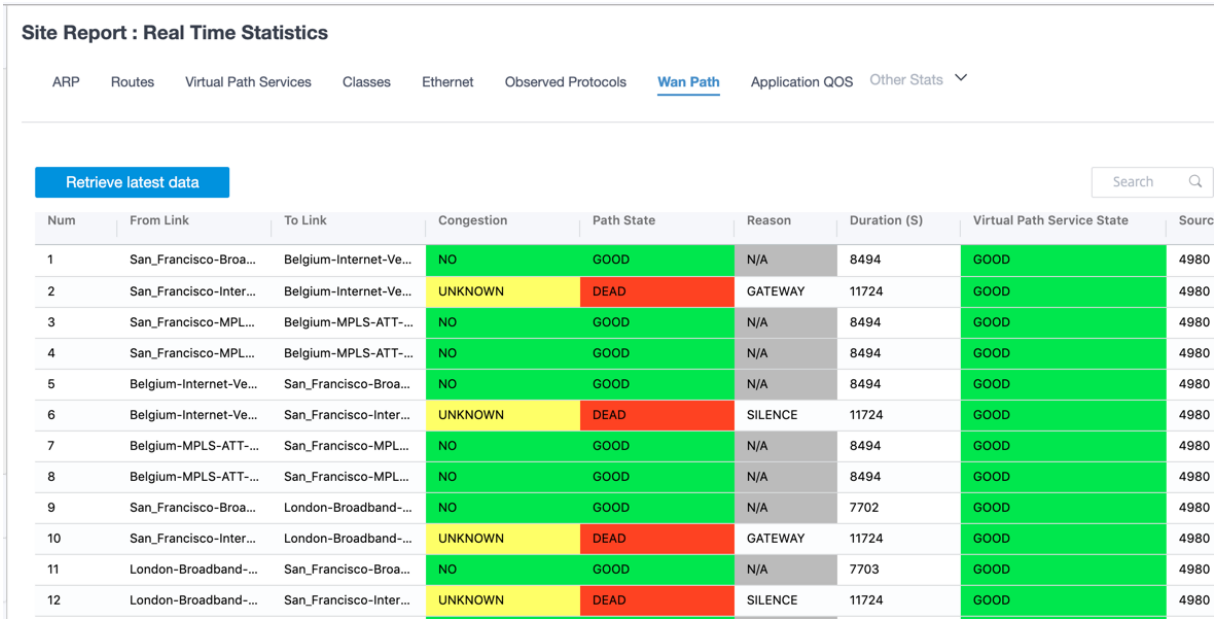


Rule Group	Rule	Protocol	Port	Service Type	Service Instance	Packets	Bytes	Kb
http/www/www-http	585	TCP	80	INTERNET	-	119265	5346866	5.6
https	585	TCP	443	INTERNET	-	17761	1396640	1.4
UNCOMMON	585	TCP	-	INTERNET	-	3	156	0.0
domain	585	UDP	53	INTERNET	-	263	19173	0.0
ntp	585	UDP	123	INTERNET	-	1	76	0.0
https	585	UDP	443	INTERNET	-	48	55856	0.0

WAN Path

To view WAN path statistics, navigate to **Reports > Real Time > WAN Path** tab.



Num	From Link	To Link	Congestion	Path State	Reason	Duration (S)	Virtual Path Service State	Sourc
1	San_Francisco-Broa...	Belgium-Internet-Ve...	NO	GOOD	N/A	8494	GOOD	4980
2	San_Francisco-Inter...	Belgium-Internet-Ve...	UNKNOWN	DEAD	GATEWAY	11724	GOOD	4980
3	San_Francisco-MPL...	Belgium-MPLS-ATT-...	NO	GOOD	N/A	8494	GOOD	4980
4	San_Francisco-MPL...	Belgium-MPLS-ATT-...	NO	GOOD	N/A	8494	GOOD	4980
5	Belgium-Internet-Ve...	San_Francisco-Broa...	NO	GOOD	N/A	8494	GOOD	4980
6	Belgium-Internet-Ve...	San_Francisco-Inter...	UNKNOWN	DEAD	SILENCE	11724	GOOD	4980
7	Belgium-MPLS-ATT-...	San_Francisco-MPL...	NO	GOOD	N/A	8494	GOOD	4980
8	Belgium-MPLS-ATT-...	San_Francisco-MPL...	NO	GOOD	N/A	8494	GOOD	4980
9	San_Francisco-Broa...	London-Broadband-...	NO	GOOD	N/A	7702	GOOD	4980
10	San_Francisco-Inter...	London-Broadband-...	UNKNOWN	DEAD	GATEWAY	11724	GOOD	4980
11	London-Broadband-...	San_Francisco-Broa...	NO	GOOD	N/A	7703	GOOD	4980
12	London-Broadband-...	San_Francisco-Inter...	UNKNOWN	DEAD	SILENCE	11724	GOOD	4980

Application QoS

To view application QoS statistics, navigate to **Reports > Real Time > Application QoS** tab.

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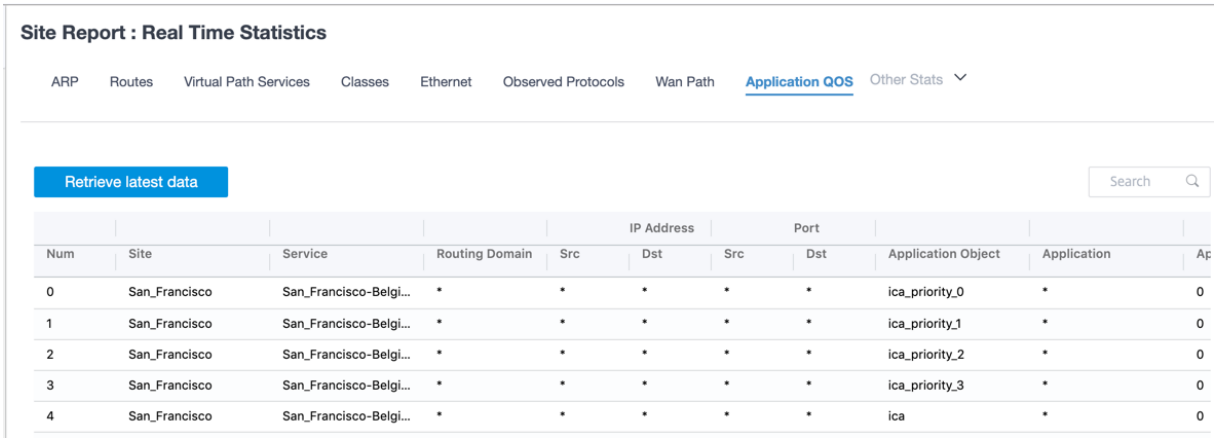


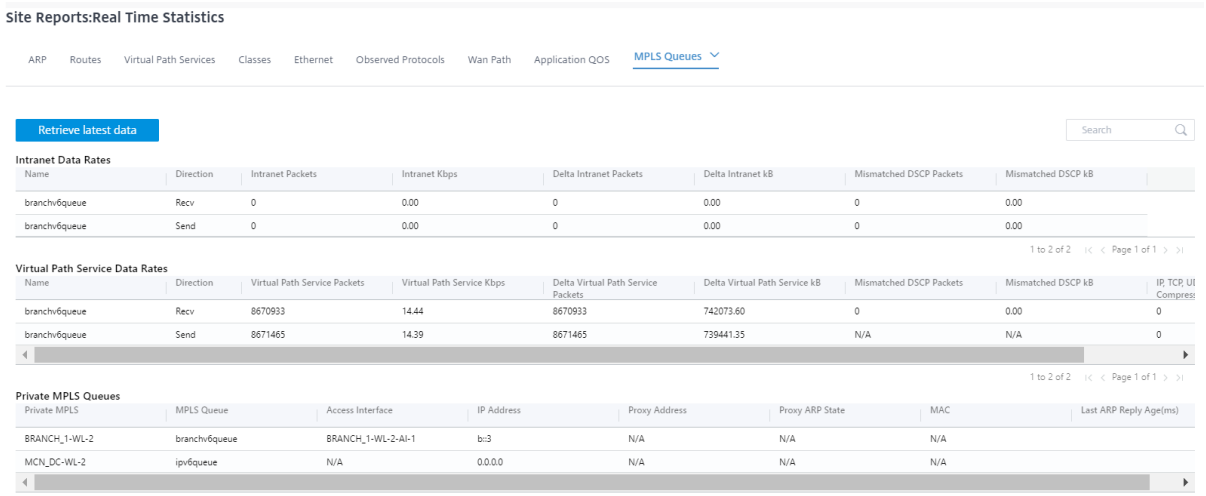
You can select other statistics as needed from the drop-down list and view the statistics.

MPLS Queues

MPLS queues allow you to define the queues corresponding to the Service Provider MPLS queues, on the MPLS WAN Links. For information on configuring MPLS queues, see MPLS Queues.

To view MPLS Queue statistics, at the site level, navigate to **Reports** > **Real Time** > **Statistics**. Click **Other Stats**, select **MPLS Queues**, and click **Retrieve latest data**. The latest MPLS queues data is retrieved from the appliance and is displayed in the SD-WAN Orchestrator.

You can view the direction, no of packets, delta packets, and mismatched DSCP packets for Intranet and Virtual path services.



For private MPLS Queues, you can view the following details:

- **Private MPLS**: The private MPLS WAN link.
- **MPLS Queue**: The MPLS queue associated with the MPLS WAN link.
- **Access Interface**: The access interface associated with the MPLS queue.
- **IP Address**: The IP address associated with the MPLS queue.

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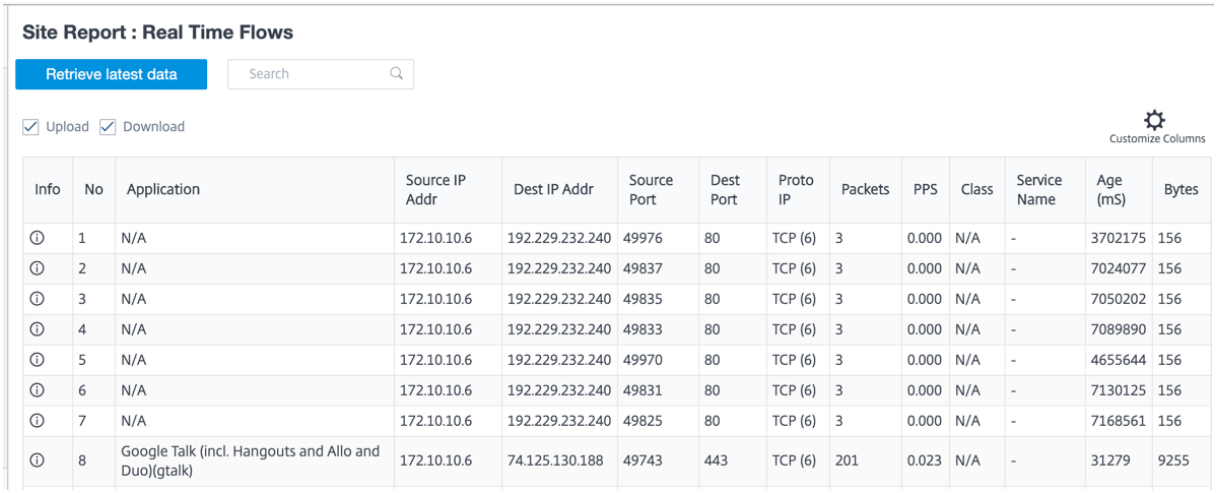
- **Proxy Address**: The proxy IP address associated with the MPLS queue.
- **Proxy ARP State**: The state of proxy address resolution protocol. Enabled, disabled, or N/A
- **MAC**: The MAC address of the interface associated with the MPLS queue.
- **Last ARP Reply age**: Time in milliseconds when the last ARP reply was received.

For more details on troubleshooting, see Troubleshooting MPLS queues.

Flows

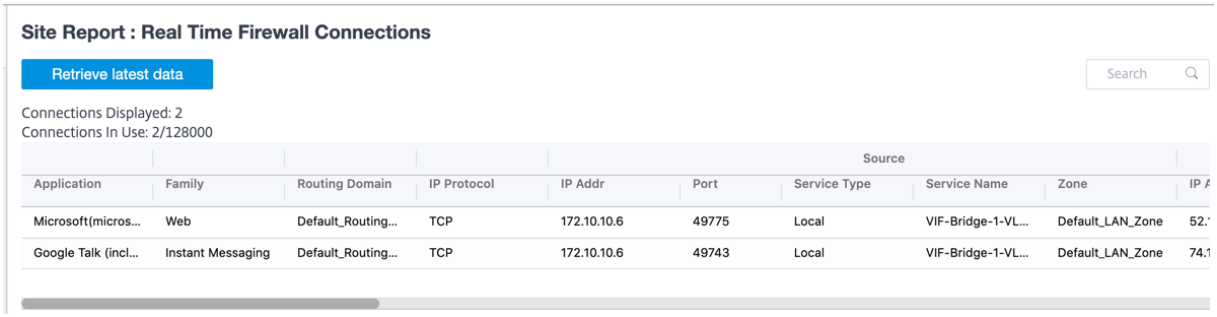
The **Flows** feature provides unidirectional flow information related to a particular session going through the appliance. This provides information on the destination service type the flow is falling into and also the information related to the rule and class type and also the transmission mode.



Info	No	Application	Source IP Addr	Dest IP Addr	Source Port	Dest Port	Proto IP	Packets	PPS	Class	Service Name	Age (mS)	Bytes
ⓘ	1	N/A	172.10.10.6	192.229.232.240	49976	80	TCP (6)	3	0.000	N/A	-	3702175	156
ⓘ	2	N/A	172.10.10.6	192.229.232.240	49837	80	TCP (6)	3	0.000	N/A	-	7024077	156
ⓘ	3	N/A	172.10.10.6	192.229.232.240	49835	80	TCP (6)	3	0.000	N/A	-	7050202	156
ⓘ	4	N/A	172.10.10.6	192.229.232.240	49833	80	TCP (6)	3	0.000	N/A	-	7089890	156
ⓘ	5	N/A	172.10.10.6	192.229.232.240	49970	80	TCP (6)	3	0.000	N/A	-	4655644	156
ⓘ	6	N/A	172.10.10.6	192.229.232.240	49831	80	TCP (6)	3	0.000	N/A	-	7130125	156
ⓘ	7	N/A	172.10.10.6	192.229.232.240	49825	80	TCP (6)	3	0.000	N/A	-	7168561	156
ⓘ	8	Google Talk (incl. Hangouts and Allo and Duo)(gtalk)	172.10.10.6	74.125.130.188	49743	443	TCP (6)	201	0.023	N/A	-	31279	9255

Firewall connections

The **Firewall connections** provide the state of the connection related to a particular session based on the firewall action configured. Firewall connections also provide complete details about the source and destination of the connection.



				Source					
Application	Family	Routing Domain	IP Protocol	IP Addr	Port	Service Type	Service Name	Zone	IP A
Microsoft(micros...	Web	Default_Routing...	TCP	172.10.10.6	49775	Local	VIF-Bridge-1-VL...	Default_LAN_Zone	52.
Google Talk (incl...	Instant Messaging	Default_Routing...	TCP	172.10.10.6	49743	Local	VIF-Bridge-1-VL...	Default_LAN_Zone	74.

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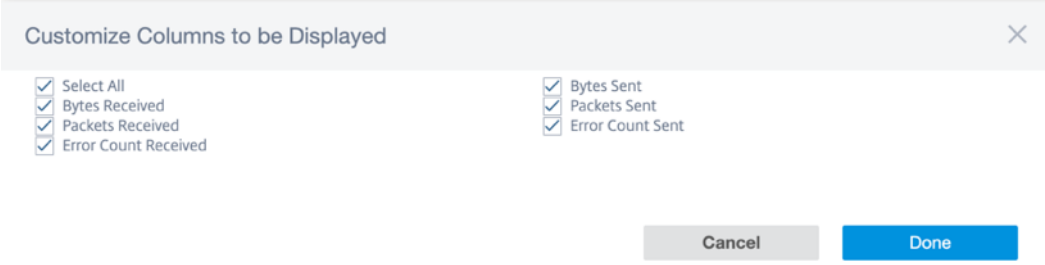
Appliance reports (Preview)

Appliance reports deliver the network traffic and system usage reports. Using this data you can troubleshoot network issues or analyze the behavior of your Citrix SD-WAN devices. You can see the following tabs under Appliance Reports page:

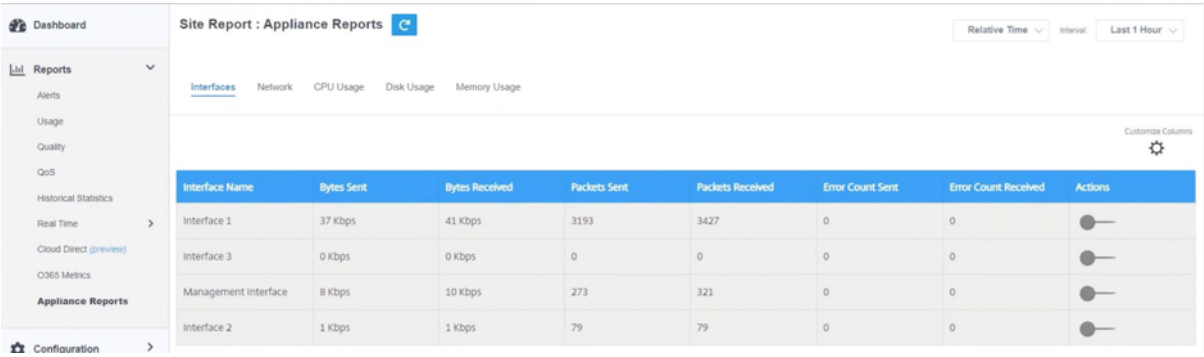
- Interface
- Network
- CPU Usage
- Disk Usage
- Memory Usage

Click each tab to view or monitor the appliance graph by hour, day, weekly, and monthly. You can toggle between Absolute and Relative time as required. The table columns are customizable. Click **Customize** column right top corner of the table and select/deselect the options that you want to display or hide in the table.



Interface

The **Interface** page shows the management interface errors/traffic. All the network is divided into different interface, such as Management Interface, Interface 1/2/3.



- **Interface Name** – Displays the interface name.
- **Bytes Sent** – Average number of bytes sent for the selected duration in Kbps.
- **Bytes Received** – Average number of bytes received for the selected duration in Kbps.
- **Packets Sent** – Average number of packets sent for the selected duration.

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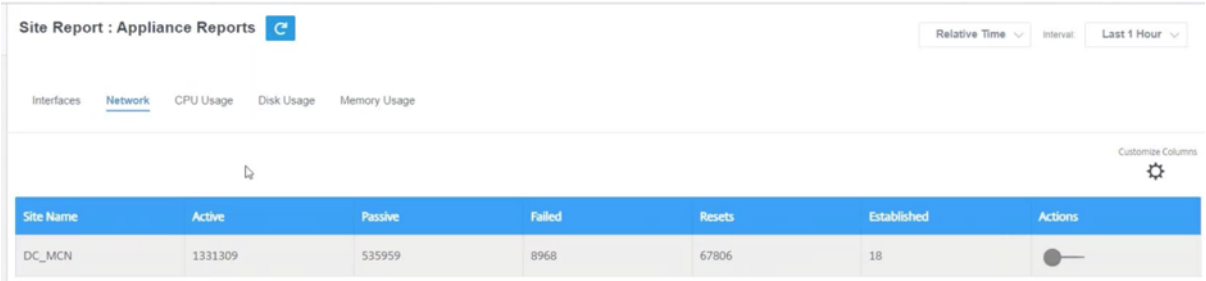
- **Packets Received** – Average number of packets received for the selected duration.
- **Error Count Sent** – Number of errors count sent for the selected duration.
- **Error Count Received** – Number of errors count received for the selected duration.
- **Actions** – You can switch on the action button to view the network graph.

Network

The **Network** page shows the number of TCP connections for each configured site.



- **Site Name** – Displays the site name.
- **Active** – Average number of active TCP connection counts for the selected duration.
- **Passive** – Average number of passive TCP connection counts for the selected duration.
- **Failed** – Average number of failed TCP connection counts for the selected duration.
- **Resets** – Average number of reset TCP connection counts for the selected duration.
- **Established** – Average number of established TCP connection counts for the selected duration.
- **Actions** – You can switch on the action button to view the network graph.

CPU usage

The **CPU Usage** page shows the CPU utilization of the SD-WAN device as a percentage. The CPU graph shows the average CPU consumption for the regular intervals over the selected time.

- **Site Name** – Displays the site name.
- **System** – Percentage of total time the CPU spent processing system-space programs.
- **Users** – Percentage of total time the CPU spent processing user-space programs.
- **Nice** – Nice is when the CPU is running a user task having below-normal priority.
- **Idle** – Percentage of total time the CPU was in Idle mode.

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- **Io Wait** – Percentage of total time the CPU spent waiting for I/O operations.
- **Irq** – The interrupt requests (IRQs) value that the kernel serves.
- **Steal** - When running in a virtualized environment, the hypervisor might steal cycles that are meant for your CPUs and give them to another, for various reasons. This time is known as steal.
- **Actions** – You can switch on the action button to view the network graph.

Disk usage

The **Disk Usage** page shows the amount of hard disk space used by the operating system and data partition in an I/O per second (IOPS) value.

- **Site Name** – Displays the site name.
- **Disk Name** – Displays the hard disk name.
- **Read IOPS** – Displays the average number of read IOPS per second over the selected time frame.
- **Write IOPS** – Displays the average number of write IOPS per second over the selected time frame.
- **Latency** – Displays the latency value of the successful read and write requests from the selected volume workload over the selected time frame. It is recommended that below 10 ms latency value is best for I/O performance.
- **Read Throughput** – Displays the average disk throughput value of the disk read operation over the selected time in Kbps.
- **Write Throughput** – Displays the average disk throughput value of the disk write operation over the selected time in Kbps.
- **Disk Utilization** – Displays the average disk utilization value in percentage over the selected time frame.
- **Actions** – You can switch on the action button to view the network graph.

Memory usage

The **Memory Usage** page shows the report of the amount of memory used.

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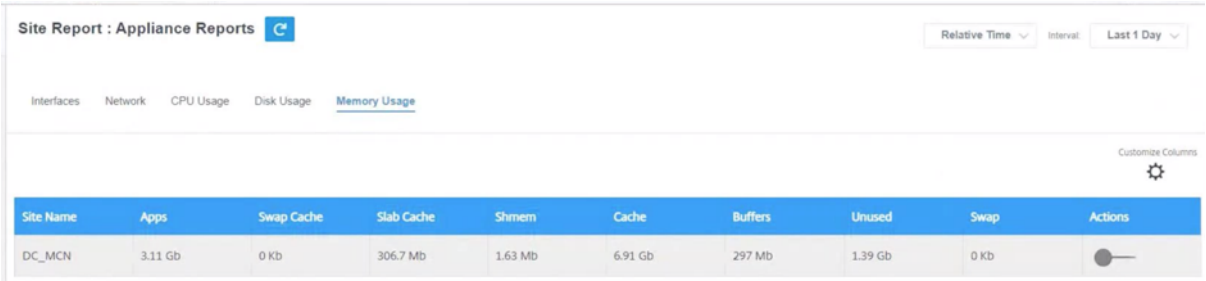
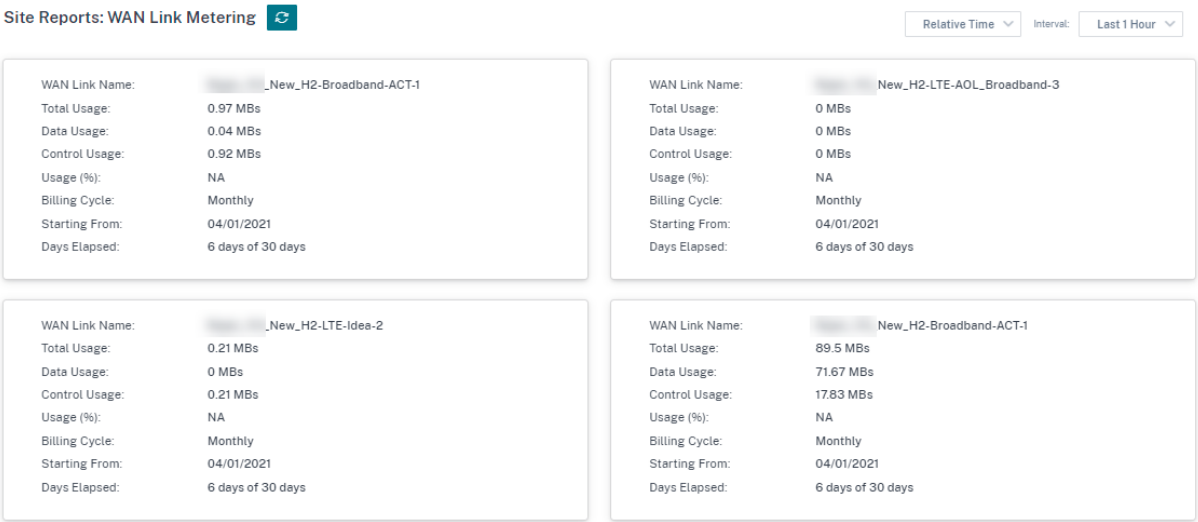


- **Site Name** – Displays the site name.
- **Apps** – Displays the used application value in Gb.
- **Swap Cache** – Displays the swap cache number in Mb. Swap cache is a list of page table entries with one entry per physical page.
- **Slab Cache** – Displays the number of pre-allocated slabs of memory. In Mb
- **Shmem** – Displays the total used shared memory value in Mb.
- **Cache** – Displays the number of cache memories used in Gb.
- **Buffers** – Displays the number of the physical memory that is used by the buffer cache.
- **Unused** – Displays the number of unused memories for cache.
- **Swap** – Displays the number of swap spaces. The swap space is used if you need some space extension for your physical memory.
- **Actions** – You can switch on the action button to view the network graph.

WAN Link Metering

WAN link metering reports provide details about the metered WAN link usage. You can view the reports to get insights into the data consumption of the metered WAN links. To view WAN link metering reports, navigate to **Reports > WAN Link Metering**.



