Engineering Simplicity

Collapsed Data Center Fabric with Juniper Apstra—Juniper Validated Design (JVD)

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Juniper Networks Validated Designs provide you with a comprehensive, end-to-end blueprint for deploying Juniper solutions in your network. These designs are created by Juniper's expert engineers and tested to ensure they meet your requirements.

Using a validated design, you can reduce the risk of costly mistakes, save time and money, and ensure that your network is optimized for maximum performance.

About this Document

This document provides an overview of steps to provision Collapsed Data Center Fabric with Juniper Apstra JVD, consisting of two switches in a collapsed spine architecture. The device models validated are listed further in the document. This document is intended for an audience familiar with Juniper technologies such as the Junos OS, QFX Series, and Juniper Apstra.

Solution Benefits

IN THIS SECTION

Juniper Validated Designs (JVDs) are network building blocks that help you successfully architect, deploy, manage, and integrate data center technologies according to best practices. Adopting validated designs allows you to address technical debt by deploying well-characterized architectures that simplify support.

The Collapsed Data Center Fabric with Juniper Astra JVD is designed for scenarios where a 3-stage data center network would be an unreasonably large investment. Collapsed fabric use cases include:

- Remote sites and branch office data center networks
- Extend current L2 domains to remote sites through EVPN
- Single-rack pods within a larger data center
- Deployments where low budget, space, or power constraints are a primary consideration
- Small data center networks needing high availability

Juniper Validated Design Benefits

JVDs are a prescriptive blueprint for building a data center fabric with well-documented capabilities and appropriate product selection. JVDs must pass rigorous testing with real-world workloads to achieve validation, verifying that all products in the Building Blocks JVD work together as expected and mitigating the risk faced while deploying a network. The core benefits of JVDs are:

- **Repeatability**—Unlock value with repeatable network designs. Because JVDs are prescriptive designs used by multiple customers all JVD customers benefit from lessons learned through both lab testing and real world deployments.
- **Reliability**—Layered testing with real traffic. JVDs are quantified and integrated best practice designs, based on carefully chosen hardware platforms and software versions, and tested with real world traffic.
- **Accelerated Deployment**—Ease installation with step-by-step guidance. Simplify deployment with guidance, automation, and prebuilt integrations.
- **Accelerated Decision-Making**—Leave behind costly bespoke networks. Bridge business and technology in designs that meet the needs of most customers and consider how features behave and operate in real-world applications and conditions.
- **Best Practice Networks**—Better outcomes for a better experience. JVDs have known characteristics and performance profiles to help you make informed decisions about your network.

Juniper Apstra

Apstra is a multi-vendor, intent-based network fabric management solution that provides closed-loop automation and assurance. Apstra translates business intent and technical objectives to essential policy and device-specific configuration. Apstra continuously self-validates and resolves issues to assure compliance. The core benefits of Apstra are:

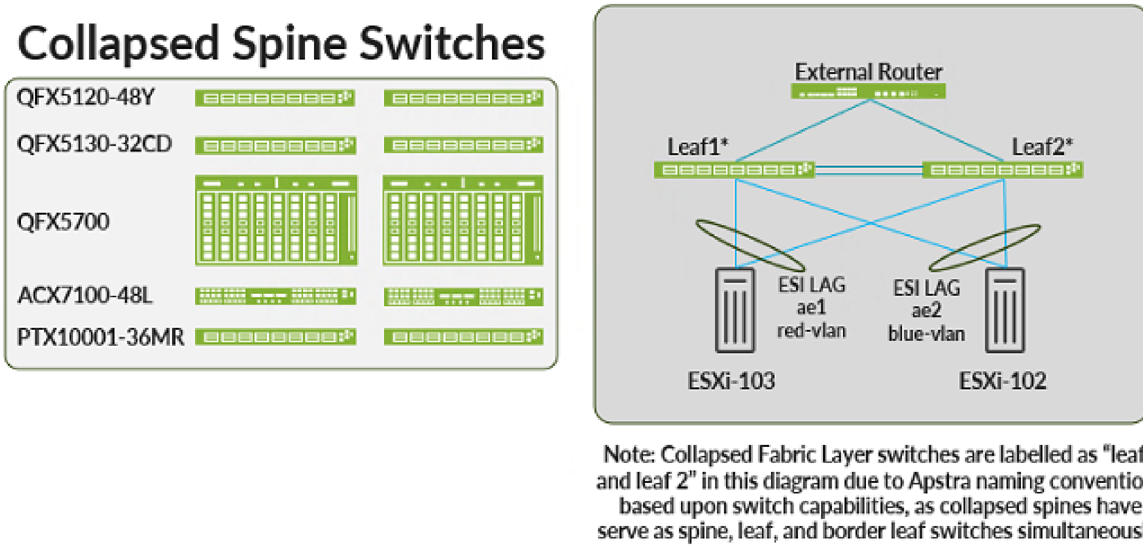
- **Intent-based networking**—Automates configuration generation and continuously validates operating state versus intent.
- **Network Automation**—Apstra is a multi-vendor network automation platform that is continuously updated to work with the latest hardware and exhaustively tested using modern DevOps practices.
- **Recoverability**—Built-in rollback capability restores known-working configuration in a fraction of the time
- **Day 2+ Management**—Apstra's rich analytics capabilities reduce Mean Time to Resolution (MTTR).
- **Simplicity**—Apstra simplifies network management. For example, by reducing the complexity of Data Center Interconnection (DCI), making it easy to unify multiple data centers while isolating failure domains for high availability and resilience

Use Case and Reference Architecture

IN THIS SECTION

The Collapsed Data Center Fabric with Juniper Apstra JVD topology is created in Juniper Apstra.

Figure 1: The Collapsed Data Center Fabric with Juniper Apstra JVD Topology



The Collapsed Data Center Fabric with Juniper Apstra JVD is a two-switch network fabric designed for small network deployments. Switches in a collapsed fabric perform the roles of spine, leaf, and border leaf switches. This allows for high availability network deployments with a minimum of switch hardware; however, resource constraints limit the real-world expandability of this design.

For customers seeking to amplify the number of ports available in this design beyond what can be provided by two switches in a collapsed fabric configuration, we recommend the Collapsed Fabric with Apstra and Access Switches JVD Extension (JVDE). For customers who need more fabric ports than can be provided by two switches in a collapsed fabric configuration, we recommend the 3-Stage Data Center Design with Juniper Apstra JVD.

The Collapsed Data Center Fabric with Juniper Apstra JVD uses EVPN-VXLAN for the control plane and eBGP for both underlay and overlay signaling. This means leaf switches can discover all the "remote" hosts without flooding the overlay with ARP/ND requests. Because the switches in the Collapsed Data Center Fabric with Juniper Apstra JVD serve all fabric roles, including border leaf, the collapsed fabric switches are tested to serve as anycast gateways as well as gateways to external networks, which require Data Center Interconnect (DCI) features.

Prerequisites

This JVD assumes that the Apstra server virtual machine (VM) and Apstra ZTP server VM are already deployed, and you know how to access the console of these VMs in order to configure them. For the purposes of this document, the virtual network of both VMs needs to be on the same subnet as the physical management network interface of the switches.

This JVD assumes that you have a basic knowledge of Apstra terminology and processes and is familiar with provisioning a data center reference architecture with a blueprint. For more information, see Juniper Apstra User Guide.

Juniper Hardware and Software Components

For this solution, the Juniper products and software versions are listed below. The listed architecture is the recommended base representation for the validated solution. As part of a complete solutions suite, we routinely swap hardware devices with other models during iterative use case testing. Each platform also goes through the same tests for each specified version of Junos OS.

Juniper Hardware Components

The following switches are tested and validated to work with the Collapsed Data Center Fabric with Juniper Apstra JVD:

- QFX5130-32CD
- QFX5120-48Y
- QFX5700
- ACX7100-48L
- PTX10001-36MR

For the purposes of this document, the following switch is used in the configuration walkthrough:

Juniper Hardware			
Platform	Role	Hostname	Junos OS Release
QFX5120-48Y	Collapsed Spine	dc1-spine1 and dc1-spine2	23.4R2-S3

Juniper Software	
Product	Version
Juniper Apstra	4.1.2

Juniper Apstra Overview

Juniper Apstra is a multivendor intent-based network software (IBNS) solution that orchestrates data center deployments and manages small to large-scale data centers through Day-0 to Day-2 operations. It is an ideal tool for building data centers for AI clusters, providing invaluable Day-2 insights through monitoring and telemetry services.

Deploying a data center fabric through Juniper Apstra is a modular function that leverages various building blocks to instantiate a fabric. These basic building blocks are as follows:

- A logical device is a logical representation of a switch's port density, speed, and possible breakout combinations. Since this is a logical representation, any hardware specifics are abstracted.
- Device profiles provide hardware specifications of a switch that describe the hardware (such as CPU, RAM, type of ASIC, and so on) and port organization. Juniper Apstra has several pre-defined device profiles that exist for common data center switches from different vendors.
- Interface maps bind together a logical device and a device profile, generating a port schema that is applied to the specific hardware and network operating system, which is represented by the device profile. By default, Juniper Apstra provides several pre-defined interface maps with the ability to create user-defined interface maps as needed.
- Rack types define logical racks in Juniper Apstra, the same way a physical rack in a data center is constructed. However, in Juniper Apstra, this is an abstracted view of it, with links to logical devices that are used as leaf switches, the kind and number of systems connected to each leaf, any redundancy requirements (such as MLAG or ESI LAG), and how many links, per spine, for each leaf.
- Templates take one or more rack types as inputs and define the overall schema/design of the fabric. You can choose between a 3-stage Clos fabric, a 5-stage Clos fabric, or a collapsed spine design. You can also choose to build an IP fabric (with static VXLAN endpoints, if needed) or a BGP EVPN-based fabric (with BGP EVPN as the control plane).
- The blueprint instantiates the fabric, taking a template as its only input. A blueprint requires additional user input to bring the fabric to life, including resources such as IP pools, ASN pools, and interface maps. Additional virtual configuration is done, such as defining new virtual networks

(VLANs/VNIs), building new VRFs, defining connectivity to systems such as hosts or WAN devices, and so on.

Configuration Walkthrough

IN THIS SECTION

This walkthrough summarizes the steps required to configure the Collapsed Data Center Fabric with Juniper Apstra JVD. For more detailed step-by-step configuration information, see Juniper Apstra User Guide . Notes provide additional guidance in this walkthrough.

This walkthrough details the configuration of the baseline design, as used during validation in the Juniper data center validation test lab. The baseline design consists of two QFX5120-48Y switches in the collapsed spine role. The goal of JVD is to provide options so that the baseline switch platform can be replaced with any validated switch platform for that role, as described in the " Juniper Hardware Components " on page 5 section. To keep this walkthrough a manageable length, only the baseline design platform is used for the purposes of this document.

Apstra: Configure Apstra Server and Add Switches

This document does not cover the installation of Apstra. For more information about installation, see Juniper Apstra User Guide .

The first step is to configure the Apstra Server. Upon connecting to the Apstra Server VM for the first time, a configuration wizard launches. Here, passwords for the Apstra server, Apstra UI, and network configuration can be configured.

Apstra: Management of Junos OS Device

There are two methods of adding Juniper devices into Apstra: manually or in bulk using ZTP:

To add devices manually (recommended):

- In the Apstra UI, navigate to **Devices > Agents > Create Offbox Agents**. This requires the devices to be configured with a minimum of the root password and management IP.

To add devices through ZTP:

- To add devices from the Apstra ZTP server and more information on the ZTP of Juniper devices, see Juniper Apstra User Guide .

For the purposes of this setup, a root password and management IPs were already configured on all switches prior to adding the devices to Apstra. To add switches to Apstra, first log on to Apstra Web UI, choose a method of device addition as per above and provide the appropriate username and password that is preconfigured for those devices.

NOTE: Apstra pulls the configuration from Juniper devices called pristine config. The Junos OS configuration 'groups' stanza is ignored when importing the pristine configuration, and Apstra will not validate any group configuration listed in the inheritance model, see Use Configuration Groups to Quickly Configure Devices . However, it's best practice to avoid setting loopbacks, interfaces (except management interface), routing-instances (except management-instance). Apstra will set the protocols LLDP and RSTP when device is successfully Acknowledged.

Create Agent Profile

For the purposes of this JVD lab, the root user and password are the same across all devices; hence, an agent profile is created, as shown below; note that this also obscures the password, which keeps it secure.

1. Navigate to **Devices > Agent Profiles.**
2. Click **Create Agent Profile**.
3. Create an agent profile named **root** with the platform set to **Junos**.
4. Add the username and password used to log into your switches.

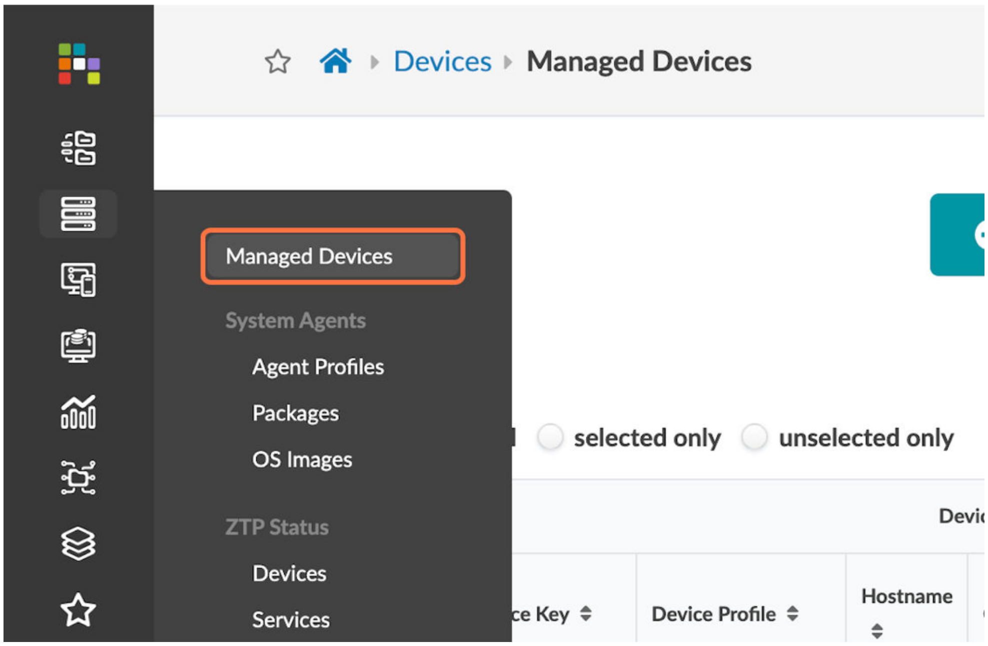
Figure 2: Create Agent Profile in Apstra

Create Offbox Agent

An IP address range can be provided to bulk-add devices into Apstra.

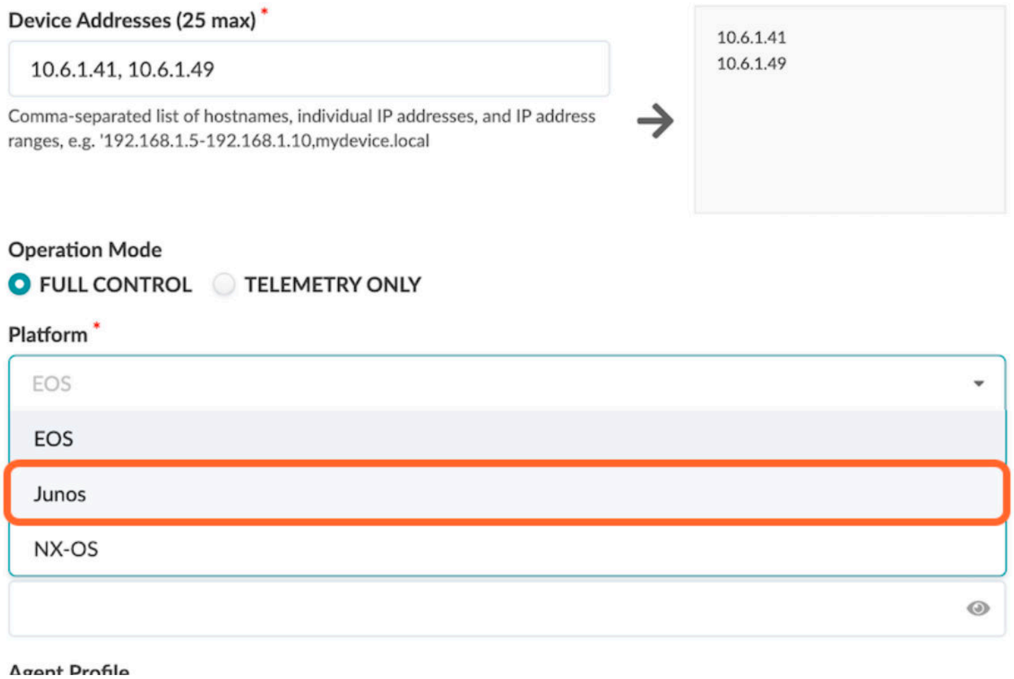
1. Navigate to **Devices** > **Managed Devices**.
2. Click on **Create Offbox Agents**.

   Figure 3: Devices Menu, with Managed Devices Highlighted



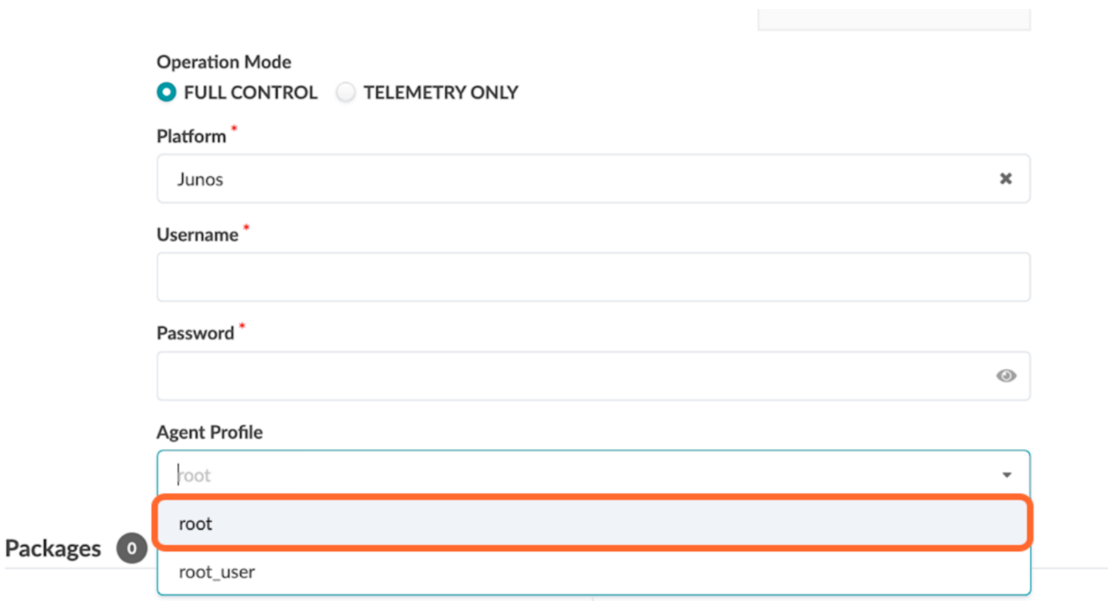
3. Add the management addresses of the switches, separated by a comma, in the Create Offbox Agents pop-up. You might enter an IP range instead if you prefer.
4. Select **Junos** as the platform and **full control** as the operation mode.

   Figure 4: Create Offbox Agents Pop-up with the Platform Option Selecting Junos



5. Select the agent profile **root** created in the previous step.

   Figure 5: Create Offbox Agents Pop-up with the Agent Profile Option Selecting Root



6. Press **Create** and wait for the systems to populate in the **Managed Devices** table.

Figure 6: Managed Devices Table Showing the Entries Created After Cicking Create in the Previous Step

10.6.1.41	XH3119130257	Juniper_QFX5120-48Y	leaf-1	Junos 22.2R3-S3.14	OOS-READY			Not assigned	OFFBOX	root	AOS_4.2.1_OB.207
10.6.1.49	XH3119130156	Juniper_QFX5120-48Y	leaf-2	Junos 22.2R3-S3.14	OOS-READY			Not assigned	OFFBOX	root	AOS_4.2.1_OB.207

Add Pristine Configuration

Click on each of the newly created systems in the **Devices > Managed Devices** table, and then add the pristine configuration by collecting from the device or pushing from Apstra. The configuration applied as part of the pristine configuration should be the base configuration or minimal configuration required to reach the devices with the addition of any users, static routes to the management switch, and so on. This creates a backup of the base configuration in Apstra and allows devices to be reverted to the pristine configuration in case of any issues.

Figure 7: Add Pristine Config

NOTE: If the pristine configuration is updated using Apstra as shown in the above figure, then run **Revert to Pristine**.

