Cisco Nexus Dashboard User Guide, Release 2.0.2

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New and Changed Information

The following table provides an overview of the significant changes to the organization and features in this guide from the release the guide was first published to the current release. The table does not provide an exhaustive list of all changes made to the guide.

Table 1. Latest Updates

Release	Change	Where Documented
2.0.2	Support for persistent IPs for DCNM services	Cluster Configuration.
2.0.2	On-boarding of Cloud APIC sites	Adding Sites.
2.0.1	First release of this document	—

Latest Version of This Document

This document is available from your Nexus Dashboard GUI as well as online at www.cisco.com. For the latest version of this document, visit *Nexus Dashboard User Guide*.

Cisco Nexus Dashboard Overview

Cisco Nexus Dashboard is a central management console for multiple data center sites and a common platform for hosting Cisco data center operation applications, such as Nexus Insights and Nexus Assurance Engine. These applications are universally available for all the data center sites and provide real time analytics, visibility, and assurance for network policies and operations. Cisco Multi-Site Orchestrator can also run on Nexus Dashboard as a hosted app.

Nexus Dashboard provides a common platform and modern technology stack for these micro-services-based applications, simplifying the life cycle management of the different modern applications and reducing the operational overhead to run and maintain these applications. It also provides a central integration point for external 3rd party applications with the locally hosted applications.

Each Nexus Dashboard cluster consists of 3 `master` nodes. In addition, you can provision up to 4 `worker` nodes to enable horizontal scaling and up to 2 `standby` nodes for easy cluster recovery in case of a master node failure.

Hardware vs Software Stack

Nexus Dashboard is offered as a cluster of specialized Cisco UCS servers (Nexus Dashboard platform) with the software framework (Nexus Dashboard) pre-installed on it. The Cisco Nexus Dashboard software stack can be decoupled from the hardware and deployed in a number of virtual form factors. For the purposes of this document, we will use "Nexus Dashboard platform" specifically to refer to the hardware and "Nexus Dashboard" to refer to the software stack and the GUI console.

This guide describes how to use the Nexus Dashboard; for hardware installation, see *Nexus Dashboard Hardware Installation Guide* and for deployment planning and Nexus Dashboard software installation, see the *Nexus Dashboard Deployment Guide*.

Available Form Factors

Cisco Nexus Dashboard, Release 2.0.2 can be deployed as a physical appliance only. This refers to software stack already deployed on the Nexus Dashboard platform hardware that you purchase.

Upgrading From Application Services Engine

Upgrading the Nexus Dashboard software is outside the scope of this document and is described in *Nexus Dashboard Deployment Guide*.

Supported Applications

For the full list of supported applications and the associated compatibility information, see the *Data Center Networking Applications Compatibility Matrix*.

Cluster Sizing Guidelines

Nexus Dashboard supports co-hosting of applications. Depending on the type and number of applications you choose to run, you may be required to deploy additional `worker` nodes in your cluster. For cluster sizing information and recommended number of nodes based on specific use cases, see the *Nexus Dashboard Capacity Planning* tool.

Adding worker nodes to your cluster is described in Managing Worker Nodes.

Network Connectivity

Cisco Nexus Dashboard is deployed as a cluster, connecting each service node to two networks. When first configuring Nexus Dashboard, you will need to provide two IP addresses for the two Nexus Dashboard interfaces—one connected to the Data Network and the other to the Management Network.

This section describes the purpose and functionality of the networks as they are used by the Nexus Dashboard services. Individual applications installed in the Nexus Dashboard may utilize the two networks for additional purposes, so we recommend consulting the specific application's documentation in addition to this document for your deployment planning.

Data network is used for:

- Nexus Dashboard node clustering
- Application to application communication
- Nexus Dashboard nodes to Cisco APIC nodes communication

  For example, the network traffic for Day-2 Operations applications such as NAE.

Management Network is used for:

- Accessing the Nexus Dashboard GUI
- Accessing the Nexus Dashboard CLI via SSH
- DNS and NTP communication
- Nexus Dashboard firmware upload
- Cisco DC App Center (AppStore)

  If you want to use the Nexus Dashboard App Store to install applications as described in Application Management (Service Catalog), the https://dcappcenter.cisco.com page must be reachable via the Management Network.

- Intersight device connector

The two networks have the following requirements:

- The two interfaces can be in the same or different subnets.

In addition, each network's interfaces across different nodes in the cluster can also be in different subnets.

- The management network must provide IP reachability to each node's CIMC via TCP ports 22/443.

  Nexus Dashboard cluster configuration uses each node's CIMC IP address to configure the node.

- For Nexus Insights and Network Assurance Engine applications, the data network must provide IP reachability to the fabrics' in-band IPs.
- For Nexus Insights and AppDynamics integration, the data network must provide IP reachability to the AppDynamics controller.
- For Multi-Site Orchestrator application, the data network can have in-band and/or out-of-band IP reachability for Cisco APIC sites but must have in-band reachability for Cisco DCNM sites.
- The data network interface requires a minimum MTU of 1500 to be available for the Nexus Dashboard traffic.

  Higher MTU can be configured if desired.

- Connectivity between the nodes is required on both networks with the following additional round trip time (RTT) requirements.

You must always use the lowest RTT requirement when deploying the Nexus Dashboard cluster and applications. For example, if you plan to co-host MSO and NI apps, site connectivity RTT must not exceed 50ms.

Application	Connectivity	Maximum RTT
Nexus Dashboard cluster	Between nodes	150 ms
Multi-Site Orchestrator (MSO)	Between nodes	150 ms
	To sites	500 ms
Nexus Insights (NI)	Between nodes	50 ms
	To sites	50 ms
Network Assurance Engine (NAE)	Between nodes	50 ms
	To sites	50 ms

Internal Networks

Two additional internal networks are required for communication between the containers used by the Nexus Dashboard:

- Application overlay is used for applications internally within Nexus Dashboard

  Application overlay must be a /16 network.

- Service overlay is used internally by the Nexus Dashboard.

Service overlay must be a /16 network.

Note that communications between containers deployed in different Nexus Dashboard nodes is VXLAN-encapsulated and uses the data interfaces IP addresses as source and destination. This means that the Application Overlay and Service overlay addresses are never exposed outside the data network and any traffic on these subnets is routed internally and does not leave the cluster nodes. For example, if you had another service (such as DNS) on the same subnet as one of the Overlay networks, you would not be able to access it from your Nexus Dashboard as the traffic on that subnet would never be routed outside the cluster. As such, when configuring these networks, ensure that they are unique and do not overlap with any existing networks or services you may need to access from the Nexus Dashboard cluster nodes.

Communication Ports

The following ports are required by the Nexus Dashboard cluster and its applications:

Purpose	Port Number	Port Type
Management Interface	—	ICMP
	22	TCP
	67	UDP
	69	UDP
	443	TCP
	5555	TCP
	9880	TCP
	30012	TCP
	30021	TCP
	30500-30600	TCP/UDP

Purpose	Port Number	Port Type
Data Interface between ND nodes	53	TCP/UDP
	443	TCP
	3379	TCP
	3380	TCP
	4789	UDP
	9969	TCP
	9979	TCP
	9989	TCP
	15223	TCP
	30002-30006	TCP
	30009-30010	TCP
	30012	TCP
	30015-30019	TCP
	30017	UDP
	30025	TCP
	30500-30600	TCP/UDP
Data Interface on APICs	22	TCP
	443	TCP
Data Interface between ND nodes and fabrics	443	TCP
	2022	TCP
	5640-5671	UDP
	5965	UDP
	8884	TCP
	9989	TCP
	30000-30001	TCP

Fabric Connectivity

You can connect the Nexus Dashboard cluster to your fabrics in two ways:

- The Nexus Dashboard cluster connected to the fabric via a Layer 3 network.
- The Nexus Dashboard nodes connected to the leaf switches as typical hosts.

Physical Node Cabling

If you deployed a virtual or cloud form factor cluster, you can skip this section.