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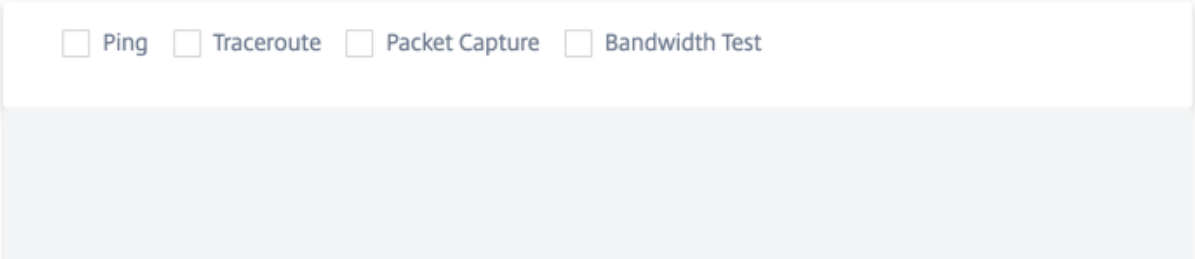
Diagnostics

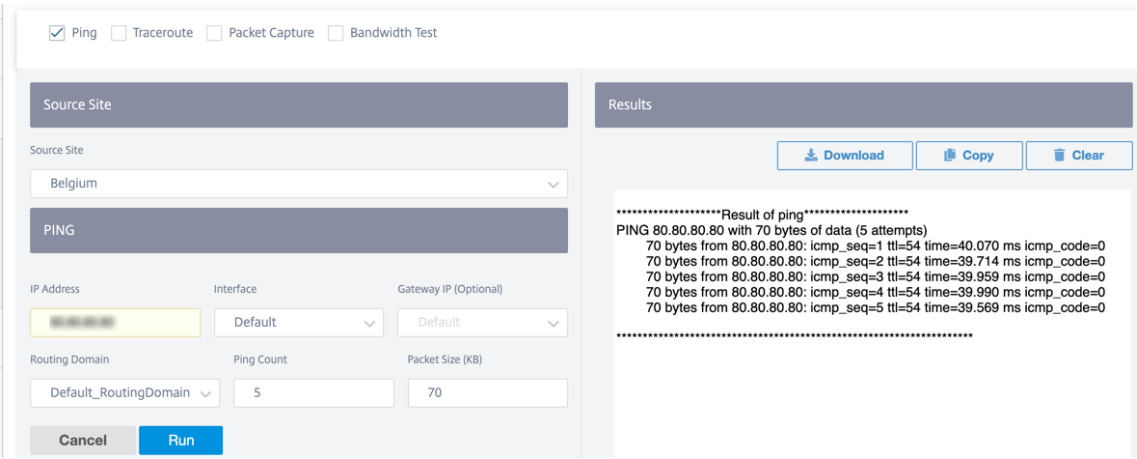
January 11, 2021

You can use Ping, Traceroute, Packet Capture, and Bandwidth test diagnostic utilities to test and investigate network connectivity issues on your SD-WAN network.

You can **Download**, **Copy**, and **Clear** the report results as needed.



- **Ping** – You can check network connectivity by pinging a remote host or a site. Enter the destination details, specify the number of times to send the ping request and the number of data bytes. Provide the destination **IP Address** and click **Run**.



- **Traceroute** - You can trace the route and the number of hops between sites. Select the source and destination site along with the path to trace and click **Run**.

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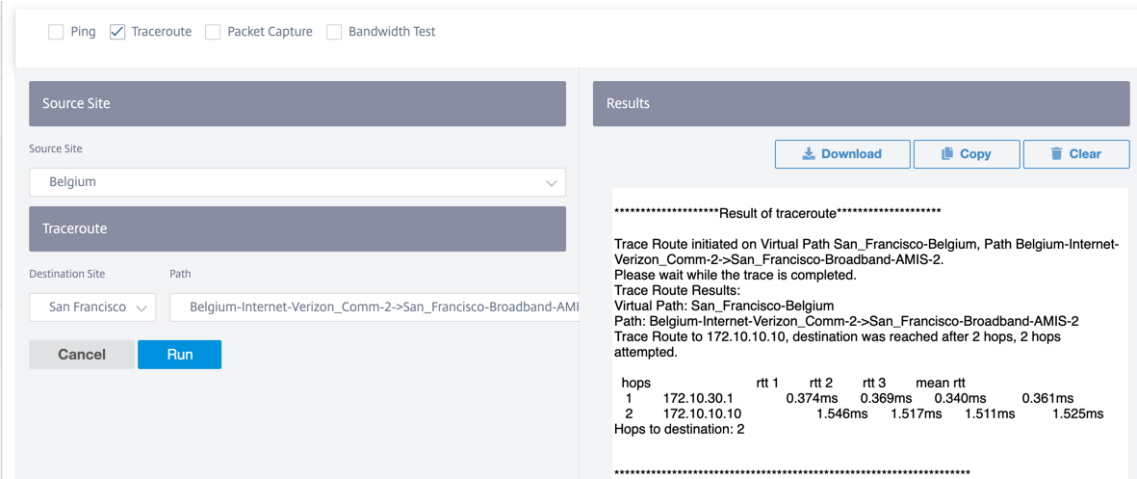
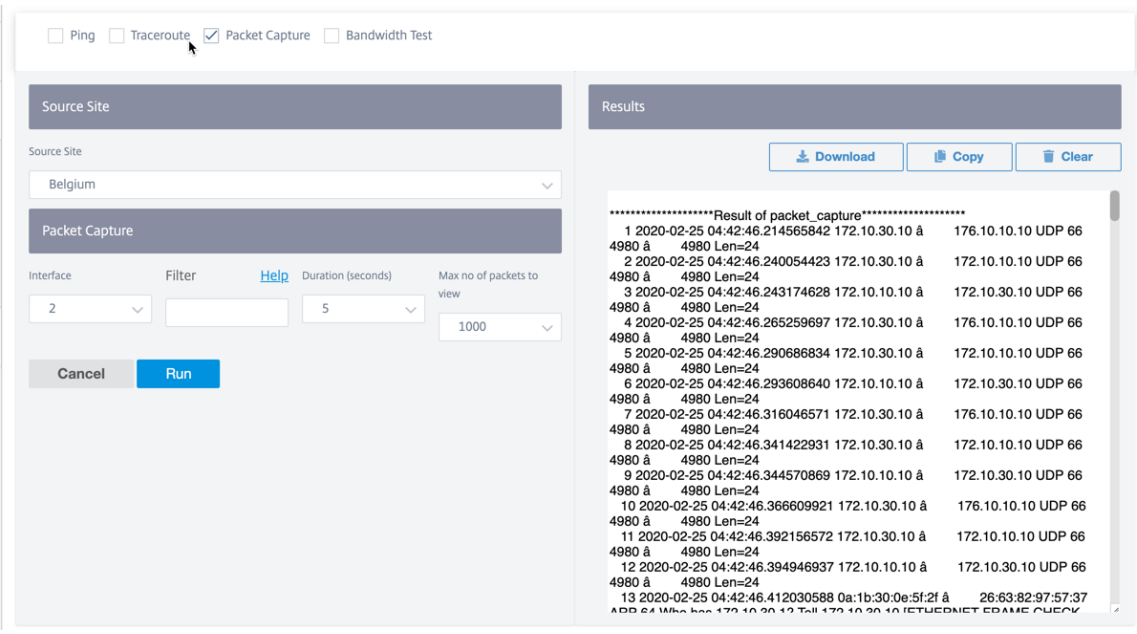


- **Packet Capture** – You can intercept the data packet that is traversing over the selected active interface present in the selected site. You can view the source and destination details.



The **Help** option provides more detail on the **Filter Options**.

- **Bandwidth Test** – You can run a bandwidth test on a specific path of a site to view the maximum, minimum and average bandwidth usage. Enter the source site, destination site, and select the path. Click **Run**.

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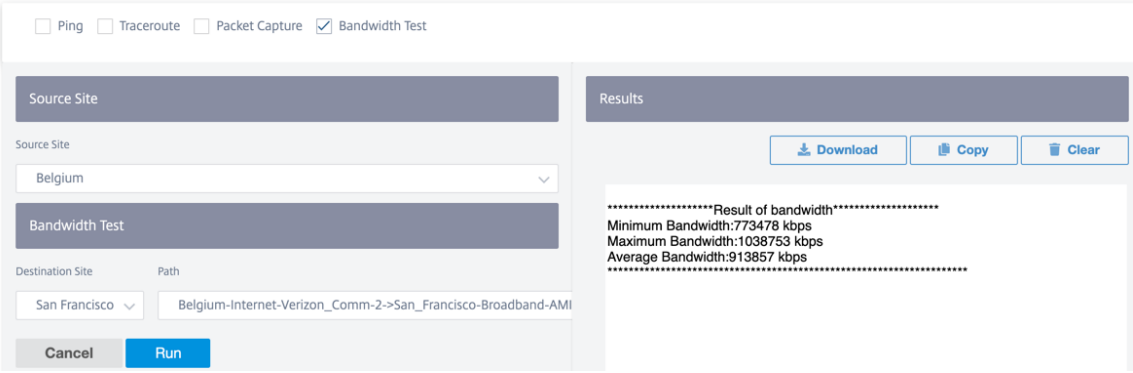


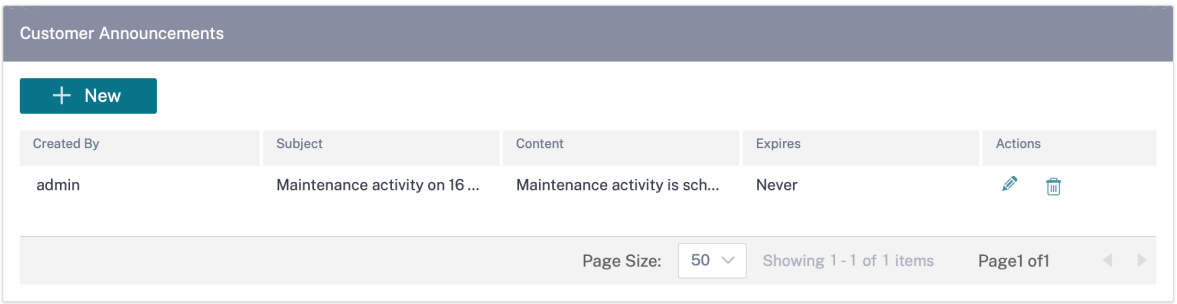
Announcements

May 17, 2021

Providers can use the **Announcements** option to send out announcements or notifications to their customers.

You can create a provider announcement by navigating to **Administration > Announcements** and clicking the **+ New** option.

Provider Administration: Announcements



Provide a subject line and enter content in HTML or plain text format. You can also set the announcement expiration.

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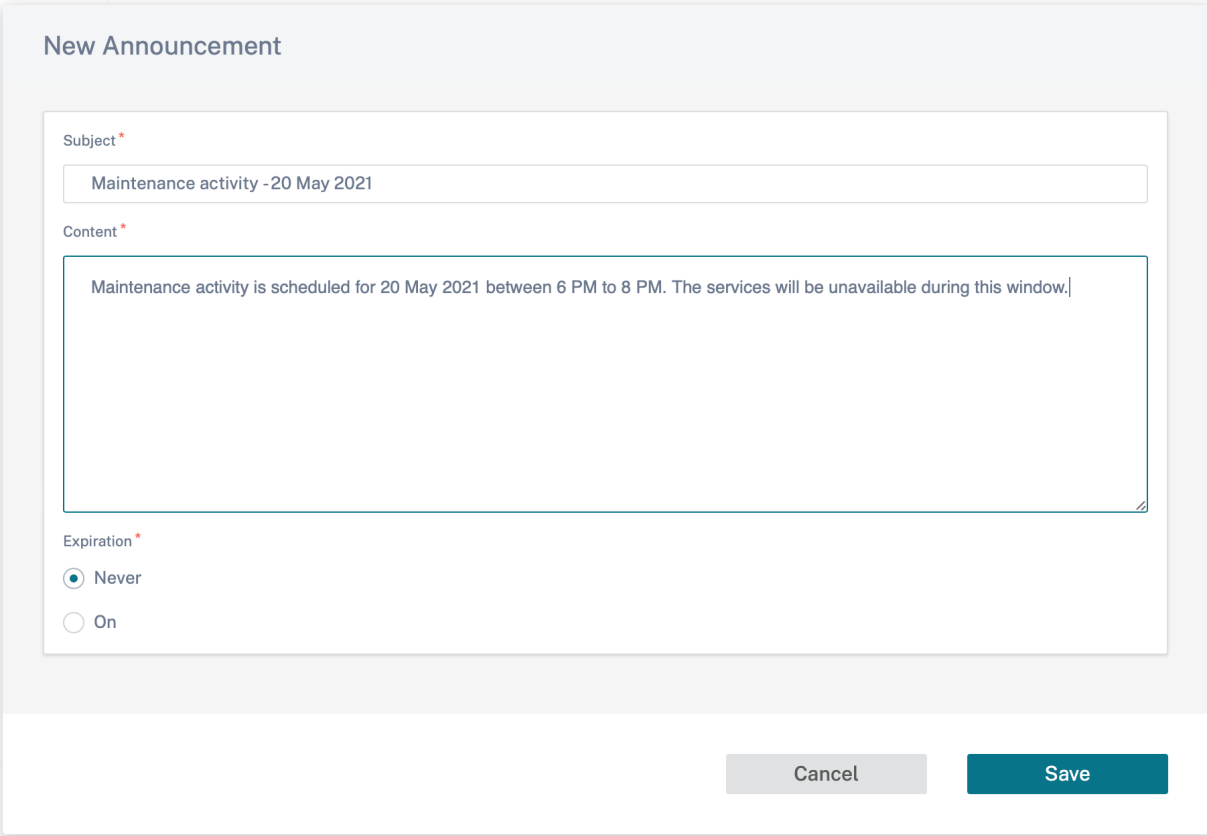
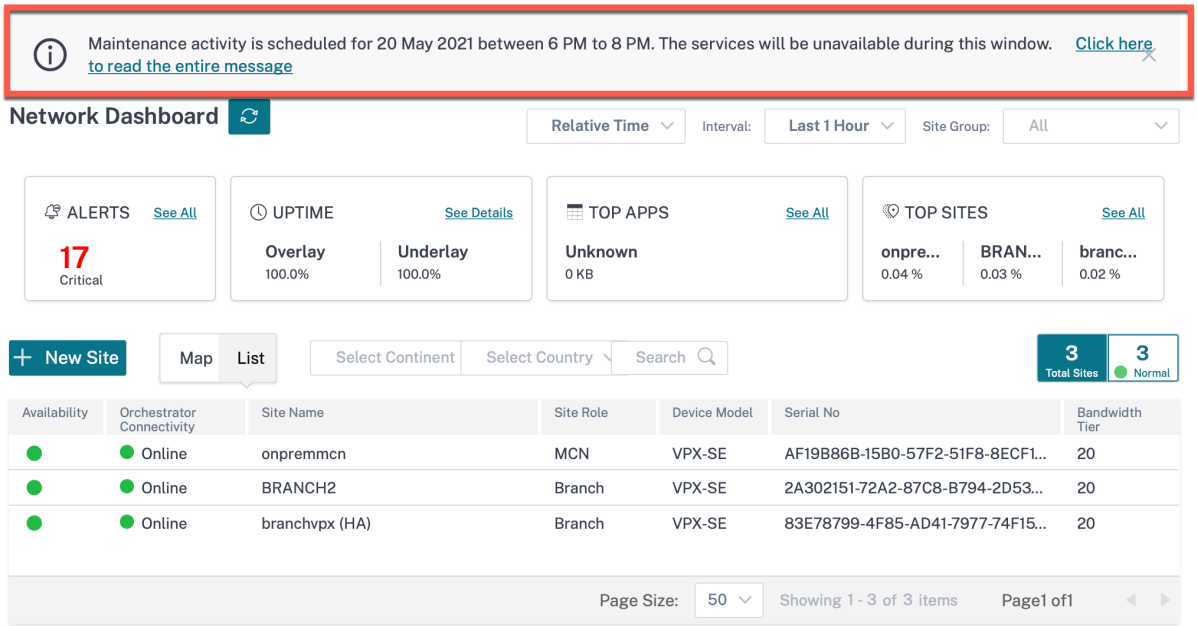


The saved announcements are displayed to all the customers.



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User administration

July 8, 2021

Citrix SD-WAN Orchestrator for On-premises supports role-based access control (RBAC). RBAC regulates access to SD-WAN Orchestrator resources based on the roles assigned to individual users. RBAC allows users to access only the data that their role demands and restricts any other data.

A role defines the permissions to view and perform various activities on Citrix SD-WAN Orchestrator for On-premises. You can assign a user with a role from the list of predefined roles.

By default, a user account is created on Citrix SD-WAN Orchestrator for On-premises with user name **admin** and password set as **password**. The user is asked to change the default password during initial login.

You can add users who can be authenticated locally and remotely. Users who are authenticated remotely are authenticated through RADIUS or TACACS+ authentication servers.

Provider roles

The following table lists the predefined provider roles.

Provider role	Description
Provider-Master-Admin-All	An administrator who can manage the provider and all of its customer information
Provider-Master-Admin-Tenant	An administrator who can manage the provider and a subset of its customer information
Provider-Master-ReadOnly-All	An administrator who can only view provider and customer information
Provider-Network-Admin (Preview)	An administrator who can only view and edit the network related information
Provider-Security-Admin (Preview)	An administrator who can only view and edit the security related information

The **Provider-Master-Admin-All** role can perform the following:

- Assign roles to users in Provider and Customer network
- Manage access to customers for all other admin roles
- Edit or delete assigned roles

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Customer roles

The following table lists the predefined customer roles:

Role	Description
Customer-Master-Admin	A customer administrator who can view and edit customer information
Customer-Master-ReadOnly-Admin	A customer administrator who can only view customer information
Customer-Network-Admin (Preview)	A customer administrator who can only view and edit network related information
Customer-Security-Admin (Preview)	A customer administrator who can only view and edit security related information

A user with **Customer-Master-Admin** role can perform the following:

- Add users and assign customer roles
- Edit or delete assigned roles

Support roles

For troubleshooting purposes, Customers can assign support roles and provide Support Team members the ability to view and edit their information. Support roles have a validity period that is defined while assigning the role. After the validity period expires, the support user loses access to Customer information. However, the support user details continue to appear under the **Administration > User Administration**. Based on the need, the Customer administrator can either delete or extend the validity of the support role.

Role	Description
Customer-Support-ReadWrite	A support team member who can view and edit the customer information
Customer-Support-ReadOnly	A support team member who can only view the customer information

Authentication types

Citrix SD-WAN Orchestrator for On-premises supports the following types of authentication:

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- **Single-factor authentication**: Single-factor authentication presents one authentication method to gain access to Citrix SD-WAN Orchestrator for On-premises for users.
- **Two-factor authentication (TFA)**: Two-factor authentication presents two authentication methods to gain access to Citrix SD-WAN Orchestrator for On-premises for users. It introduces an extra layer of security in the login sequence.

The following authentication methods are supported for single-factor and two-factor authentication:

- **Local**: When selected, the user must use the password configured on Citrix SD-WAN Orchestrator for On-premises to gain access.
- **RADIUS**: When selected, the user must use the RADIUS server password to gain access.
- **TACACS+**: When selected, the users must use the TACACS+ server password to gain access.

The following table lists the primary and secondary authentication methods supported for users who are authenticated locally:

	Primary Authentication Type	Secondary Authentication Type
Single-factor authentication	Local	-
Two-factor authentication	Local	RADIUS or TACACS+

The following table lists the primary and secondary authentication methods supported for users who are authenticated remotely:

	Primary Authentication Type	Secondary Authentication Type
Single-factor authentication	Local, RADIUS, or TACACS+	-
Two-factor authentication	Local, RADIUS, or TACACS+	RADIUS or TACACS+

If **Two-factor authentication** is enabled and the RADIUS/TACACS+ servers are configured as a secondary authentication type, then the **Secondary password** field is visible at the login page.

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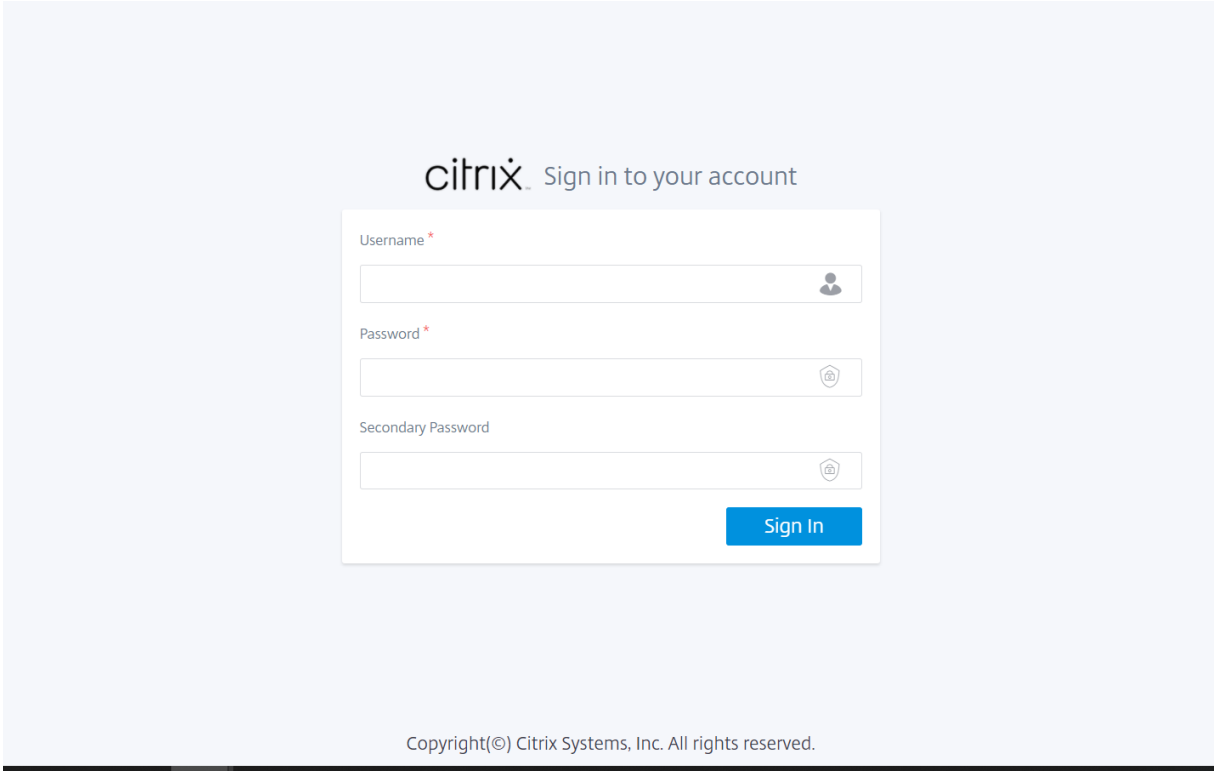

Add a user

Navigate to **Administration** > **User Administration** > click **+ New** > Enter the following details > click **Add**.

- Enter the user name.
- **Single factor authentication**: Enables only the primary authentication for logging in the users.
- **Two factor authentication**: Enables both primary and secondary authentication for logging in the users. For more information, see Remote Authentication Servers.
- **Primary Authentication Type**: Select Local or the IP address of the remote authentication server.
- **Secondary Authentication Type**: Select the IP address of the remote authentication server.

  > **NOTE**
  >
  > The **Secondary Authentication Type** field is grayed out if Single factor authentication is chosen.

- **Role**: Select a role from the list of the available roles.
- **Deny access to Customers**: (Available only at the provider level). While adding users, providers can deny access to specific customers.

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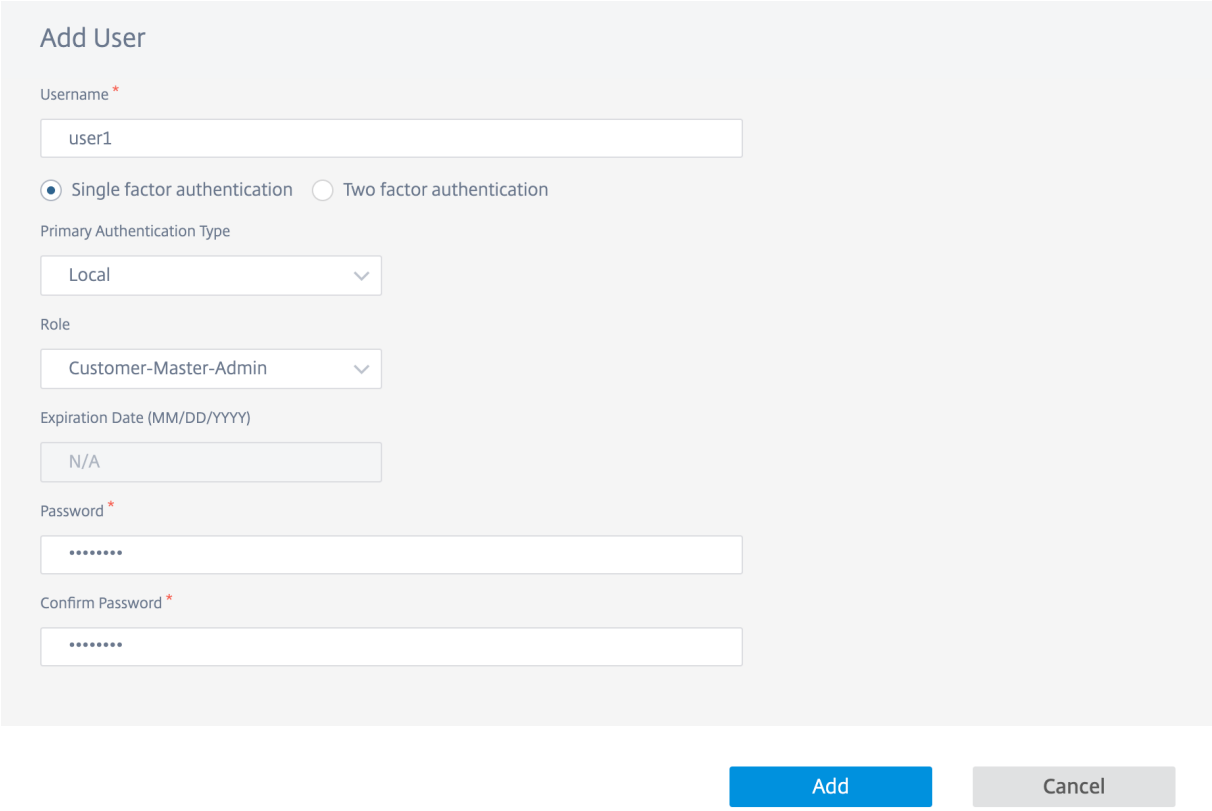
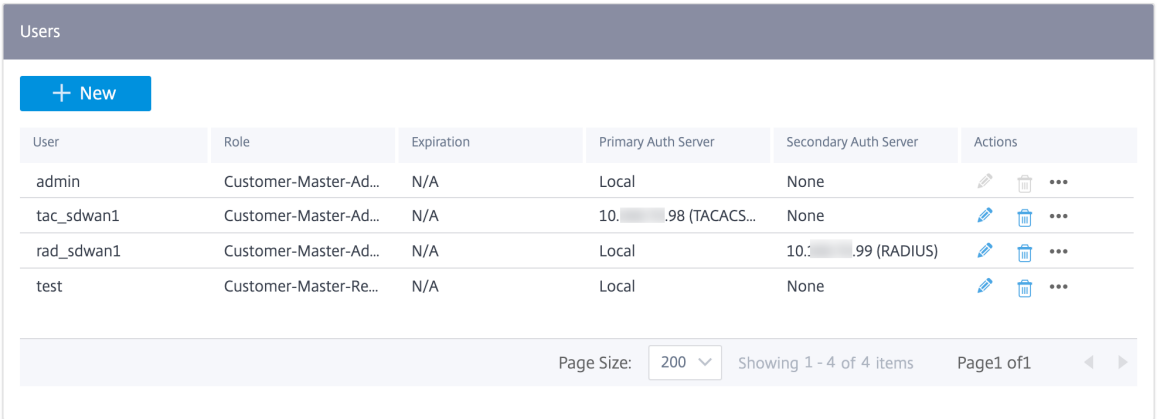
- **Expiration Date (MM/DD/YYYY)**: The date up to which the support user has access to customer information. The default validity period is for two weeks from the date the role is assigned.
- Enter your password. The length of the password must be between 8–128 characters.