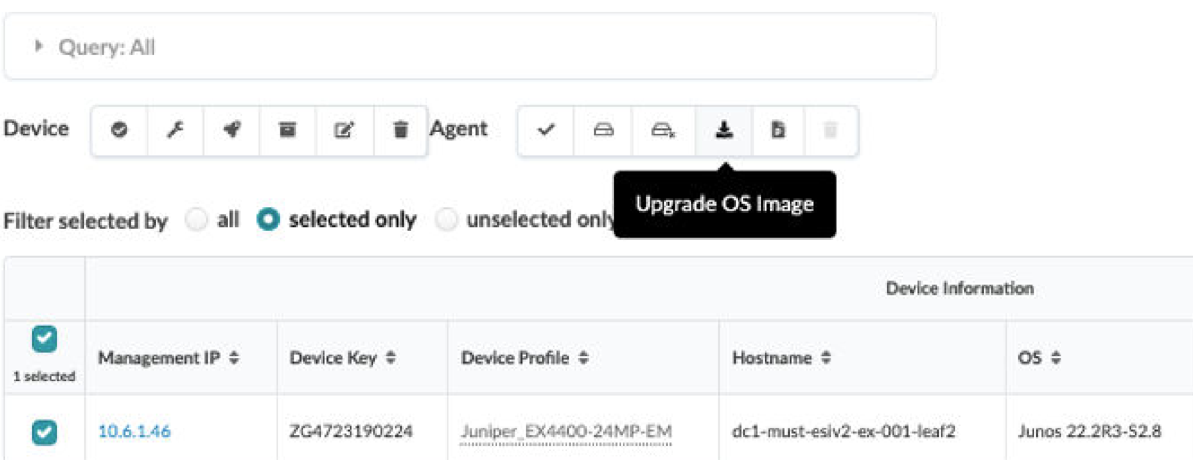
Upgrade Junos OS

If your switches are not running the operating system release recommended by this JVD, you should upgrade them to the recommended version. For the purposes of this JVD, the recommended Junos OS version is 23.4R2-S3.

> **NOTE**: Important: A maintenance window is required to perform any device upgrade, as upgrades can be disruptive.Best practice recommendations for upgrade: Upgrade devices using the Junos OS CLI as outlined in the Junos OS Software Installation and Upgrade Guide , along with the Junos OS version release notes, as Apstra currently only performs basic upgrade checks. However, this JVD summarizes the steps to upgrade if Apstra is intended to be used for upgrades.If a device is added to the blueprint, set it to *undeploy*, unassign its serial number from the blueprint, and commit the changes, which reverts it back to Pristine Config. Then, proceed to upgrade. Once the upgrade is complete, add the device back to the blueprint.

Apstra allows devices upgrade. However, the current best practice recommendation is to upgrade devices using the Junos OS CLI as outlined in the Junos OS Software Installation and Upgrade Guide , along with the Junos OS version release notes. This is because Apstra currently only performs basic upgrade checks. If you want to upgrade the device within Apstra, here is how you do it:

Figure 8: Upgrade Device from Apstra



To register a Junos OS image on Apstra, either provide a link to the repository where all OS images are stored or upload the OS image as shown below. In the Apstra UI, navigate to **Devices > OS Images** and click **Register OS Image**.

Figure 9: Upload OS Image

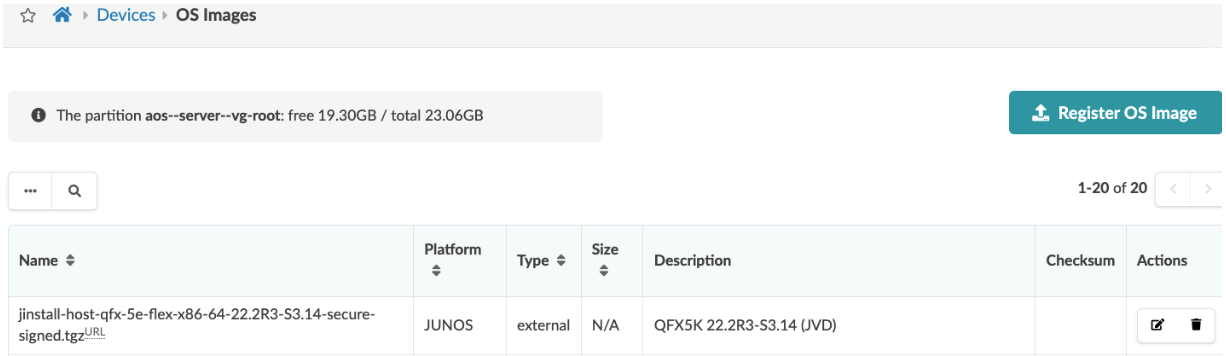
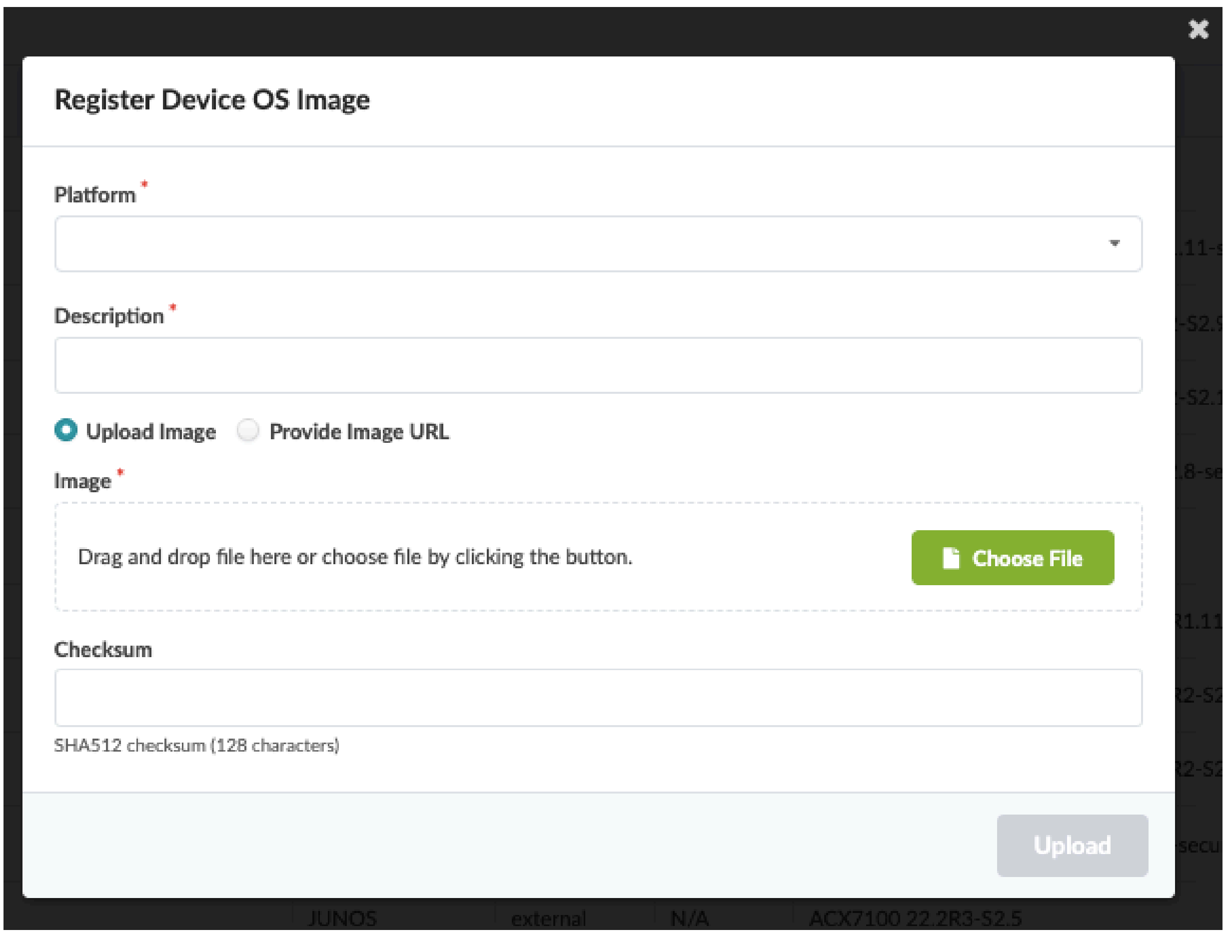


Figure 10: Register OS Image by Uploading or Provide Image URL



Fabric Provisioning

1. Navigate to **Devices** > **Managed Devices**.

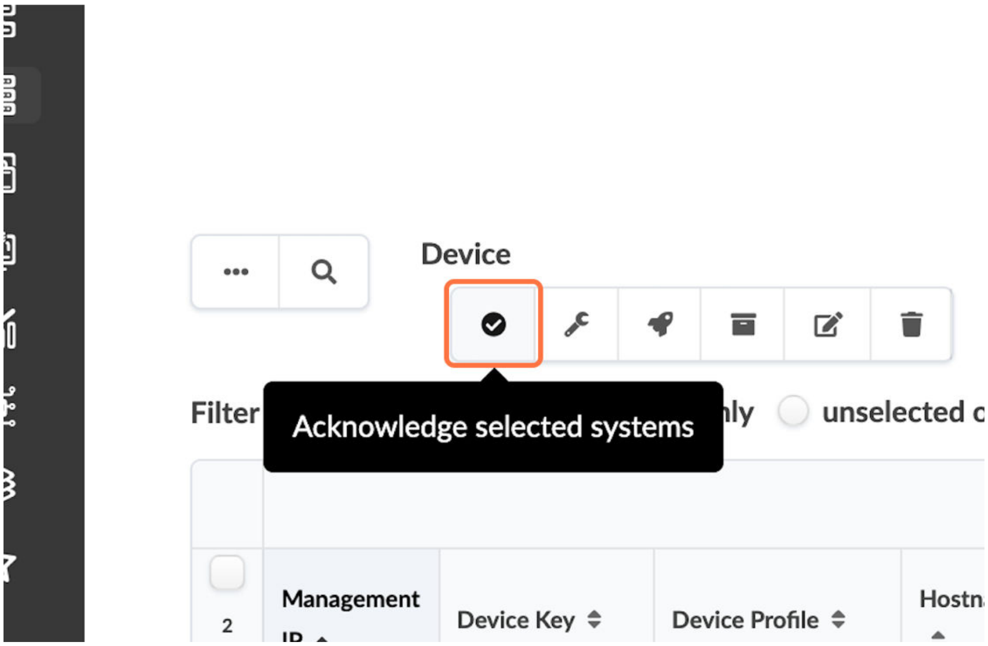
2. Check **Discovered Devices** and **Acknowledge the Devices**.

3. Click the checkbox interface to select all the devices once the offbox agent is added and the device information is collected.

4. Click **Acknowledge**.

   This places the switch under the management of the Apstra server.

   Figure 11: Managed Devices Table Control Panel with the Acknowledge Selected Systems Highlighted



5. Once a switch is acknowledged, the status icon under the **Acknowledged?** table header changes from a red **no entry** symbol to a green checkmark. Verify this change for all switches. If there are no changes, repeat the procedure to acknowledge the switches again.

Figure 12: Managed Devices Table Showing the Switches Successfully Under Apstra Management

	10.6.1.49	XH3119130156	Juniper_QFX5120-48Y	Leaf-2	Junos 22.2R3-S3.7-EVO	IS-ACTIVE			JVD_CF_without-Access_BluePrint_SM	OFFBOX	root	AOS_4.2.1_OB.207	UPGRADE	SUCCESS	
	10.6.1.41	XH3119130257	Juniper_QFX5120-48Y	Leaf-1	Junos 22.2R3-S3.7-EVO	IS-ACTIVE			JVD_CF_without-Access_BluePrint_SM	OFFBOX	root	AOS_4.2.1_OB.207	UPGRADE	SUCCESS	

NOTE: After a device is managed by Apstra, all device configuration changes should be performed using Apstra. Do not perform configuration changes on devices outside of Apstra, as Apstra might revert those changes.

Once the devices are successfully acknowledged, perform the *collect pristine config* step detailed above once again, as Apstra adds LLDP and RSTP protocols to the switch configurations.

Identify and Create Logical Devices, Interface Maps with Device Profiles

> **NOTE**: **Note:** The device profiles covered in this JVD document are not modular chassis-based. For modular chassis-based devices such as QFX5700 the linecard profiles, chassis profile are available in Apstra and linked to the device profile. These cannot be edited; however, they can be cloned, and custom profiles can be created for linecard, chassis and device profile as shown below in Figure 11 and Figure 12.

The following steps define the Collapsed Data Center Fabric with Juniper Apstra JVD baseline architecture and devices. Before provisioning a blueprint, a replica of the topology is created. We define the ERB data center reference architecture and devices in the following steps.

This involves selecting logical devices for the collapsed spine switches. Logical devices are abstractions of physical devices that specify common device form factors such as the amount, speed, and roles of ports. Vendor-specific information is not included, which permits building the network definition before selecting vendors and hardware device models. The Apstra software installation includes many predefined logical devices that can be used to create any variation of the logical device.

- Logical devices are then mapped to device profiles using interface maps. The ports mapped to the interface maps match the device profile and physical connections. Again, the Apstra software installation includes many predefined interface maps and device profiles.
- Finally, the racks and templates are defined using the configured logical devices and device profiles, which are then used to create a blueprint.

The Juniper Apstra User Guide explains the device lifecycle, which must be understood when working with Apstra blueprints and devices.

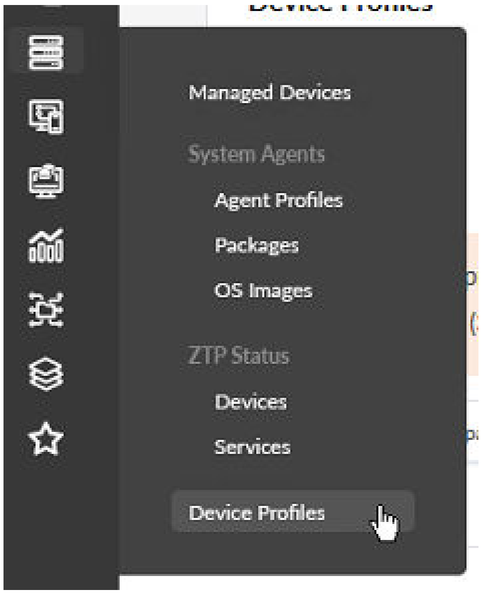
Create Device Profile

For all devices covered in this document, the device profiles (defined in Apstra and found under **Devices > Device Profiles**) were exactly matched by Apstra when adding devices into Apstra, as covered in "Apstra: Management of Junos OS Device" on page 8 . During the validation of supported devices, there are instances where device profiles had to be custom-made to suit the linecard setup on the device, for instance, QFX5700. For more information on device profiles, see Apstra User Guide for Device Profiles .

1. Navigate to **Devices > Device Profiles**, then review the devices listed based on the number and speed of ports.

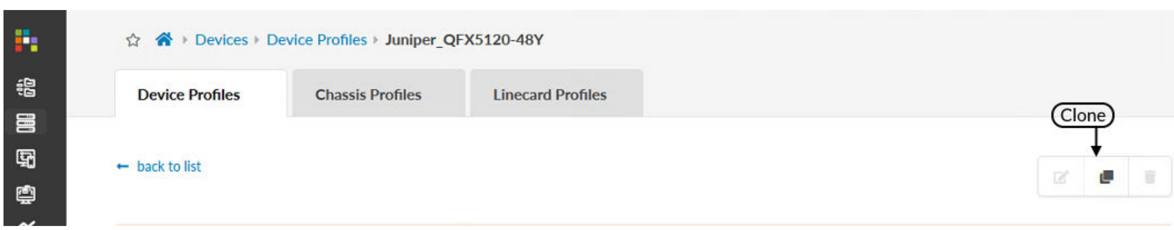
2. Select the device that most closely resembles the switch for which you want to create a device profile.

   Figure 12: Devices Menu with the Device Profiles Button Highlighted



3. Press the **Clone** button once you are confident that the device profile you selected most closely resembles your switch.

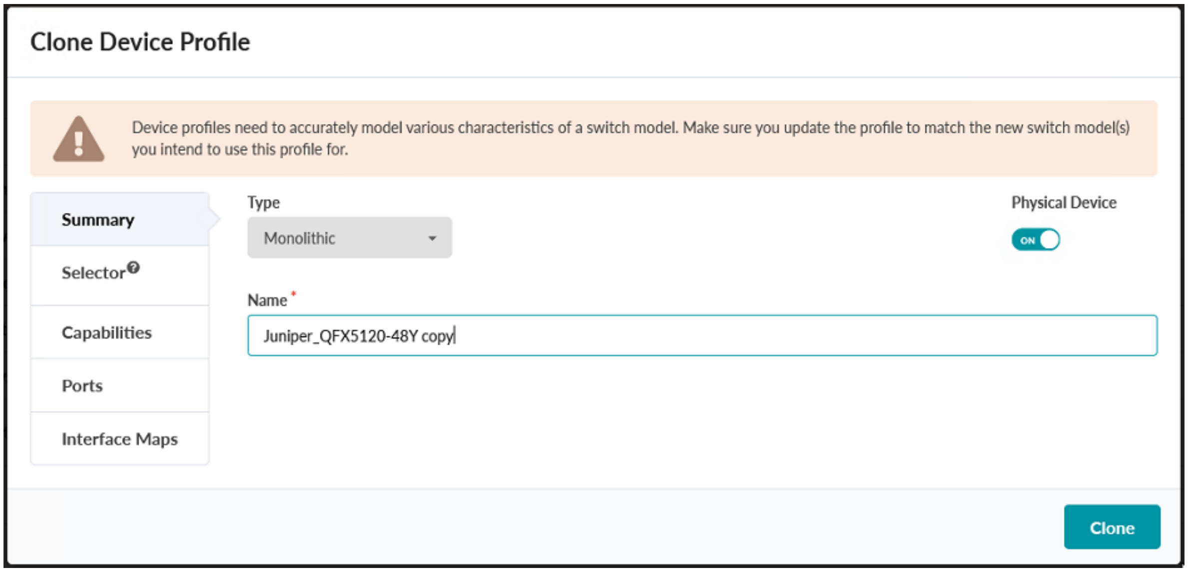
   Figure 13: Device Profile Page with the Clone Button Pointed Out



NOTE: System already added, or default logical devices cannot be changed.

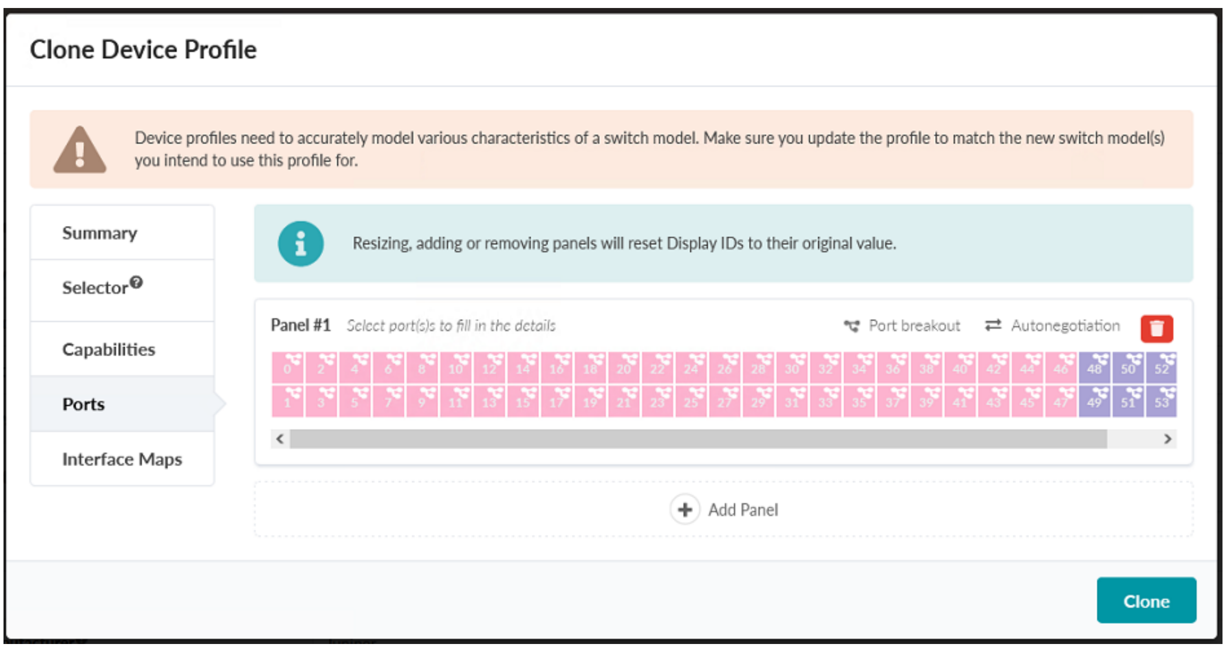
4. Name the cloned profile that you will use for this blueprint.

   Figure 14: Clone Device Profile Pop-Up



5. Click **Ports** to verify that the port selection matches your device. If it does not, modify the port layout, then press **Clone**.