The following figure shows the Nexus Dashboard physical node interfaces:

- `eth1-1` and `eth1-2` must be connected to the Management network
- `eth2-1` and `eth2-2` must be connected to the Data network

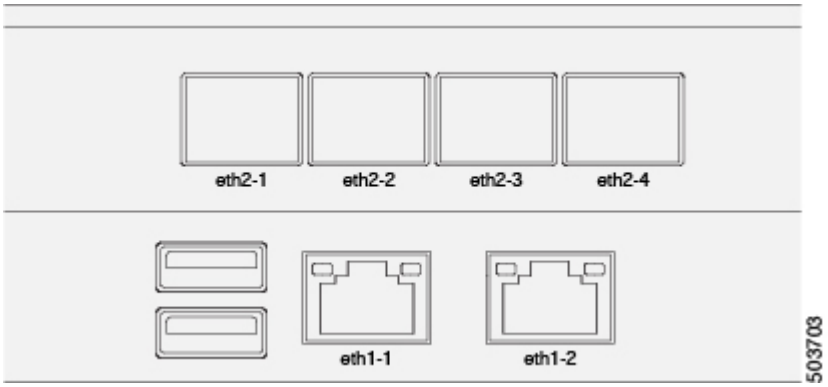


Figure 1. Node Connectivity

The interfaces are configured as Linux bonds: one for the data interfaces and one for the management interfaces. All interfaces must be connected to individual host ports, PortChannel or vPC are not supported.

Connecting via External Layer 3 Network

Connectivity depends on the type of applications deployed in the Nexus Dashboard:

- If you are deploying Multi-Site Orchestrator to manage Cisco ACI fabrics only, you can establish connectivity from the data interface to either the in-band or out-of-band (OOB) interface of each site's APIC.
- If you are deploying Multi-Site Orchestrator to manage Cisco DCNM fabrics, you must establish connectivity from the data interface to the in-band interface of each site's DCNM.
- If you are deploying Day-2 Operations applications, such as Nexus Insights, you must establish connectivity from the data interface to the in-band network of each fabric.

If you plan to connect the cluster across an external Layer 3 network, keep the following in mind:

- For ACI fabrics, you must configure an L3Out and the external EPG for Cisco Nexus Dashboard data network connectivity in the management tenant.

  Configuring external connectivity in an ACI fabric is described in *Cisco APIC Layer 3 Networking Configuration Guide*.

- For DCNM Fabrics, if the data interface and DCNM's in-band interface are in different subnets, you must add a route to the Nexus Dashboard's data network on DCNM.

  You can add the route from the DCNM UI by navigating to **Administration** > **Customization** > **Network Preference** > **In-Band (eth2)**, then adding the route and saving.

- If you specify a VLAN ID for your data interface during setup of the cluster, the host port must be configured as trunk allowing that VLAN.

However, in most common deployments, you can leave the VLAN ID empty and configure the host port in access mode.

The following two figures show two distinct network connectivity scenarios when connecting the Nexus Dashboard cluster to the fabrics via an external Layer 3 network. The primary purpose of each depends on the type of application you may be running in your Nexus Dashboard.

Note that the "L3 Network" and the "Management Network" can be the same network infrastructure, for example in case the Nexus Dashboard nodes have the management and data network interfaces in the same subnet.