Using the **Actions** column, you can change the user role, update the password, and edit the authentication type. You can also delete the user if necessary.

Network Administration: User Administration



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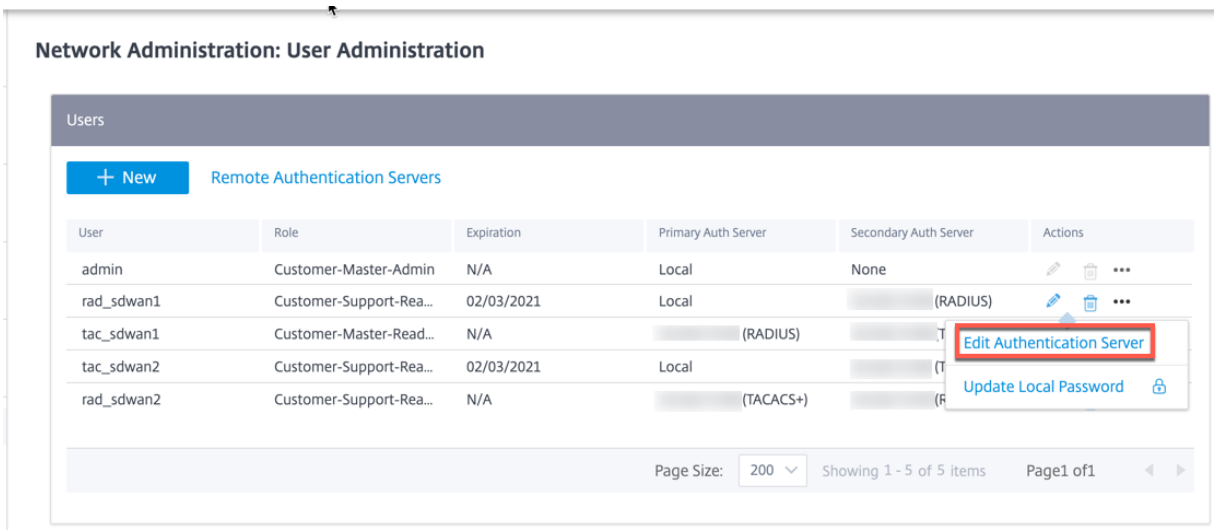
Limitation

Citrix SD-WAN Orchestrator for On-premises does not support duplication of user names for a different customer under the same provider. When this action is performed, you see the error message **Error while account creation**.

Change authentication type

You can change the authentication type of a user from single-factor authentication to two-factor authentication and conversely.

To change the authentication type of a user, in the **Actions** column, click **...** and then **Edit Authentication Server**.



If you have currently selected **Single factor authentication**, you can switch to two-factor authentication. Click **Two factor authentication** and select the remote server from **Secondary Authentication Type** drop-down list. Click **Apply**.

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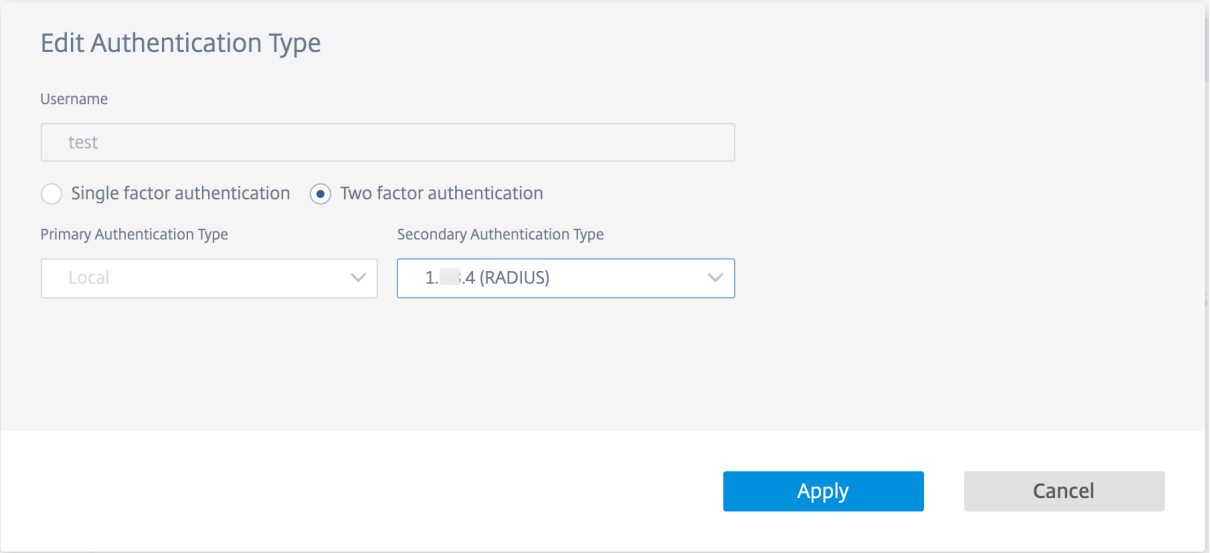

If you have currently selected two factor authentication, you can choose to change only the secondary authentication type or switch to single factor authentication.

To switch to single factor authentication, click **Single factor authentication**. The **Secondary Authentication Type** drop-down list gets disabled and only the **Primary Authentication type** drop-down list is enabled.

Primary Authentication Type can only be set at the time of user creation and it cannot be edited later.

Change password

You can change the password of local users. To change the password of a user, in the **Actions** column, click **...** and **Update Local Password**.

> **NOTE**
>
> You can modify the password only for local users. For users authenticated remotely, you must update the password on the external server.

Change user role

To change the user role, click the **Edit** icon in the **Actions** column. Select a **Role** and click **Apply**.

> **NOTE**
>
> You cannot edit the role of the default admin user.

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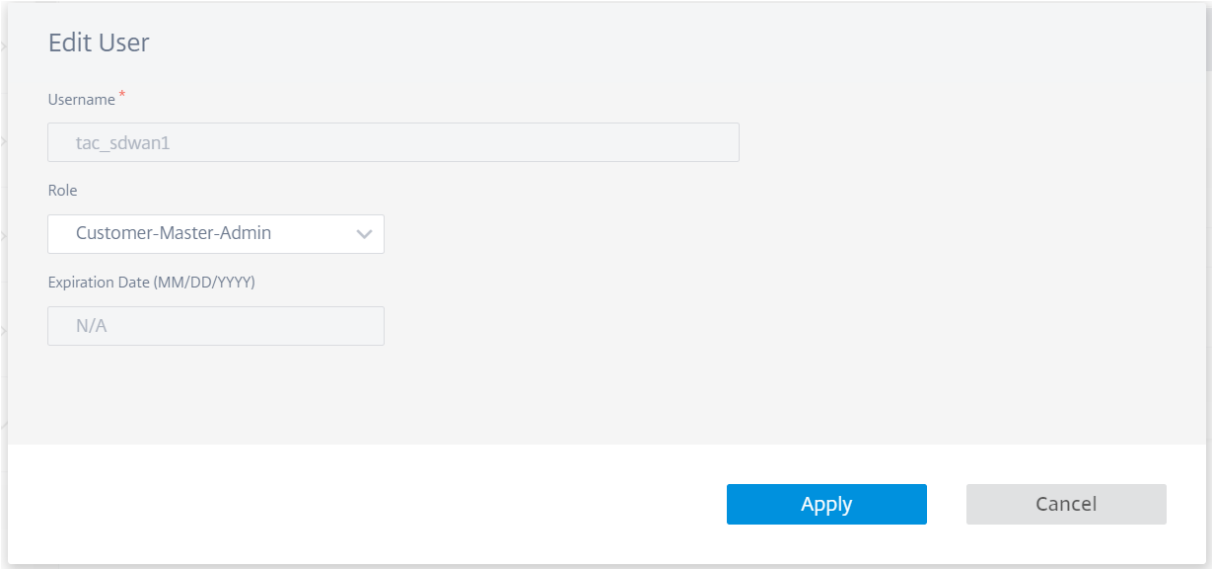

Domain name

July 9, 2021

The domain name is a vanity URL used in the address bar to access Citrix SD-WAN Orchestrator for On-premises. Using domain name makes it easier to remember and also allows you to use your company brand name.

To use a domain name ensure that you have a local DNS server configured with a DNS record linking the domain name to Citrix SD-WAN Orchestrator for On-premises management IP address. Ensure that the domain name is configured during early configuration. On setting up a domain name, Citrix SD-WAN Orchestrator for On-premises reboots and certificates are regenerated automatically. The same domain name must be configured on the individual appliances. For more details, see On-prem SD-WAN Orchestrator configuration on SD-WAN appliance.

It is not mandatory to configure a domain name. If you do not have a domain name and you still want to use DNS Server for IP address resolution, configure DNS records that point to Citrix SD-WAN Orchestrator for On-premises IP for the following three FQDNs:

- sdwanzt.citrixnetworkapi.net
- download.citrixnetworkapi.net
- sdwan-home.citrixnetworkapi.net

For example, if a Citrix SD-WAN Orchestrator for On-premises domain is configured as **citrix.com**,then you must create the DNS record in the DNS Server for the below FQDN and Citrix SD-WAN Orchestrator for On-premises IP address:

- download.citrix.com

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- sdwanzt.citrix.com
- sdwan-home.citrix.com

In advanced configuration:

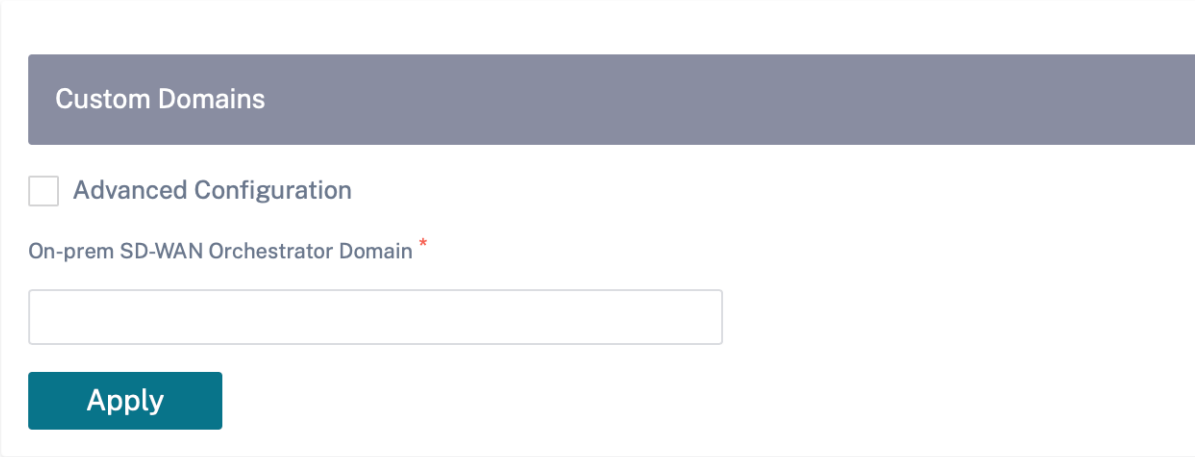
For Example: If a Citrix SD-WAN Orchestrator for On-premises domain is configured as **citrix.com**, **Download Management Service Domain** is configured as **download.citrix.com**, and the **Statistics Management Service Domain** is configured as **statistics.citrix.com**, then you must create the DNS record in the DNS Server for the below FQDN and corresponding IP Address:

- download.citrix.com
- sdwanzt.citrix.com
- statistics.citrix.com

Configuring or changing a domain name for an existing configuration affects Citrix SD-WAN Orchestrator for On-premises and appliance connectivity. You must manually perform the certificate authentication process or use the Site zero-touch deployment settings option.

> **Note**
>
> In a provider managed setup, only provider administrators have access to edit domain name related information.

To configure a domain name, at the network level, navigate to **Administration > Domain Name** and provide a Citrix SD-WAN Orchestrator for On-premises domain name.



HTTPS certificate

May 17, 2021

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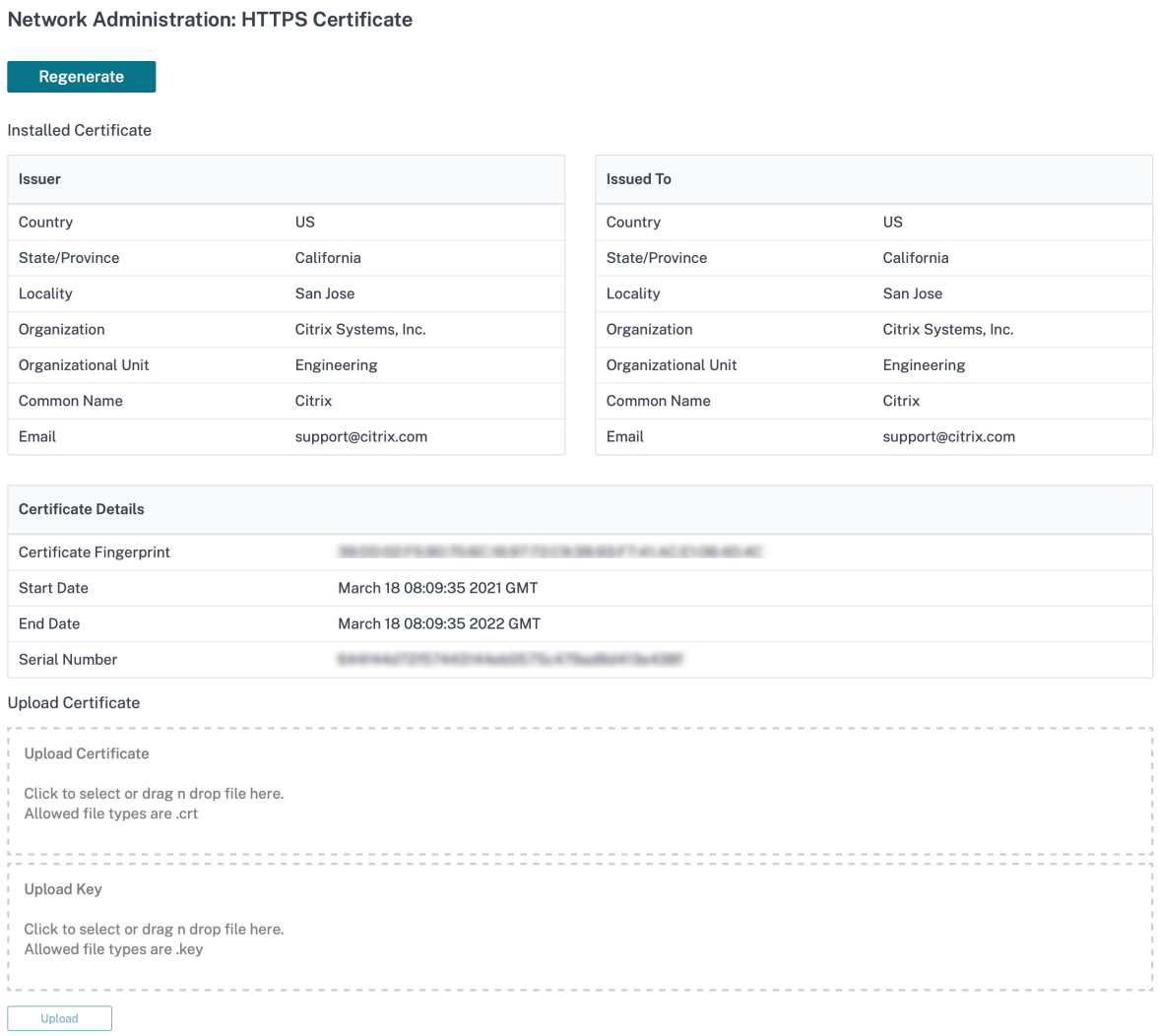
HTTPS certificate is required for establishing secure management HTTPS connection to Citrix SD-WAN Orchestrator for On-premises. You can use the default HTTPS certificate available on the Citrix SD-WAN Orchestrator for On-premises GUI or upload a custom HTTPS certificate generated from any other framework such as OpenSSL or from a trusted authority. Custom HTTPS certificate allows you to have control over the security and the other subject parameters related to the certificate.

To view the default certificate, navigate to **Administration > HTTPS Certificate**.

> **Note**
>
> In a provider managed setup, only provider administrators have access to regenerate and upload HTTPS certificate.



The **Installed Certificate** section provides a summary of the certificate that is installed on the appliance. The appliance uses this certificate to identify itself in the network.

The **Issued to** section provides details about who the certificate was issues to. The **Common Name** in

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the certificate matches with the name of the appliance, since the certificate is bound to the appliance name. The **Issuer** section provides the details of the certificate signing authority, who signed the certificate. The Certificate details include the fingerprint of the certificate, serial number, and the validity period for the certificate.

To regenerate the certificate, navigate to **Administration > HTTPS Certificate** and click **Regenerate**.

> **Note**
>
> Regenerating the certificate disconnects any existing connected HTTPS sessions and restarts the HTTPS server. After the certificate is successfully regenerated, the GUI gets refreshed automatically.

You can generate HTTPS certificates from any other framework such as OpenSSL or from a trusted authority and upload it on the Citrix SD-WAN Orchestrator for On-premises. Certificate format supported is .crt and key format supported is .key.

To upload a custom HTTPS certificate, click **Upload** or drag the certificate and key files in the **Upload Certificate** and **Upload Key** boxes respectively. After successful upload, the GUI gets refreshed automatically.

Disk space management

July 9, 2021

You can increase the disk space allocated for Citrix SD-WAN Orchestrator for On-premises.

Increase disk space on Citrix Hypervisor

To increase the disk space on Citrix Hypervisor.

1. Shut down the virtual machine (VM) from the hypervisor.
2. Select the virtual machine and click the **Storage** tab.

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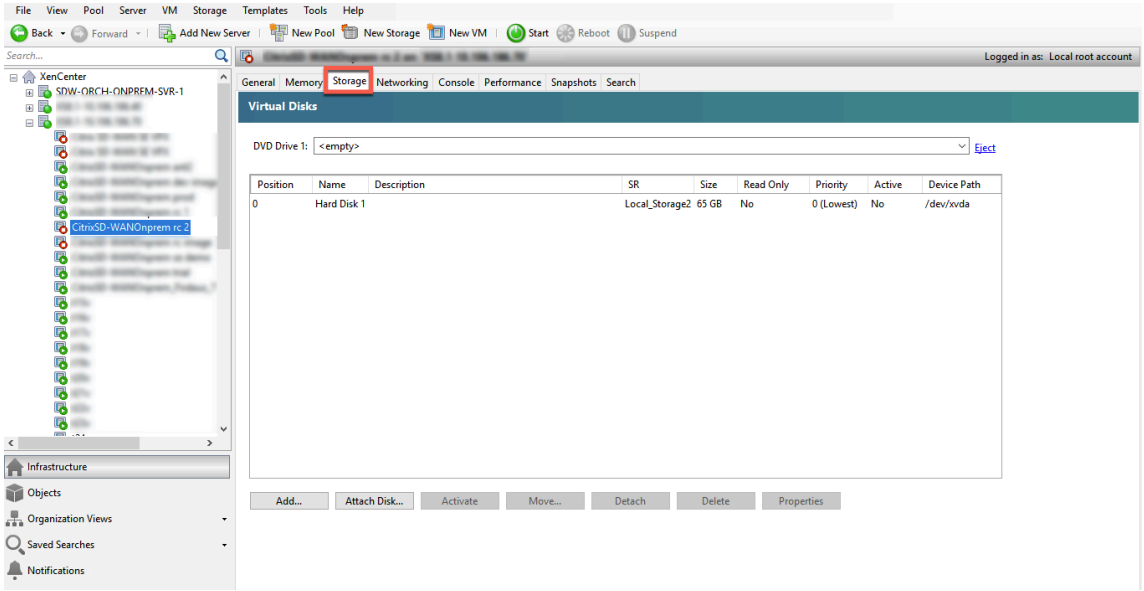
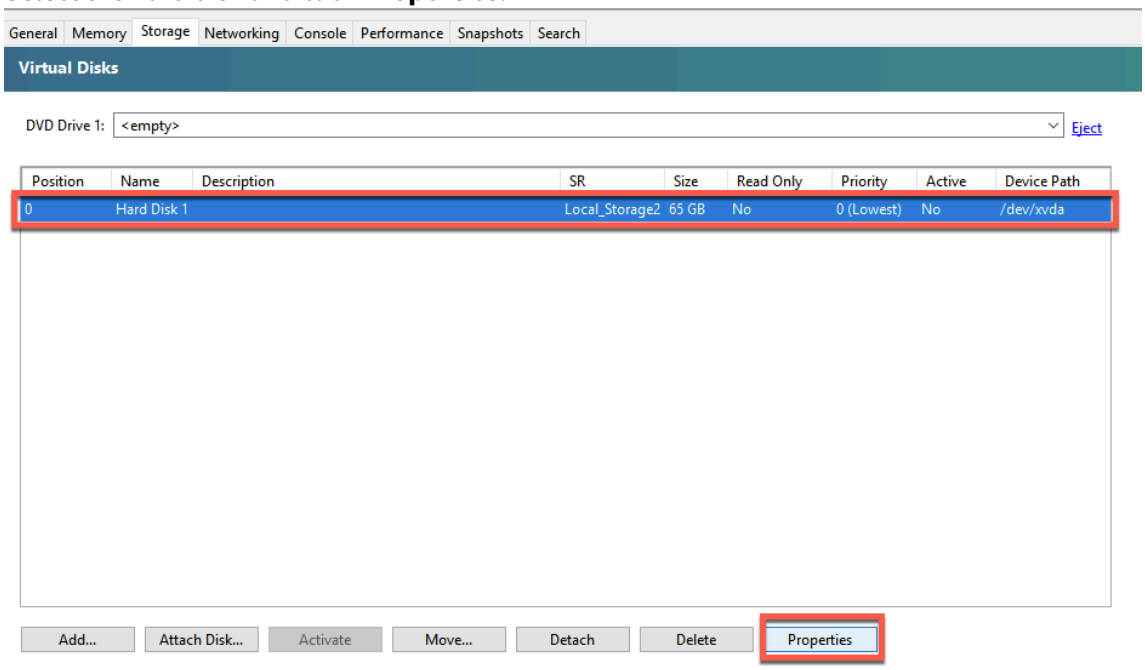


3. Select the hard disk and click **Properties**.



4. Click the **Size and Location** option and update the **Size** of your disk space. Click **OK**.

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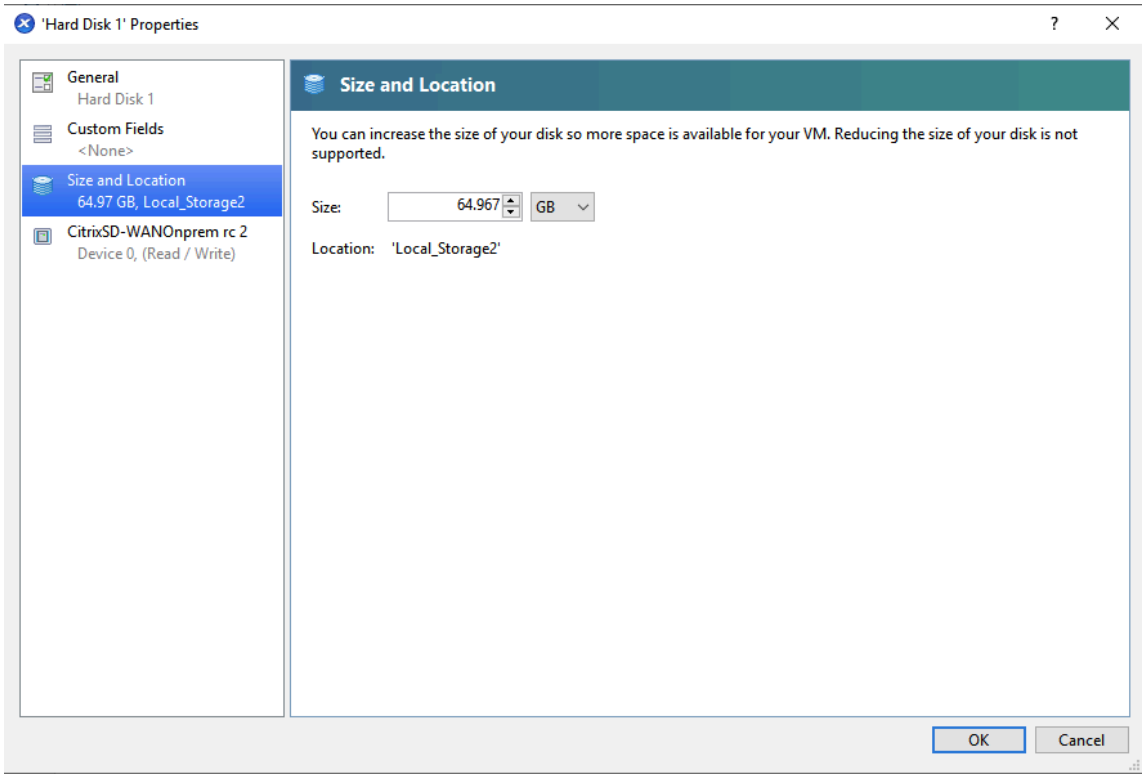
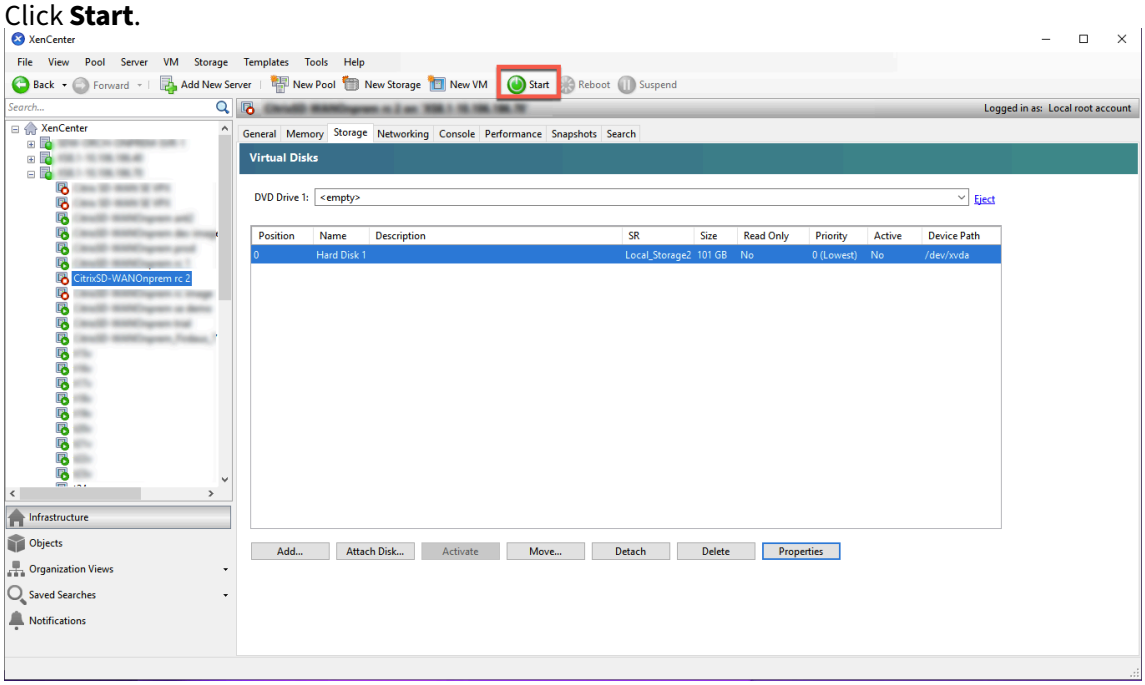


5. Click **Start**.



Increase disk space on ESXi Server

To increase the disk space on the ESXi server.