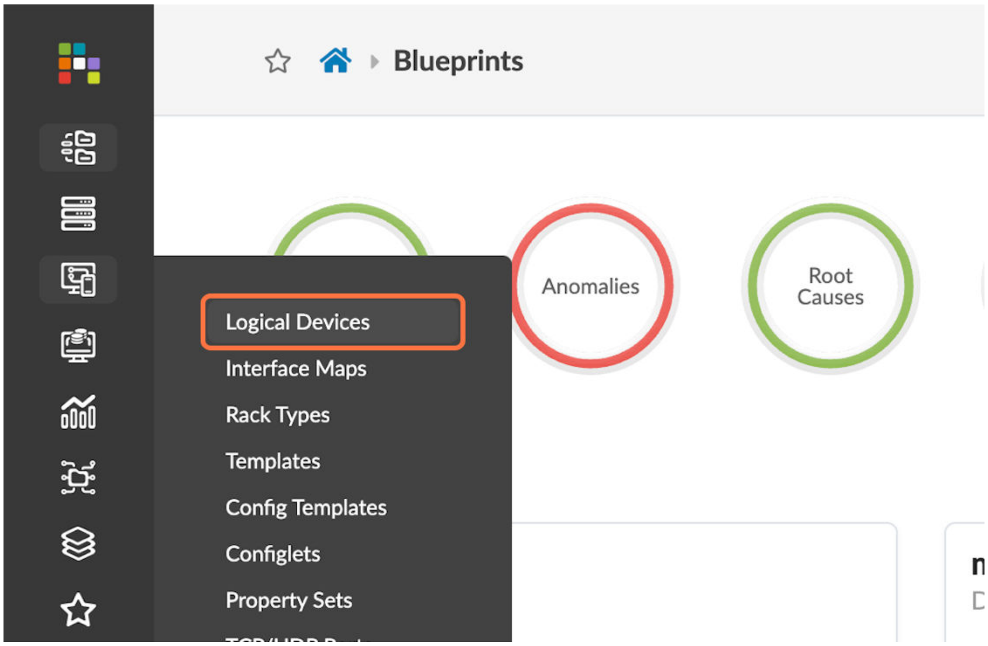
Figure 14: Clone Device Profile Pop-up



Create Logical Device

1. Navigate to **Design** > **Logical Devices** and then select the **Create Logical Dev**ice button in the upper-right corner.

Figure 15: Design Menu with the Logical Device Button Highlighted



2. Create a logical device with the name *JVD_QFX5120-48-y-8c*.

Figure 16: The Create Logical Device Page

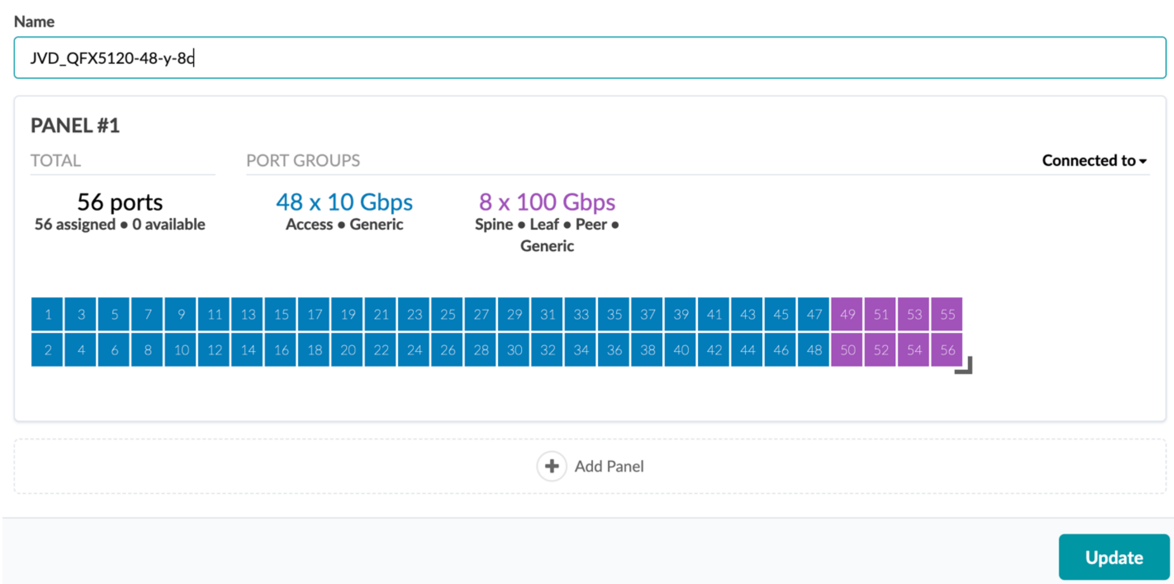
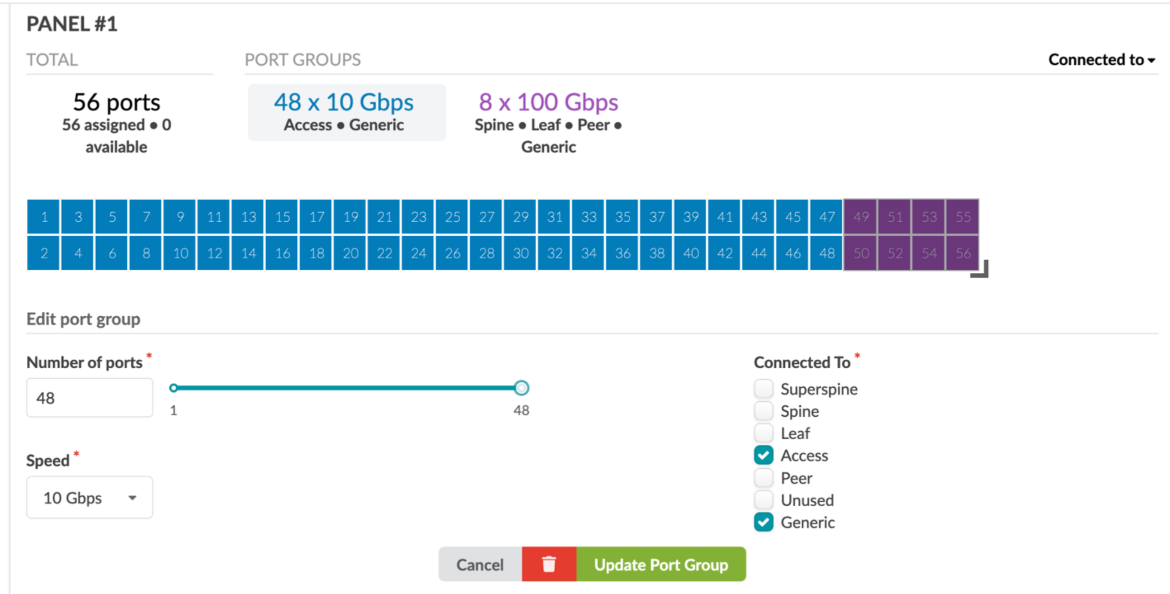
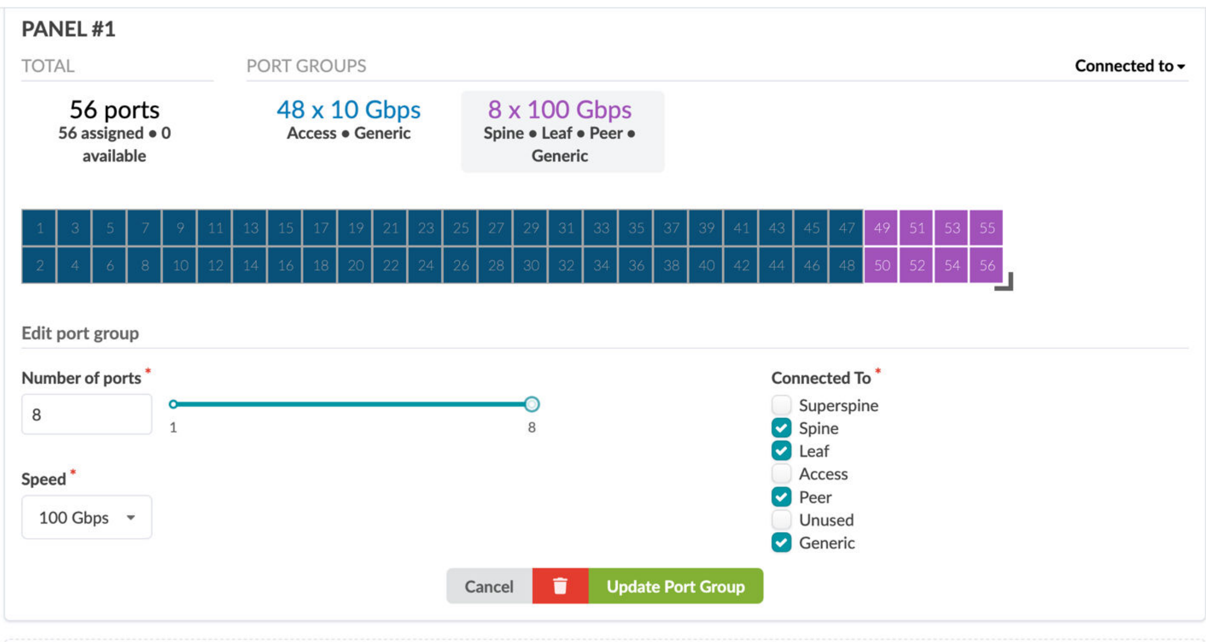


Figure 17: Create Logical Devices Page with the Access Ports Highlighted 48 10 Gbps Ports Assigned for Access and Generic Devices



3. Assign eight 100 Gbps ports for spine, leaf, peer, and generic connections.

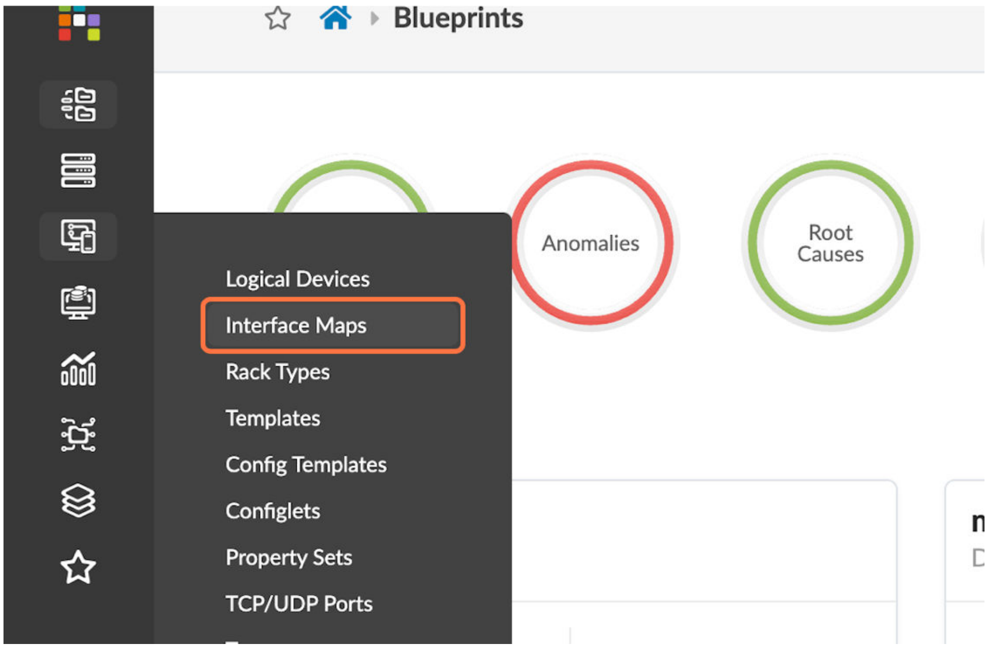
Figure 18: Create Logical Devices Page with the Uplink Ports Highlighted



Create Interface Map

1. Navigate to **Design** > **Logical Devices** and then select the **Create Interface Map** button in the upper-right corner.

   Figure 19: Design Menus with the Interface Maps Button Highlighted

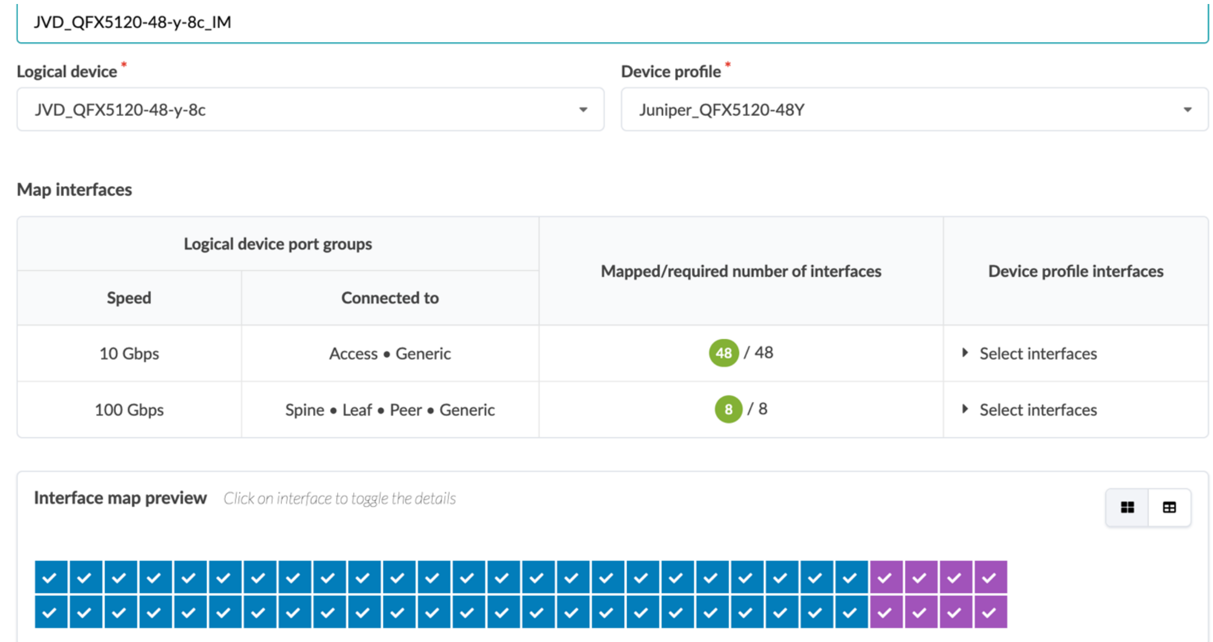
   

2. Name the interface map *JVD_QFX5120-48y-8c_IM.*

3. Select the logical device and device profile created earlier.

4. Click **Select** with all interfaces assigned **interfaces** text in the **Device profile interfaces** column, and then assign all 48x10 Gbps ports and 8x100 Gbps ports as appropriate.

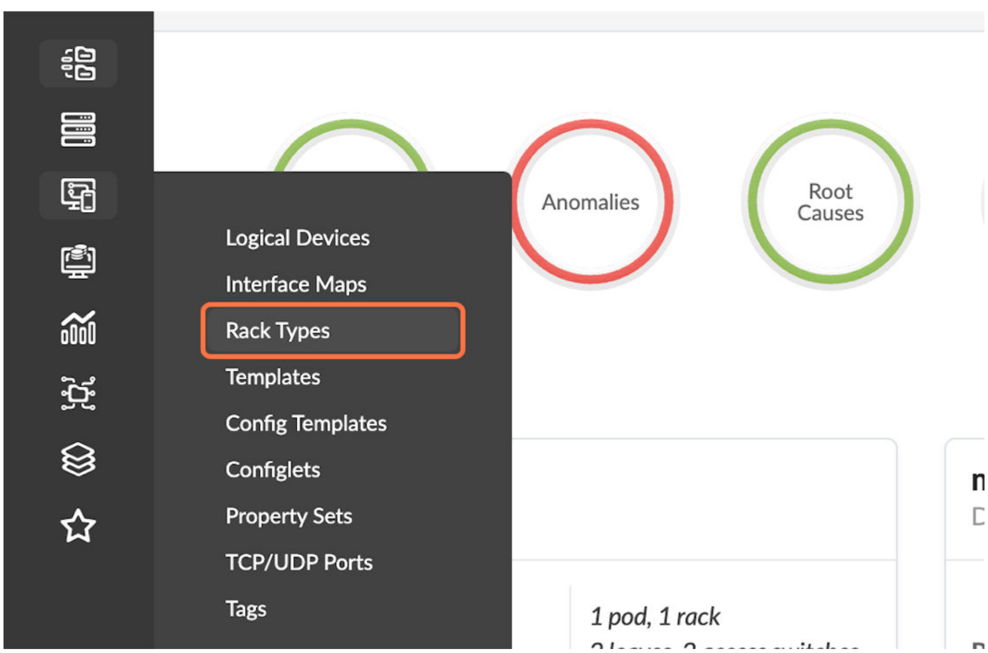
Figure 20: Create Interface Map Pop-up Showing the Interface Map Preview



Create Rack Type

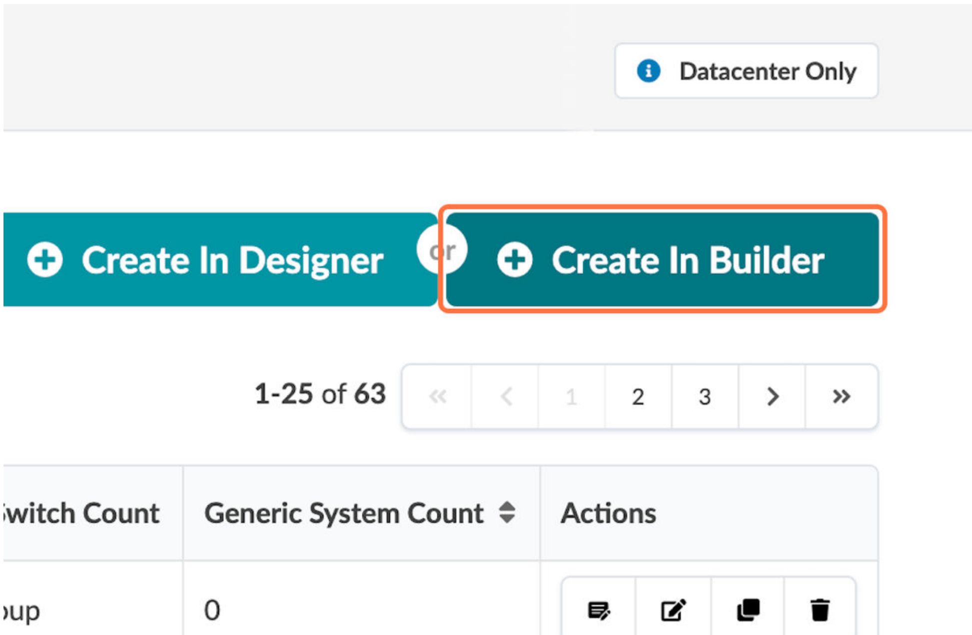
1. Navigate to **Design** > **Rack Types**.

   Figure 21: Design Menu with the Rack Types Button Highlighted



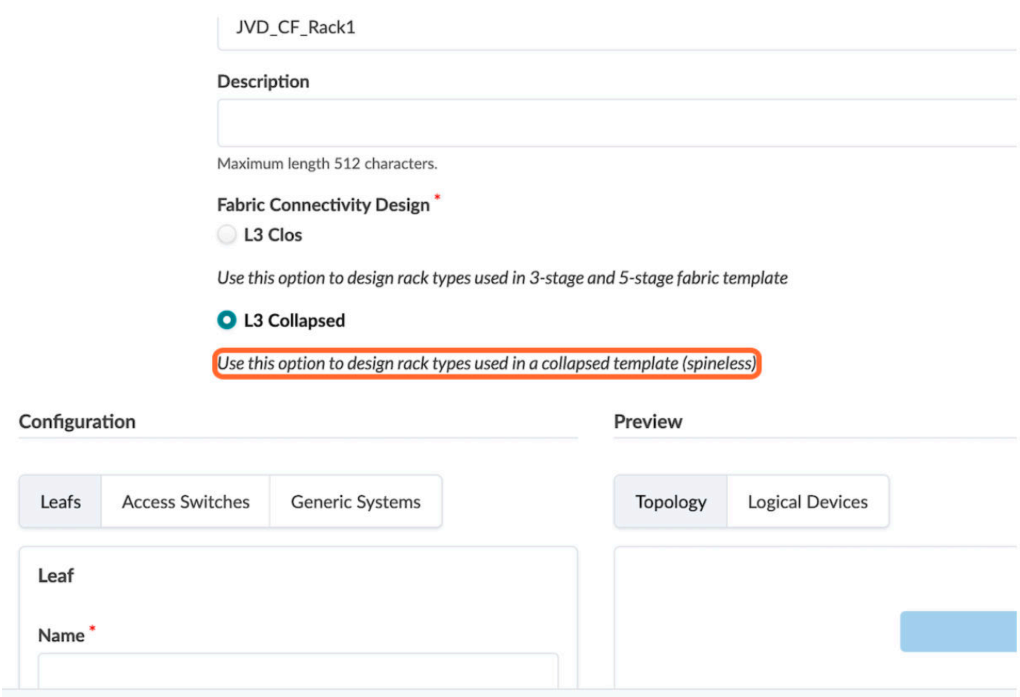
2. Select **Create In Builder** in the upper-right corner.