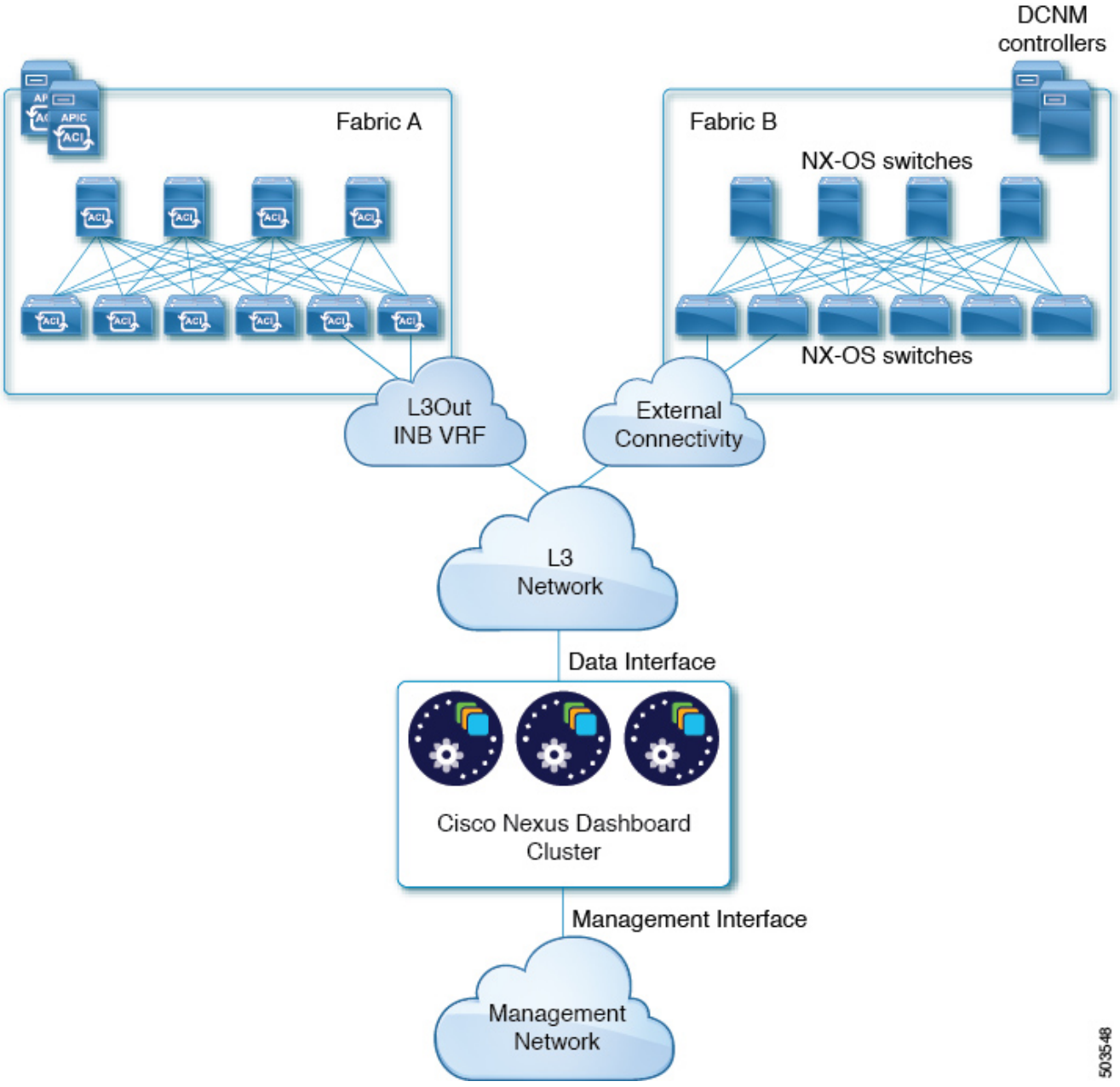


Figure 2. Connecting via External Layer 3 Network, Day-2 Operations Applications

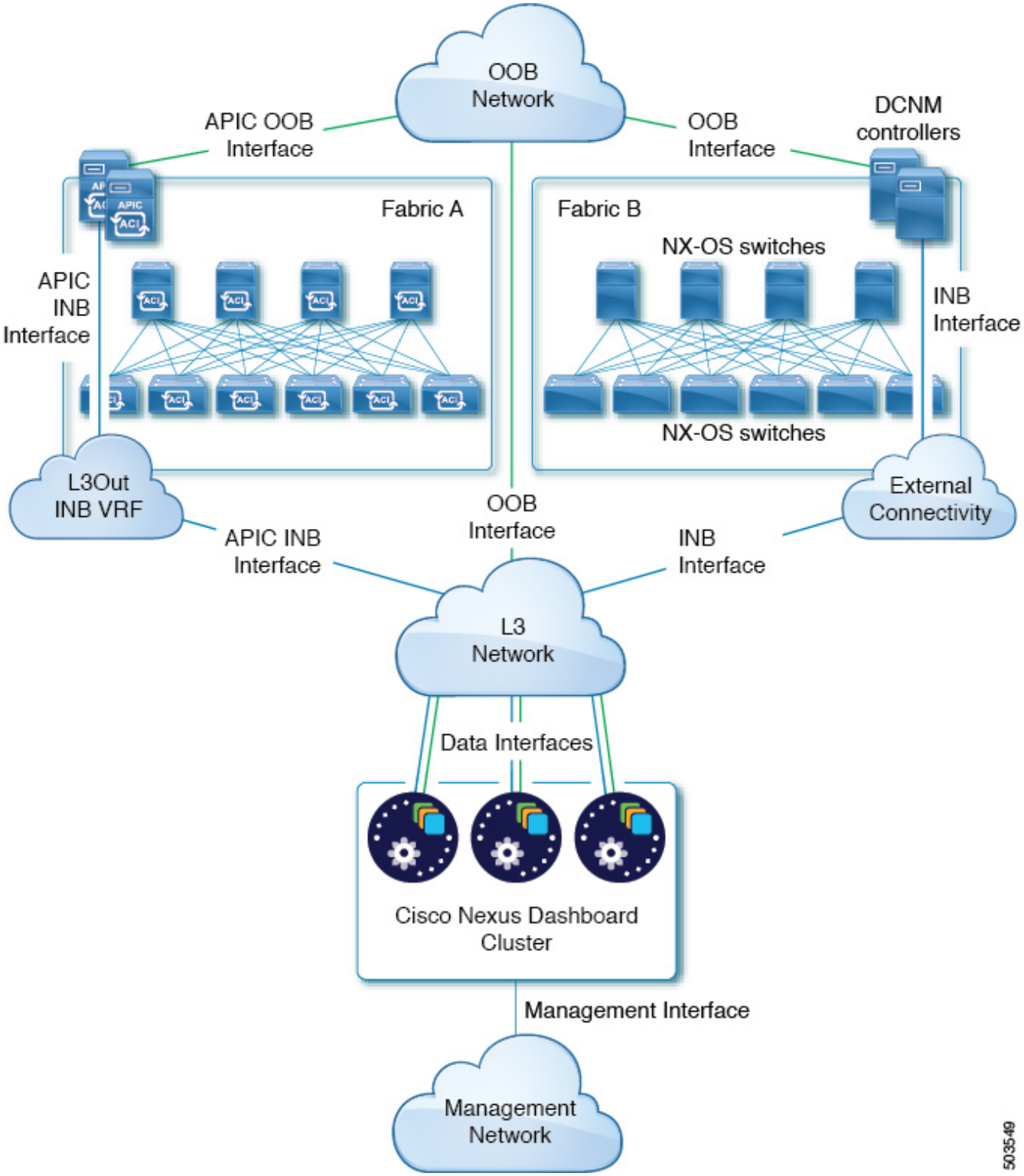


Figure 3. Connecting via External Layer 3 Network, Multi-Site Orchestrator

Connecting the Nodes Directly to Leaf Switches

Like in the previous example, connectivity depends on the type of applications deployed in the Nexus Dashboard:

- If you are deploying Day-2 Operations applications, you will use the data interface IP to communicate to the in-band network of each fabric.

For ACI fabrics, the data interface IP subnet connects to an EPG/BD in the fabric and must have a contract established to the local in-band EPG in the management tenant. We recommend deploying

the Nexus Dashboard in the management tenant and in-band VRF. Connectivity to other fabrics is established via an L3Out.

- In addition, if you are deploying Multi-Site Orchestrator, you must also establish connectivity to the out-of-band (OOB) interface of each site's Cisco APIC cluster.

If you plan to connect the cluster directly to the leaf switches, keep the following in mind:

- For ACI fabrics, we recommend configuring the bridge domain (BD), subnet, and endpoint group (EPG) for Cisco Nexus Dashboard connectivity in management tenant.

  Because the Nexus Dashboard requires connectivity to the in-band EPG in the in-band VRF, creating the EPG in the management tenant means no route leaking is required.

- For ACI fabrics, you must create a contract between the fabric's in-band management EPG and Cisco Nexus Dashboard EPG.
- If you specify a VLAN ID for your data network during setup of the cluster, the Nexus Dashboard interface and the port on the connected network device must be configured as trunk

  However, in most cases we recommend not assigning a VLAN to the data network, in which case you must configure the ports in access mode.

- For ACI fabrics, if several fabrics are monitored with apps on the Services Engine cluster, L3Out with default route or specific route to other ACI fabric in-band EPG must be provisioned and a contract must be established between the cluster EPG and the L3Out's external EPG.

The following two figures show two distinct network connectivity scenarios when connecting the Nexus Dashboard cluster directly to the fabrics' leaf switches. The primary purpose of each depends on the type of application you may be running in your Nexus Dashboard.

Note that the "L3 Network" and the "Management Network" can be the same network infrastructure, for example in case the Nexus Dashboard nodes have the management and data network interfaces in the same subnet.