1. Shut down the virtual machine (VM) from the hypervisor.

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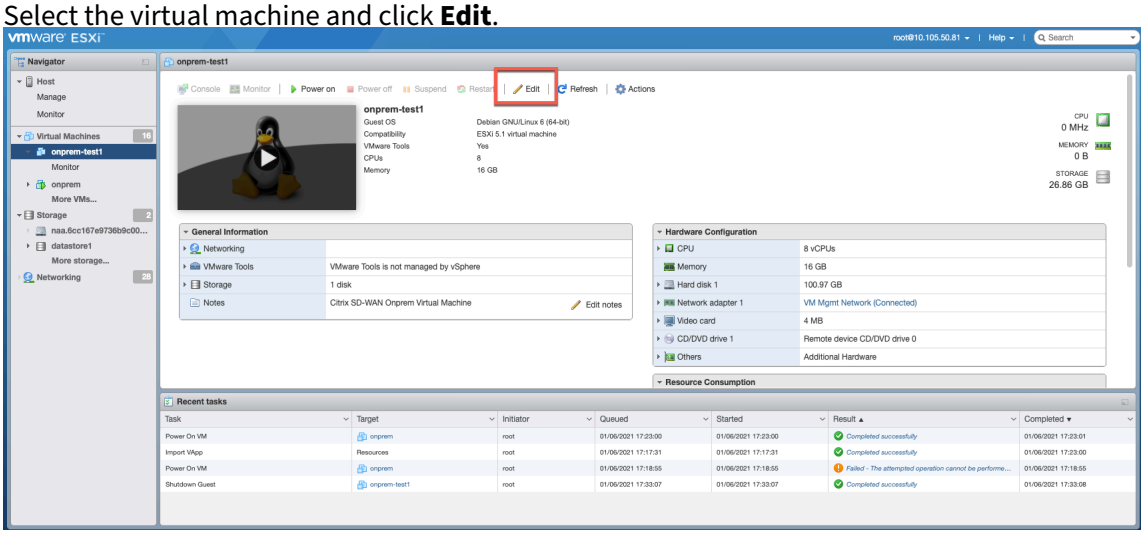
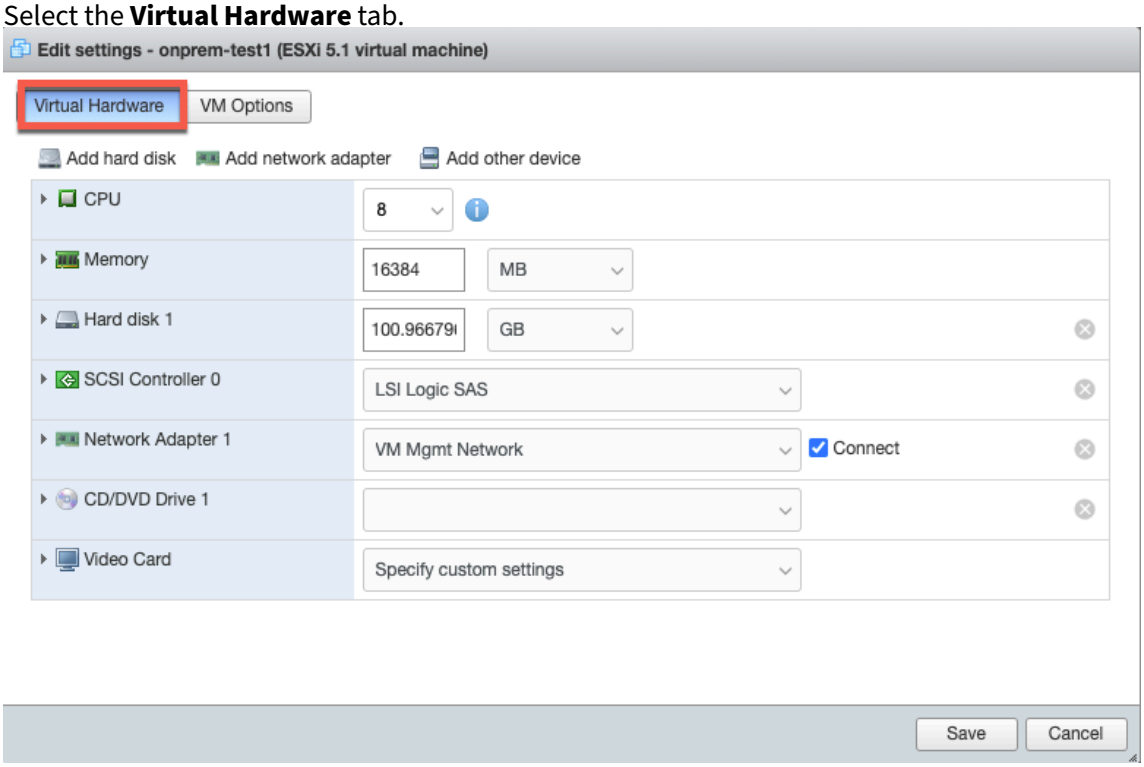
2. Select the virtual machine and click **Edit**.



3. Select the **Virtual Hardware** tab.



4. Increase the hard disk space in the **Hard disk** field and click **Save**.

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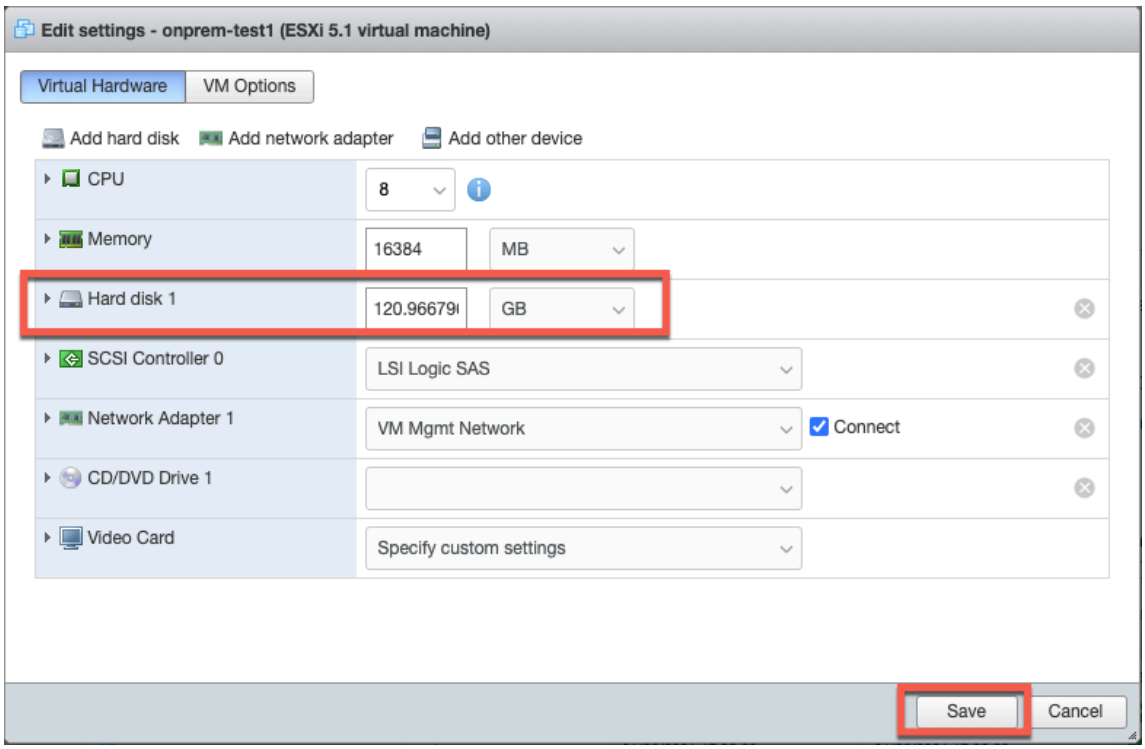
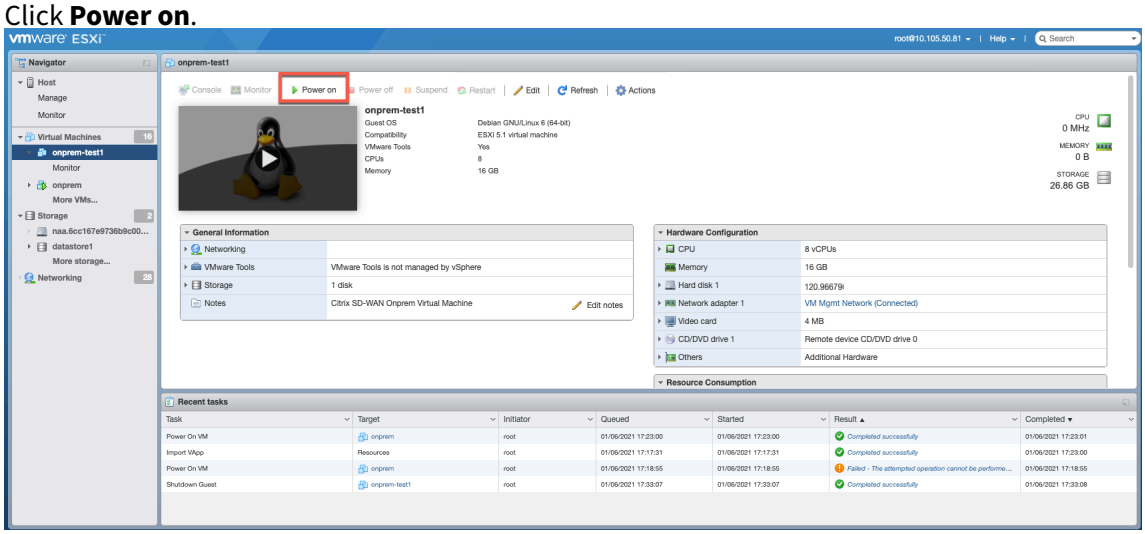


5. Click **Power on**.



March 8, 2021

Replace an affected Citrix SD-WAN appliance

To replace an affected appliance in Citrix SD-WAN Orchestrator for On-premises:

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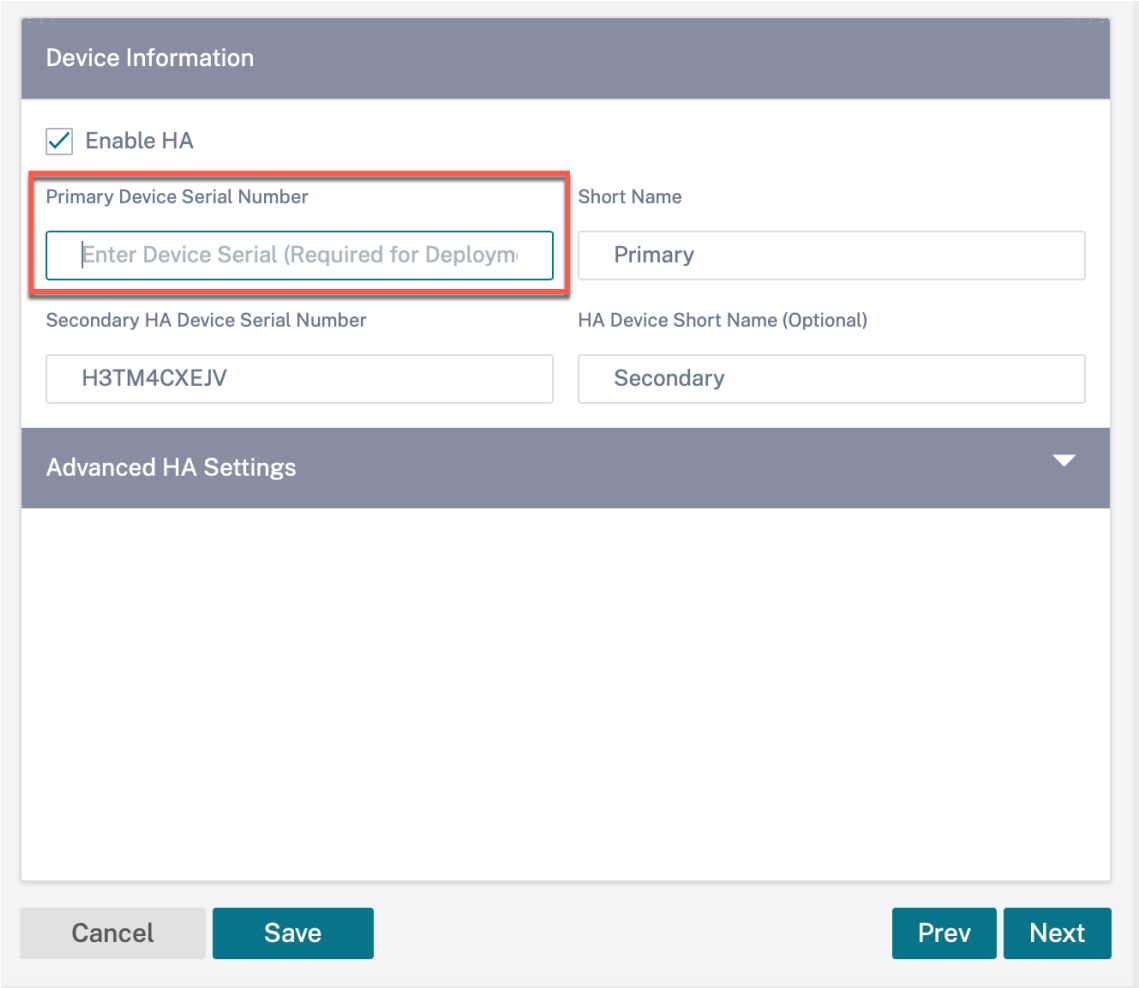
1. Log in to Citrix SD-WAN Orchestrator for On-premises and select the affected site. At the site level, navigate to **Configuration > Site Configuration > Device Information** and remove the serial number from the **Primary Device Serial Number** field. Click **Save**.

   > **Note**
   >
   > If the appliance is still reachable through Citrix SD-WAN Orchestrator for On-premises, then the appliance is in “Factory Reset” state.



2. Navigate to **Dashboard > Devices** and ensure that the affected appliance is removed from the list.

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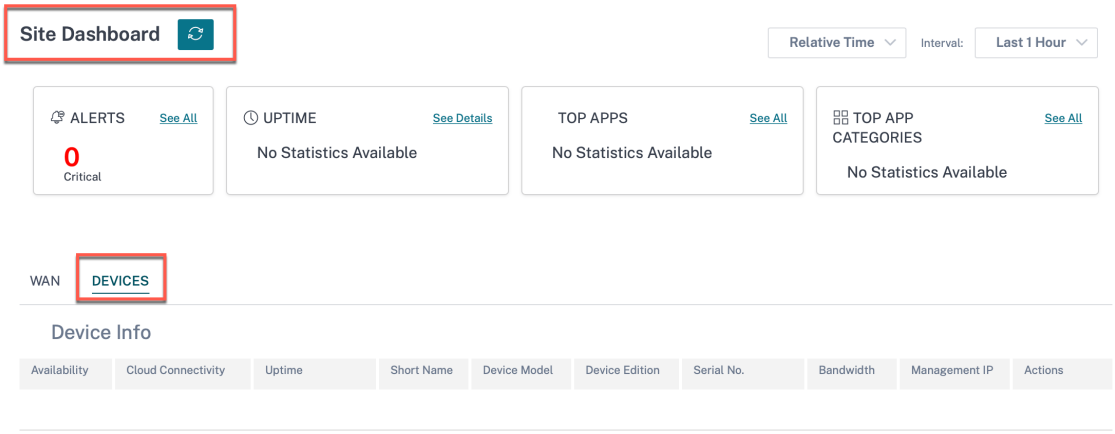

3. Make a note of the affected appliance's power and cabling setup and then remove the appliance from the rack.
4. Mount the new appliance on the rack and redo the power and cabling as it was for the affected appliance.
5. In the Citrix SD-WAN Orchestrator for On-premises UI, at the site level, navigate to **Configuration > Site Configuration > Device Details**. Add the serial number of the new appliance in the **Primary Device Serial Number** field. Click **Save**.

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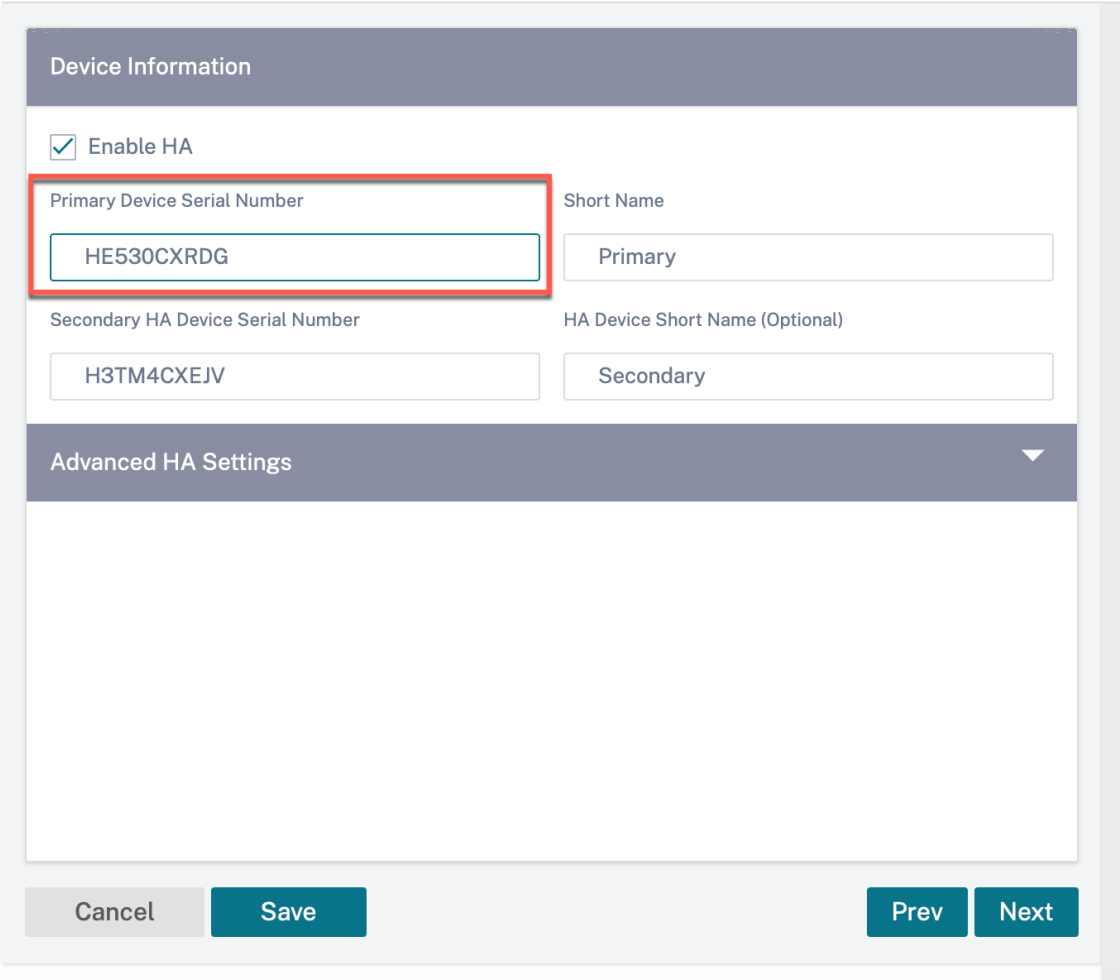
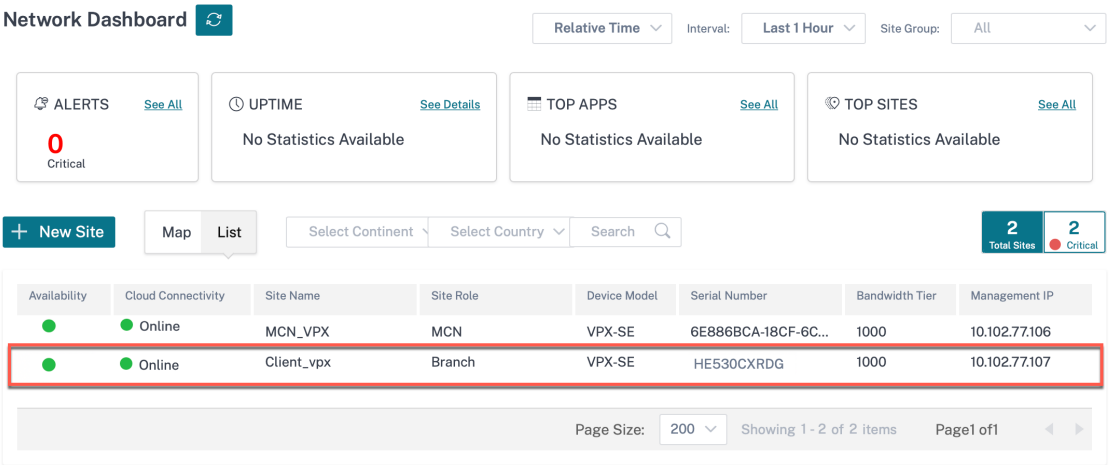


6. Configure Zero-touch deployment. For more information, see Zero-touch deployment.
7. Allow a few minutes for the appliance to update cloud connectivity on the site dashboard.



8. At the network level, navigate to **Configuration > Network Config Home** and click **Deploy Config/Software**.

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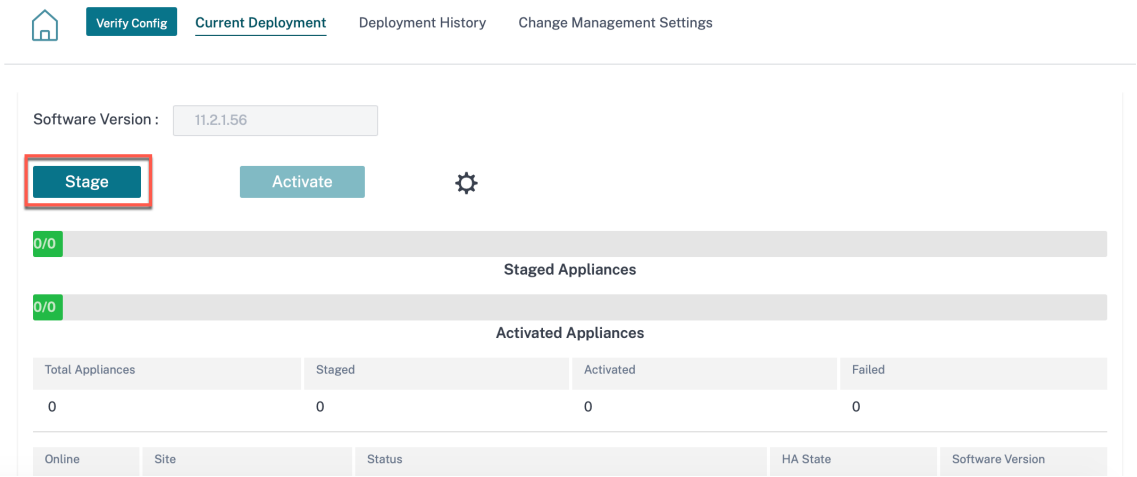
9. Click **Stage**.