Figure 22: The Rack Types Page with the Create in Builder Button Highlighted



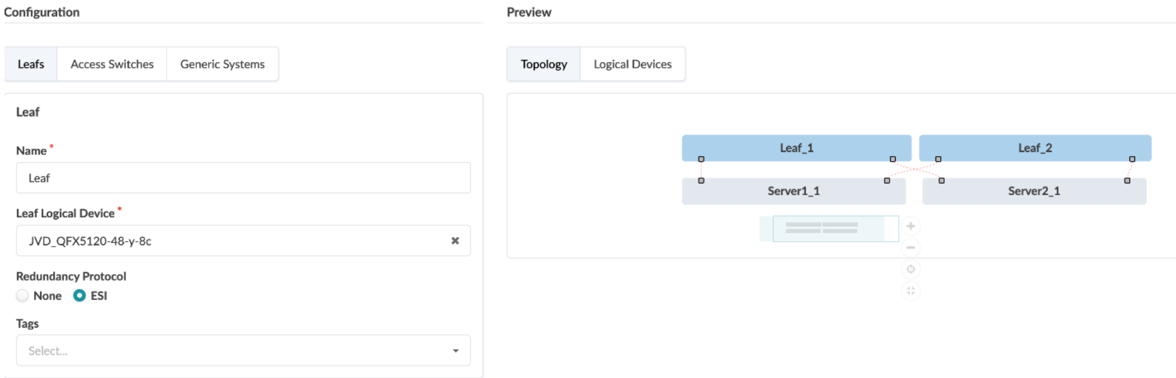
3. Create a rack with the name *JVD_CF_Rack1* and select **L3 collapsed**.

   Figure 23: Rack Type Creation in Builder with L3 Collapsed Highlighted



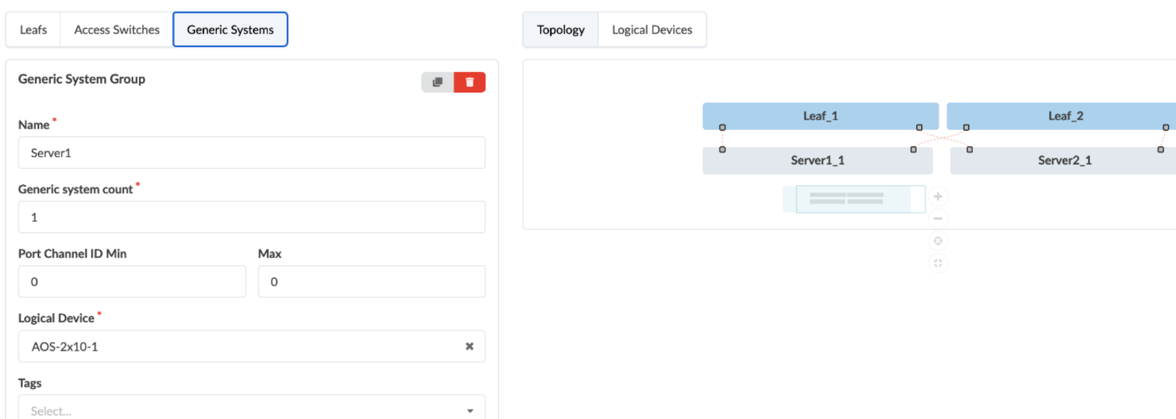
4. Under **Leafs**, select **ESI** as the redundancy protocol.

   Figure 24: Rack Type Creation in Builder with ESI Under Leafs Highlighted



5. Under **Generic Systems**, click **Add new generic system group**, and then select **AOS-2x10-1** as the logical device. This action connects the leafs to the generic systems, such as servers in high availability mode.

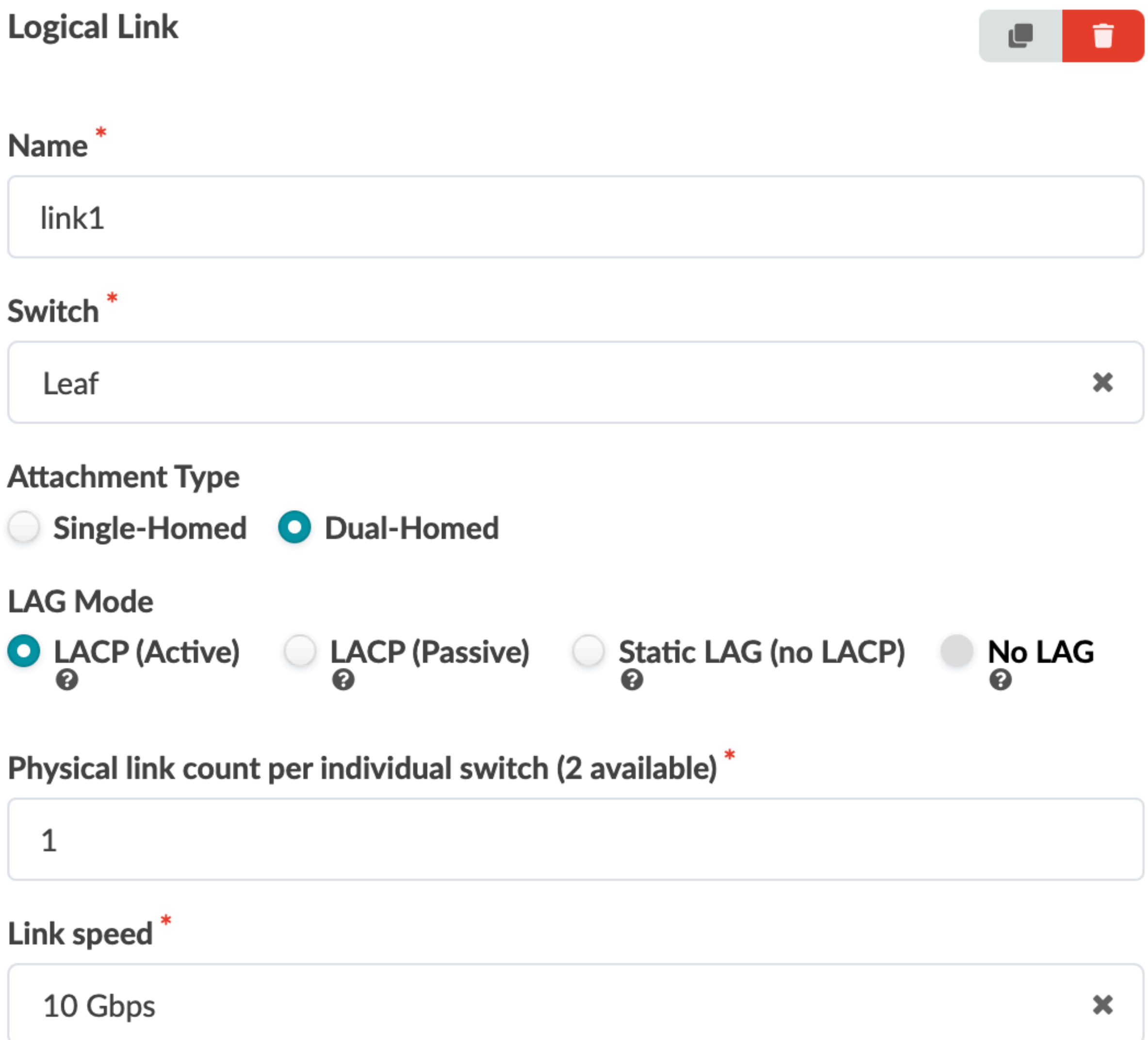
   Figure 25: Rack Type Creation in Builder with Generic Systems Selected

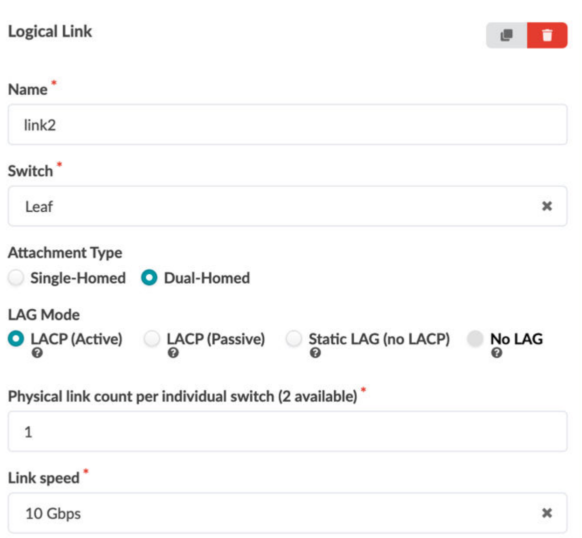


6. While still under Generic Systems, click **Add logical link** and create two logical links: *link1* and *link2*. Both will be dual-homed from *server1* and *server2* with LACP and have 10 Gbps speeds.

7. Click **Create** when done.

Figure 26: Rack Type Creation in Builder Showing Only the Logical Links Being Created

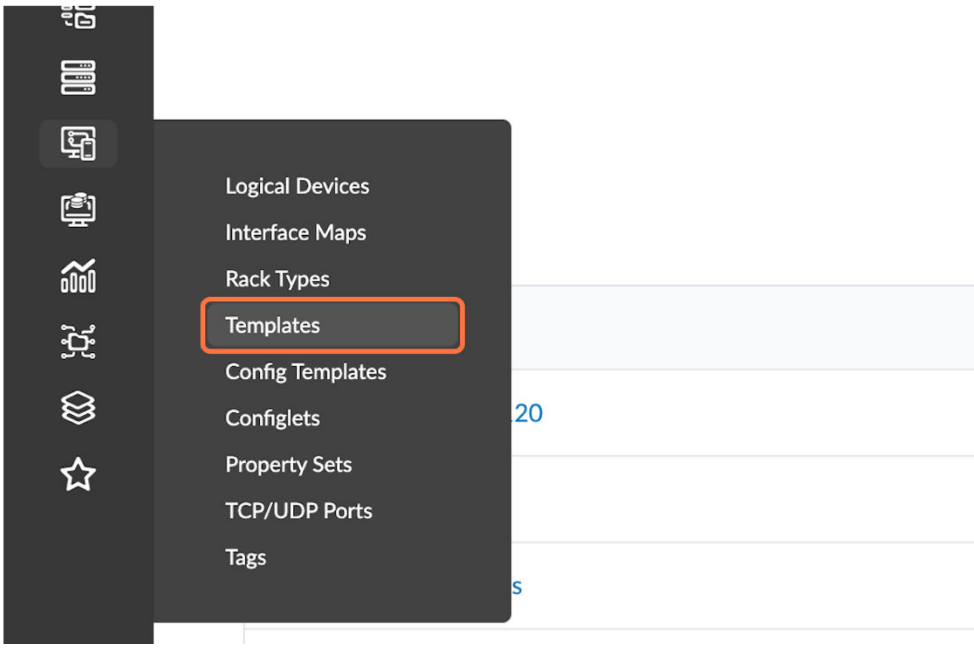

Logical Link
Name *
link1
Switch *
Leaf
Attachment Type
Single-Homed
Dual-Homed
LAG Mode
LACP (Active)
LACP (Passive)
Static LAG (no LACP)
No LAG
Physical link count per individual switch (2 available) *
1
Link speed *
10 Gbps


Logical Link
Name *
link2
Switch *
Leaf
Attachment Type
Single-Homed
Dual-Homed
LAG Mode
LACP (Active)
LACP (Passive)
Static LAG (no LACP)
No LAG
Physical link count per individual switch (2 available) *
1
Link speed *
10 Gbps

Create Templates

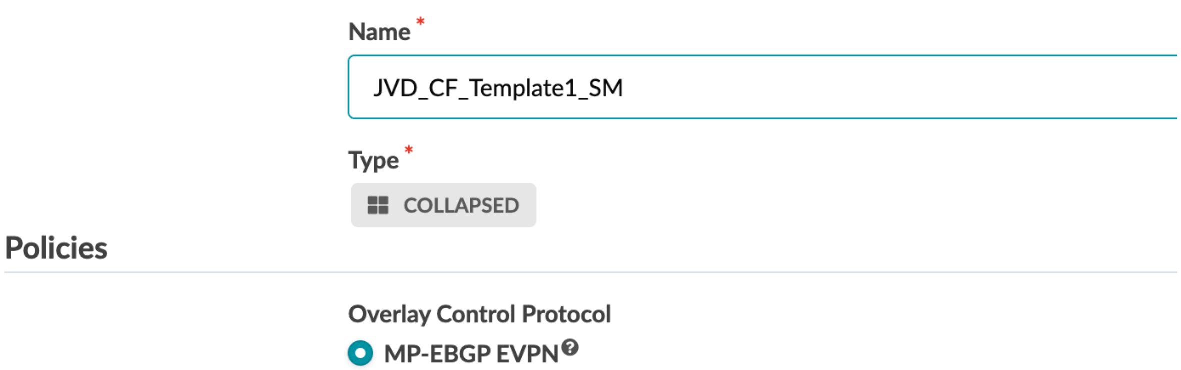
1. Navigate to **Design** > **Templates** and then select the **Create Template** button in the upper-right corner.

   Figure 27: The Design Menu with the Templates Button Highlighted

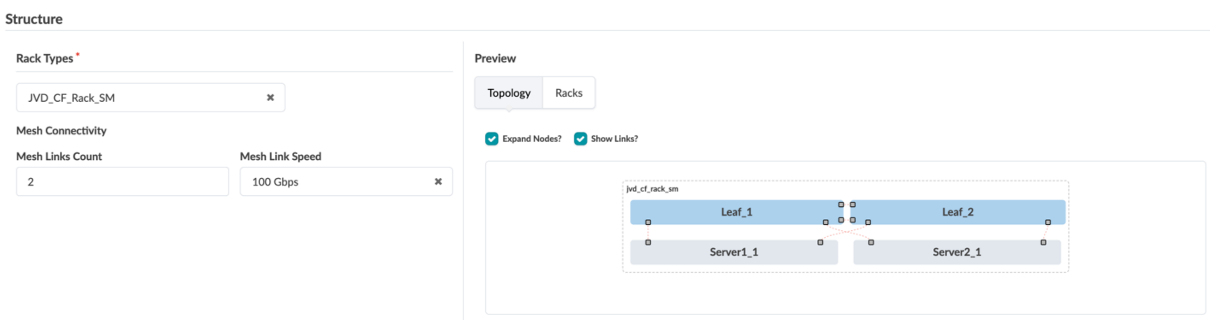
2. Name the template *JVD_CF_Template1_SM*, with **Type Collapsed**, and select **MP-BGP-EVPN** as the overlay control protocol.

   Figure 28: Create Template Pop-up with MP-EBGP-EVPN for the Overlay Control Protocol Selected

3. Select the rack created earlier (*JVD_CF_Rack_SM*), choose two mesh links, set the mesh link speed to 100 Gbps, and click **Create**.

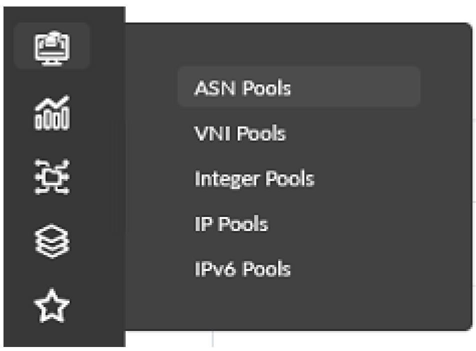
Figure 29: Create Template Pop-up with Mesh Links Information Filled In



Create ASN POOL

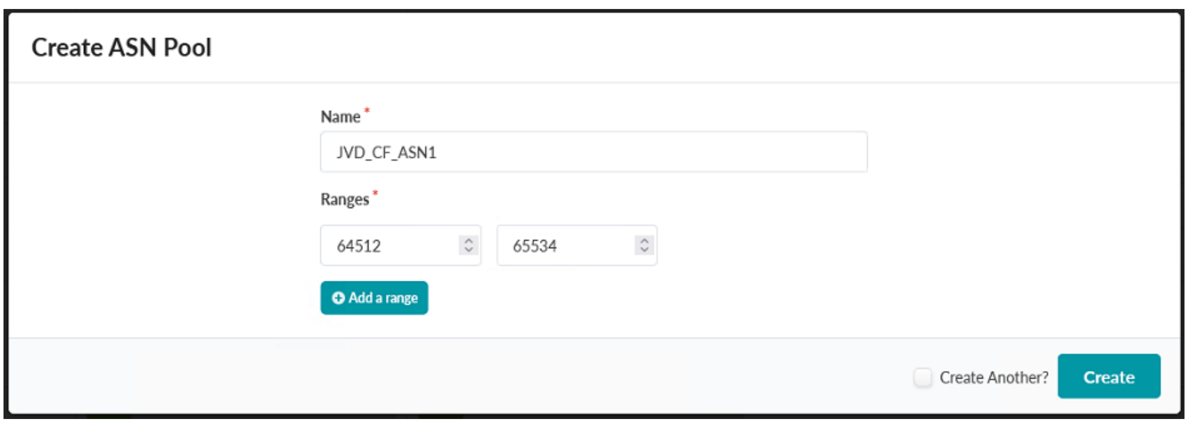
1. Navigate to **Resources > ASN Pools** and then select the **Create ASN Pool** button in the upper-right corner.

   Figure 30: Resources Menu with the ASN Pools Button Highlighted

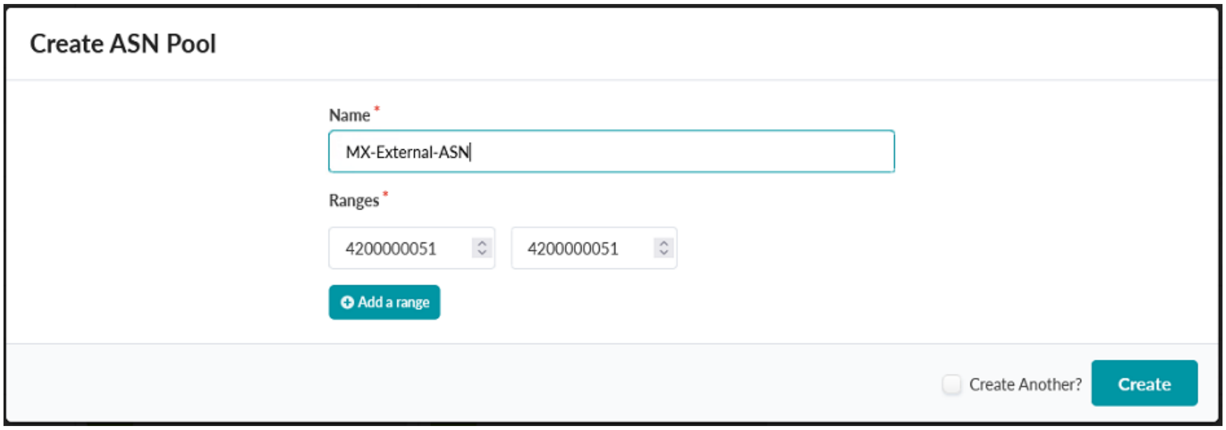
2. Create an ASN pool with the name *JVD_CF_ASN1* for internal ASNs. This guide uses 64512-65534 for this ASN Pool.

   Figure 31: Create ASN Pool Pop-up Showing the Creation of the ASN Pool JVD_CF_ASN1

3. Create a second ASN pool named *MX-External-ASN* for external ASNs. This guide uses the single AS 4200000051 for this ASN Pool.