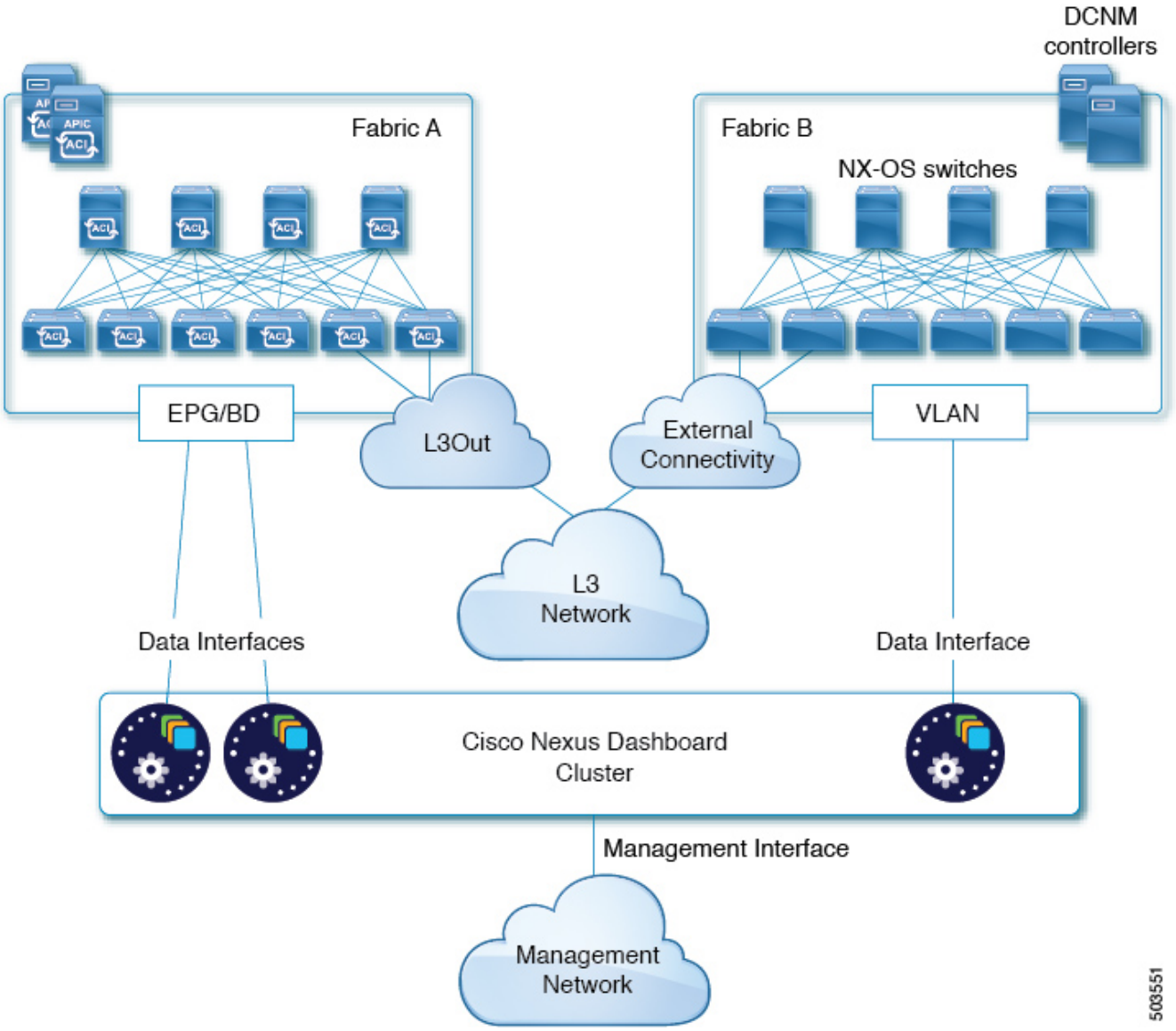


Figure 4. Connecting via an EPG/BD, Day-2 Operations Applications

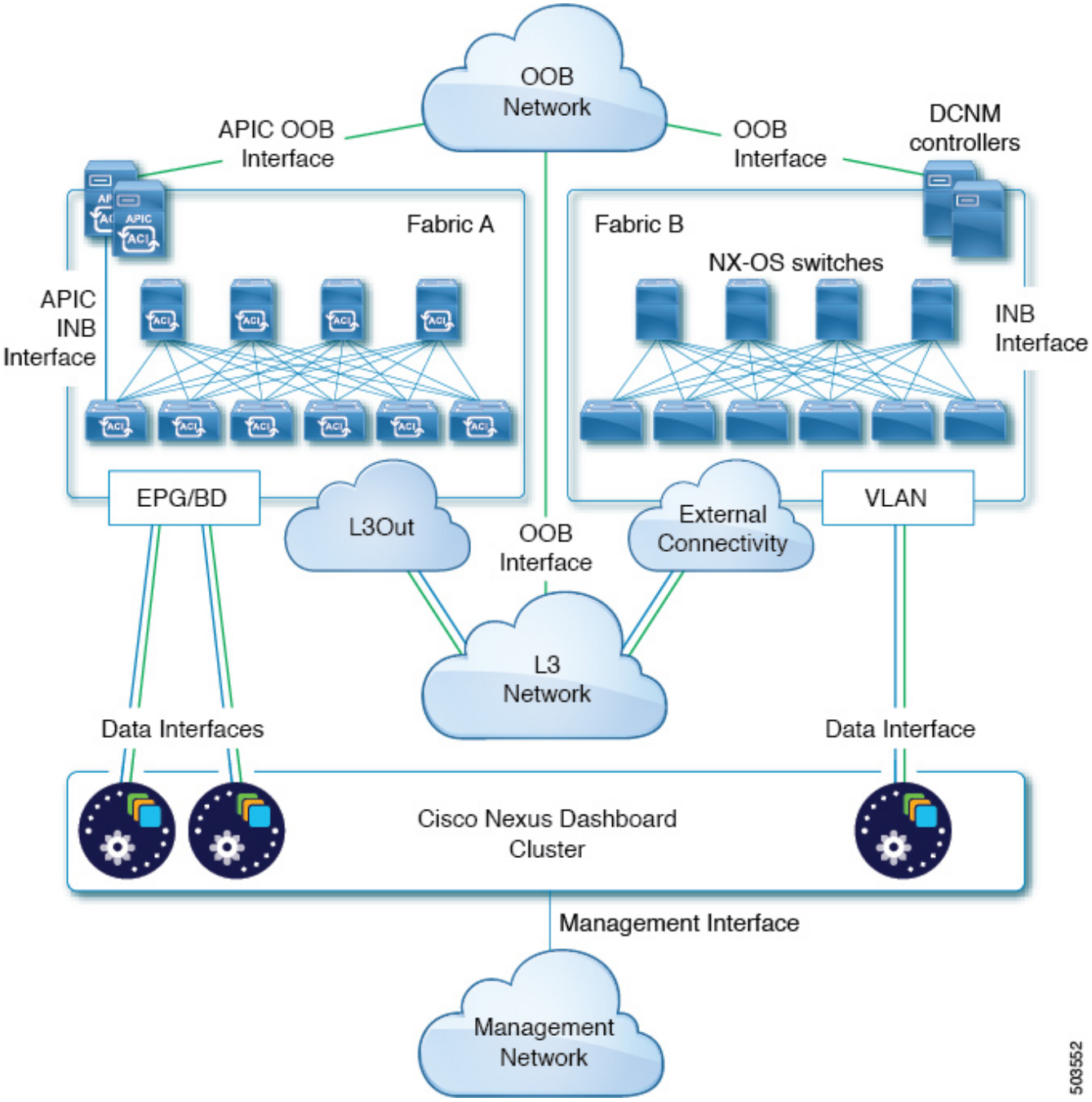


Figure 5. Connecting via an EPG/BD, Multi-Site Orchestrator

GUI Overview

After you have deployed the Cisco Nexus Dashboard cluster, you can perform all remaining actions using its GUI. To access Cisco Nexus Dashboard GUI, simply browse to any one of the nodes' management IP addresses:

```
https://<node-mgmt-ip>
```

Depending on the permissions of the user logged in to the Nexus Dashboard GUI, the UI will display only the objects and settings the user is allowed to access. The following sections describe all GUI elements as visible by an `admin` user. For more information on user configuration and permissions, see Users.

Dashboard

The **Dashboard** provides a wholistic view of the Cisco Nexus Dashboard. You can use this view to monitor system health, sites, and apps connectivity status.

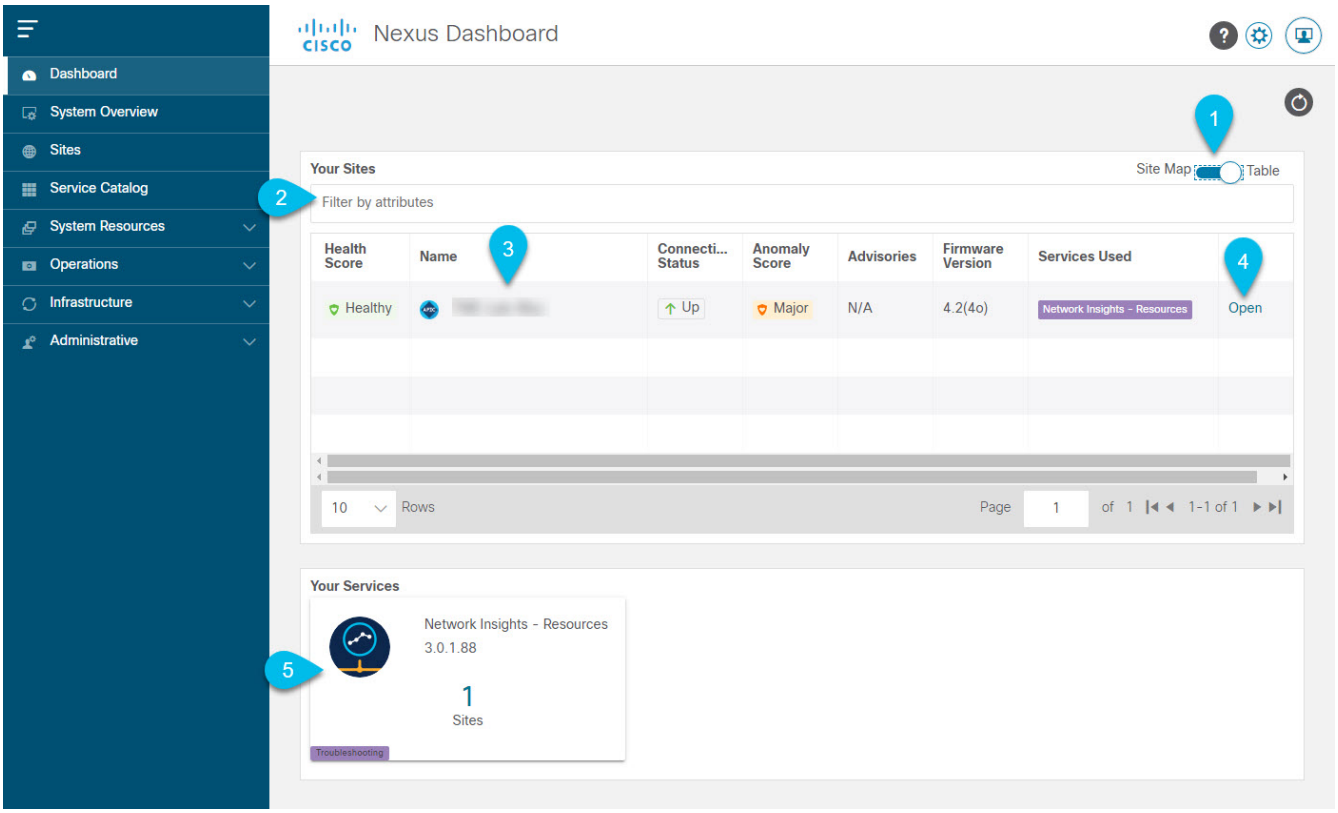


Figure 6. Dashboard View

The **Dashboard** view contains the following information:

1. You can toggle the **Site Map** view to change between the geographical view and the detailed list of available sites.
2. The **Filter by attributes** field allows you to filter the list based on one or more attribute-value pairs.

3. You can click the site **Name** to open a **Details** pane that contains additional information such as IP addresses of the site's controllers, its inventory, etc.
4. You can click the **Open** link to open the GUI for the site's controller, such as APIC, Cloud APIC, or DCNM.
5. Similarly, clicking an application in the **Your Services** area will open that application's GUI.

System Overview

The **System Overview** provides information about the Nexus Dashboard application resources usage.