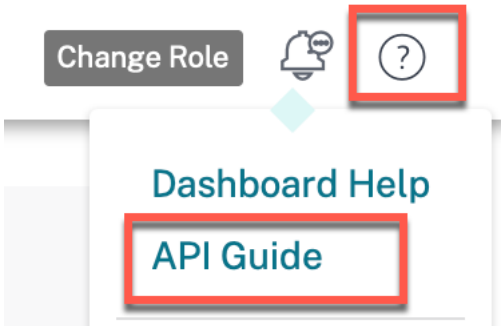
10. Click **Activate** after staging is completed.
11. Navigate to the site dashboard and verify the successful activation of the appliance.

API guide for Citrix SD-WAN Orchestrator for On-premises

July 9, 2021

To access the Citrix SD-WAN Orchestrator for On-premises API Guide on the Swagger UI:

1. Log in to the Citrix SD-WAN Orchestrator for On-premises and click **?** at the top-right corner of the UI and then click **API Guide**.



The Swagger spec details are displayed.

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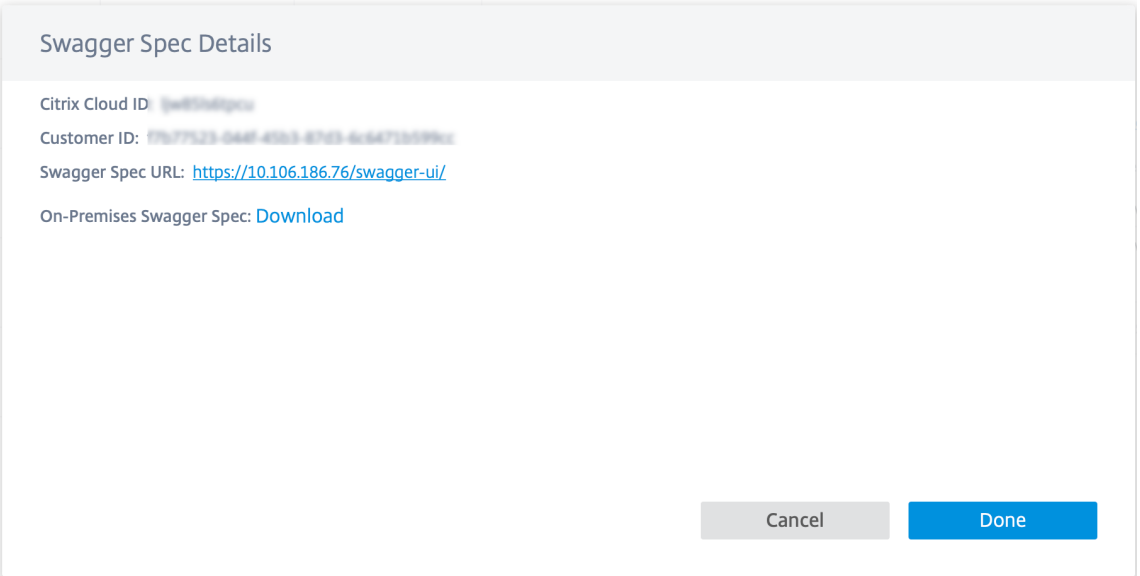
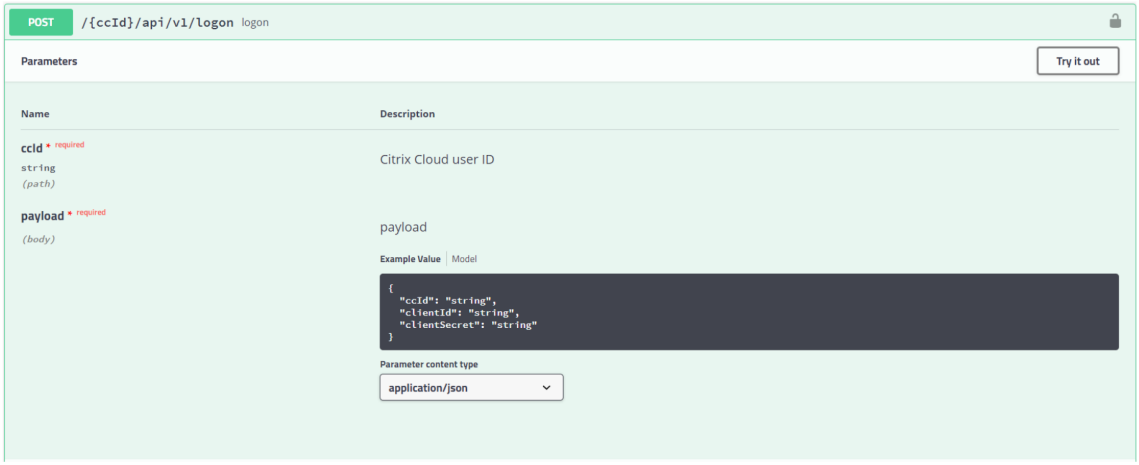


2. Click the Swagger spec URL to access the API guide.
3. In the API page, navigate to **auth-controller** > **/{ccId}/api/v1/logon** > **Try it out**.



4. From the Citrix SD-WAN Orchestrator for On-premises **Swagger Spec Details**, copy the **Citrix Cloud ID** and paste it in the textbox under **Citrix Cloud user ID**.
5. Similarly, copy and paste the Client ID, Client secret and Citrix Cloud ID in the respective payload fields and click **Execute**.

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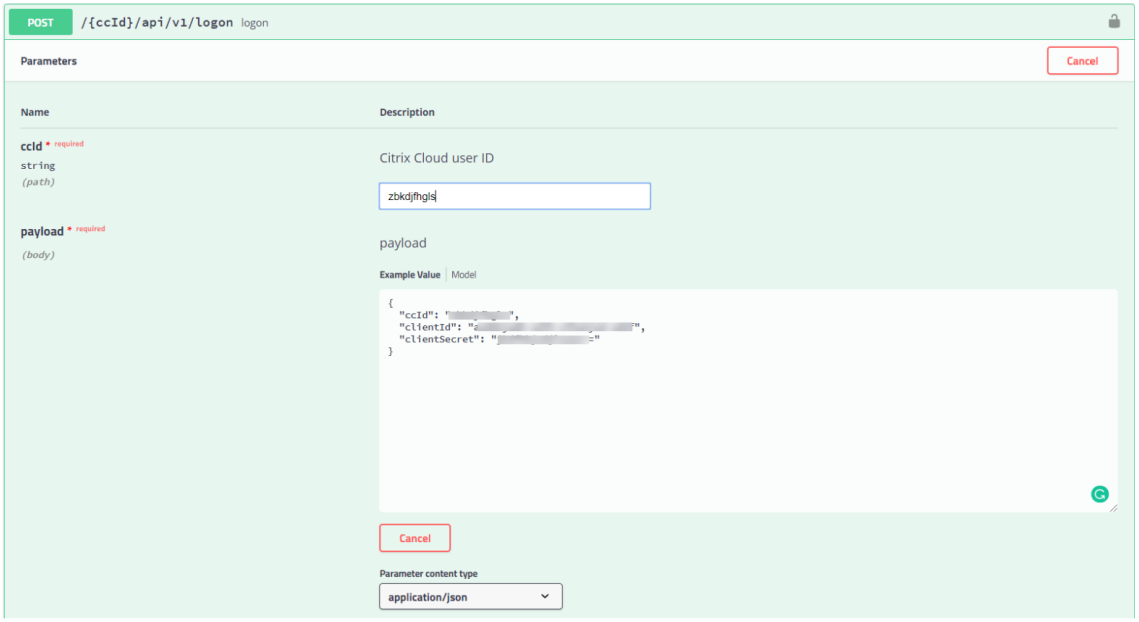
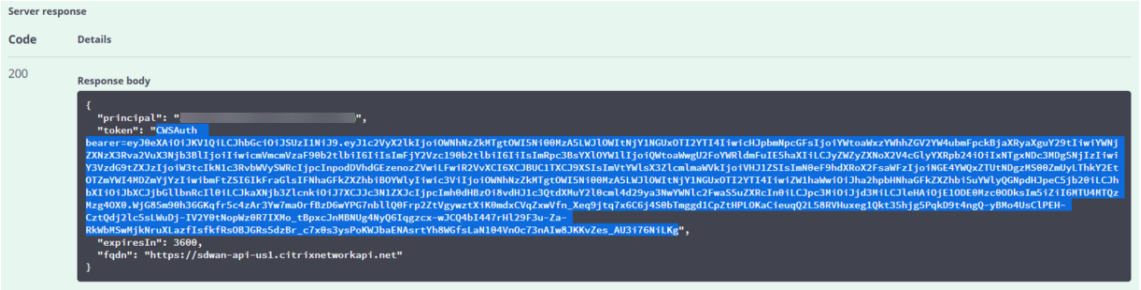


6. Copy the **token** value from the **Server response**.



7. Click **Authorize** on the top of the API page and paste the **token** value in the **Value** field. Click **Authorize**.

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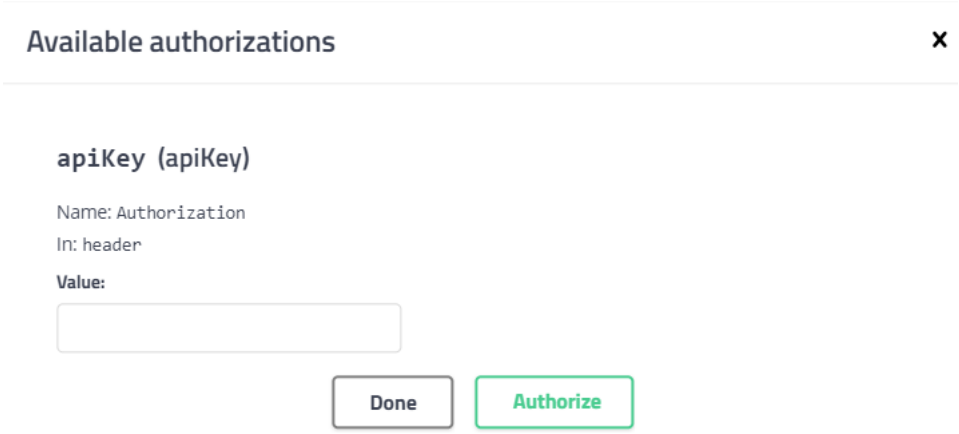

This completes the authorization process and you must now be able to access and use Citrix SD-WAN Orchestrator for On-premises APIs.

Orchestrator administration

July 9, 2021

This section provides you the information on administrative activities that can be performed on the Citrix SD-WAN Orchestrator for On-premises platform.

Software

You can download Citrix SD-WAN appliance software version required for all the appliances in your network and stored in Citrix SD-WAN Orchestrator for On-premises. Use the stored software to upgrade your Citrix SD-WAN Orchestrator for On-premises software to the latest version.

> **Note**
>
> Provider managed setup is introduced from Citrix SD-WAN Orchestrator for On-premises 10.3 release. Downgrading to software releases lower than Citrix SD-WAN Orchestrator for On-premises 10.3 release is not supported.

Publish software

In a provider managed setup, Citrix SD-WAN Orchestrator for On-premises allows provider administrators to download Citrix SD-WAN appliance software version required for all the appliances in your network. Provider administrators can publish the downloaded software version. The published software is downloaded and stored in Citrix SD-WAN Orchestrator for On-premises. Customer administrators

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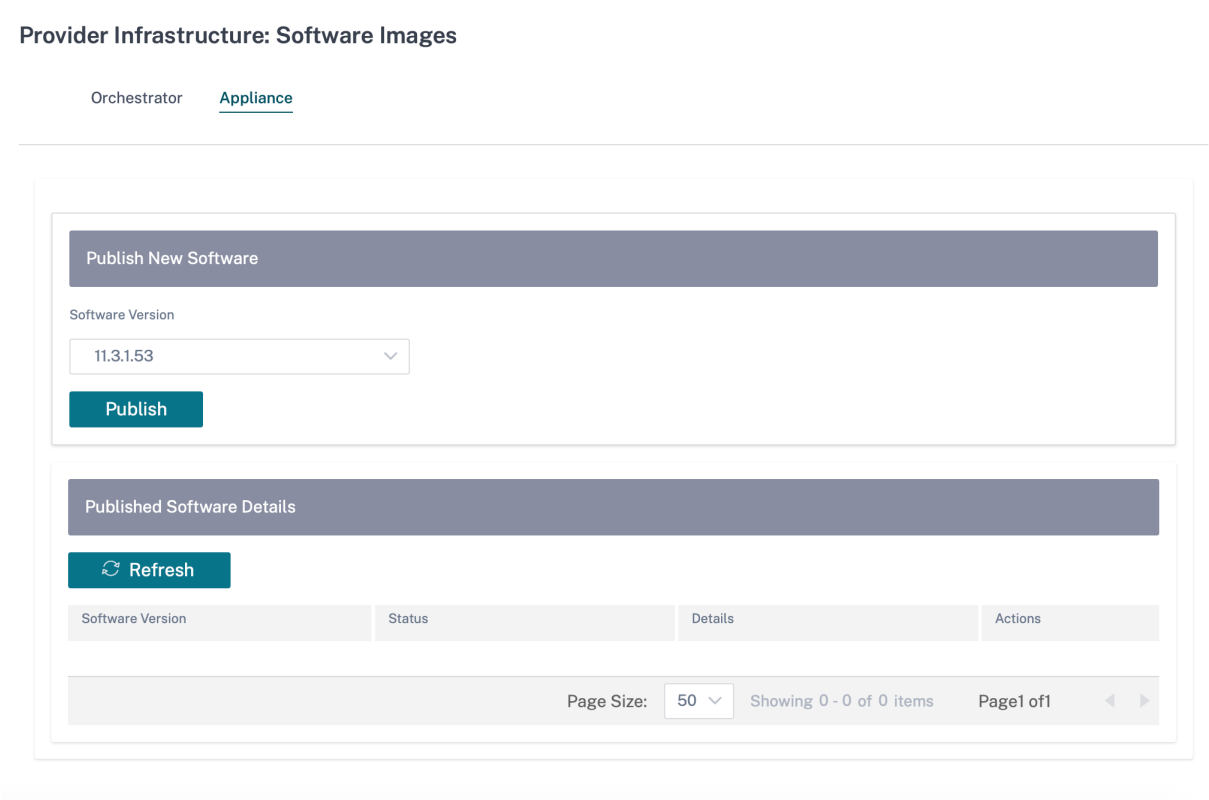
can deploy the published software to all the appliances managed by Citrix SD-WAN Orchestrator for On-premises.

In a customer managed setup, customer administrators can download Citrix SD-WAN appliance software version required for all the appliances in the network. They can publish the software in Citrix SD-WAN Orchestrator for On-premises and deploy the software to all appliances.

To publish software, navigate to **Infrastructure > Orchestrator Administration > Software Images > Appliance**.



You can choose a software version to be published from a pre-built list of software versions that are supported by the current Citrix SD-WAN Orchestrator for On-premises. For newer software versions that are not available in the list, upgrade to the latest Citrix SD-WAN Orchestrator for On-premises release which supports the new software version. For information on upgrading Citrix SD-WAN Orchestrator for On-premises, see Software upgrade.

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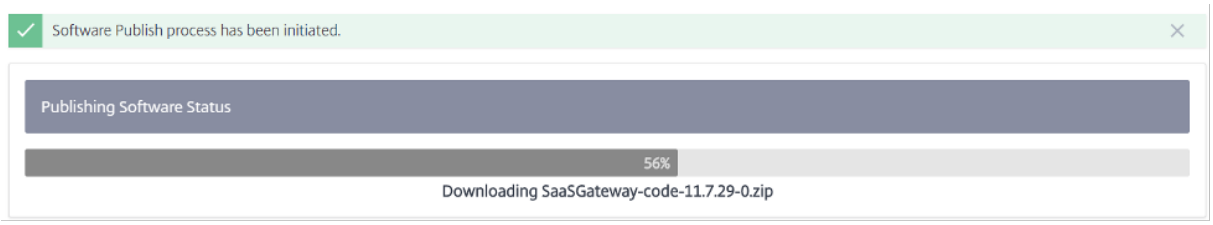
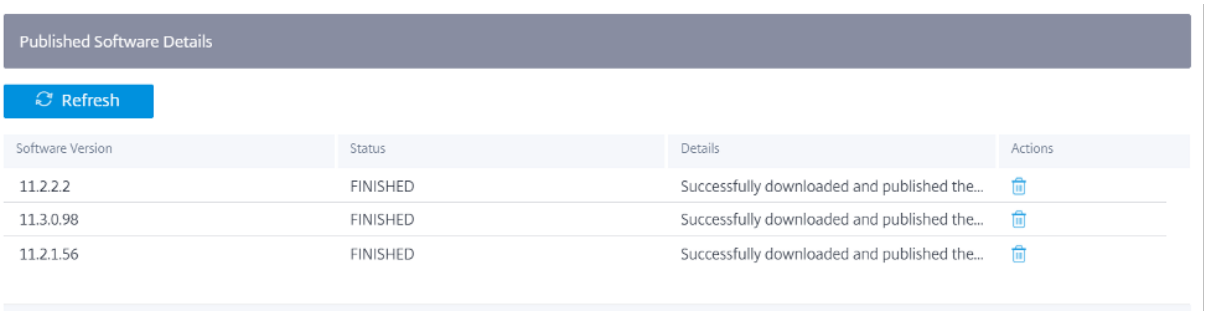
Citrix SD-WAN Orchestrator for On-premises downloads Citrix SD-WAN software of the selected version for all the platforms. A progress bar indicates the progress of the publishing process.



The published software versions are displayed under **Published Software Details**. At any given point Citrix SD-WAN Orchestrator for On-premises can store up to three published software versions. If you are intending to publish another software version, delete one of the three versions available before beginning the publishing process.



After the publishing is successful you can deploy, stage, and activate the software to all the appliances on the network from the **Network Configuration** page. For more information, see Network Configuration. For a successful deployment, ensure that all the appliances are connected to Citrix SD-WAN Orchestrator for On-premises. For more details, see Connectivity with Citrix SD-WAN appliances.

Software upgrade

In a provider managed setup, only provider administrators can upgrade the Citrix SD-WAN Orchestrator for On-premises software to the latest version.

In a customer managed setup, customer administrators can upgrade Citrix SD-WAN Orchestrator for On-premises software to the latest version.

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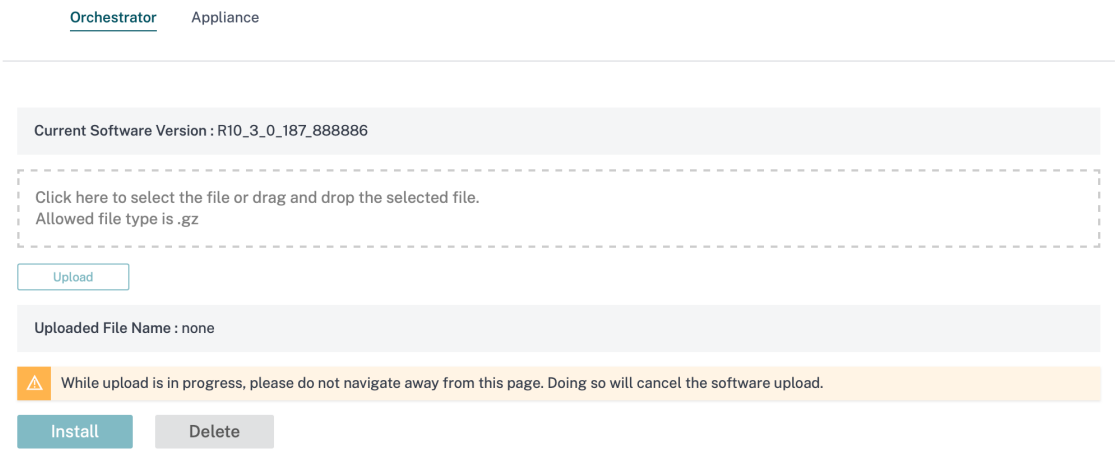
> **NOTE**
>
> Download the appropriate Citrix SD-WAN Orchestrator for On-premises software package to your local computer. You can download this package from Downloads page.

Perform the following steps to upload and install a new version of the Citrix SD-WAN Orchestrator for On-premises software:

1. In the Citrix SD-WAN Orchestrator for On-premises UI, navigate to **Infrastructure > Orchestrator Administration > Software Images > Orchestrator**.
2. Click inside the box and select the ctx-onprem-1 (latest date).tar.gz binary file that you have downloaded and saved on your local system.



3. Click **Upload** to upload the selected software package to the current Citrix SD-WAN Orchestrator for On-premises virtual machine.
4. After the upload completes, click **Install**.
5. When prompted to confirm, click **Install**.

Management settings

> **Note**
>
> In a provider managed setup, only provider administrators have access to edit configuration under **Infrastructure > Orchestrator Administration > Management Settings**.

Management IP and DNS

After Citrix SD-WAN Orchestrator for On-premises Virtual Machine (VM) is deployed and a management IP is configured either manually or through DHCP, you can change the **Management IP and DNS** settings through Citrix SD-WAN Orchestrator for On-premises GUI. Citrix SD-WAN Orchestrator

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for On-premises stack takes about 3 minutes to restart. Once the management IP address is changed the SSH connections get re-established.

To configure/change the management IP and DNS settings, at the network level, navigate to **Infrastructure > Orchestrator Administration > Management Settings > Management IP & DNS**.

Provide the following details:

- **IP Address**: The IP address for Citrix SD-WAN Orchestrator for On-premises VM.
- **Gateway IP Address**: The Gateway IP address that Citrix SD-WAN Orchestrator for On-premises use to communicate with external networks.
- **Subnet Mask**: The subnet mask to define the network in which Citrix SD-WAN Orchestrator for On-premises is available.
- **Primary DNS**: The IP address of the primary DNS server to which all DNS requests from Citrix SD-WAN Orchestrator for On-premises are forwarded to.
- **Secondary DNS**: The IP address of the secondary DNS server to resolve DNS requests if the primary DNS server is not available.

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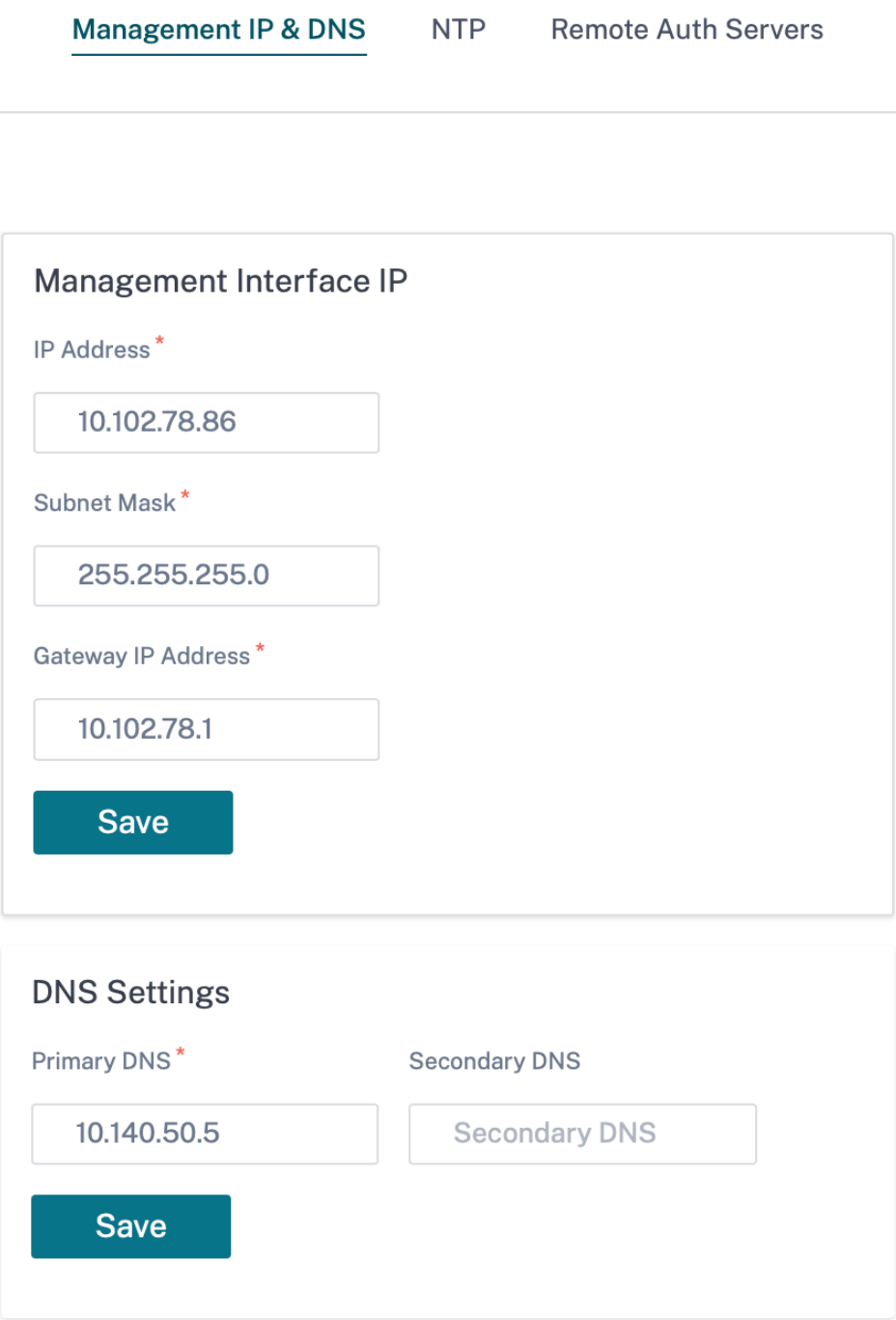

NTP settings

You can either set the date and time manually, or use a Network Time Protocol (NTP) server to synchronize the clock time of Citrix SD-WAN Orchestrator for On-premises with Coordinated Universal

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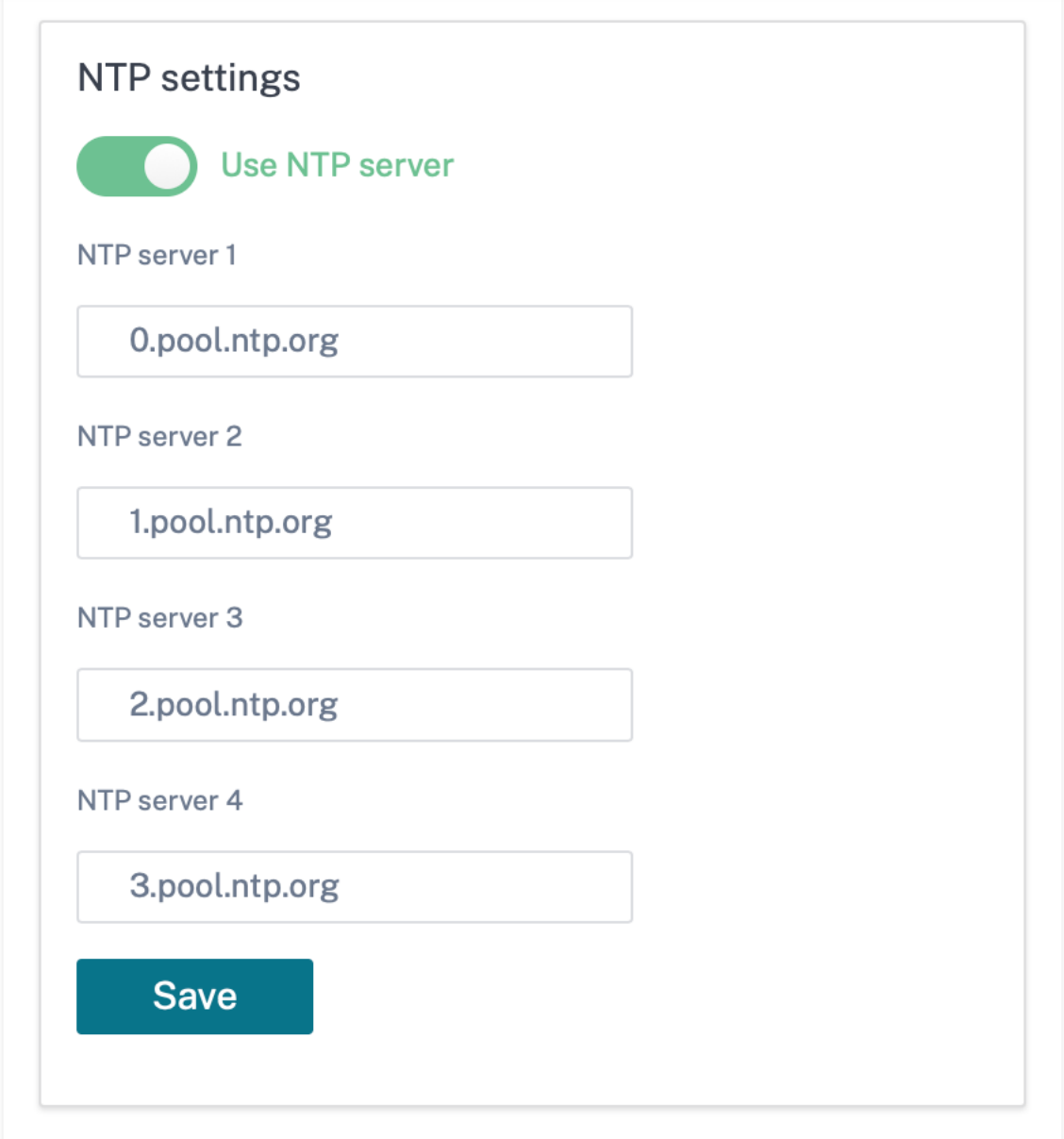
Time (UTC).