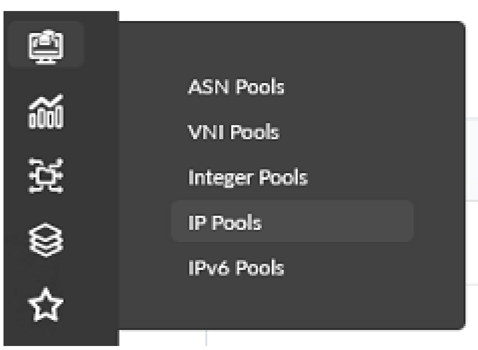
Figure 32: Create ASN Pool Pop-up Showing the Creation of the ASN Pool MX-External-ASN



Create IP and Loopback Pool

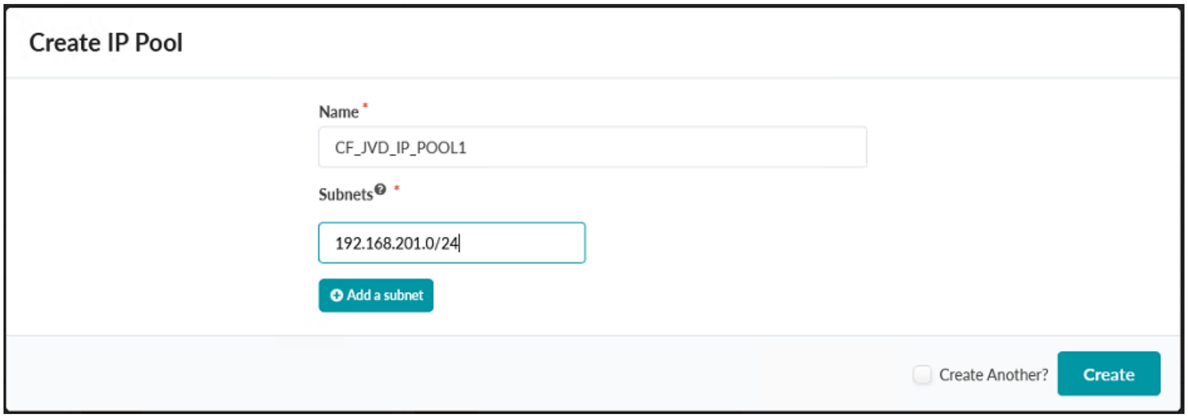
1. Navigate to **Resources > ASN Pools** and then select the **Create IP Pool** button in the upper-right corner

   Figure 33: Resources Menu with the ASN Pools Button Highlighted



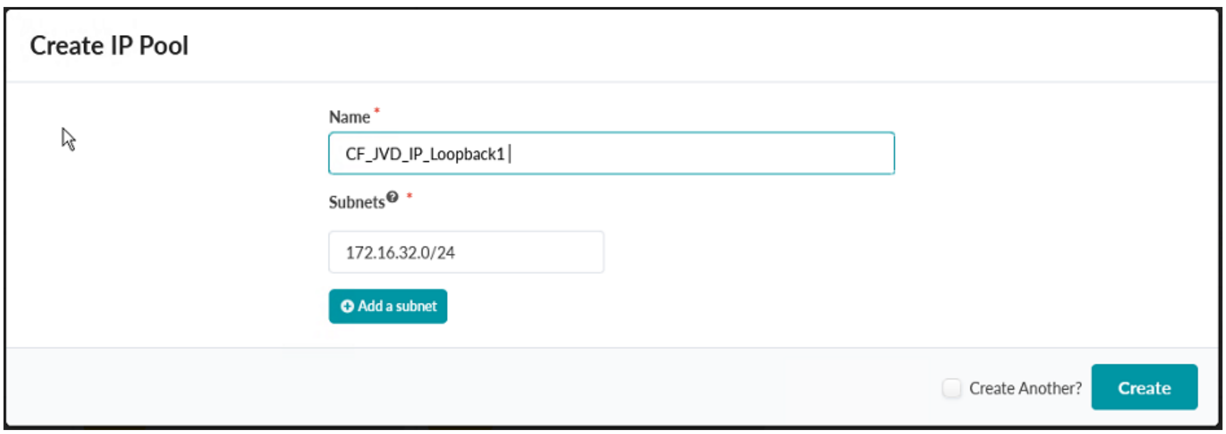
2. Create an IP pool named *CF_JVD_IP_POOL1* with a subnet of 192.168.201.0/24 and click **Create**.

   Figure 34: Create IP Pool Pop-up Showing the Creation of the CF_JVD_IP_POOL1 IP Pool



3. Create a second IP pool named *CF_JVD_IP_Loopback1* with a subnet of 172.16.32.0/24 and click **Create**.

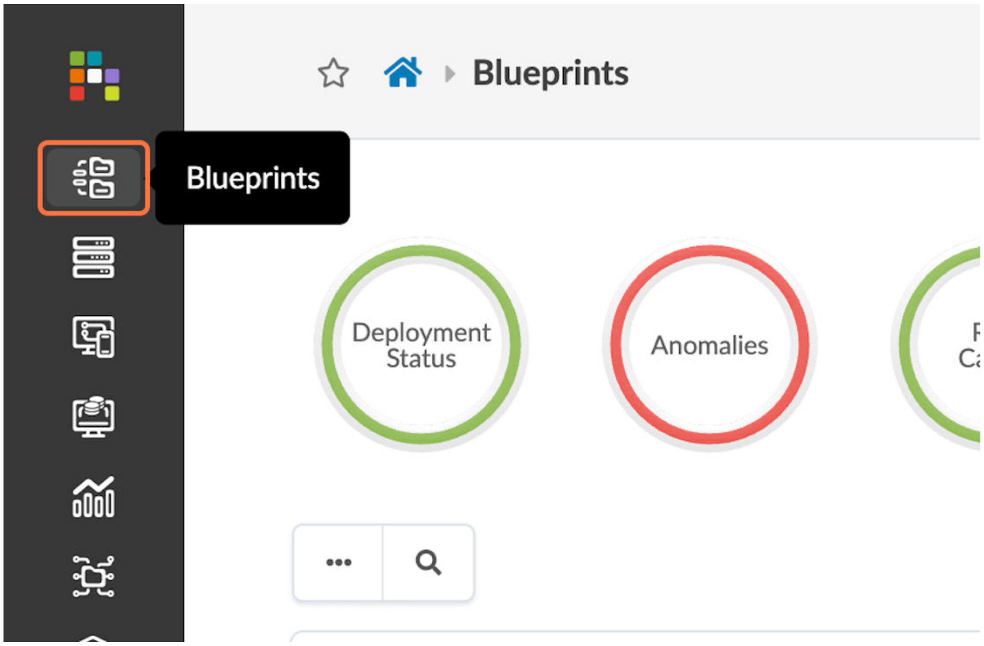
Figure 35: Create IP Pool Pop-up Showing the Creation of the CF_JVD_IP_Loopback1 IP Pool



Create IP and Loopback Pool

1. Navigate to **Blueprints** and then select the **Create Blueprint** button in the upper-right corner.

   Figure 36: Blueprints Button on the Main Menu Highlighted



2. Name the blueprint *JVD_CF_without-Access_BluePrint_SM*.

3. Select **Datacenter** for the **Reference Design**.

4. For **Filter Templates**, select **COLLAPSED**.

5. Select the template created earlier (*JVD_CF_Template1_SM*) and choose **IPv4** for the links.

Figure 37: Create Blueprint Pop-up with Inputs Populated for this JVD

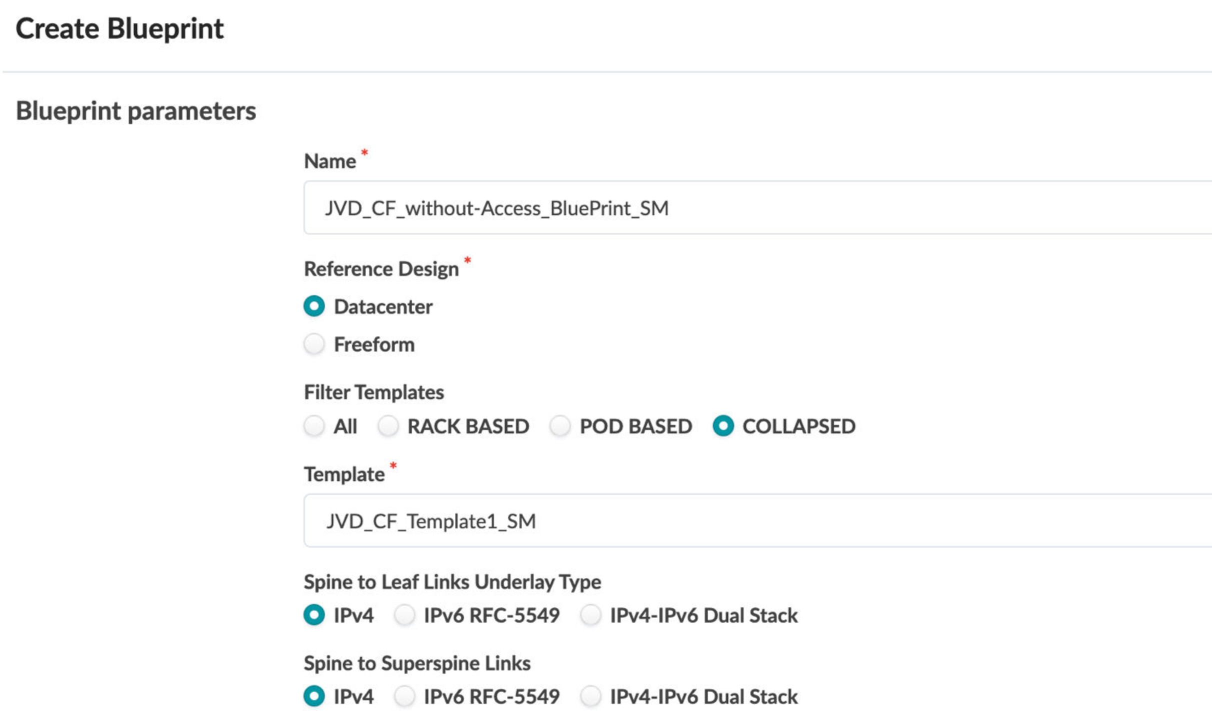
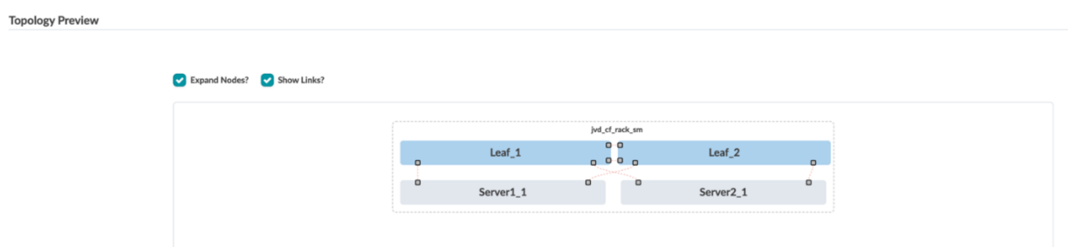


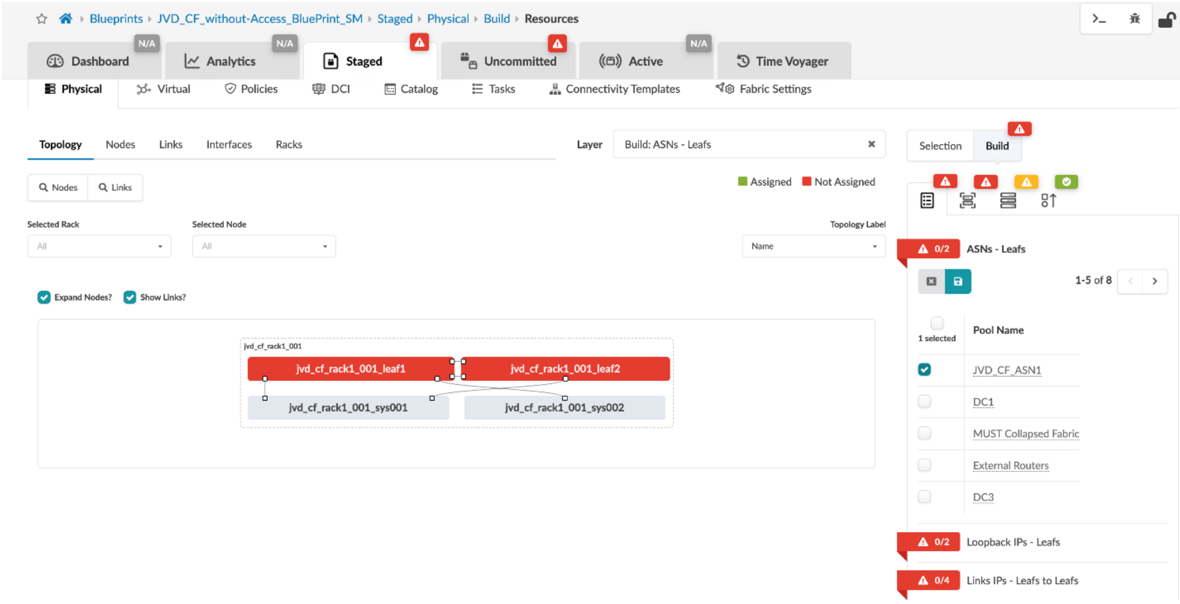
Figure 38: Create Blueprint Pop-up Showing the Topology Preview



Configure Blueprint

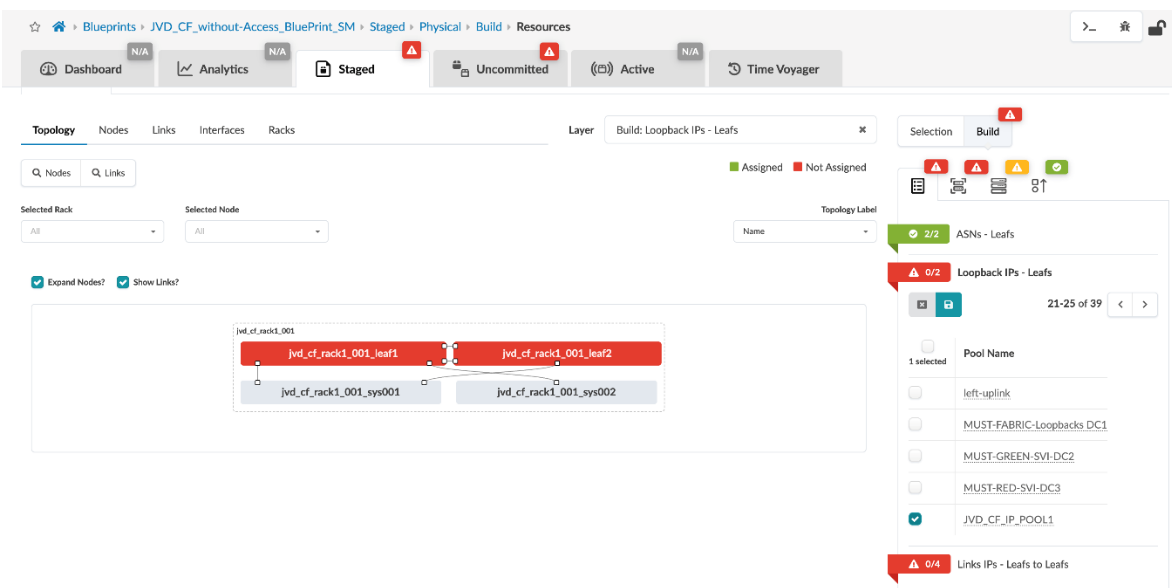
1. Navigate to **Blueprints** and then select the blueprint that was just created.
2. Go to **Staged** > **Topology** and click on the icon beside the words *ASNs – Leafs* in the panel on the right side of the screen.
3. Select the ASN previously created for internal use (*JVD_CF_ASN*).

   Figure 39: Staged Tab in the JVD_CF_Without-Access_BluePrint_SM Blueprint Showing ASN Assignment Options



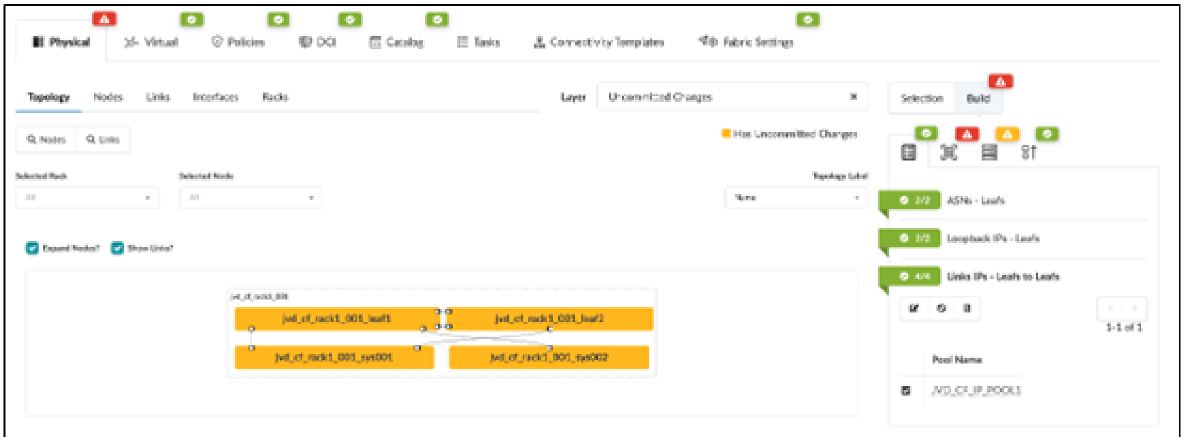
4. Next, assign the loopback IP pool that was created earlier.

   Figure 40: Staged Tab in the JVD_CF_Without-Access_BluePrint_SM Blueprint Showing Loopback IP Assignment Options



5. Select the link IP pool created earlier.

   Figure 41: Staged Tab in the JVD_CF_Without-Access_BluePrint_SM Blueprint Showing Link IP Assignment Options



6. Deploy the systems by assigning system IDs to the switches.

Figure 42: Staged Tab in the JVD_CF_Without-Access_BluePrint_SM Blueprint Showing System ID Assignment Tab

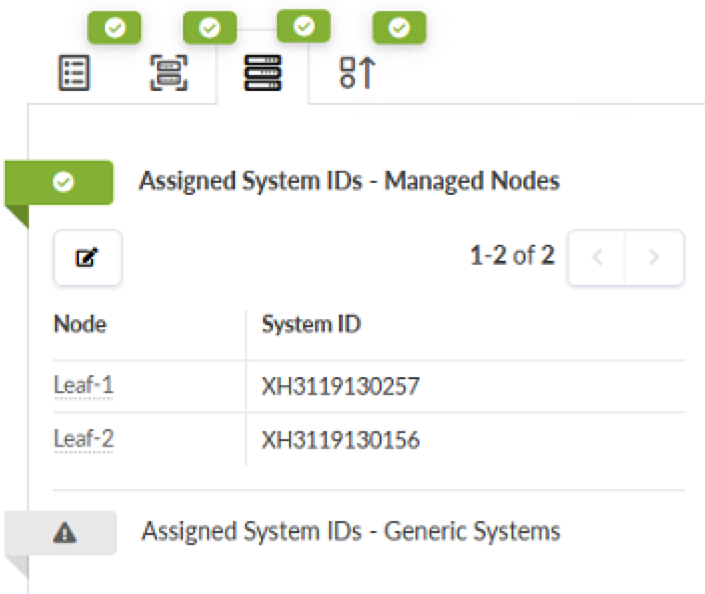
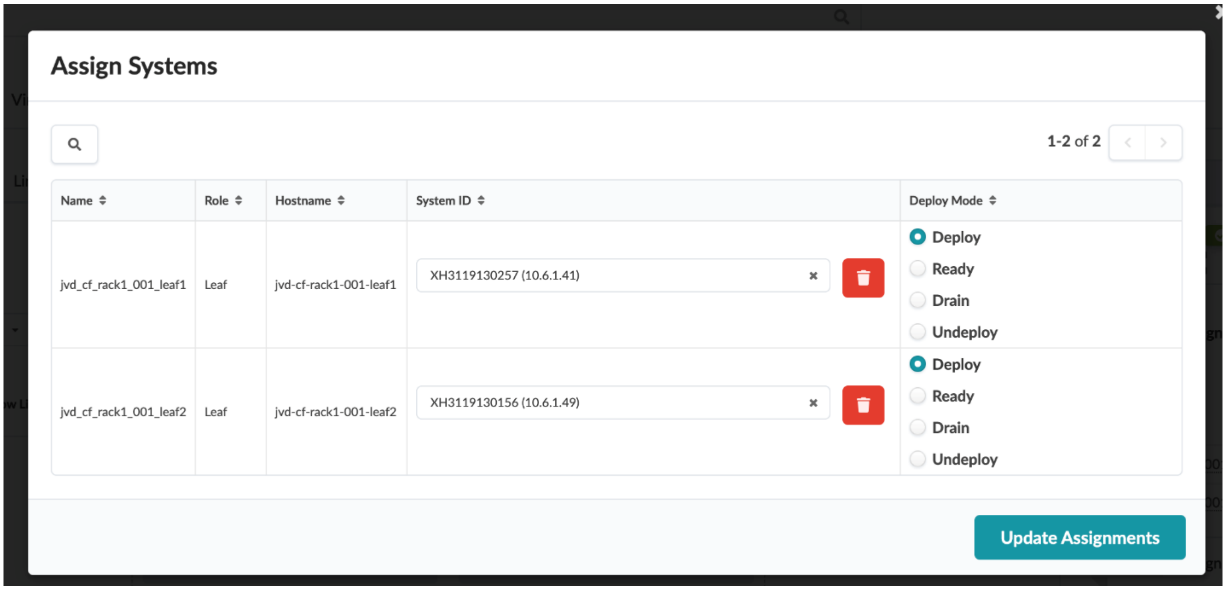


Figure 43: Assign Systems Pop-up in the JVD_CF_Without-Access_BluePrint_SM BluePrint

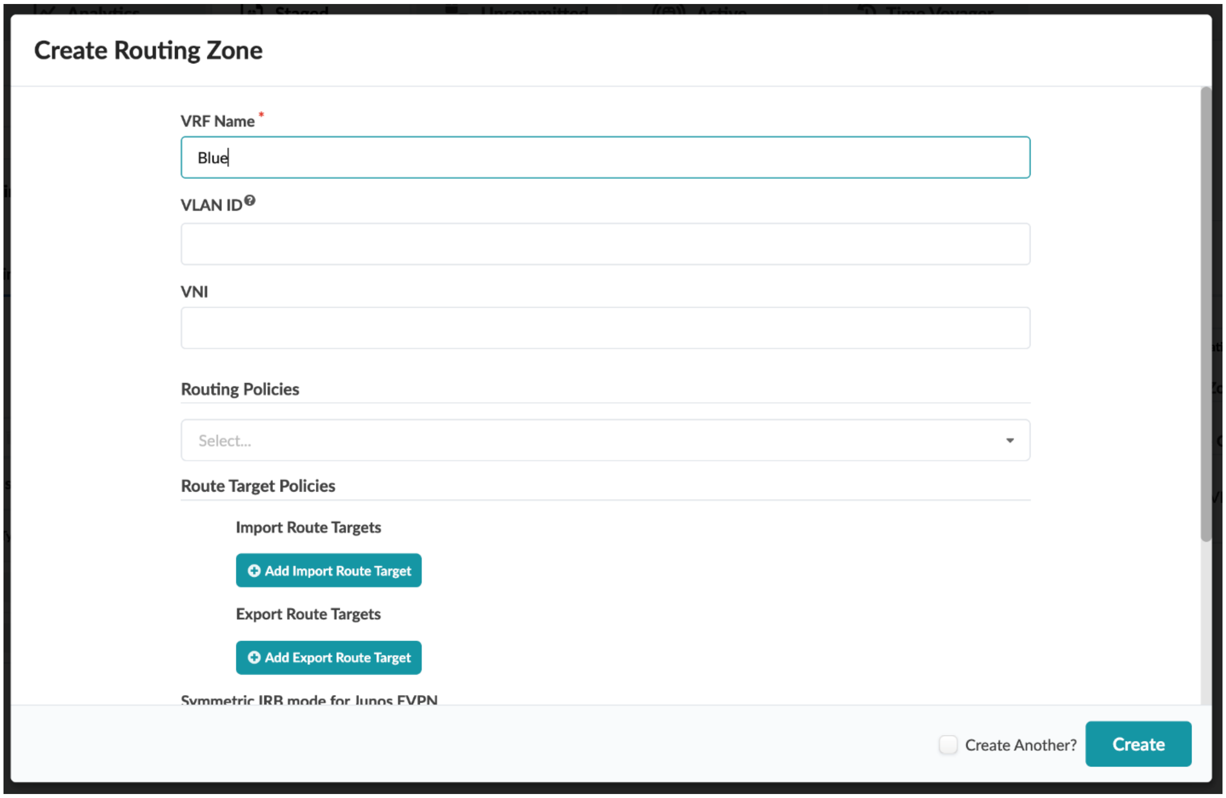


Create VRFs

1. From within the *JVD_CF_without-Access_BluePrint_SM* blueprint, navigate to **Staged** > **Virtual** > **Routing-Zone** and then select the **Create Routing Zone** button in the upper-right corner of the main content frame.