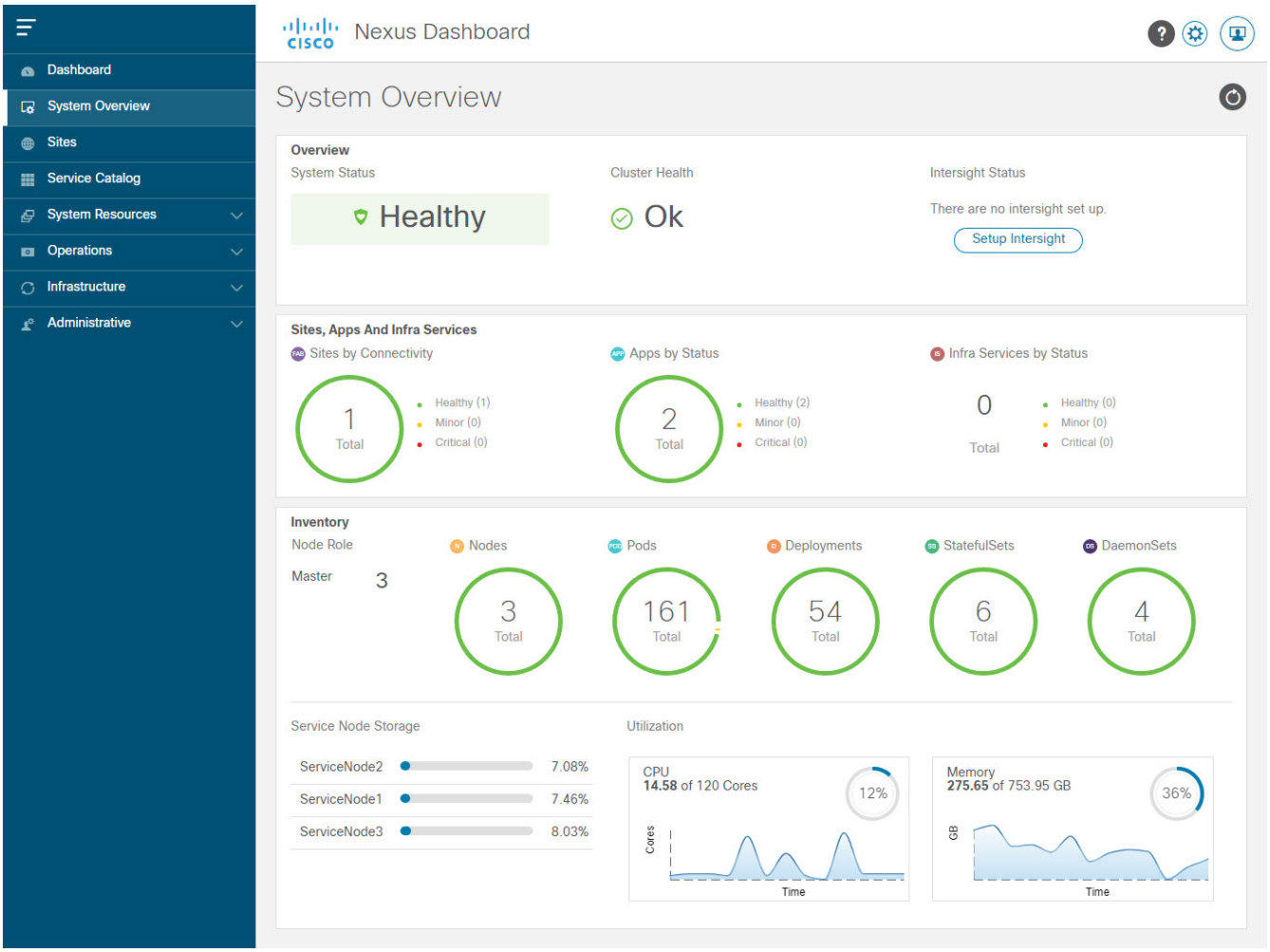


Figure 7. System Overview

- The **Overview** tile displays System Status, Cluster Health, and Cisco Intersight Status.
- The **Sites, Apps, and Infra Services** tile displays the `Sites` by connectivity, as well as `Apps` and `Infra Services` by status.

  Connectivity indicates whether the sites are up (`Healthy`) or down (`Critical`). The `Minor` status is currently unused and always displays `(0)`.

  Status is displayed in number of apps or services that are `healthy`, have `minor` faults, or have `critical` faults.

- The **Inventory** tile provides details of the `nodes`, `pods`, `deployments`, `stateful sets`, `daemon sets`.

The following additional information is also shown:

- `Service Node Storage`
- `Utilization`
- `Memory`

Note that you can click different areas in the **System Overview** tab to open the corresponding GUI screens where you can see additional details or make configuration changes.

Services

The **Services** category in the left navigation pane provides a single pane of glass access to managing applications in your Nexus Dashboard.

Any application that is already installed and enabled is listed directly under the **Services** category providing you with quick access to the application's GUI.

The **Services Catalog** screen allows you to manage existing applications or explore, download, and install the applications available on the DC App Center. It also provides the following information about applications that are already deployed:

- **Name** — the name of the application
- **Description** — description of the application
- **Versions** — number of application versions available
- **Pods** — number of pods used by the application
- **Containers** — number of containers in use by the application

For additional information on managing applications, see [Service Catalog (Application Management)].

System Resources

The **System Resources** category in the left navigation pane displays the application resources provided by the Nexus Dashboard cluster.

The category contains the following subcategories:

- **Nodes** — displays the details of the service nodes configured and running on the selected app. Up to seven nodes are admitted in a cluster; three master nodes and four worker nodes.

  Only worker nodes can be registered using the GUI. Master nodes are brought up using the command line as specified in Deploying the Cisco Nexus Dashboard section

- **Pods** — displays the configured pods running on the selected app.
- **Containers** — displays all the configured containers, container status, IP address, and the configured service node.
- **Deployments** — displays all the deployments, status, IP address, and the configured service

node.

- **StatefulSets** — displays all the configured statefulsets, status, IP address, and the configured service node.
- **Services** — displays all the configured services, status, namespaces, IP addresses.
- **Namespaces** — displays the service name, cluster IP, configured ports and the selectors for the app.

Operations

The **Operations** category in the left navigation pane displays the actions that can be performed on Cisco Nexus Dashboard.

The category contains the following subcategories:

- **Firmware Management** — Firmware Management is used to perform cluster (firmware) upgrade or downgrade.
- **Tech Support** — An administrator can perform technical support collections.
- **Audit Logs** — Audit Logs are user triggered configuration changes.
- **Backup and Restore** — Backup and Restore displays the backed up and restoredconfiguration.

Infrastructure

The **Infrastructure** category in the left navigation pane allows you to management the Nexus Dashboard cluster, Cisco Intersight connector, and application Infra services.

- **Cluster Configuration** — provides cluster details such as name, app subnet, and service subnet. It also provides details of the NTP and DNS servers.
- **Resource Utilization** — provides real-time information about the resource utilization of your Nexus Dashboard cluster.
- **Intersight** — provides access to Cisco Intersight device connector configuration.

  The Cisco NIA app depends on the Intersight Device Connector for app to be configured and available on the service node.

- **App Infra Services** — provides information about the infra services running on your Nexus Dashboard and allows you to restart individual microservices if needed.

Administrative

The **Administrative** category in the left navigation pane allows you to manage authentication and users.

- **Authentication** — allows you to configure remote authentication domains as described in Authentication.
- **Security** — allows you to view and edit the security configurations, such keys and certificates.

- **Users** — allows you to create and update local Nexus Dashboard users as described in Users or view the users configured on any remote authentication servers you added to the Nexus Dashboard.

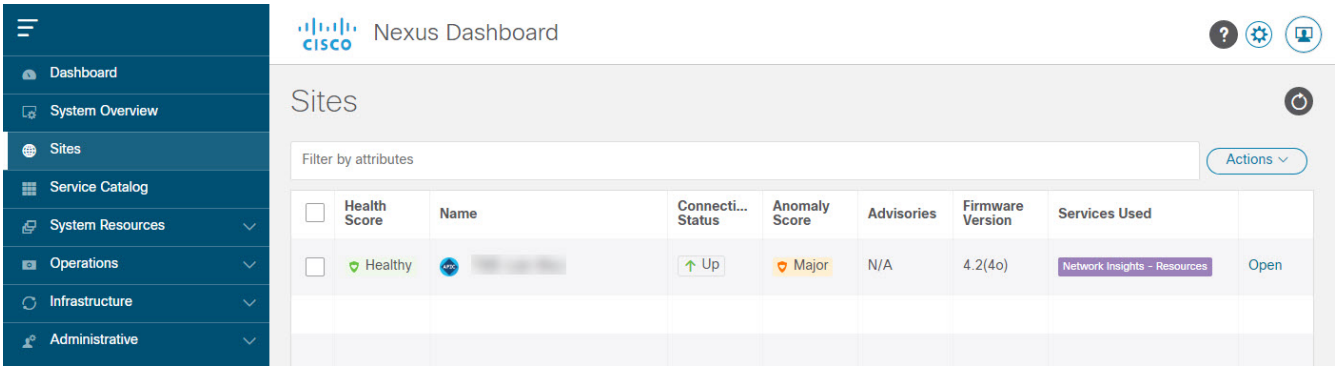
Site Management

With Cisco Nexus Dashboard, you can on-board multiple Cisco ACI and Cisco DCNM fabrics as individual sites to the same cluster. Once the fabrics are on-boarded, they can be used by the applications running on the same Cisco Nexus Dashboard cluster.