To configure NTP server, at the network level, navigate to **Infrastructure > Orchestrator Administration > Management Settings > NTP** and enable **Use NTP server**.

Provide the NTP server IP address or domain name. You can provide up to four NTP servers, but ensure that at least one is configured. If one NTP server is down, Citrix SD-WAN Orchestrator for On-premises automatically synchronizes with the other NTP server. If you specify a domain name for an NTP server, ensure that the external DNS server is configured to point the domain name to the IP address.



To configure date and time manually, disable the **Use NTP server** option and manually select the date and time.

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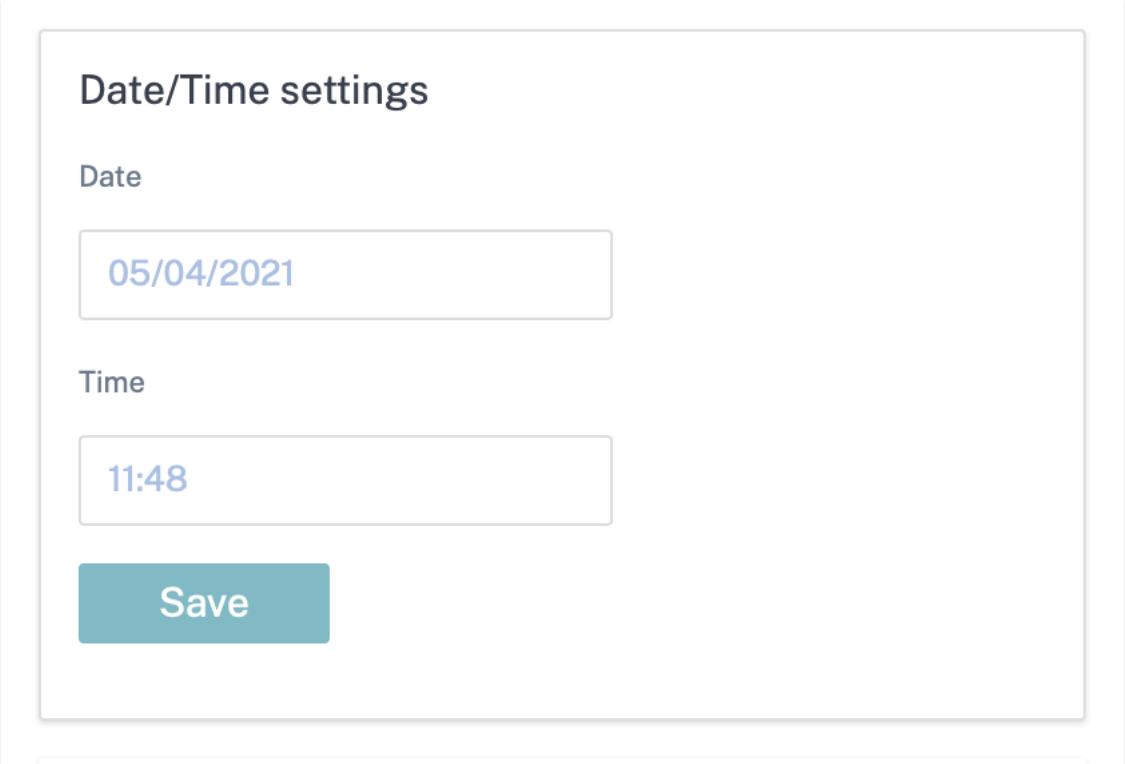

Select the time zone based on your country/city.

> **NOTE**
>
> Reboot the Orchestrator VM after changing the time zone. Some logs continue to use the previous time zone, until the reboot is done. For instructions, see Reboot Orchestrator VM.

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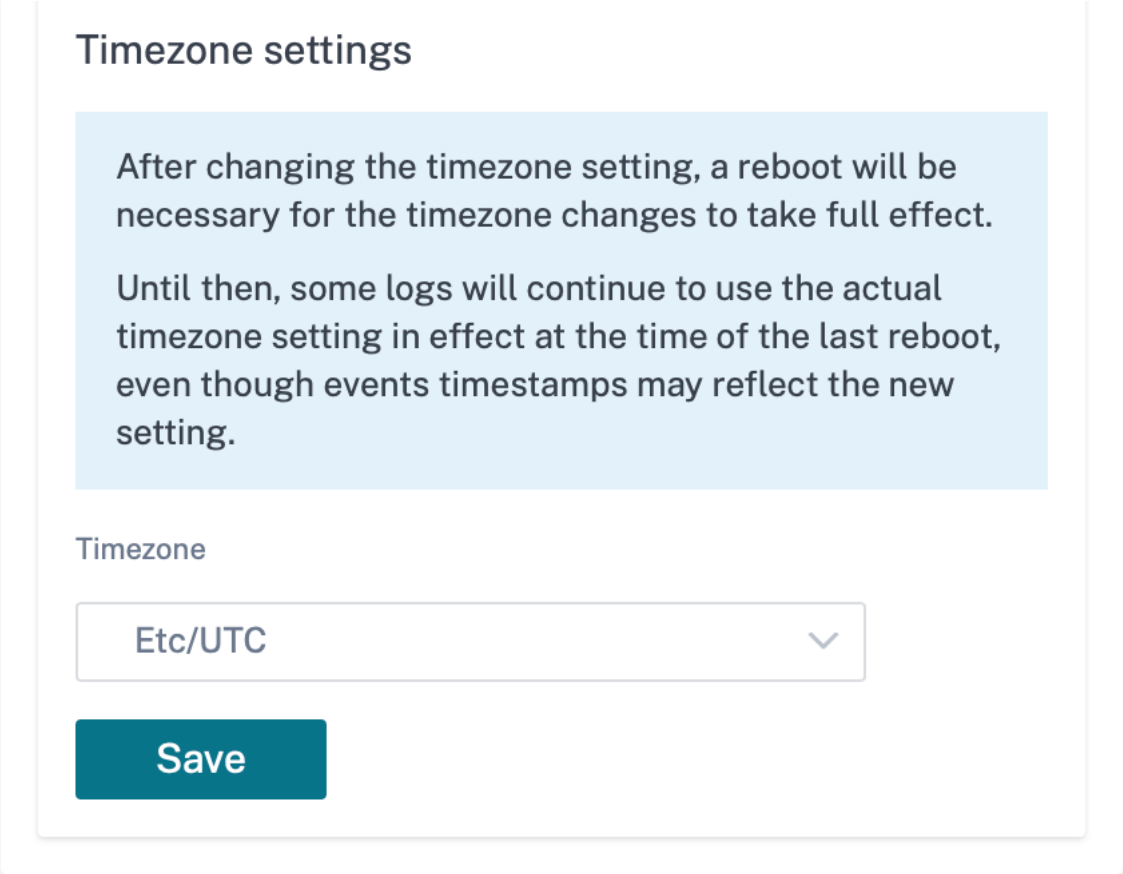

Remote Authentication Servers

In a provider managed setup, only provider administrators can configure RADIUS or TACACS+ servers for the users who are authenticated remotely. Customer administrators can use the remote authentication servers configured by the provider administrators. In a customer managed setup, customer administrators can configure RADIUS or TACACS+ servers.

> **NOTE**
>
> Ensure that the required user accounts are created on the RADIUS or TACACS+ authentication server.

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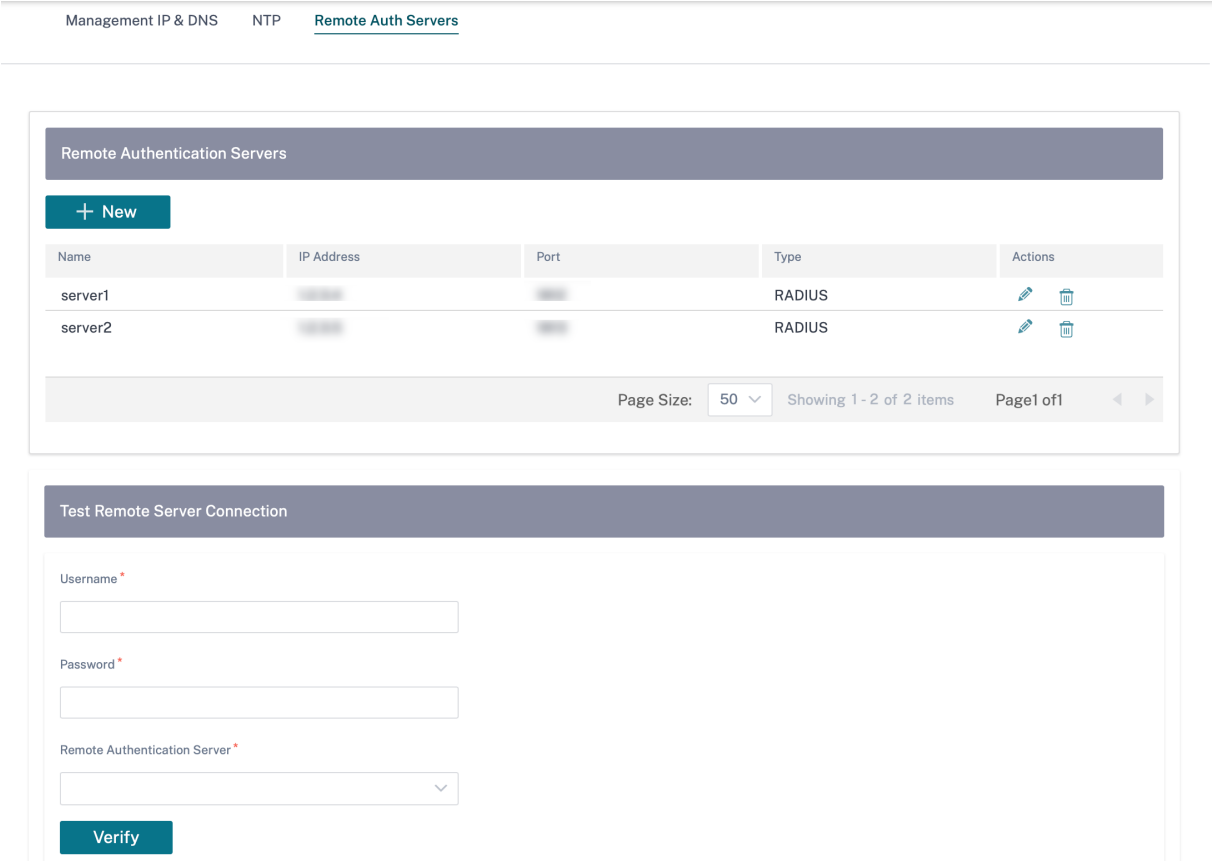

To configure remote authentication, navigate to **Infrastructure > Orchestrator Administration > Management Settings > Remote Auth Servers**. Click **+ New**. Enter the following details:

- **Enable**: Enables remote authentication server configuration.
- **Server Name**: The name of the remote authentication server.
- **Server Type**: The type of remote authentication server - RADIUS or TACACS+.
- **IP Address**: The host IP address for the remote authentication server.
- **Port**: The port number for the remote authentication server. The default port for the RADIUS server is 1812 and the TACACS+ server is 49.
- **Server Key** and **Confirm Server Key**: A secret key to use when connecting to the remote authentication server.
- **Authentication Type**: (available only for TACACS+ server) Select the encryption method to use to send the user name and password to the TACACS+ server.
  - **PAP**: Uses Password Authentication Protocol (PAP) to strengthen user authentication by assigning a strong shared secret to the TACACS+ server.
  - **ASCII**: Uses the ASCII character set to strengthen user authentication by assigning a strong shared secret to the TACACS+ server.
- **Timeout**: The time interval (in seconds) to wait for an authentication response from the remote authentication server.

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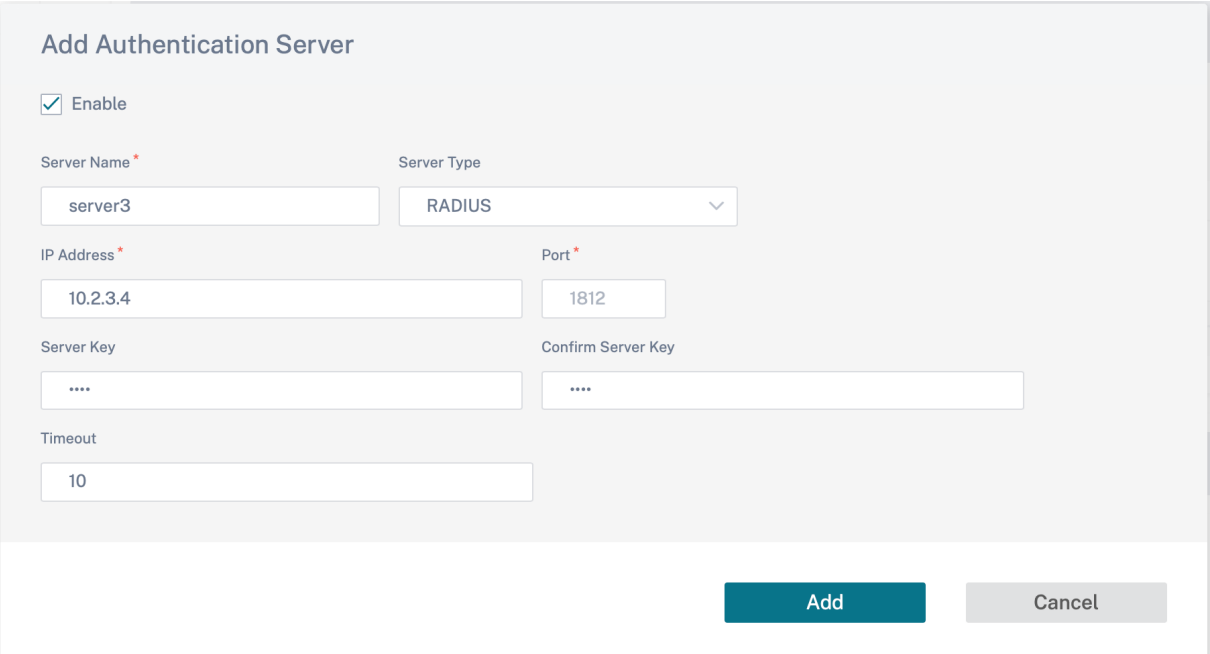

You can also test the remote server connection. Under **Test Remote Server Connection**, provide your **Username** and **Password**. Select the remote authentication server and click **Verify**.

Database management

You can create backup of the current database running on Citrix SD-WAN Orchestrator for On-premises and later use the backed-up file to restore the same database state.

> **Note**
>
> - In a provider managed setup, only provider administrators have access to create database backup and restore the same.
> - You cannot restore the database backup taken in a provider managed setup on a customer managed setup. Similarly, you cannot restore the database backup taken in a customer managed setup on a provider managed setup.

To create database backup, navigate to **Infrastructure** > **Orchestrator Administration** > **Database Management**. Click **Backup**.

Click download under the **Actions** column to download the backed-up database.

Click **Upload** to browse and upload the downloaded file. You can also drag the downloaded file and drop it on the screen.

To restore, click **Restore** under the **Actions** column.

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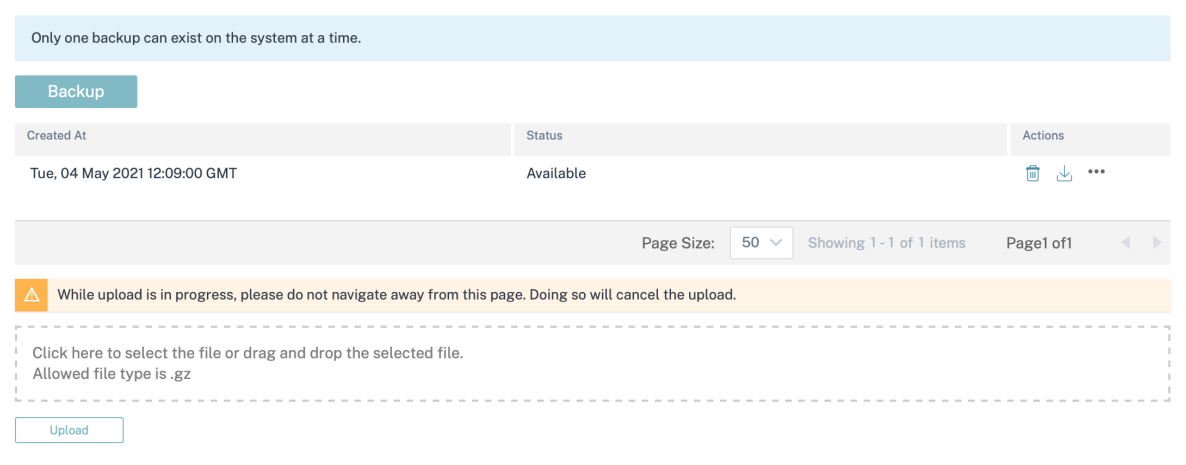
NOTE

- You can save only one database backup at a time. To replace an existing backup with the latest, delete the existing backup and click **Backup**.
- Restore of the database must be done to the same release of Citrix SD-WAN Orchestrator for On-premises from where the data backup was taken.
- The database backup only takes the backup of configuration and statistics. It does not back up the platform related data.



Storage Management (Preview)

Citrix SD-WAN Orchestrator for On-premises supports migrating customer configurations, statistics, local database, and published Citrix SD-WAN release version from an existing disk to a new disk.

In a provider managed setup, only provider administrators can perform disk migration. Customer administrators in the provider managed setup do not have privileges to perform disk migration. In a customer managed setup, customer administrators can perform disk migration.

You can perform disk migration either to increase the disk space or for disaster recovery.

- **Add a new disk**: You can add a new disk having storage size at least twice as that of the current data consumed by the Citrix SD-WAN Orchestrator for On-premises. Through Citrix SD-WAN Orchestrator for On-premises UI, you can activate the new disk and migrate the existing customer configurations, statistics, local database, and published Citrix SD-WAN release version. Once the newly added disk is activated, Citrix SD-WAN Orchestrator for On-premises gets rebooted.
- **Disaster recovery**: In the event of a disaster, you can attach the disk containing the data to a new instance of Citrix SD-WAN Orchestrator for On-premises virtual machine which is on the same version of Citrix SD-WAN Orchestrator for On-premises. Activate the disk without choosing **Migrate Data** option in the Citrix SD-WAN Orchestrator for On-premises UI. Once the disk is

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activated, Citrix SD-WAN Orchestrator for On-premises gets rebooted.

> **NOTE**
>
> - When disk migration is in progress, do not power off or manually reboot Citrix SD-WAN Orchestrator for On-premises. Powering off or manual reboot can cause data loss.
> - When a disk is migrated from a disk partition that was added earlier to a newly created disk partition, after migration, the data in the old disk is not removed. To remove the data in the old disk, attach it to another operating system and delete the data securely.

Limitations

The following are the limitations with the disk migration process:

- The users in the old release are not migrated to the new release. Post migration, delete the users and create them again.
- STS created on the old Citrix SD-WAN Orchestrator for On-premises virtual machine is not migrated. However, post migration, the UI lists the STS generated on the old Citrix SD-WAN Orchestrator for On-premises virtual machine. Delete the STS manually.
- Database backup created in the old Citrix SD-WAN Orchestrator for On-premises is not migrated. Post migration if it is getting listed, delete it manually.
- By default, it is assumed that the new Citrix SD-WAN Orchestrator for On-premises to which the disk is migrated to has connectivity to all two factor authentication servers. If the admin account is using two factor authentication servers and if the connections to the two factor authentication servers are not available, then even the admin cannot log in. In such scenarios, contact Citrix support.
- After migrating to the new disk, you cannot increase the disk space allocated for Citrix SD-WAN Orchestrator for On-premises.
- In the disaster recovery scenario, you must reconfigure the custom domain after activating the disk.
- In the disaster recovery scenario, after activating the disk, you must either perform non-cloud zero-touch deployment or cloud brokered zero-touch deployment to establish connectivity between Citrix SD-WAN appliances on the sites with Citrix SD-WAN Orchestrator for On-premises.

Add a new disk on Citrix Hypervisor

1. Select the virtual machine (VM) from the hypervisor. Select the **Storage** tab and click **Add**.

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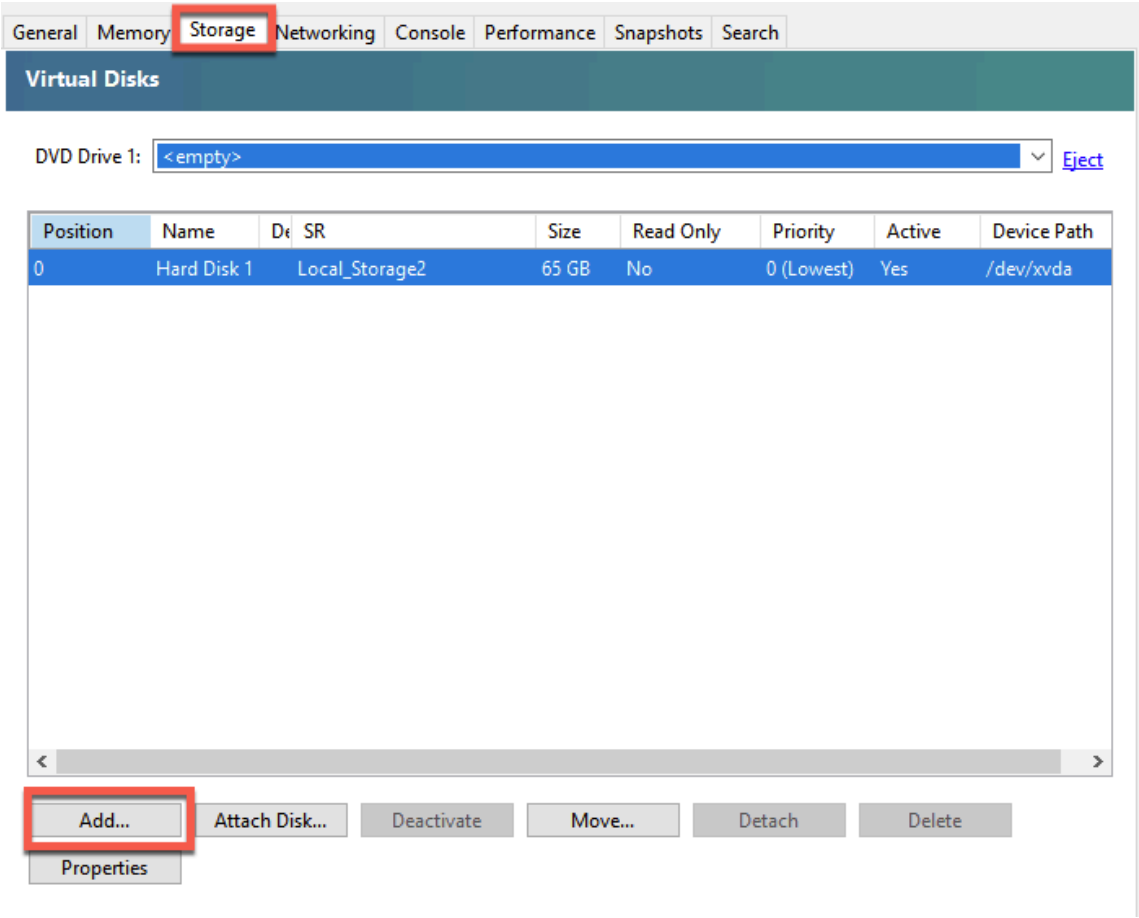

2. Provide details such as name, description, size, and location of the new disk. Click **Add**. The newly added disk gets listed under the **Storage** tab.