2. Create two VRFs: **Blue** and **Red**.

Figure 44: Create Routing Zone Pop-up in the JVD_CF_Without-Access_BluePrint_SM Blueprint



Create Virtual Networks

1. From within the *JVD_CF_without-Access_BluePrint_SM* blueprint, navigate to **Staged** > **Virtual** > **Virtual Networks** and then select the **Create Virtual Networks** button in the upper-right corner of the main content frame.

2. Create VXLANs for the **Blue** and **Red** VLANs.

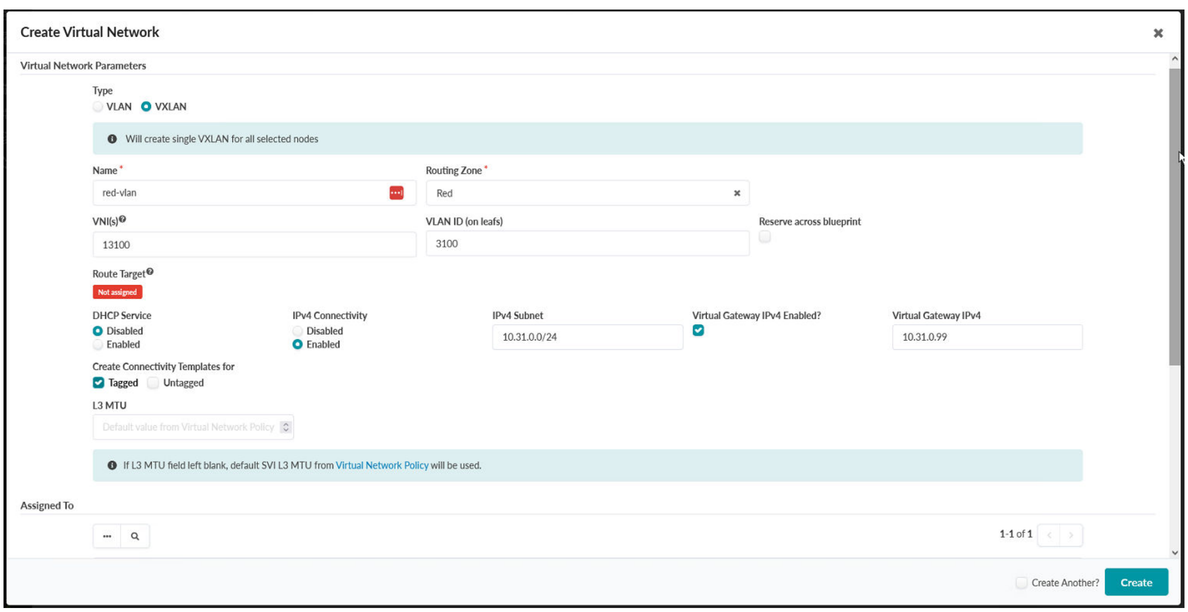
3. Create the VXLANs with the following parameters:

First VXLAN Options	First VXLAN Values	Second VXLAN Options	Second VXLAN Values
Name	red-vlan	Name	blue-vlan
Routing Zone	Red	Routing Zone	Blue
VNI	13100	VNI	13200

(Continued)

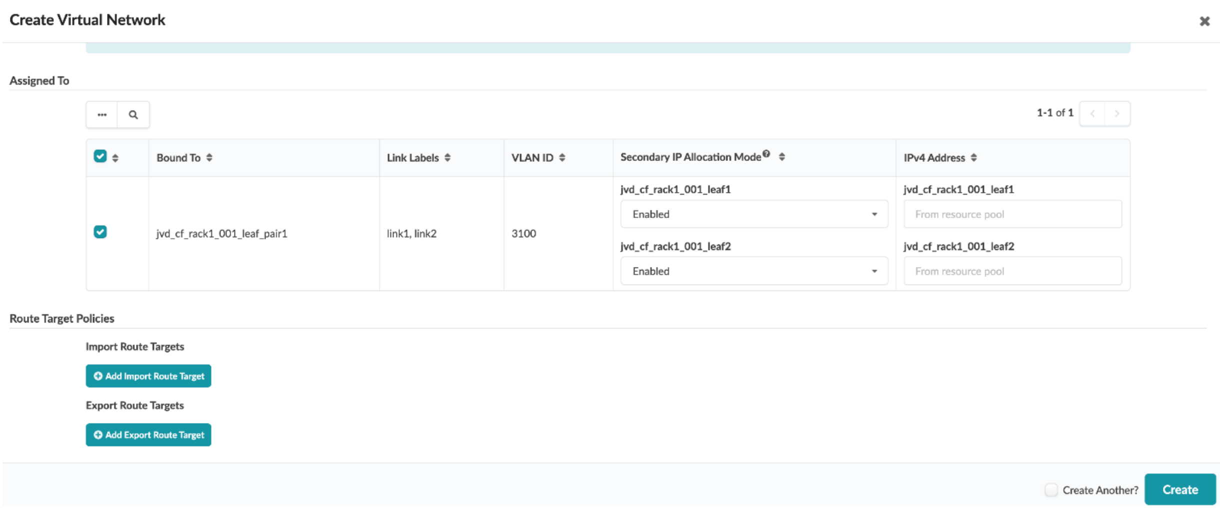
First VXLAN Options	First VXLAN Values	Second VXLAN Options	Second VXLAN Values
VLAN ID	3100	VLAN ID	3200
DHCP Service	Disabled	DHCP Service	Disabled
IPv4 Connectivity	Enabled	IPv4 Connectivity	Enabled
IPv4 Subnet	10.31.0.0/24	IPv4 Subnet	10.32.0.0/24
Virtual Gateway IPv4 Enabled	Yes	Virtual Gateway IPv4 Enabled	Yes
Virtual Gateway IPv4	10.31.0.99	Virtual Gateway IPv4	10.32.0.99
Create Connectivity Templates For	Tagged	Create Connectivity Templates For	Tagged

Figure 45: Upper Part of the Create Virtual Network Pop-up in the JVD_CF_Without-Access_BluePrint_SM Blueprint



4. Before you click **Create**, ensure you enable both switches.

Figure 46: Upper Part of the Create Virtual Network Pop-up in the JVD_CF_Without-Access_BluePrint_SM Blueprint



Assign Virtual Networking Resources

1. From within the *JVD_CF_without-Access_BluePrint_SM* blueprint, navigate to **Staged** > **Virtual** > **Routing Zones,** and then update the leaf loopback IPs for the *Blue* and *Red* routing zones by selecting the icon next to the words *Leaf Loopback IPs* in the *Resource Allocation* panel on the right-hand side of the screen.

2. Click the **edit** icon to open the *Update Pool Assignments* pop-up. Assign *JVD_CF_Loopback1* to both routing zones.

   Figure 47: Staged Tab in the JVD_CF_Without-Access_BluePrint_SM Blueprint Showing Link IP Assignment Options

3. Click **Update** when you are done.

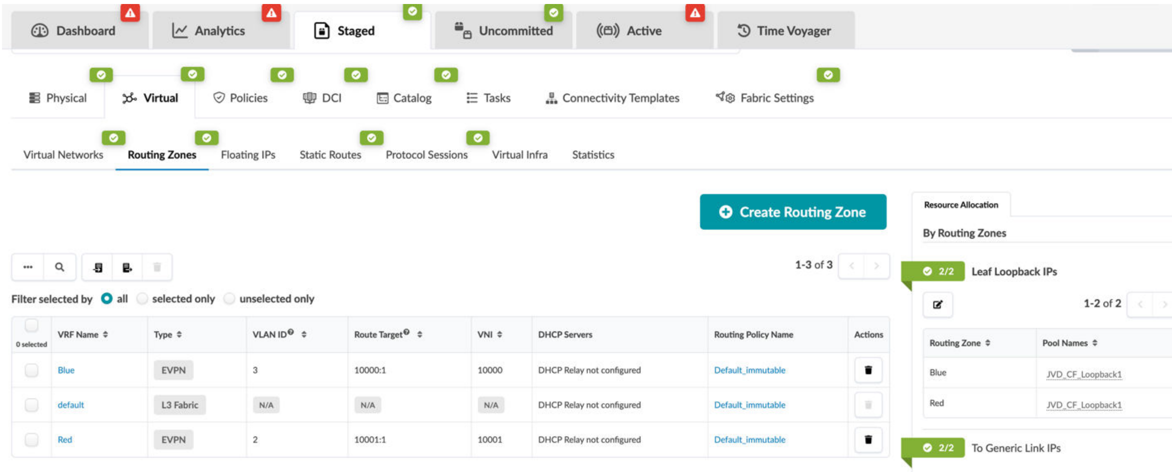


Figure 48: Update Pool Assignments Pop-up in the JVD_CF_Without-Access_BluePrint_SM Blueprint

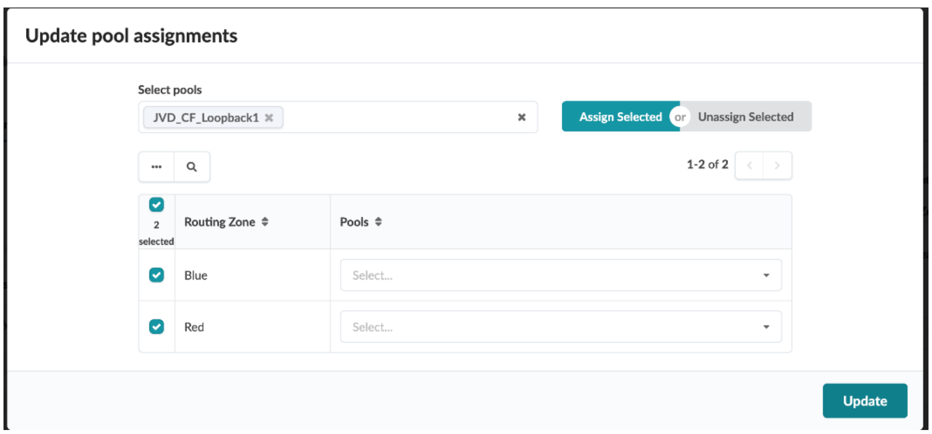
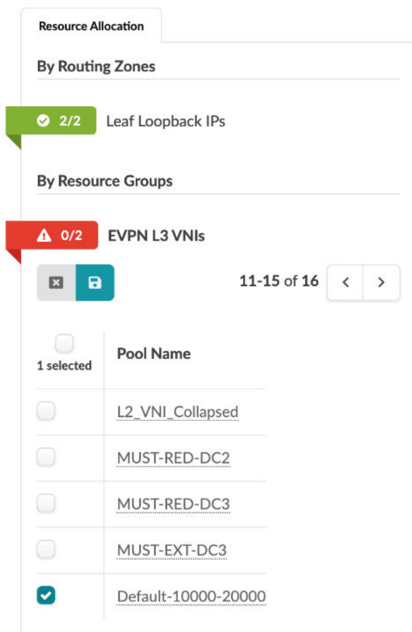


Figure 49: Resource Allocation Panel Showing the EVPN L3 VNIs Section Expanded



4. In the *Resource Allocation* panel on the right side of the screen, click the icon next to the words *EVPN L3 VNIs*.

5. Click the **edit** button, select the default VNI from the list, and click **save**.

6. While still within the *JVD_CF_without-Access_BluePrint_SM* blueprint, navigate to **Staged > Connectivity Templates** and assign the **Tagged VxLAN 'Blue-vlan'** to ae2 and the **Tagged VxLAN 'Red-vlan'** to ae1. To do this, click the check box next to each *Tagged VxLAN*, and then click the **Assign** icon (it looks like two links in a chain), which appears when you make that selection.

Figure 50: Tagged VXLAN Connectivity Templates and the Control Panel to Assign Them

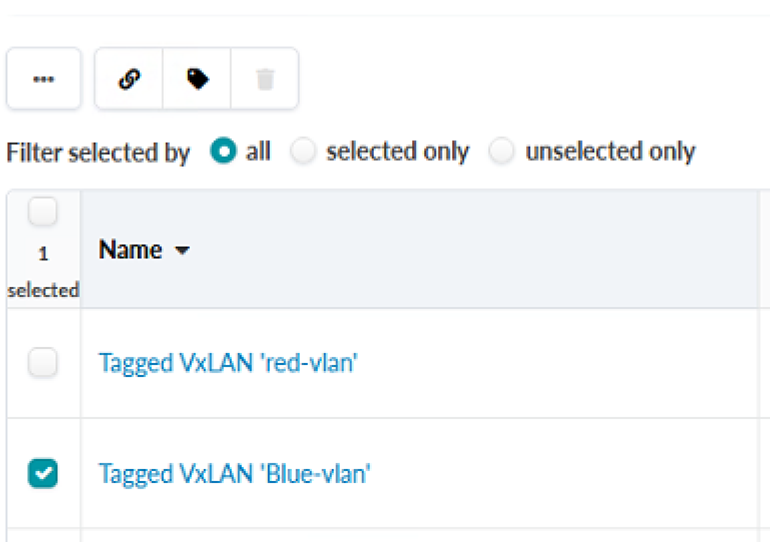


Figure 51: Assign Connectivity Template Pop-up Showing the Tagged VXLAN 'Blue-vlan'

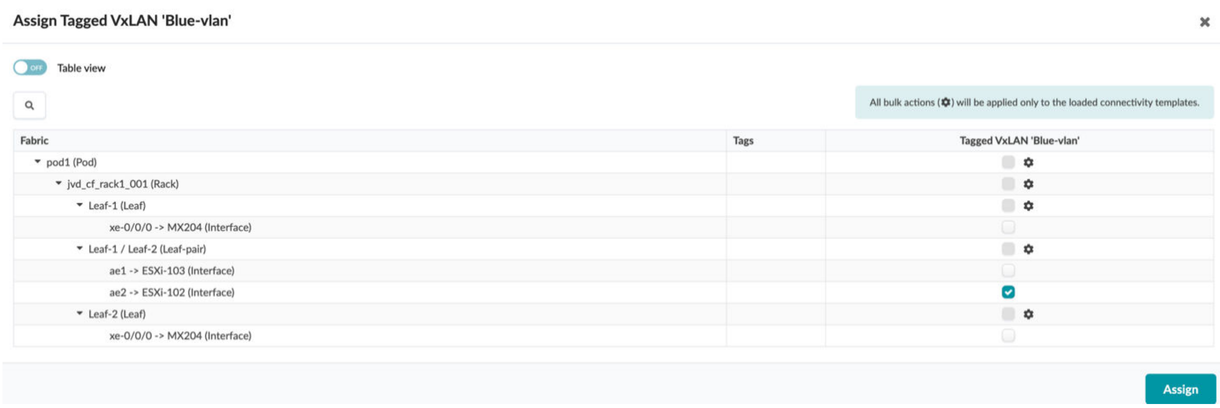
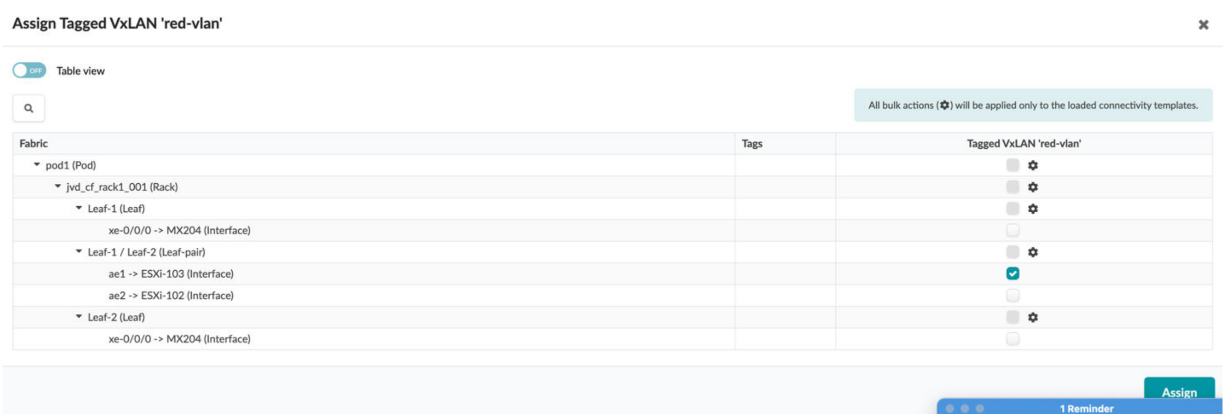


Figure 52: Assign Connectivity Template Pop-up Showing the Tagged VXLAN 'red-vlan'

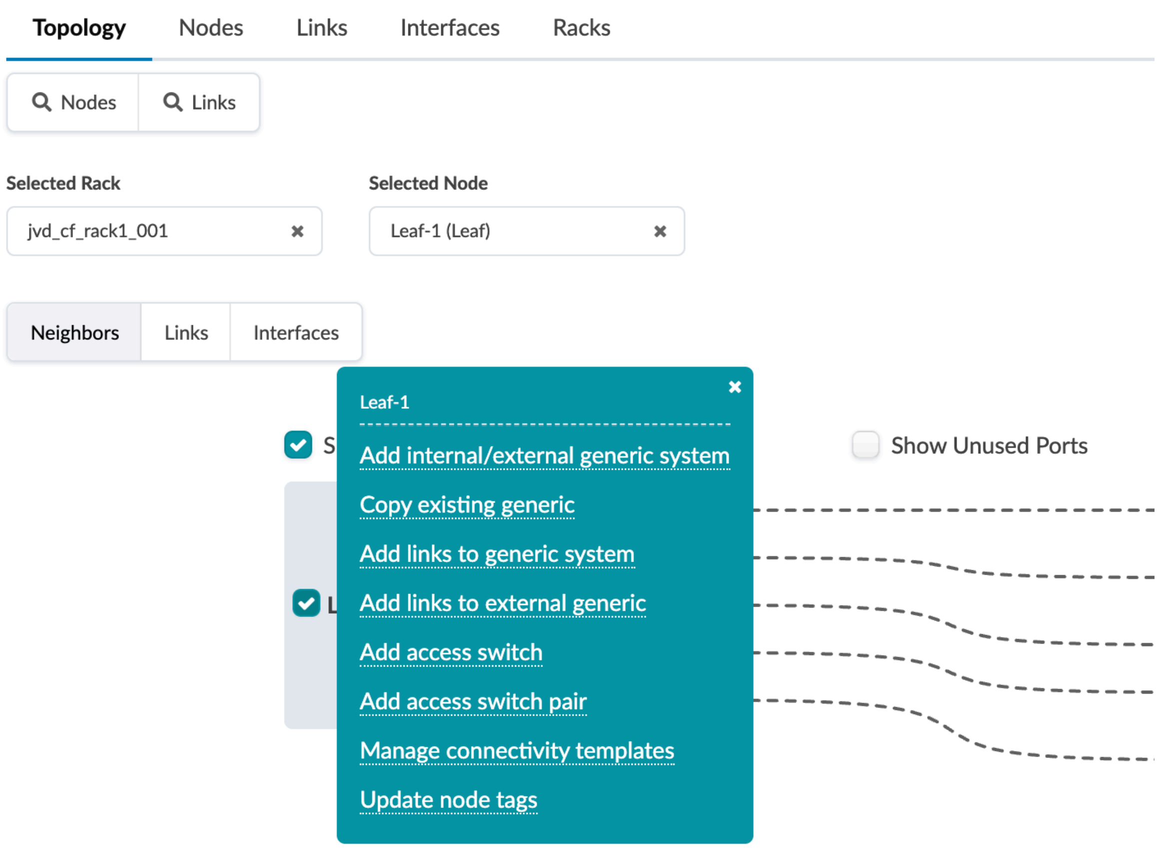


Add External Router

1. From within the *JVD_CF_without-Access_BluePrint_SM* blueprint, navigate to **Staged** > **Physical** and click on *Leaf-1* in the topology.