To add a site, you need its controller's management IP address and credentials. The Cisco Nexus Dashboard nodes must have IP reachability to the site's controller's management IP. The login credentials are not stored in the Cisco Nexus Dashboard cluster, and are only used to copy the SSL keys to the sites' controllers. Sites added to the Cisco Nexus Dashboard cluster are not enabled in the apps by default, so you will need to explicitly enable directly from each app's own GUI.

After you on-board one or more sites to your Nexus Dashboard, you can view them in the Nexus Dashboard GUI by selecting **Sites** from the left navigation sidebar. You can also use the **Sites** page to launch directly into any of the site's GUIs by clicking the **Open** link next to the site's name.

If you are using remote authentication to login to your Nexus Dashboard and you have the same login domain and user configured in the site you are launching, you will be able to login to the site's GUI automatically without having to re-authenticate yourself.



Adding Sites

Before you begin

- Fabric connectivity must be already configured.
- While Cisco Nexus Dashboard supports on-boarding Cisco ACI, Cloud ACI, and DCNM fabrics, applications shipping with this release of Nexus Dashboard support on-premises Cisco ACI fabrics only. For additional information about application and fabric compatibility, see the *Cisco Data Center Networking Applications Compatibility Matrix*.
- If adding a Cisco DCNM site, the site must be running Release 11.5(1) or later.
- If adding a Cisco APIC or Cloud APIC site, the site must be running Release 4.2(4) or later.
- If adding a Cisco APIC site, EPG/L3Out for Cisco Nexus Dashboard data network IP connectivity must be pre-configured.

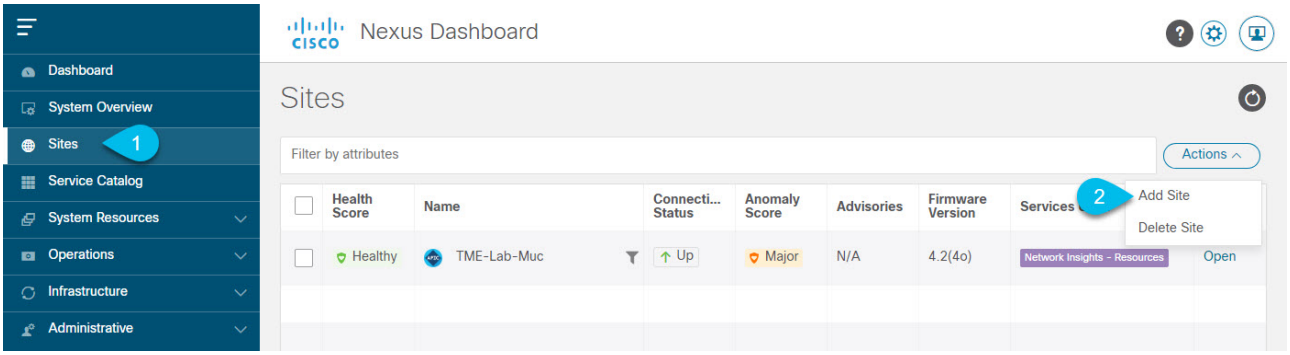
  Refer to Fabric Connectivity for more information.

- If adding a Cisco APIC site and planning to deploy Cisco NIR application:

- IP connectivity from Cisco Nexus Dashboard to Cisco APIC Inband IP over data network must be configured.
- IP connectivity from Cisco Nexus Dashboard to the leaf nodes and spine nodes Inband IPs must be configured.

To add a site:

1. Log in to your Nexus Dashboard GUI.
2. Add a site.

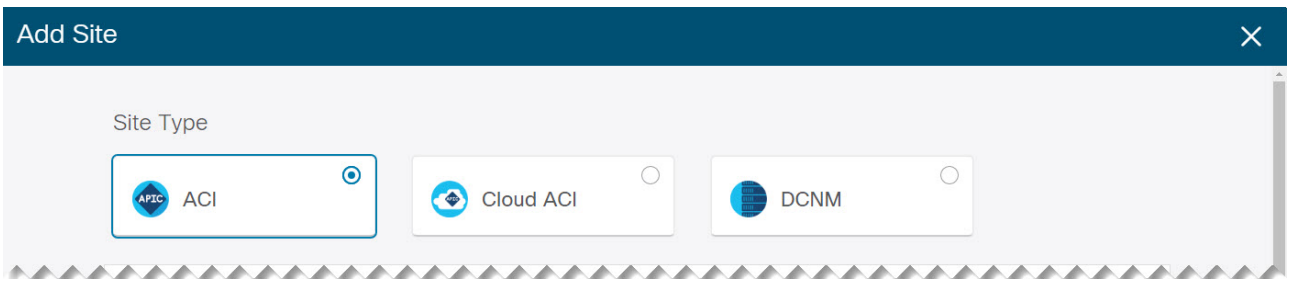


   a. From the left sidebar, select **Sites**.
   b. In top right of the main pane, click the **Actions** menu and select **Add Site**.

      The **Add Site** screen opens.

3. Select the type of site you want to add.

While Cisco Nexus Dashboard supports on-boarding all three types of fabrics, for specific fabric types and versions compatible with your applications, see the *Applications Compatibility Matrix*.



   - **ACI** — for on-premises ACI sites managed by Cisco APIC
   - **Cloud ACI** — for cloud ACI sites managed by Cisco Cloud APIC
   - **DCNM** — for on-premises sites managed by Cisco DCNM

4. Provide the site's information.
   a. If adding an `ACI` site, provide the following:
      - **Site Name** — used throughout the Nexus Dashboard GUI when referring to this site.
      - **Host Name/IP Address** — used to communicate with the Cisco APIC.
      - **User Name** and **Password** — used to manage the site.

- (Optional) **Login Domain** — if you leave this field empty, the site's local login is used.
- (Optional) **In-Band EPG** — required when connecting to an ACI fabric via an EPG and bridge domain. For more information on fabric connectivity, see Fabric Connectivity.

  You must provide the In-Band EPG if you plan to use this site with the Nexus Insights application.

b. If adding a `Cloud ACI` site, provide the following:
   - **Site Name** — used throughout the Nexus Dashboard GUI when referring to this site.
   - **Host Name/IP Address** — used to communicate with the Cisco Cloud APIC.
   - **User Name** and **Password** — used to manage the site.
   - (Optional) **Login Domain** — if you leave this field empty, the site's local login is used.

c. If adding a `DCNM` site, provide the following:
   - **Host Name/IP Address** — used to communicate with the Cisco DCNM.

     This must be the in-band IP address of DCNM.
   - **User Name** and **Password** — used to manage the site.
   - **Sites on DCNM** — click **Add Sites** to select the DCNM fabrics managed by the controller you provided.

5. Click **Add** to finish adding the site.
6. (Optional) Click on the **Geographical Location** map to specify where the site is located.
7. (Optional) Repeat these steps for any additional sites.

Deleting Sites

Before you begin

- Ensure that the site is not used by any applications installed in your Nexus Dashboard.

  Deleting a site will cause an interruption to all applications using this site.
- When a Cisco ACI fabric is added as a site to Cisco Nexus Dashboard, some policies may be created in the Cisco APIC. If the Cisco Nexus Dashboard is clean rebooted without deleting the on-boarded site, the policies created on Cisco APIC will not be deleted. To clean up these policies on Cisco APIC, the site should be re-added and deleted.

To remove one or more sites:

1. Log in to your Nexus Dashboard GUI.
2. From the left sidebar, select **Sites**.
3. Select one or more sites that you want to remove.
4. In top right of the main pane, click the **Actions** menu and select **Delete Site**.
5. In the **Confirm Delete** window, provide the login information for the site

6. Click **OK** to remove the site.

Application Management (Service Catalog)

With Cisco Nexus Dashboard, you can manage all of your applications including their entire lifecycle from the **Service Catalog** GUI page. This page also allows you to explore the Cisco DC App Center and discover all the applications that are available for the Nexus Dashboard.