> **NOTE**
>
> The disk size must be at least twice as that of the current data consumed by the Citrix SD-WAN Orchestrator for On-premises.

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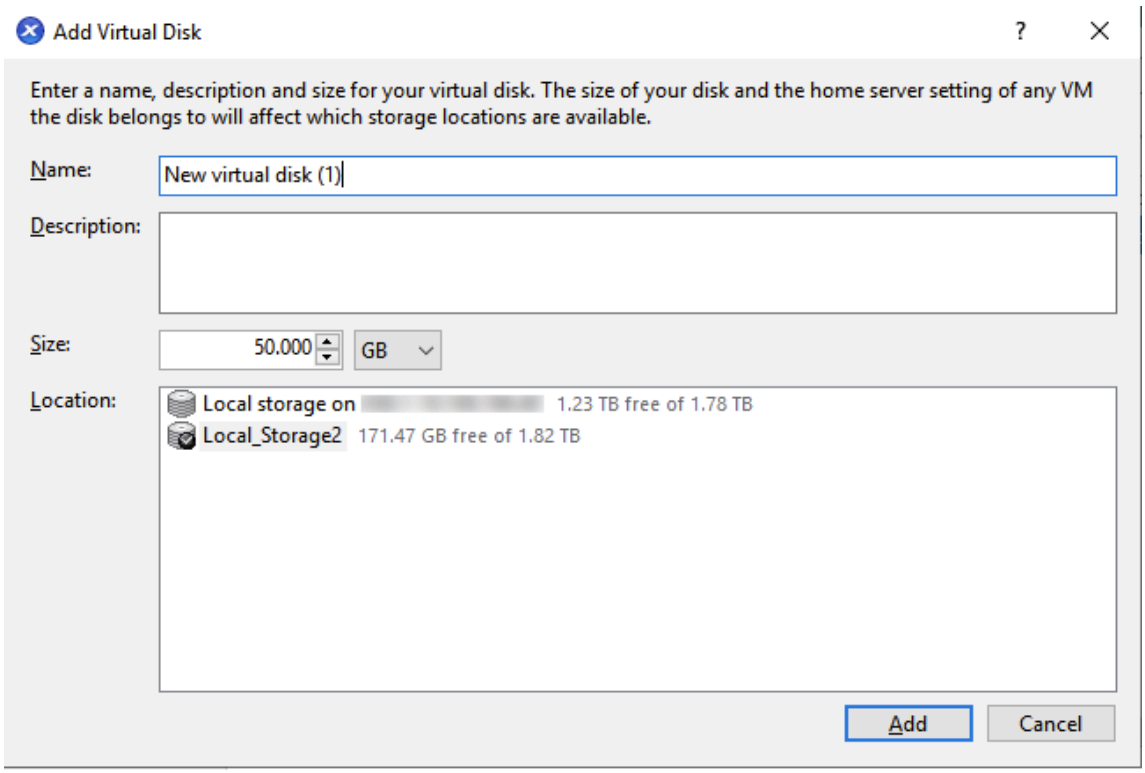

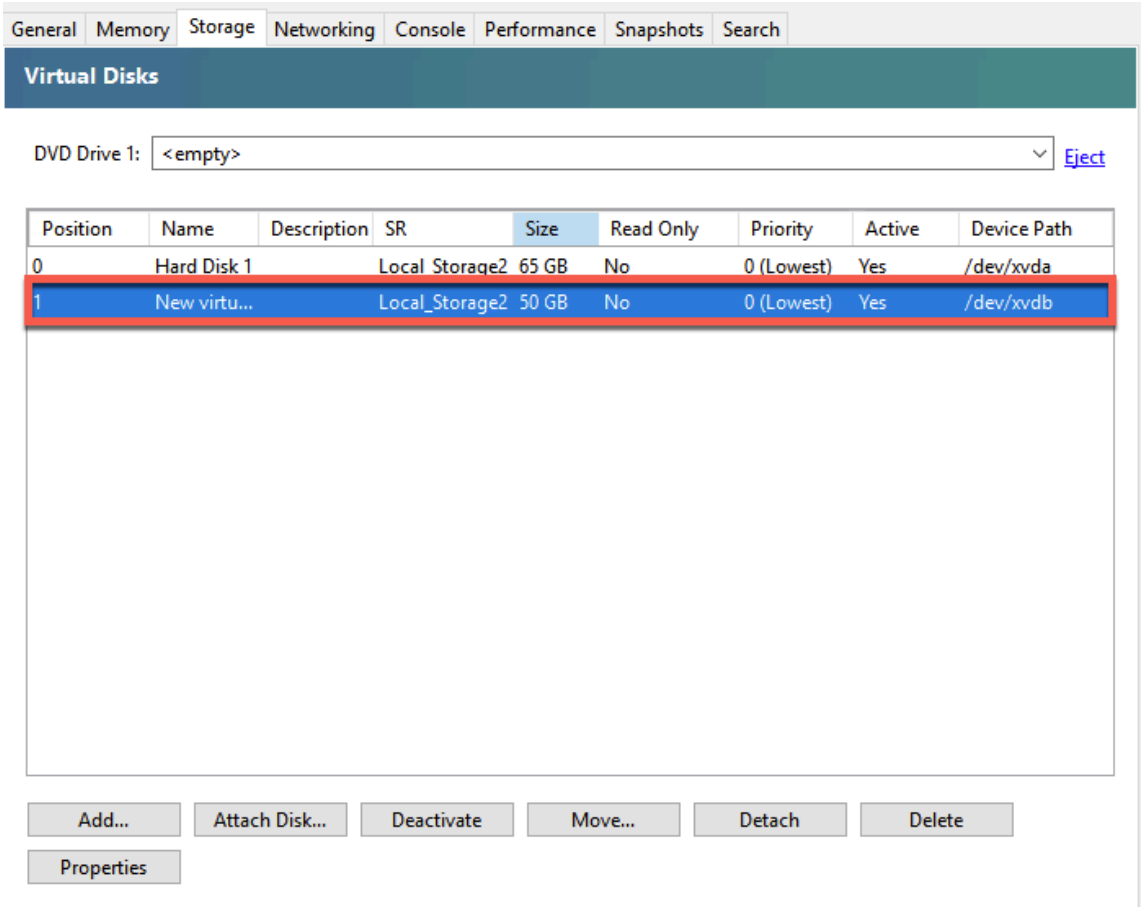

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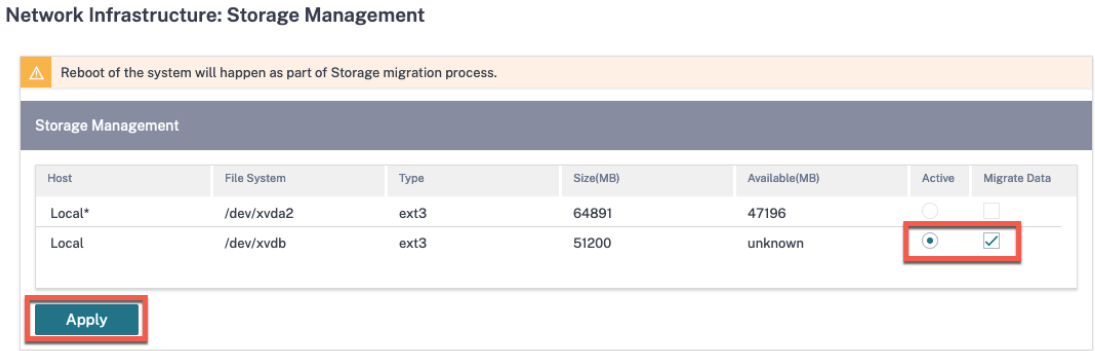
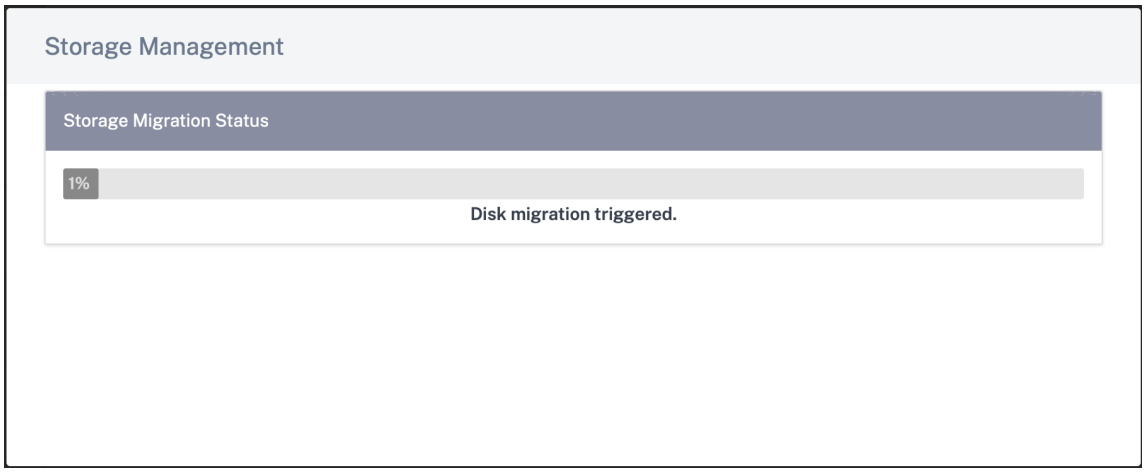
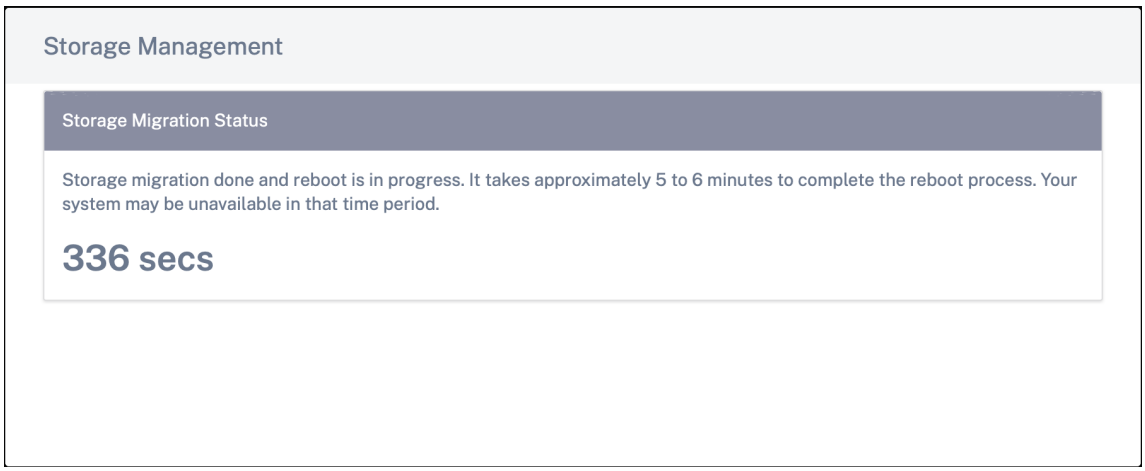
3. Login to the Citrix SD-WAN Orchestrator for On-premises UI and navigate to **INFRASTRUCTURE > Orchestrator Administration > Storage Management**. The newly attached disk automatically gets listed under **Storage Management**.

4. Choose the **Active** radio button and select the **Migrate Data** check box. Click **Apply**.



5. The disk migration process is triggered. Customer configurations, statistics, local database, and Citrix SD-WAN release version on the existing disk get migrated to the new disk. After the migration is completed, Citrix SD-WAN Orchestrator for On-premises gets rebooted.





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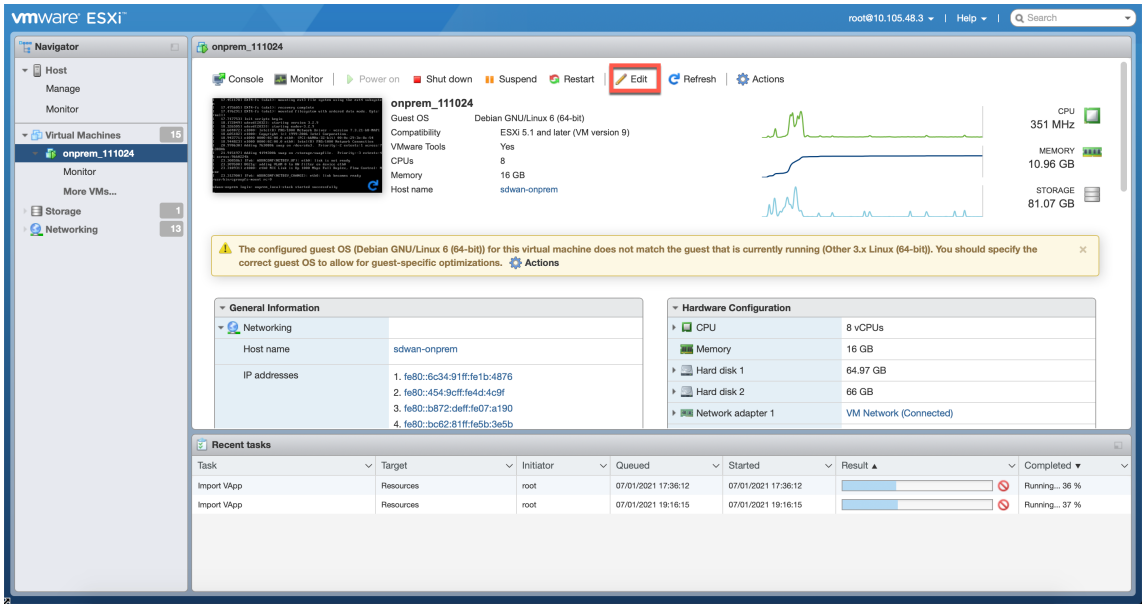
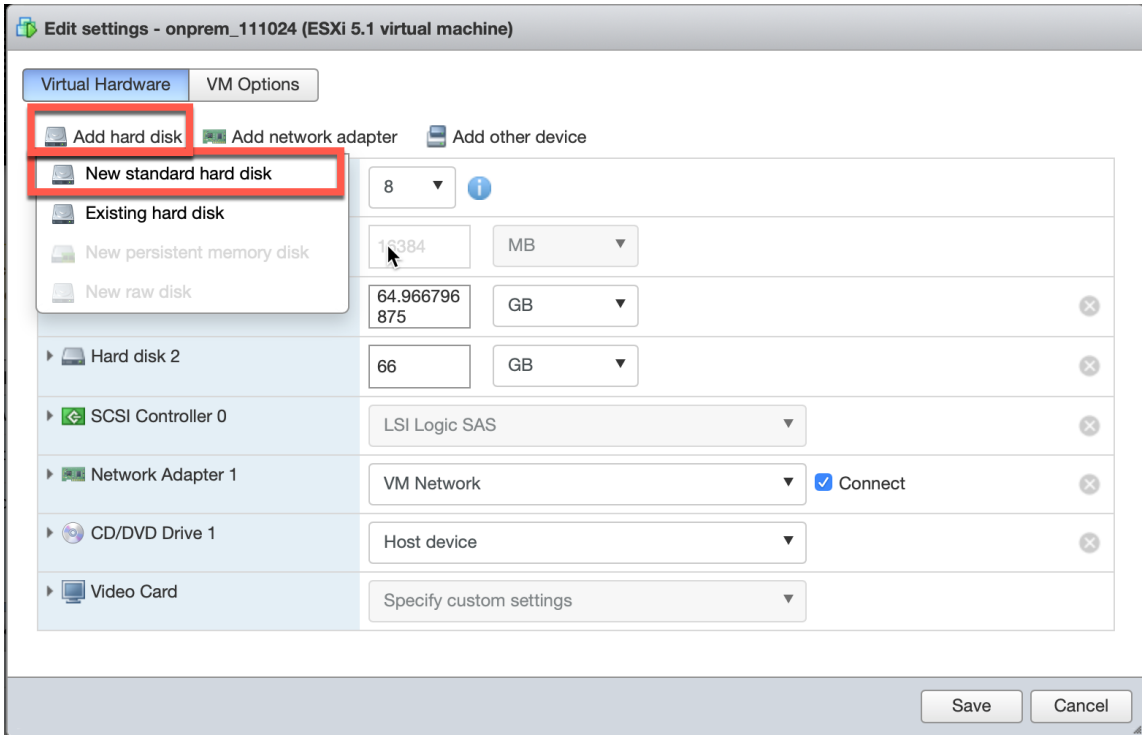
Add a new disk on ESXi Server

1. Log in to your ESXi server and select the virtual machine. Click **Edit**.



2. Click **Add hard disk > New standard hard disk**.



3. Enter the disk storage space and other settings based on your preference. Click **Save**.

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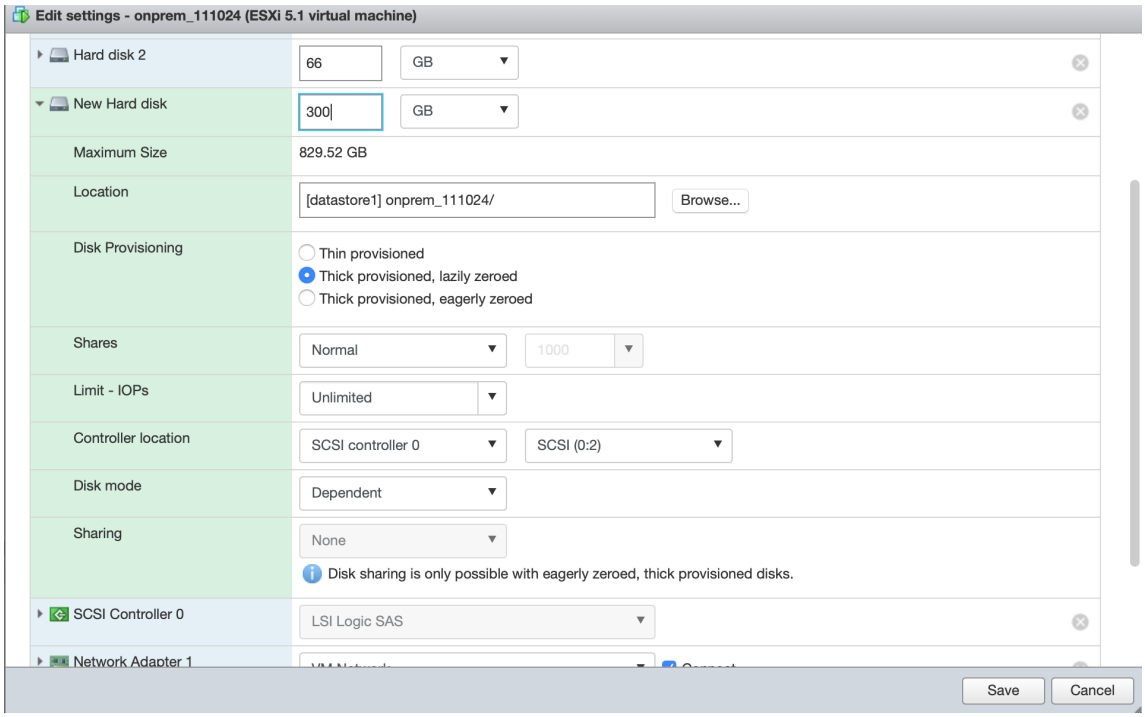
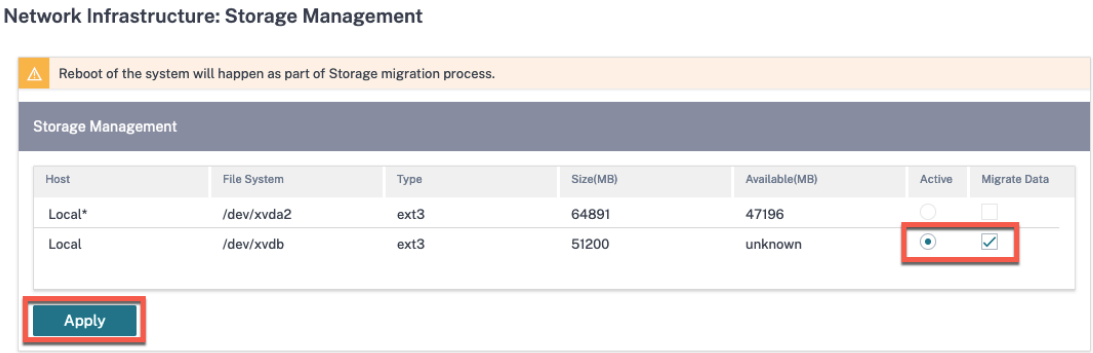
> **NOTE**
>
> The disk size must be at least twice as that of the current data consumed by the Citrix SD-WAN Orchestrator for On-premises.



4. Login to the Citrix SD-WAN Orchestrator for On-premises and navigate to **INFRASTRUCTURE > Orchestrator Administration > Storage Management**. The newly attached disk gets listed here.

5. Choose the **Active** radio button and select the **Migrate Data** check box. Click **Apply**.



6. The disk migration process is triggered. Customer configurations, local database, Citrix SD-WAN release version, and database statistics on the existing disk get migrated to the new disk. After the migration is completed, Citrix SD-WAN Orchestrator for On-premises gets rebooted.

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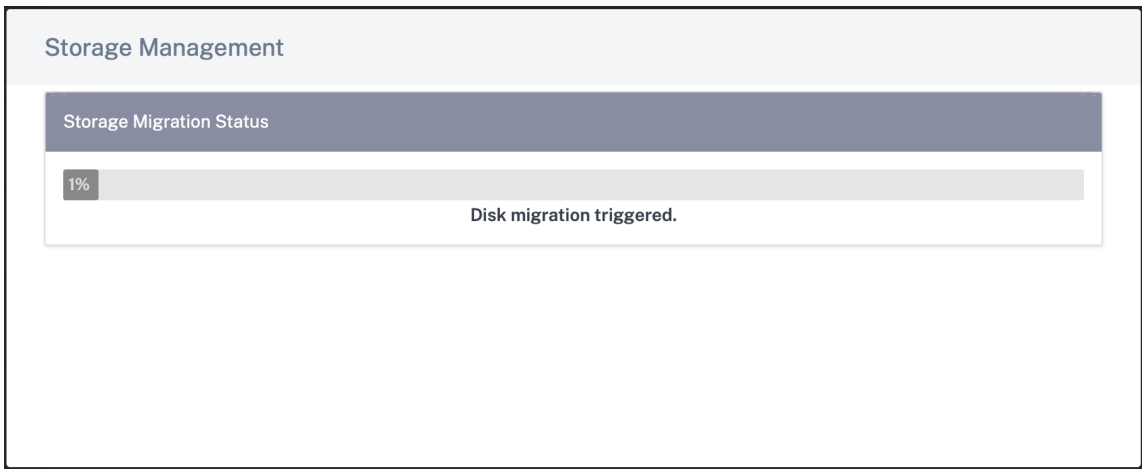

Disaster recovery on Citrix Hypervisor

1. Select the virtual machine (VM) from the hypervisor. Select the **Storage** tab and click **Attach Disk**.

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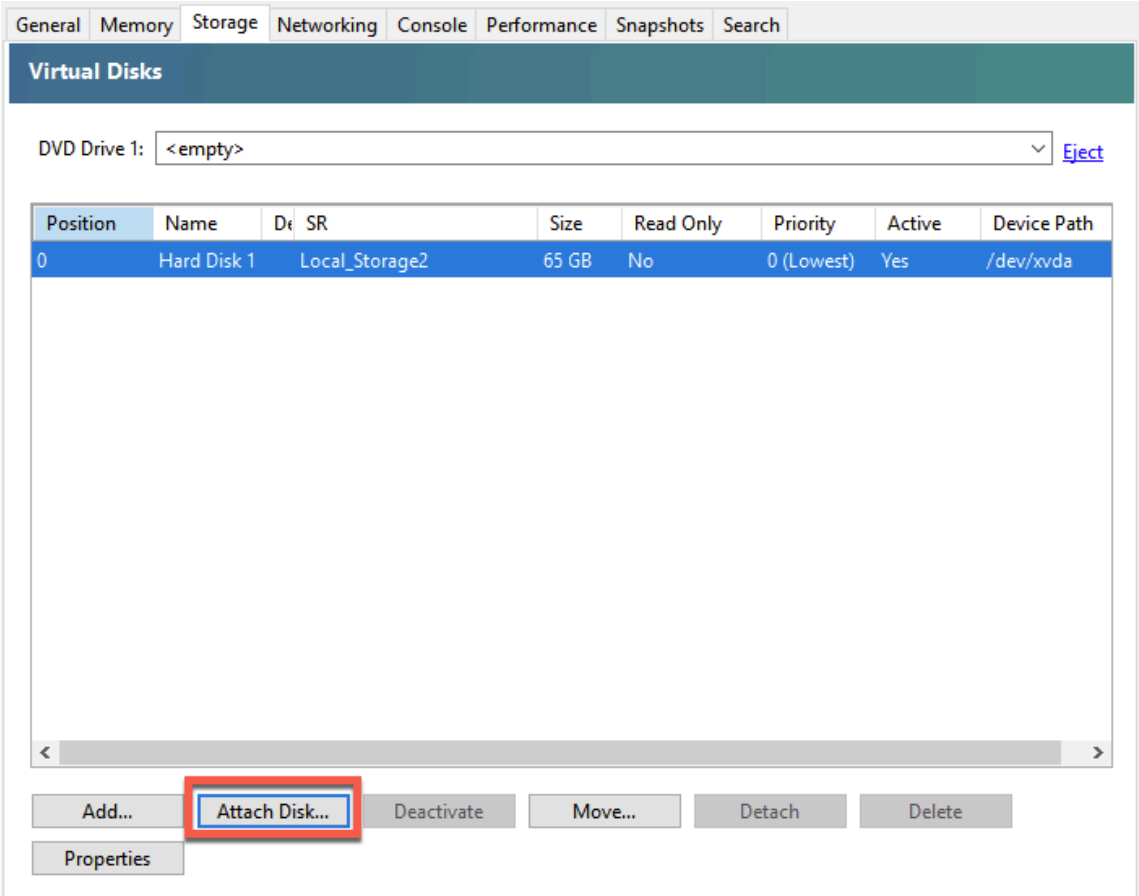

2. Select the disk attached to the Citrix SD-WAN Orchestrator for On-premises which hit disaster and click **Attach**.

   If the disk is not listed, ensure that the disk attached to Citrix SD-WAN Orchestrator for On-premises which hit disaster is detached and Citrix SD-WAN Orchestrator for On-premises is in shutdown state.