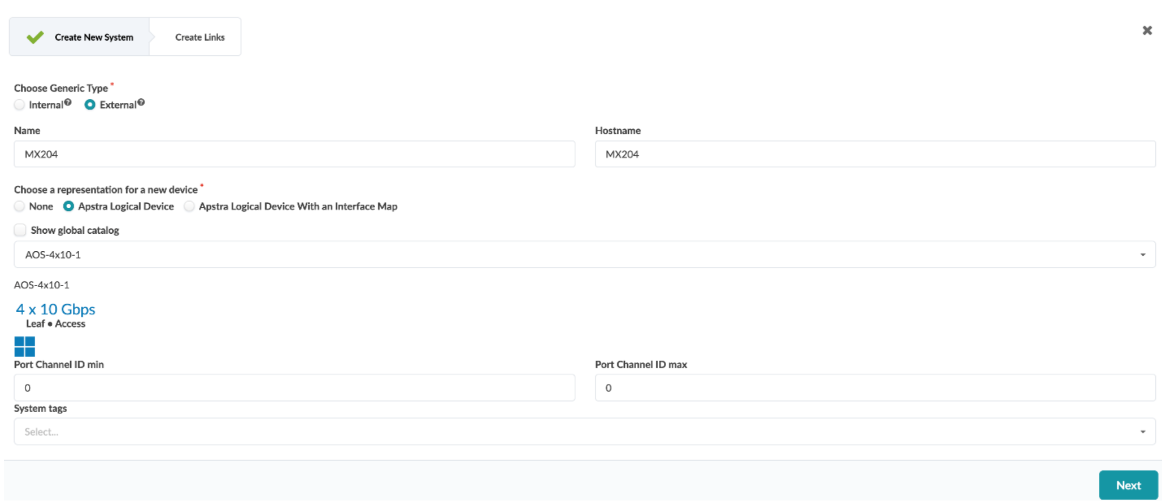
2. Select the checkbox on Leaf-1 and select **Add internal/external generic system**. When complete, you should see a new link on the graphic.

   Figure 53: Leaf-1 Pop-up Showing the Ability to Add an External Generic System



3. Create the external system, name it **MX204** and select a logical device with 4x10 Gbps ports, and then click **Next**.

   Figure 54: First Part of the Assign Internal External Pop-up in the JVD_CF_Without-Access_BluePrint_SM Blueprint

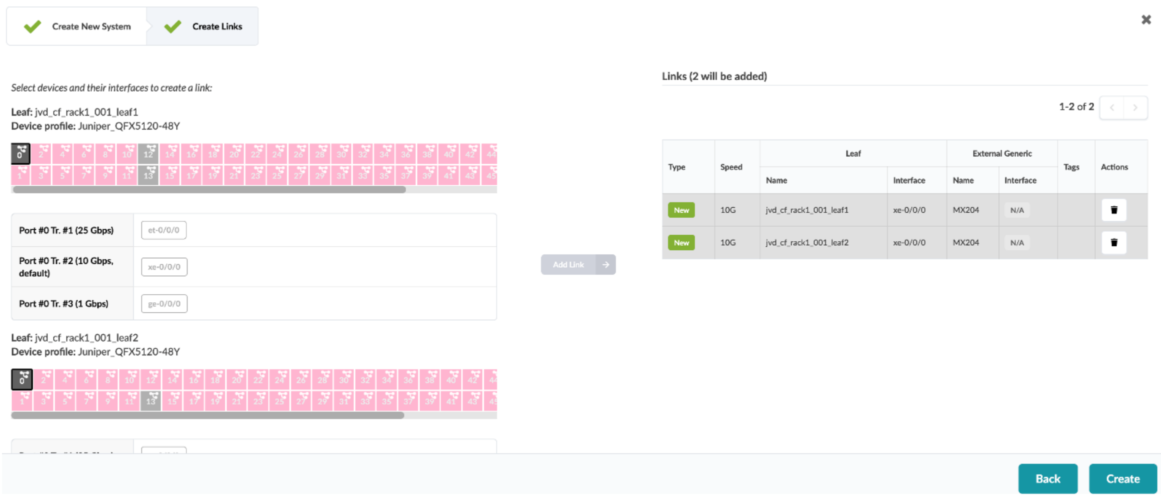


4. Create links for the new system to both Leaf-1 and Leaf-2. This is done by selecting an interface, then selecting a port speed.

5. Click **Add Link**. Do this for both switches.

6. Click **Create** once you're done.

   Figure 55: Second Part of the Assign Internal External Pop-up in the JVD_CF_Without-Access_BluePrint_SM Blueprint



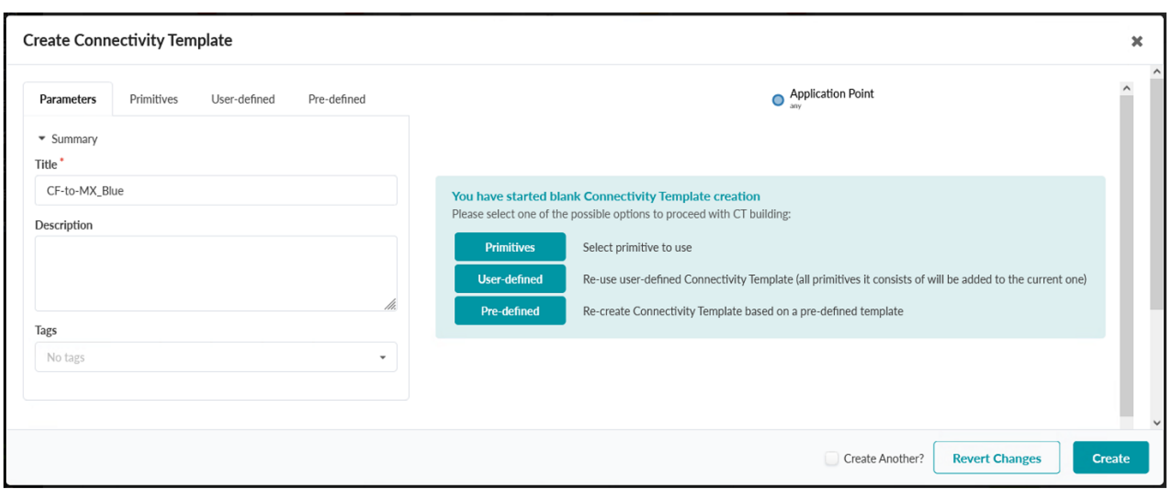
Now that the router has been added, a connectivity template must be created for it.

7. Navigate to **Staged > Connectivity Templates.**

8. Click the **Add Template** button in the upper-right corner.

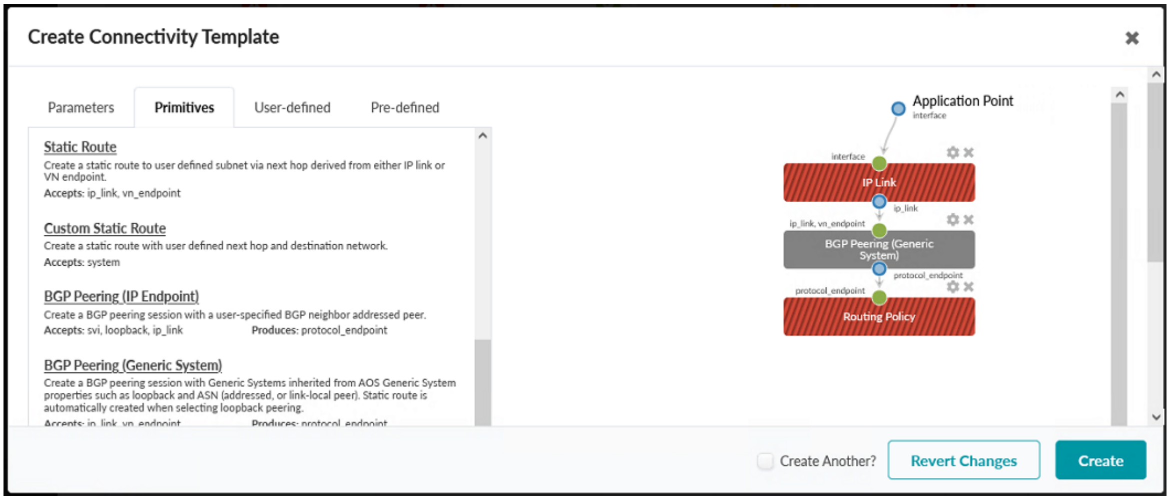
9. Name the template **CF-to-MX_Blue**.

   Figure 56: Create Connectivity Template Pop-up in the JVD_CF_Without-Access_BluePrint_SM Blueprint



10. Click on the **Primitives** tab and then select the primitives **IP Link**, **BGP Peering (Generic System)**, and **Routing Policy**.

Figure 57: Primitives Tab in the Create Connectivity Template Pop-up in the JVD_CF_without-Access_BluePrint_SM Blueprint



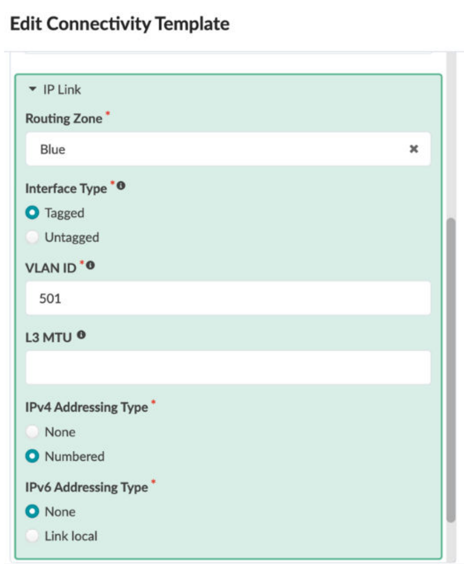
11. Click **Parameters** and expand the **IP Link** section.

12. Choose the routing zone **Blue**.

13. Set the interface type to **Tagged** and enter VLAN ID of **501**.

14. Set **IPv4 Addressing Type** to **Numbered**, and **IPv6 Addressing Type** to **None**.

 Figure 58: Expanded IP Link Section of the Parameters Tab



15. Expand **BGP Peering (Generic System)** and configured.

16. Set the **IPv4 AFI** to **ON**, and the **IPv6 AFI** to **OFF**.

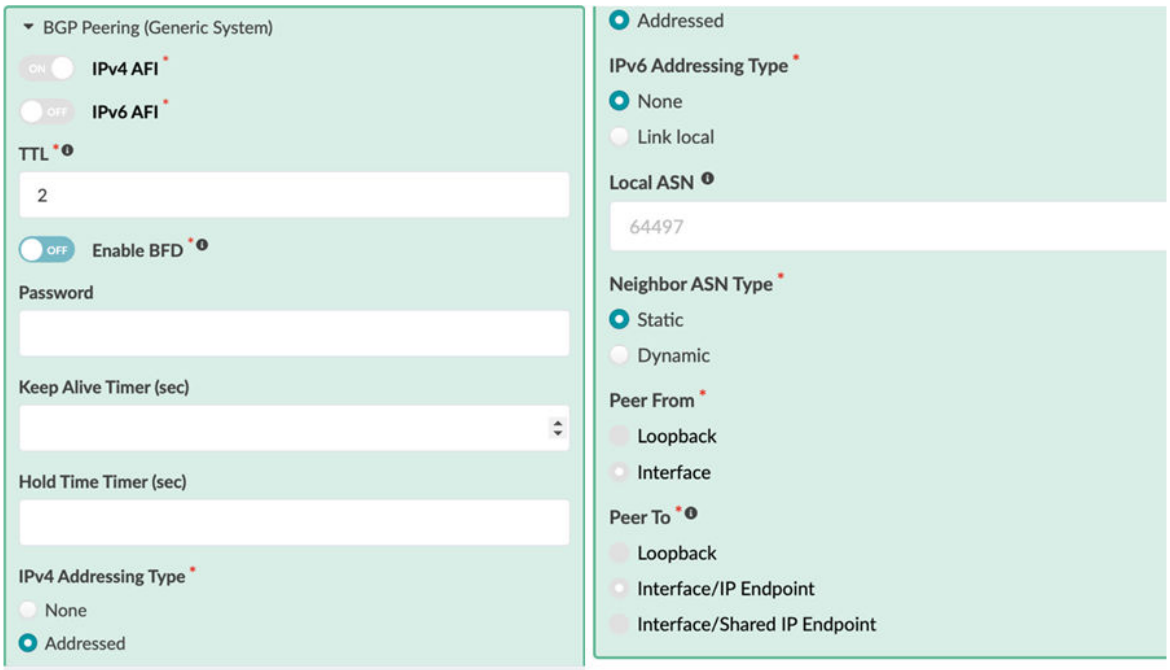
17. Configure a TTL of **2**, and do not enable BFD.

18. Set the **IPv4 Addressing Type** to **Addressed**, leaving the **IPv6 Addressing Type** to **None**.

19. Leave the **Local ASN Type** unconfigured.

20. Set the **Neighbor ASN Type** to **Static**.

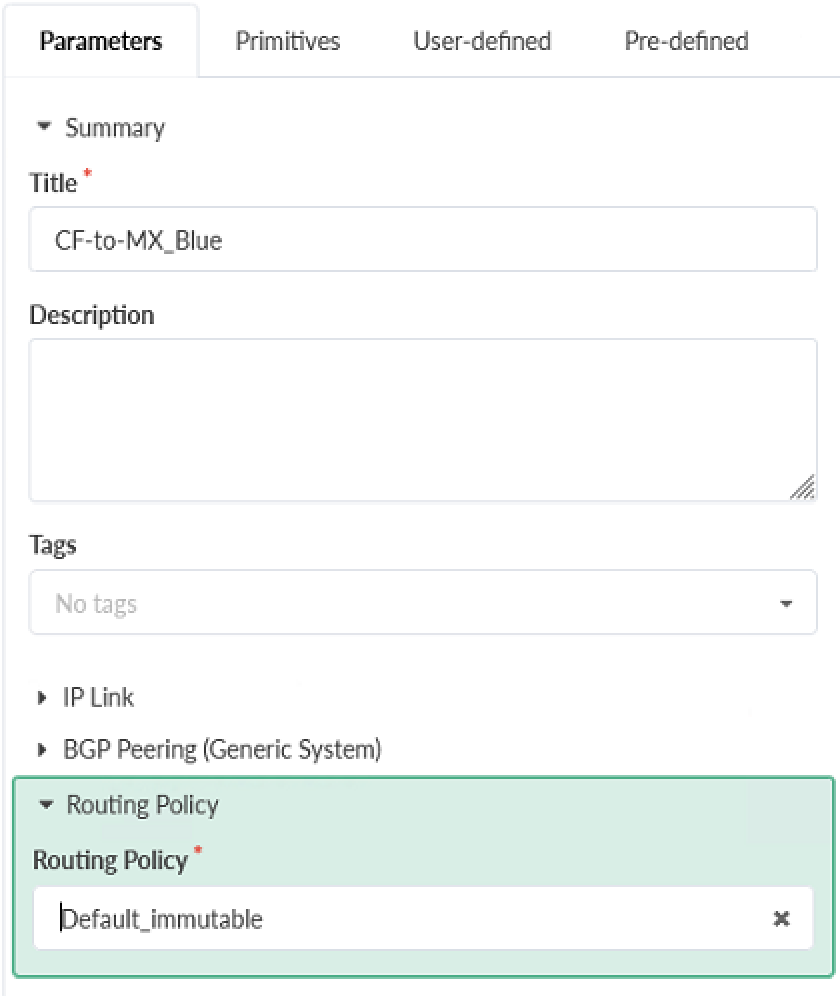
    Figure 59: Expanded IP Link Section of the Parameters Tab



21. Expand and configure the **Routing Policy** section and set it to **Default_immutable**.

22. Click **Create**.

    Figure 60: Expanded Routing Policy Section in the Parameters Tab



Finally, the connectivity template *CF-to-MX_Blue* needs to be assigned to the Leaf-1 and Leaf-2 interfaces, which are connected to the external router (MX204).

23. Click the **Assign** icon in line with the *CF-to-MX_Blue* connectivity template.

24. Click the checkboxes to assign the connectivity template to the interfaces connected to the external router and click **Assign**.

    Figure 61: CF-to-MX_Blue Connectivity Template Listing, with the Assign Button Highlighted

    Figure 62: Assign-CF-to-MX_Blue Pop-up

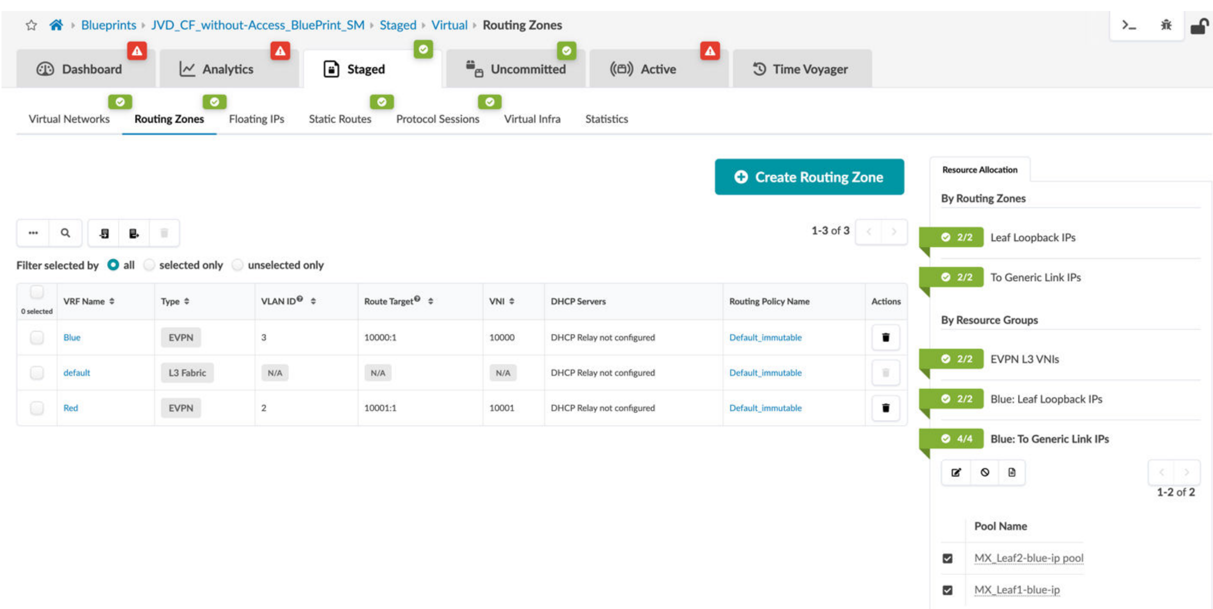
Finally, IP addresses are assigned to interfaces on Leaf-1 and Leaf-2, which are connected to the external router for the *Blue VRF*. To create IP pools.

25. Navigate to **Resources > IP Pool** from the *Create IP and Loopback Pool* section above. These IP pools will be named **MX_Leaf2-blue-ip** and **MX_Leaf1-blue-ip**.

26. Assign the IP pools by navigating to **Staged > Routing Zones** inside the blueprint.

27. Click on the icon next to *Blue: To Generic Link IPs* in the *Routing Zones* panel on the right-hand side of the screen to assign the IP pools you just created.

Figure 63: Blue: To Generic Link IPs Section of the Routing Zones Panel is Shown Expanded



NOTE: The MX204 referenced above is a stand-in for a generic router, and not considered a key component of this JVD. Similar steps can be taken to connect any router. The MX interface configuration is provided below in order to provide an example of how routing on a router is set up to interface with the network described in this JVD.