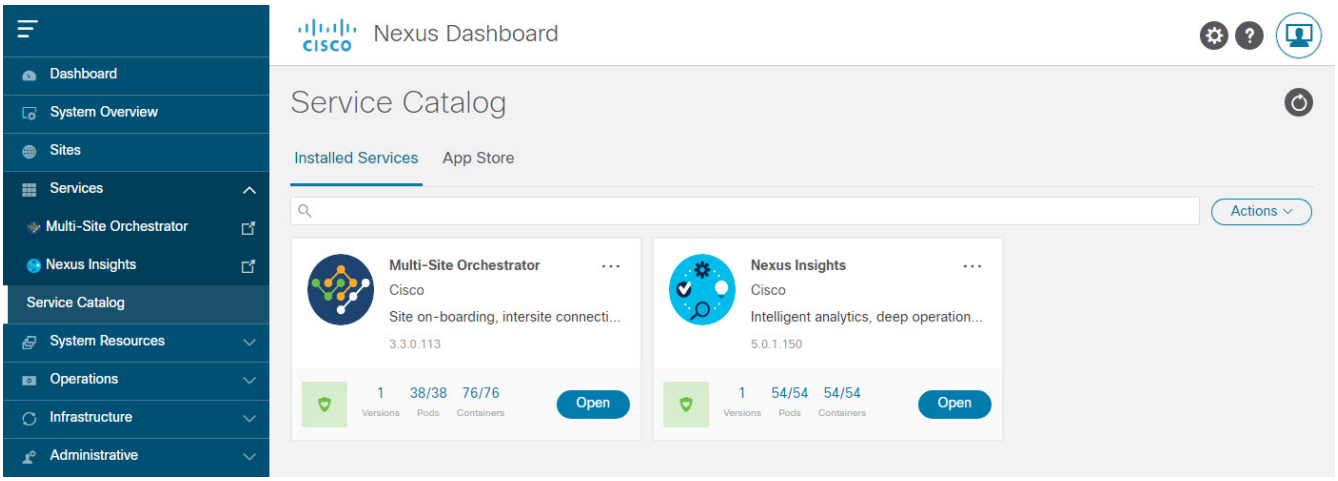


Figure 8. Available Applications

Installing Applications Using App Store

The App Store screen allows you to deploy applications directly from the Cisco DC App Center.

Before you begin

- You must have administrative privileges to install applications.
- The Cisco DC App Center must be reachable from the Nexus Dashboard via the Management Network directly or using a proxy configuration.

  Setting up a proxy is described in Cluster Configuration.

- Keep in mind that only the latest versions of applications are available for installation using the App Store.

  If you want to install a version of an application prior to the latest available in the App Store, you can follow the manual installation procedures as described in Installing Applications Manually.

- You must have configured the App Infra Services with deployment profiles appropriate for your use case, as described in App Infra Services.

To install an application from the App Store:

1. Log in to your Nexus Dashboard GUI.
2. Install an application from the **App Store**.

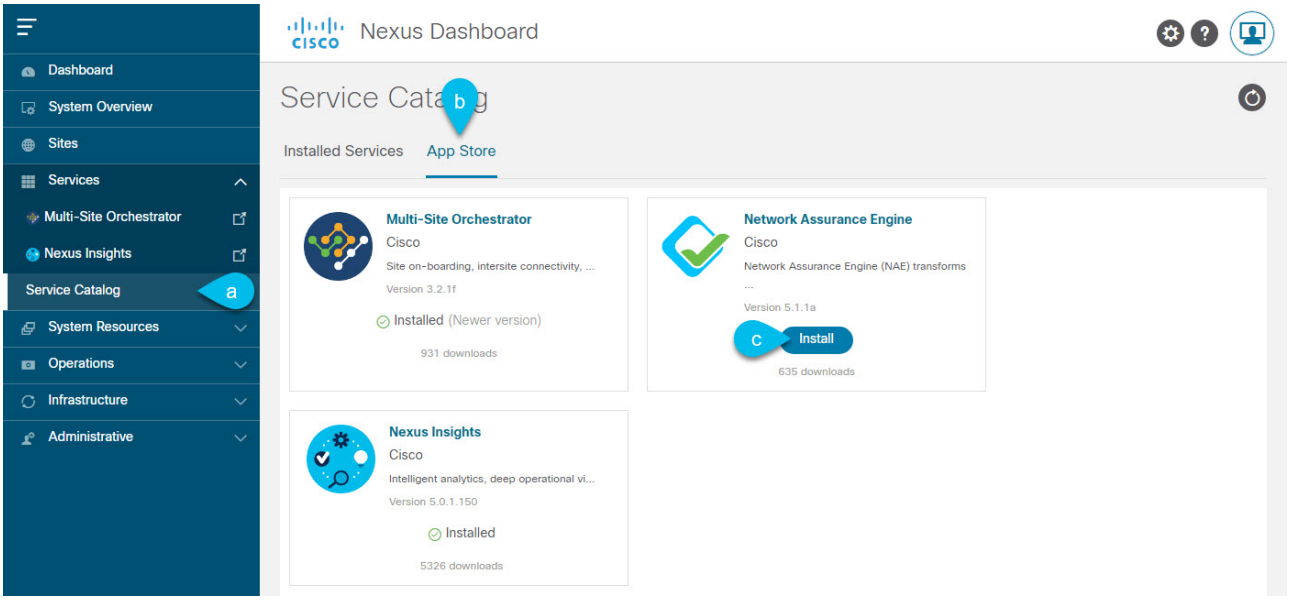


Figure 9. Cisco DC App Center

a. From the left sidebar, select **Services** > **Service Catalog**.

b. In the main pane, select the **App Store** tab.

c. In the tile of the application you want to install, click **Install**.

   Nexus Dashboard will download the application directly from the DC App Center and install it. After the process completes, the application will be available in your **Service Catalog**.

3. Enable the application.

   By default, after the application is installed, it remains in the `disabled` state. Follow the steps described in Enabling Applications to enable it.

   This may take up to 20 minutes depending on the application.

Installing Applications Manually

Alternatively, you may choose to manually download the applications from the DC App Center and then upload them to the Nexus Dashboard to install.

Before you begin

- You must have administrative privileges to install applications.
- You must have configured the App Infra Services with deployment profiles appropriate for your use case, as described in App Infra Services.

To manually download an application:

1. Browse to the Cisco DC App Center.
2. In the **Search for apps...** field, enter the name of the application you want to download and press Enter.

   For example, `network insights`

3. On the search results page, click the application.
4. On the application page, click **Download**.
5. In the **License Agreement** window, click **Agree and download**.

   This will download the application's `.aci` file to your system.

To install an application:

1. Log in to your Nexus Dashboard GUI.
2. Upload the application.
   a. From the left sidebar, select **Service Catalog**.
   b. In top right of the main pane, click the **Actions** menu and select **Upload App**.
   c. Choose the app file you downloaded.

      You can choose to upload the application from an `http` service or from your local machine.

      Select **Remote** and provide the URL to the `.aci` file or select **Local**, then click **Choose File** and select the application file you downloaded to your local system.

      Finally click **Upload** to upload the app.
3. Wait for the upload and initialization process to finish.
4. Enable the app.

   By default, after the application is installed, it remains in the `disabled` state. Follow the steps described in Enabling Applications to enable it.

   This may take up to 20 minutes depending on the application.

Enabling Applications

By default, after the application is installed, it remains in the `disabled` state. This section describes how to enable an application.

Before you begin

- You must have already installed the application as described in [Installing Applications].
- You must have configured the App Infra Services with deployment profiles appropriate for your use case, as described in App Infra Services.

To enable an application:

1. Log in to your Nexus Dashboard GUI.
2. From the left sidebar, select **Service Catalog**.
3. In the application's tile, click **Enable**.

   Enable <application-name> window opens.

4. From the **Deployment Profile** dropdown, select the application profile you want to use.

   When you enable an application, you will be prompted to select a **Deployment Profile** as shown in the figure below, which will define the resources that the Nexus Dashboard will allocate to the application.

   The application deployment profiles are different from the Infra services deployment profiles, which you select when you restart an infrastructure service as described in App Infra Services. The Infra services deployment profiles must be configured before you enable the applications.