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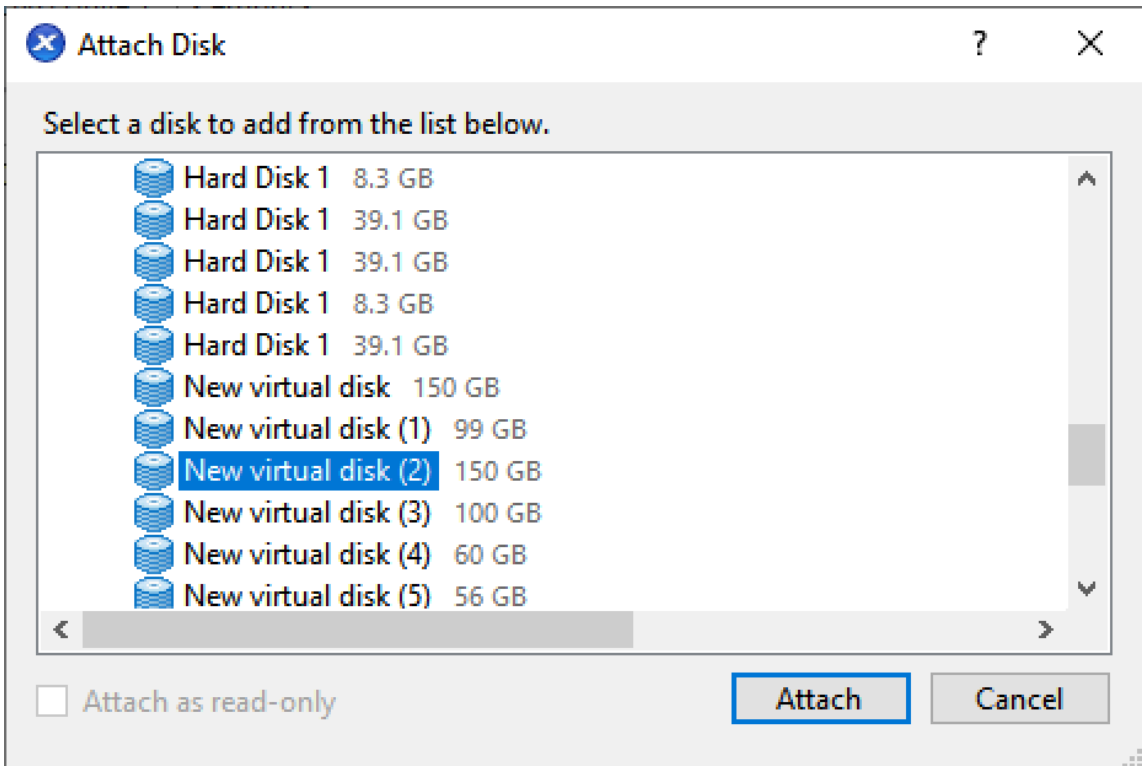
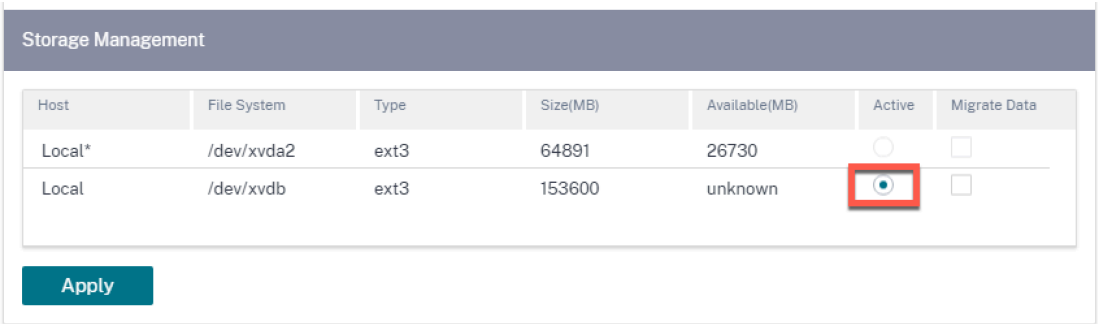


3. Login to the Citrix SD-WAN Orchestrator for On-premises UI and navigate to **INFRASTRUCTURE > Orchestrator Administration > Storage Management**. The newly attached disk gets listed here.

4. Choose only the **Active** radio button (clear the **Migrate Data** check box if selected) and click **Apply**.

> **Note**
>
> Do not select the **Migrate Data** check box. Citrix SD-WAN Orchestrator for On-premises triggers the migration at the back-end and reboots itself once the migration is completed.



5. After the migration is completed, Citrix SD-WAN Orchestrator for On-premises gets rebooted.

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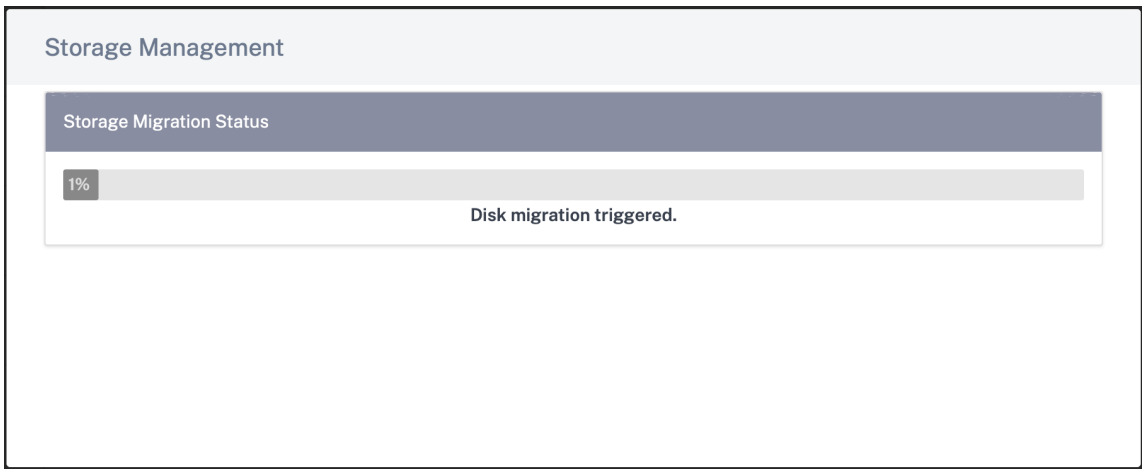

Disaster recovery on ESXi server

1. Log in to the ESXi server and select the virtual machine. Click **Edit**.

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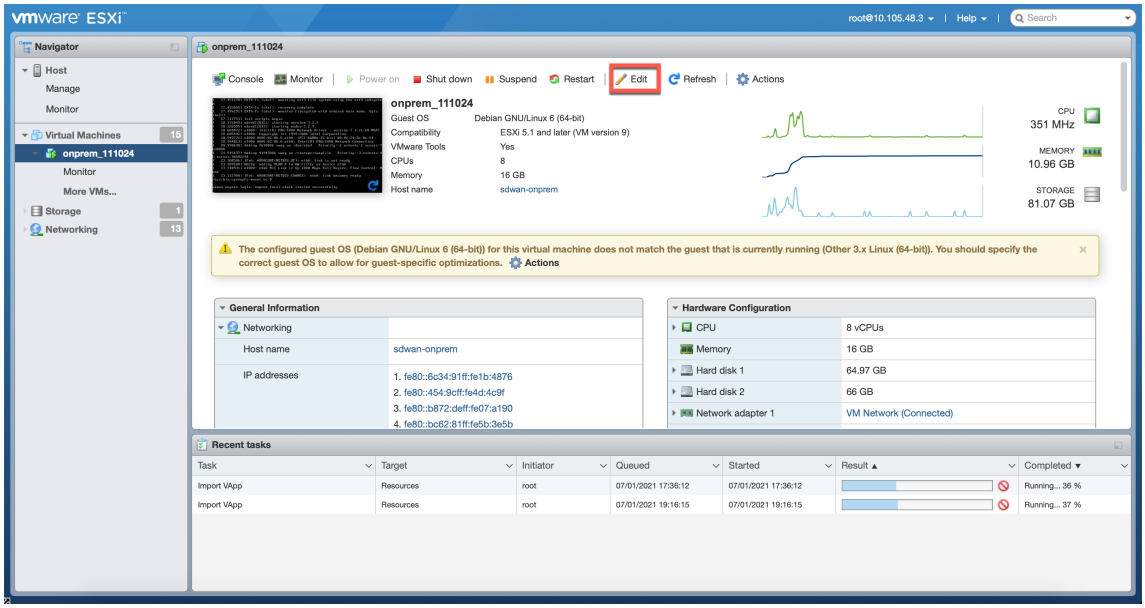
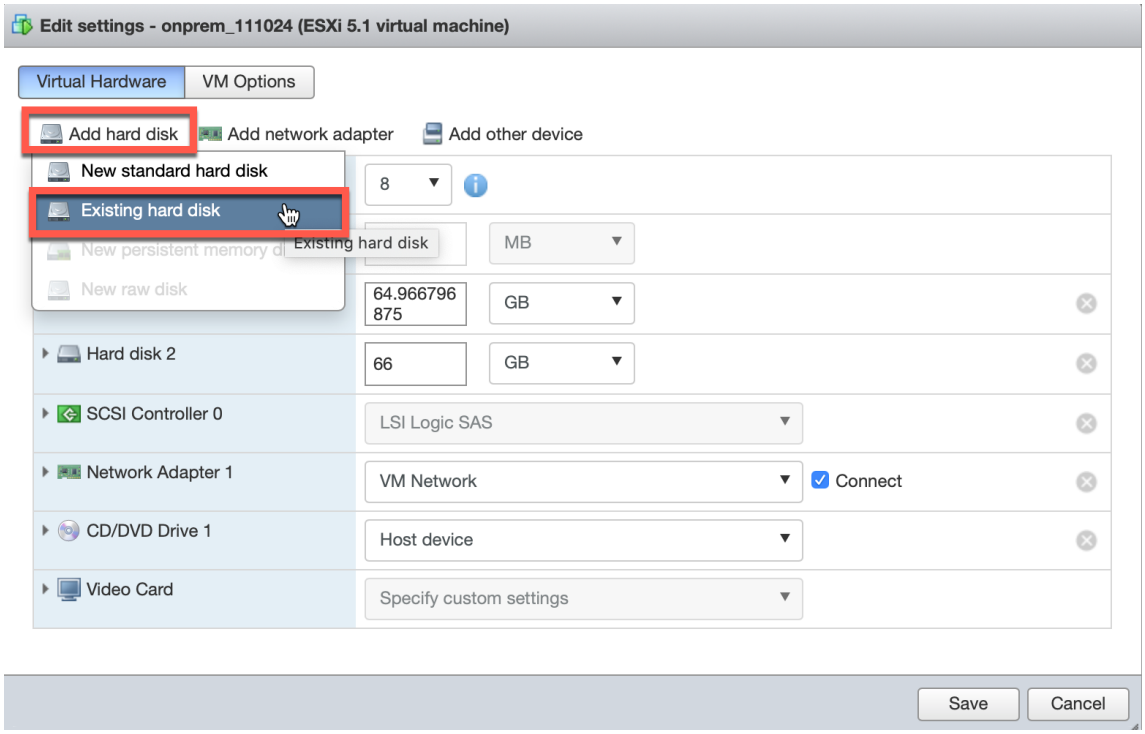


2. Click **Add hard disk > Existing hard disk**.



3. Browse for the disk attached to the Citrix SD-WAN Orchestrator for On-premises which hit disaster and click **Select**.

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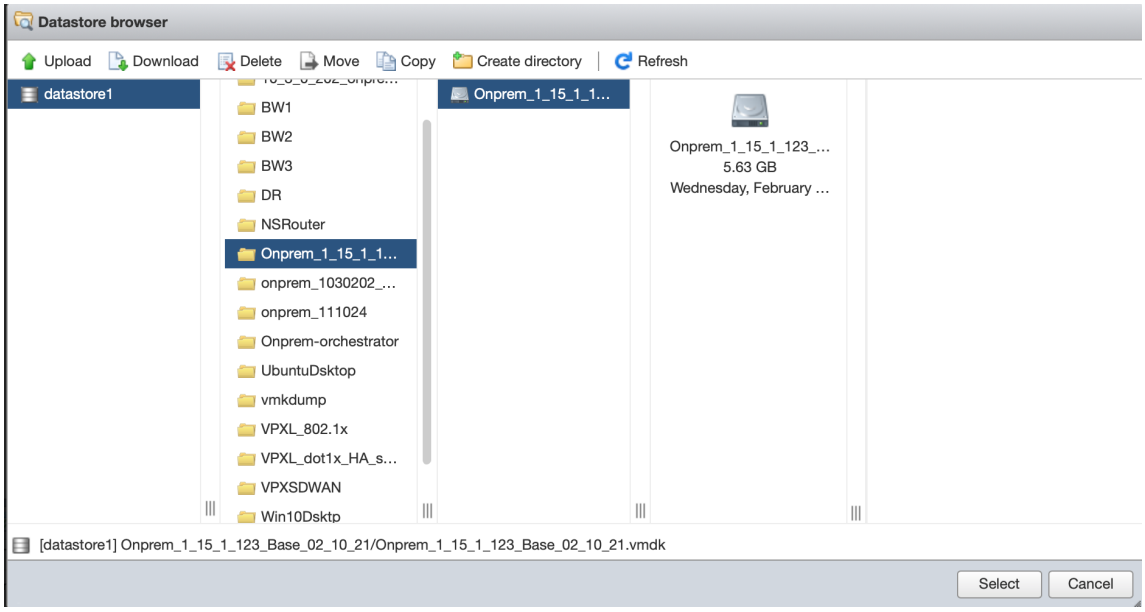
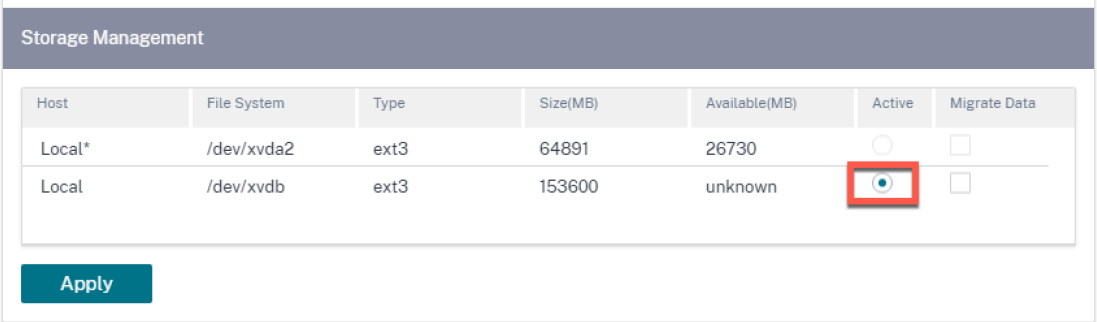


4. Login to the Citrix SD-WAN Orchestrator for On-premises UI and navigate to **INFRASTRUCTURE > Orchestrator Administration > Storage Management**. The newly attached disk gets listed here.

5. Choose only the **Active** radio button (clear the **Migrate Data** check box if selected) and click **Apply**.

> **Note**
>
> Do not select the **Migrate Data** check box. Citrix SD-WAN Orchestrator for On-premises triggers the migration at the back-end and reboots itself once the migration is completed.



6. After the migration is completed, Citrix SD-WAN Orchestrator for On-premises gets rebooted.

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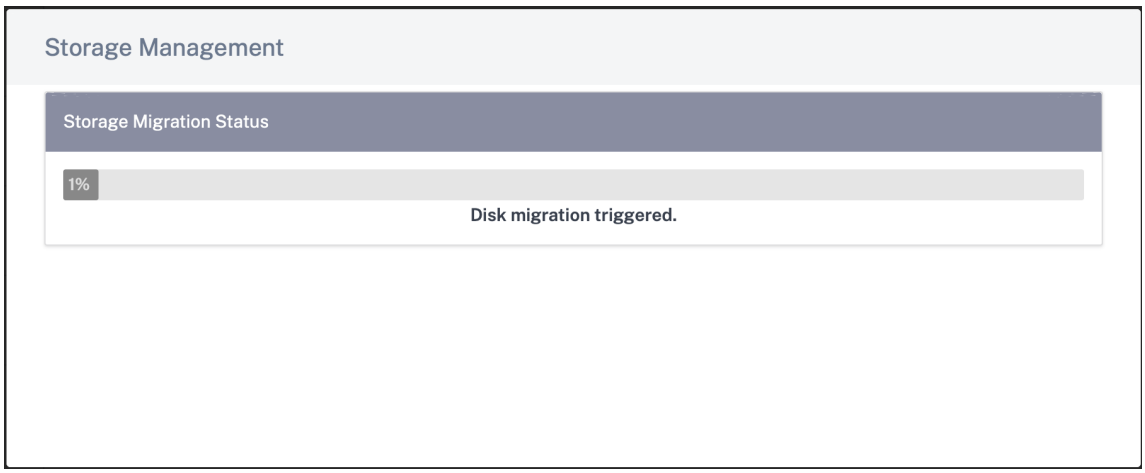

Orchestrator diagnostics

May 17, 2021

This section provides information on the diagnostic activities that can be performed on Citrix SD-WAN Orchestrator for On-premises infrastructure.

> **Note**
>
> In a provider managed setup, provider administrators have access to all the GUI pages **Infrastructure > Orchestrator Diagnostics**. Customer administrators have access to view only **Platform events and logs** and **Platform health** GUI pages.

Platform events and logs

Any change in platform level attributes, such as CPU, memory, or storage in the system is logged as an event and displayed on the Citrix SD-WAN Orchestrator for On-premises.

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For example, if CPU usage exceeds the set limit, a platform event is logged and an alarm is triggered. The alarm comes up in the Notifications bar. The notification gets cleared if the CPU usage gets decreased. The **Platform Events & Logs** page maintains the history of all platform related alarms that were triggered. If the CPU usage decreases, the alarm status becomes INACTIVE. If it is still above the limits, the alarm status remains ACTIVE.

To view the platform events, navigate to **Infrastructure** > **Orchestrator Diagnostics** > **Platform Events & Logs**.

The following details are displayed for logged platform events:

- **Description**: The description of the platform event.
- **Alarm Status**: The status of the alarm. If the platform attribute exceeds the set limit, then the status is ACTIVE. If the platform level attribute subsides to a value within the set limit, then alarm status is INACTIVE.
- **Resource**: The platform level attribute – CPU, Memory, or Storage.
- **Current Value**: The latest value of the logged platform attribute.
- **Created At**: The time when the platform event occurred.

Description	Alarm Status	Resource	Current Value	Created At
UPPER THRESHOLD EXCEEDED	ACTIVE	Memory	70.1	Sun 22 November, 2020 at ...
UPPER WARNING THRESHOLD EX...	ACTIVE	CPU	51.4	Sun 22 November, 2020 at ...

Page Size: 200 Showing 1 - 2 of 2 items Page1 of1

Platform health

You can view the health of the Citrix SD-WAN Orchestrator for On-premises platform. The health information includes real-time values (in percentage) for CPU usage, Memory usage, and free storage available.

To view the platform health, navigate to **Infrastructure > Orchestrator Diagnostics > Platform Health**.

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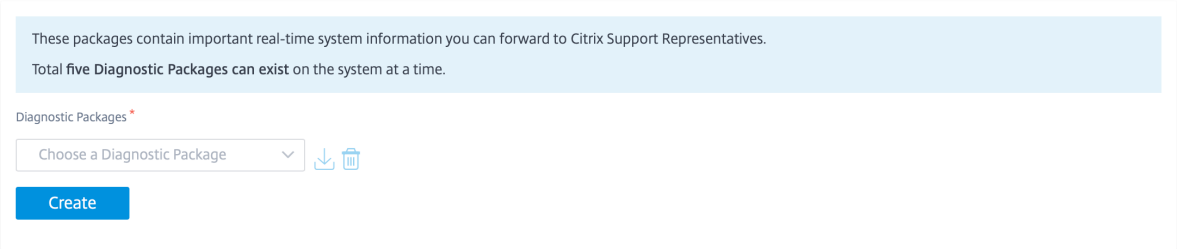
CPU Usage	1%
Memory Usage	74%
Free Storage	35%

Diagnostic info

A diagnostic package consists of System Log files, system information, and other necessary details that assist the Support team in diagnosing and resolving issues with your system.

To create a diagnostic package, navigate to **Infrastructure** > **Orchestrator Diagnostics** > **Diagnostic info**. Click **Create**. After the package is created, you can download it to your computer and then share it with the Support team.

> **NOTE**
>
> Citrix SD-WAN Orchestrator for On-premises can store a maximum of five diagnostic packages at a time.



Restart Citrix SD-WAN Orchestrator for On-premises app

You can restart only the Citrix SD-WAN Orchestrator for On-premises app without rebooting the Operating System (OS). During restart, Citrix SD-WAN Orchestrator for On-premises app goes offline and the all services become unavailable. It takes approximately 6 minutes for the restart to complete. After the restart, Citrix SD-WAN Orchestrator for On-premises login page is displayed.

To restart Citrix SD-WAN Orchestrator for On-premises app, navigate to **Infrastructure > Orchestrator Diagnostics > Restart Orchestrator App**. Click **Restart** and **Yes, Restart** to confirm.

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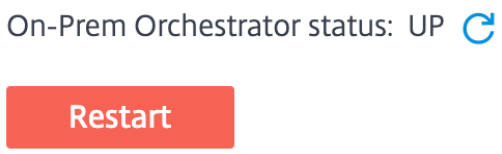
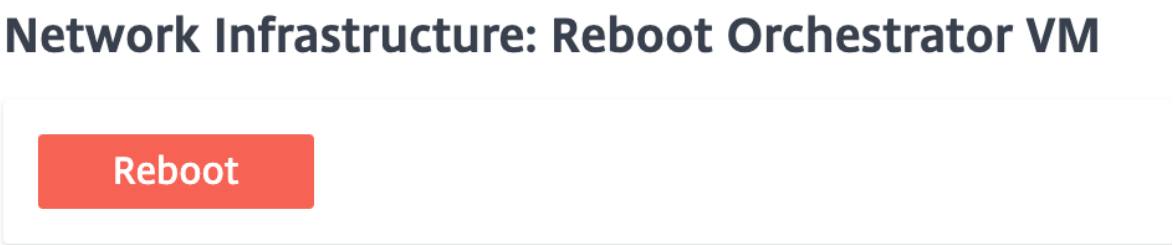


Reboot Citrix SD-WAN Orchestrator for On-premises VM

The Reboot process restarts the Operating System (OS) of Citrix SD-WAN Orchestrator for On-premises. During the reboot, Citrix SD-WAN Orchestrator for On-premises goes offline and all services become unavailable. It takes approximately 6 to 8 minutes for the reboot to complete. After the reboot, Citrix SD-WAN Orchestrator for On-premises login page is displayed.

You can reboot Citrix SD-WAN Orchestrator for On-premises as part of a troubleshooting activity or during a maintenance activity.

To reboot, navigate to **Infrastructure > Orchestrator Diagnostics > Reboot Orchestrator VM**. Click **Reboot** and **Yes, Reboot** to confirm.



Alarms

July 9, 2021

You can view the platform specific and service specific alarms associated with Citrix SD-WAN Orchestrator for On-premises. Platform specific alarms show platform related alerts such as storage issue, RAM, CPU. Service alarms show the status of the microservices running in Citrix SD-WAN Orchestrator for On-premises.

To view the alarms, click the bell icon on the top right corner of the Citrix SD-WAN Orchestrator for On-premises UI and select **Platform Alarms** or **Service Alarms** as needed.

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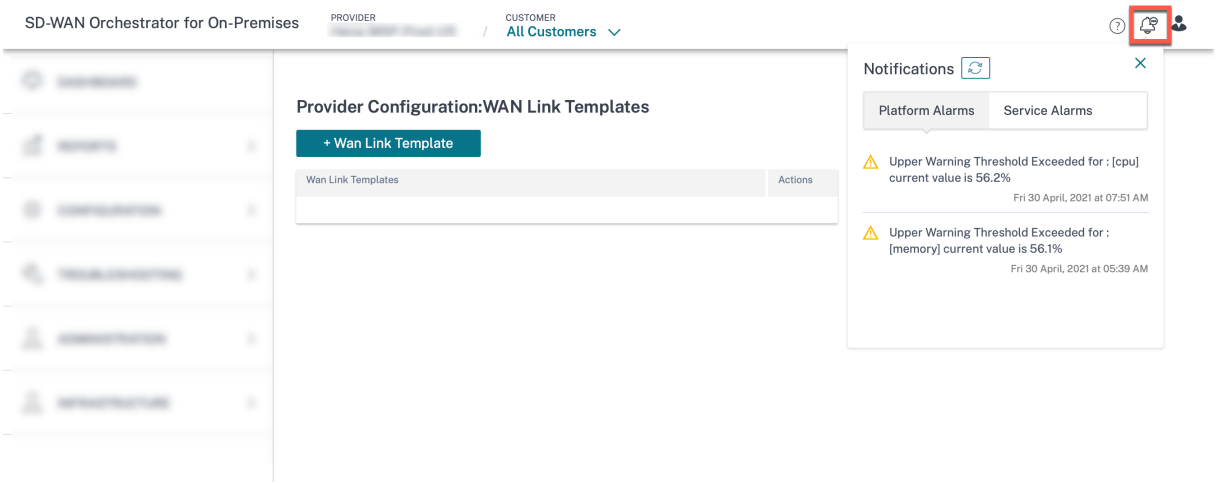

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