Below is the MX interface config towards the Leaf-1 and Leaf-2 switches.

```
set interfaces xe-0/0/3:2 vlan-tagging

set interfaces xe-0/0/3:2 unit 501 description to.blue-DC3-Leaf-1-Cf

set interfaces xe-0/0/3:2 unit 501 vlan-id 501

set interfaces xe-0/0/3:2 unit 501 family inet address 10.202.1.4/31

set interfaces xe-0/0/3:2 unit 502 description to.red-DC3-Leaf-1-Cf

set interfaces xe-0/0/3:2 unit 502 vlan-id 502

set interfaces xe-0/0/3:2 unit 502 family inet address 10.202.1.8/31


set interfaces xe-0/0/3:3 vlan-tagging

set interfaces xe-0/0/3:3 unit 500 family inet address 10.202.1.2/31

set interfaces xe-0/0/3:3 unit 501 description to.blue-DC3-Leaf-2-Cf

set interfaces xe-0/0/3:3 unit 501 vlan-id 501

set interfaces xe-0/0/3:3 unit 501 family inet address 10.202.1.6/31

set interfaces xe-0/0/3:3 unit 502 description to.red-DC3-Leaf-2-Cf

set interfaces xe-0/0/3:3 unit 502 vlan-id 502

set interfaces xe-0/0/3:3 unit 502 family inet address 10.202.1.10/31
```

Verification

Below is the output from the switches which verify configuration success.

Output from Leaf-1:

```
root@Leaf-1> show lacp interfaces
Aggregated interface: ae1
    LACP state:       Role   Exp   Def  Dist  Col  Syn  Aggr  Timeout  Activity
      xe-0/0/13      Actor    No    No   Yes  Yes  Yes   Yes     Fast    Active
      xe-0/0/13    Partner    No    No   Yes  Yes  Yes   Yes     Fast    Active
    LACP protocol:        Receive State  Transmit State          Mux State
      xe-0/0/13                 Current   Fast periodic Collecting distributing
Aggregated interface: ae2
    LACP state:       Role   Exp   Def  Dist  Col  Syn  Aggr  Timeout  Activity
      xe-0/0/12      Actor    No    No   Yes  Yes  Yes   Yes     Fast    Active
      xe-0/0/12    Partner    No    No   Yes  Yes  Yes   Yes     Fast    Active
    LACP protocol:        Receive State  Transmit State          Mux State
      xe-0/0/12                 Current   Fast periodic Collecting distributing
{master:0}
root@Leaf-1> show vlans
Routing instance        VLAN name             Tag          Interfaces
default-switch          default               1

evpn-1                  vn3100                3100
                                                           ae1.0*
                                                           vtep.32769*
evpn-1                  vn3200                3200
                                                           ae2.0*
                                                            vtep.32769*
{master:0}
root@Leaf-1> show arp vpn Blue
MAC Address       Address         Name         Interface           Flags
00:50:56:8e:c9:1d 10.32.0.105     10.32.0.105   irb.3200 [ae2.0]     permanent remote
{master:0}
root@Leaf-1> show arp vpn Red
MAC Address       Address         Name           Interface        Flags
00:50:56:8e:b6:03 10.31.0.106     10.31.0.106    irb.3100 [ae1.0]  permanent remote
{master:0}
root@Leaf-1> show ethernet-switching table
MAC flags (S-static MAC, D- dynamic MAC, L-locally learned, P-Persistent static
           SE-statistics enabled, NM-non configured MAC, R-remote PE MAC, O-ovsdb MAC)
```

```
Ethernet switching table : 2 entries, 2 learned
Routing instance : evpn-1
Vlan        MAC                 MAC    GBP    Logical    SVLBNH/      Active
name        address             flags  tag    interface  VENH Index   source
vn3100      00:50:56:8e:b6:03   DLR           ae1.0
vn3200      00:50:56:8e:c9:1d   DL            ae2.0
{master:0}
root@Leaf-1> show evpn database
Instance: evpn-1
VLAN  DomainId  MAC address  Active source                  Timestamp        IP address
13100      00:1c:73:00:00:01 irb.3100                       Mar 14 18:01:36  10.31.0.99
13100      00:50:56:8e:b6:03 00:02:00:00:00:00:01:00:00:01 Mar 18 07:35:19  10.31.0.106
13200      00:1c:73:00:00:01 irb.3200                       Mar 14 18:01:36  10.32.0.99
13200      00:50:56:8e:c9:1d 00:02:00:00:00:00:02:00:00:02 Mar 14 18:02:40  10.32.0.105
{master:0}
root@Leaf-1> show interfaces terse | match in
Interface               Admin Link Proto    Local                 Remote
pfe-0/0/0.16383         up    up   inet
                                   inet6
pfh-0/0/0.16383         up    up   inet
pfh-0/0/0.16384         up    up   inet
xe-0/0/0.501            up    up   inet     10.202.1.6/31
xe-0/0/0.502            up    up   inet     10.202.1.10/31
xe-0/0/3.0              up    down inet
xe-0/0/4.0              up    up   inet
xe-0/0/5.0              up    up   inet
xe-0/0/6.0              up    up   inet
xe-0/0/7.0              up    up   inet
xe-0/0/8.0              up    up   inet
xe-0/0/9.0              up    up   inet
xe-0/0/11.0             up    up   inet
xe-0/0/22.0             up    down inet
xe-0/0/23.0             up    down inet
et-0/0/48.0             up    up   inet
et-0/0/49.0             up    up   inet
et-0/0/50.0             up    up   inet
et-0/0/54.0             up    up   inet     192.168.201.0/31
et-0/0/55.0             up    up   inet     192.168.201.2/31
bme0.0                  up    up   inet     128.0.0.1/2
em0.0                   up    up   inet     10.6.1.41/26
em2.32768               up    up   inet     192.168.1.2/24
irb.0                   up    down inet
irb.3100                up    up   inet     10.31.0.99/24
```

```
irb.3200                up    up   inet     10.32.0.99/24
jsrv.1                  up    up   inet     128.0.0.127/2
lo0.0                   up    up   inet     172.16.32.0         --> 0/0
lo0.2                   up    up   inet     172.16.32.4         --> 0/0
lo0.3                   up    up   inet     172.16.32.2         --> 0/0
lo0.16384               up    up   inet     127.0.0.1           --> 0/0
lo0.16385               up    up   inet
```

Output from Leaf-2:

```
{master:0}
root@Leaf-2> show lacp interfaces
Aggregated interface: ae1
    LACP state:       Role   Exp   Def  Dist  Col  Syn  Aggr  Timeout  Activity
      xe-0/0/13      Actor    No    No   Yes  Yes  Yes   Yes     Fast    Active
      xe-0/0/13    Partner    No    No   Yes  Yes  Yes   Yes     Fast    Active
    LACP protocol:        Receive State  Transmit State          Mux State
      xe-0/0/13                 Current   Fast periodic Collecting distributing
Aggregated interface: ae2
    LACP state:       Role   Exp   Def  Dist  Col  Syn  Aggr  Timeout  Activity
      xe-0/0/12      Actor    No   Yes    No   No   No   Yes     Fast    Active
      xe-0/0/12    Partner    No   Yes    No   No   No   Yes     Fast   Passive
    LACP protocol:        Receive State  Transmit State          Mux State
      xe-0/0/12               Defaulted   Fast periodic           Detached
{master:0}
root@Leaf-2> show vlans
Routing instance        VLAN name             Tag          Interfaces
default-switch          default               1

evpn-1                  vn3100                3100
                                                           ae1.0*
                                                           esi.1816*
                                                           vtep.32769*
evpn-1                  vn3200                3200
                                                           ae2.0
                                                           esi.1815*
                                                           vtep.32769*
{master:0}
root@Leaf-2> show arp vpn Blue
MAC Address       Address      Name           Interface              Flags
00:50:56:8e:c9:1d 10.32.0.105  10.32.0.105    irb.3200 [.local..15]  permanent remote
{master:0}
```

```
root@Leaf-2> show arp vpn Red
MAC Address       Address      Name           Interface               Flags
00:50:56:8e:b6:03 10.31.0.106  10.31.0.106    irb.3100 [ae1.0]        permanent remote
{master:0}
root@Leaf-2> show ethernet-switching table
MAC flags (S-static MAC, D-dynamic MAC, L-locally learned, P-Persistent static SE-statistics
enabled, NM-non configured MAC, R-remote PE MAC, O-ovsdb MAC)
Ethernet switching table : 2 entries, 2 learned
Routing instance : evpn-1
Vlan    MAC                MAC   GBP Logical   SVLBNH/     Active
name    address            flags tag interface VENH Index  source
vn3100  00:50:56:8e:b6:03  DLR       ae1.0
vn3200  00:50:56:8e:c9:1d  DR        esi.1815  1807       00:02:00:00:00:00:02:00:00:02
{master:0}
root@Leaf-2> show evpn database
Instance: evpn-1
VLAN  DomainId  MAC address   Active source                Timestamp        IP address
13100     00:1c:73:00:00:01  irb.3100                      Mar 14 18:02:00  10.31.0.99
13100     00:50:56:8e:b6:03  00:02:00:00:00:00:01:00:00:01 Mar 18 07:35:43  10.31.0.106
13200     00:1c:73:00:00:01  irb.3200                      Mar 14 18:02:00  10.32.0.99
13200     00:50:56:8e:c9:1d  00:02:00:00:00:00:02:00:00:02 Mar 14 18:03:04  10.32.0.105
{master:0}
root@Leaf-2> show interfaces terse | match in
Interface               Admin Link Proto    Local                 Remote
pfe-0/0/0.16383         up    up   inet
                                   inet6
pfh-0/0/0.16383         up    up   inet
pfh-0/0/0.16384         up    up   inet
xe-0/0/0.501            up    up   inet     10.202.1.4/31
xe-0/0/0.502            up    up   inet     10.202.1.8/31
xe-0/0/1.0              up    down inet
xe-0/0/2.0              up    down inet
xe-0/0/3.0              up    down inet
xe-0/0/4.0              up    up   inet
xe-0/0/5.0              up    up   inet
xe-0/0/6.0              up    down inet
xe-0/0/7.0              up    up   inet
xe-0/0/9.0              up    up   inet
xe-0/0/11.0             up    up   inet
et-0/0/48.0             up    up   inet
et-0/0/49.0             up    up   inet
et-0/0/50.0             up    up   inet
et-0/0/54.0             up    up   inet     192.168.201.1/31
```

```
et-0/0/55.0             up    up   inet     192.168.201.3/31
bme0.0                  up    up   inet     128.0.0.1/2
em0.0                   up    up   inet     10.6.1.49/26
em2.32768               up    up   inet     192.168.1.2/24
irb.0                   up    down inet
irb.3100                up    up   inet     10.31.0.99/24
irb.3200                up    up   inet     10.32.0.99/24
jsrv.1                  up    up   inet     128.0.0.127/2
lo0.0                   up    up   inet     172.16.32.1         --> 0/0
lo0.2                   up    up   inet     172.16.32.5         --> 0/0
lo0.3                   up    up   inet     172.16.32.3         --> 0/0
lo0.16384               up    up   inet     127.0.0.1           --> 0/0
lo0.16385               up    up   inet
```

PING from Host-2 (Red VRF) 10.31.0.106 to Host-1 (Blue VRF) 10.32.0.105:

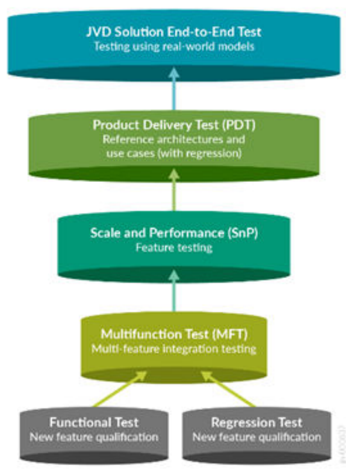
```
must@cf-test-2:~$ ping 10.32.0.105
PING 10.32.0.105 (10.32.0.105) 56(84) bytes of data.
64 bytes from 10.32.0.105: icmp_seq=1 ttl=54 time=47.5 ms
64 bytes from 10.32.0.105: icmp_seq=2 ttl=54 time=47.6 ms
64 bytes from 10.32.0.105: icmp_seq=3 ttl=54 time=48.9 ms
^C
--- 10.32.0.105 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms rtt min/avg/max/mdev =
47.542/47.994/48.884/0.629 ms
```

Validation Framework

IN THIS SECTION

The key to the JVD program is extensive testing of best practice architectures. JVDs qualify and quantify these best practice architectures, allowing you to know exactly what you're buying and to spend your time deploying and managing your network instead of designing it.

JVDs employ a layered testing approach to deliver reliability and repeatability. Individual features receive functional testing. Multifunction testing builds on this functional testing to see if multiple features work together. Product delivery testing builds upon multifunctional testing to validate that these features combined perform as expected for tested use cases. JVD testing builds upon product delivery testing by testing multiple products together (including third-party integrations where appropriate) to ensure that all these products combined make an industry-leading solution.

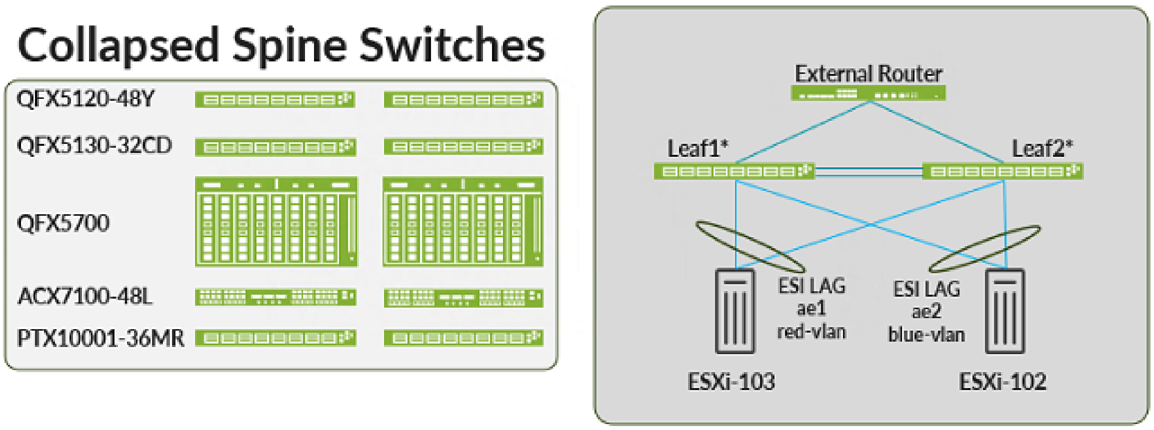


Testing with real-world applications and traffic provides more accurate data regarding performance and response to different configurations. The standardized nature of JVDs ensures the same network architecture is deployed in multiple testing environments. Using JVDs by multiple customers allows for any lessons learned in production deployments to rapidly benefit all JVD customers. The more JVDs that are deployed worldwide, the greater the value they provide to all.

Test Bed

The test bed environment consists of a Collapsed Data Center Fabric with Juniper Apstra JVD with two ESXi servers (labeled “ESX1-102” and "ESXi-103" in the diagram below) connected to the collapsed fabric switches (labeled “DC3-Collapsed-Spine1 and DC3-Collapsed-Spine2 in the diagram below). An external router is connected to the collapsed fabric switches as well. A traffic generator is connected to the test ports on the external router, the collapsed fabric switches, and the ESXi servers.

Figure 64: Collapsed Data Center Fabric with Juniper Apstra JVD Test Environment



Note: Collapsed Fabric Layer switches are labelled as "leaf1 and leaf 2" in this diagram due to Apstra naming conventions based upon switch capabilities, as collapsed spines have serve as spine, leaf, and border leaf switches simultaneously.

Platforms / Devices Under Test (DUT)

To review the software versions and platforms on which this JVD was validated by Juniper Networks, see the Validated Platforms and Software section in this document.

Test Bed Configuration

Contact your Juniper Networks representative to obtain the full archive of the test bed configuration used for this JVD.

Test Objectives

IN THIS SECTION

The JVD test plan for this JVD's primary objective is to qualify the Collapsed Data Center Fabric with Juniper Apstra. The qualification includes validation of Apstra blueprint deployment, incremental configuration pushes through Apstra, Apstra Telemetry/Analytics checking, and verification of traffic flow through the fabric.

JVD features:

- The JVD will be deployed with a collapsed spine architecture and EVPN VXLAN fabric.
- Servers are connected and tested as single-homed and multihomed using the EVPN ESI technique.
- In the case of multihomed ESI servers, LACP is enabled between the servers and the collapsed fabric switches.
- Both the overlay and underlay of the Collapsed Data Center Fabric with Juniper Apstra are built using eBGP.
- EVPN routes are shared through overlay eBGP sessions.
- IP ECMP is enabled in the fabric to enable multi-path collapsed spine to collapsed spine reachability.
- BFD is enabled for underlay eBGP and overlay eBGP for better convergence.
- L3 interface IRB is associated with switching instances for routing.
- IRBs are enabled with an anycast model to save IP address space for the servers.
- IPv4/IPv6 servers are verified in this JVD.

Test Goals

Collapsed Data Center Fabric with Juniper Apstra JVD testing uses the following flow:

- Initial design and blueprint deployment through Apstra
- Validation of fabric operation and monitoring through Apstra Analytics/Telemetry Dashboard
- Validation of end-to-end traffic flow
- System health, ARP, ND, MAC, BGP (route, next hop), interface traffic counters, and so on.
- Test for anomalies

In order to pass validation, the Collapsed Data Center Fabric with Juniper Apstra must pass the following scenarios:

Event Testing:

- Node Reboot—simulated real-world switch outage.
- Field scenarios like interface down/up and laser on/off impact to the fabric and check anomalies reporting in Apstra.
- Traffic recovery was validated after all failure scenarios.
- Maintenance situations such as Junos OS image change (performed and tested).
- Field error condition handling, including restarting the RPD and BGP neighbor.

Test Non-Goals

There were no test non-goals for this JVD.

Results Summary and Analysis

For the Collapsed Data Center Fabric with Juniper Apstra, comprehensive functional testing was performed on all validated switch platforms using the Junos OS Release 23.4R2-S3 and Apstra management software release of 4.2.1:

Baseline system test:

1. Enabling devices for Apstra, applying pristine configuration, and designing logical devices and interface maps.
   - Provisioning of the Collapsed Data Center Fabric with Juniper Apstra JVD architecture using Apstra.
   - Create racks, templates, and blueprints.
2. Assign interface and cabling maps and resources to all devices, including the fabric switches and external routers.
3. Modifying Apstra blueprints to swap and test each validated switch platform.
4. Apstra commits to deploy configurations to devices.
5. Provisioning:
   - Virtual networks
   - Routing zones

- Assign EVPN loopbacks for VRFs
- Create IRBs through Apstra.

Operational and Trigger Tests:

1. Operational testing of switches was carried out for the following:
    - Junos OS control plane functionality and fabric connectivity checks.
    - Tenant addition and removal.
    - Device upgrade to 23.4R2-S3 release.
    - Rebooting devices cause no issues when devices boot up.
    - Process restarts with the aim of minimal packet loss and full restoration of both control and data planes.
        - L2 Address Learning Daemon
        - Interface-control
        - RPD
    - Move four MAC hosts from one port to another without connectivity issues.
    - BFD failover tests by deactivating BGP on leaf switches with ESI configured to allow for traffic convergence.
    - Reset DHCP bindings to ensure fabric forwards DHCP requests and address assignment is released and reassigned.
    - Extended negative tests in an 8-hour cycle to ensure switches restore to baseline state and resume normal traffic forwarding:
        - Process restart
        - Deactivate BGP
        - Link failures
2. Connectivity tests for the following were carried out:
    - Link failure
    - Multihomed link failure
3. Resiliency tests for overlay connectivity testing for the following scenarios:
    - Intra-VLAN

- Inter-VLAN to every host
- Traffic to external routes
- DHCP client/server flows

Scale testing numbers are as follows:

Features	Scale Numbers
VLANs	2000
V4 host entries (MAC-IP)	10000
VNI	2000
VTEP	2
ESI	4
IRB	2000
BGP Routing Table	168000
EVPN Table	10000

Performance numbers are as follows:

Features	Scale Numbers
Singlehomed Access Link Failure	Traffic recovery time < 50msec
Multihomed Access Link Failure	Traffic recovery time < 50msec
Dual homed collapsed spine node reboot	Traffic recovery time < 500msec
BGP protocol flap	Traffic recovery time < 500msec
Global MAC initialization time for 20k entries	< 10sec

NOTE: The maximum VLANs per aggregated Ethernet (AE) interface is 2,000 on the QFX5120. Attempting to define more VLANs than this will cause a commit warning too many VLAN-IDs on an untagged interface. The other validated platforms for this JVD do not have this limitation.

Overall, the JVD validation testing didn't detect any issues and all performance parameters were within the threshold and performed as expected.

Recommendations

The Collapsed Data Center Fabric with Juniper Apstra simplifies the data center provisioning process. Not only does it help in managing the data center for Day 0 and Day 1 operations, but it simplifies Day 2 operations by enabling customers to upgrade devices, manage devices, and monitor device telemetry. As an inherently multi-vendor management platform, Apstra also provides customers the ability to choose vendors, something that is especially valuable today, as data center technology is evolving rapidly with the advent of the AI technology.

Junos OS Release 23.4R2-S3 is the minimum recommended software version for this JVD.

The Juniper hardware and software listed in this JVD are the best suited in terms of features and performance and for the roles specified in this JVD.

Revision History

Date	Version	Description
January 2025	JVD-DCFABRIC-COLLAPSED-01-01	Initial publish