   The application profiles are defined by the application developer and contain a set of tested and verified resource requirements based on specific use cases. You can find more detailed information about available profiles in the application's documentation, but the following table summarizes recommended profiles for each application and deployment scenario:

Deployment Scenario	Nexus Insights profile	Network Assurance Engine profile	Multi-Site Orchestrator profile
<50 switches and <10,000 flows	`physical-small`	`physical-standard-nae-small`	`Production`
51-100 switches and <10,000 flows	`physical-standard`	`physical-standard-nae-medium`	`Production`
101-500 switches and/or >10,000 flows	`physical-standard`	`physical-standard-nae-large`	`Production`

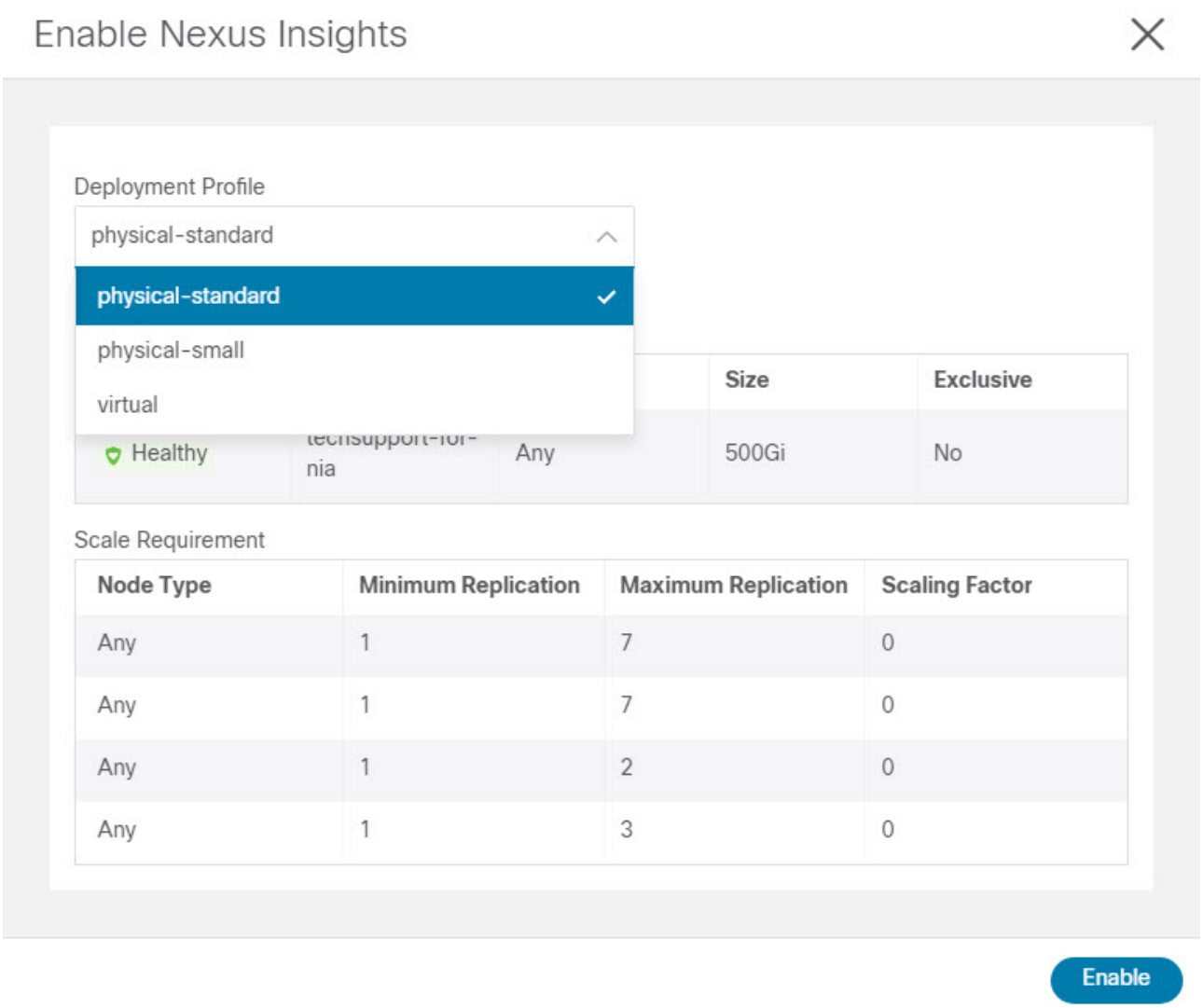


Figure 10. Application Deployment Profile

The deployment profile can be changed in one of the following three ways:

- When you first enable the application as described here.
- When you **Restart** the application.

  You can restart an application from the **(...)** menu on the application tile.

- When you upgrade the application.

  You will be automatically prompted to select the deployment profile again.

5. Click **Enable** to enable the application.

Updating Applications

The process for updating applications is similar to first deploying it, as described in Installing Applications Using App Store or Installing Applications Manually.

When you upload a new version of an existing application, you will be able to select one of the available versions from the **(...)** menu on the application tile in the **Service Catalog** screen.

To update an existing application:

1. Deploy the new version as described in Installing Applications Using App Store or Installing Applications Manually.
2. Navigate to the **Service Catalog** screen in the Nexus Dashboard GUI.
3. Click the **(...)** menu on the application's tile.
4. Select **Available Version**.
5. In the available versions window that opens, click **Activate** next to the new version.

Disabling Applications

1. Log in to your Nexus Dashboard GUI.
2. From the left sidebar, select **Service Catalog**.

   All applications installed in your Nexus Dashboard are displayed here.
3. Click **...** on the application's tile and select **Disable** to disable the application.

Restarting Applications

1. Log in to your Nexus Dashboard GUI.
2. From the left sidebar, select **Service Catalog**.

   All applications installed in your Nexus Dashboard are displayed here.
3. Click **...** on the application's tile and select **Restart** to restart the application.

Uninstalling Applications

Before you begin

You must disable the application before you can delete it.

1. Log in to your Nexus Dashboard GUI.
2. From the left sidebar, select **Service Catalog**.

   All applications installed in your Nexus Dashboard are displayed here.
3. Click **...** on the application's tile and select **Delete** to remove the application.

Operations

Firmware Management (Cluster Upgrades)

This section describes how to manage different firmware versions and perform cluster upgrades.

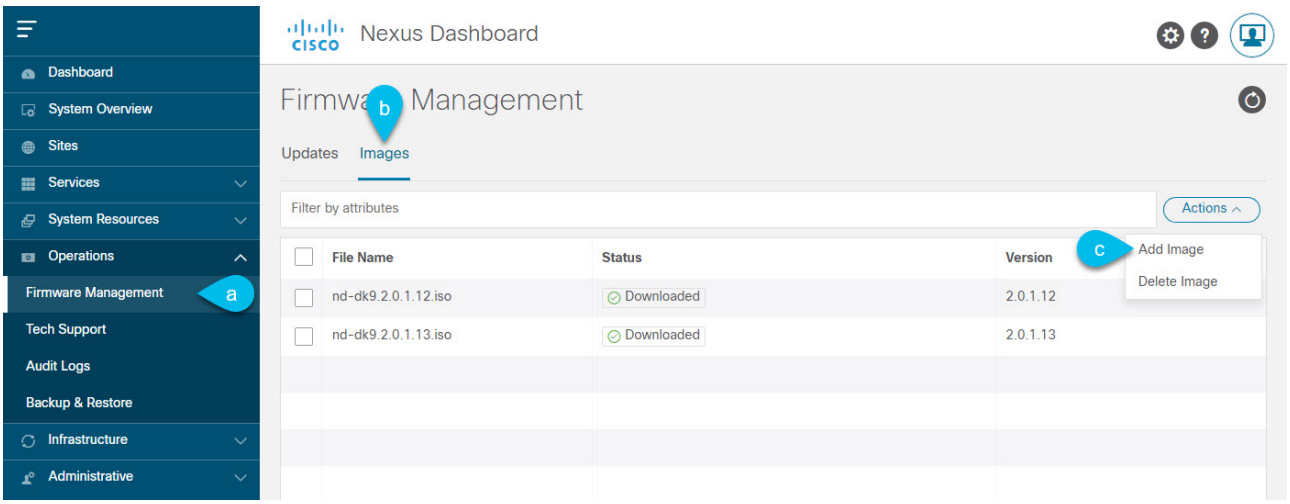
The upgrade process involves uploading a new image and then deploying it. As such, the same workflow can be used for cluster firmware downgrades as well.

This release of Nexus Dashboard does not support downgrades. If you want to downgrade to an earlier release, you will need to deploy a new cluster and reinstall the applications.

Adding Images

Before you can upgrade your Nexus Dashboard cluster, you need to make the upgrade image available by adding it using the GUI.

1. Log in to your Nexus Dashboard GUI.
2. Add an image.



   a. From the left sidebar, select **Operations** > **Firmware Management**.

   b. In the main pane, select the **Images** tab.

      The page will list any previously added images.

   c. In top right of the main pane, click the **Actions** menu and select **Add Image**.

3. In the **Add Firmware Image** window that opens, choose whether your image is stored on a remote server or local system.

   a. If specifying a remote image, provide the full **URL** to the image.

   b. If uploading a local image, click **Choose File** and select the image file from your local system.

4. Click **Upload** to upload the image.

Upgrading the Cluster

Before You begin

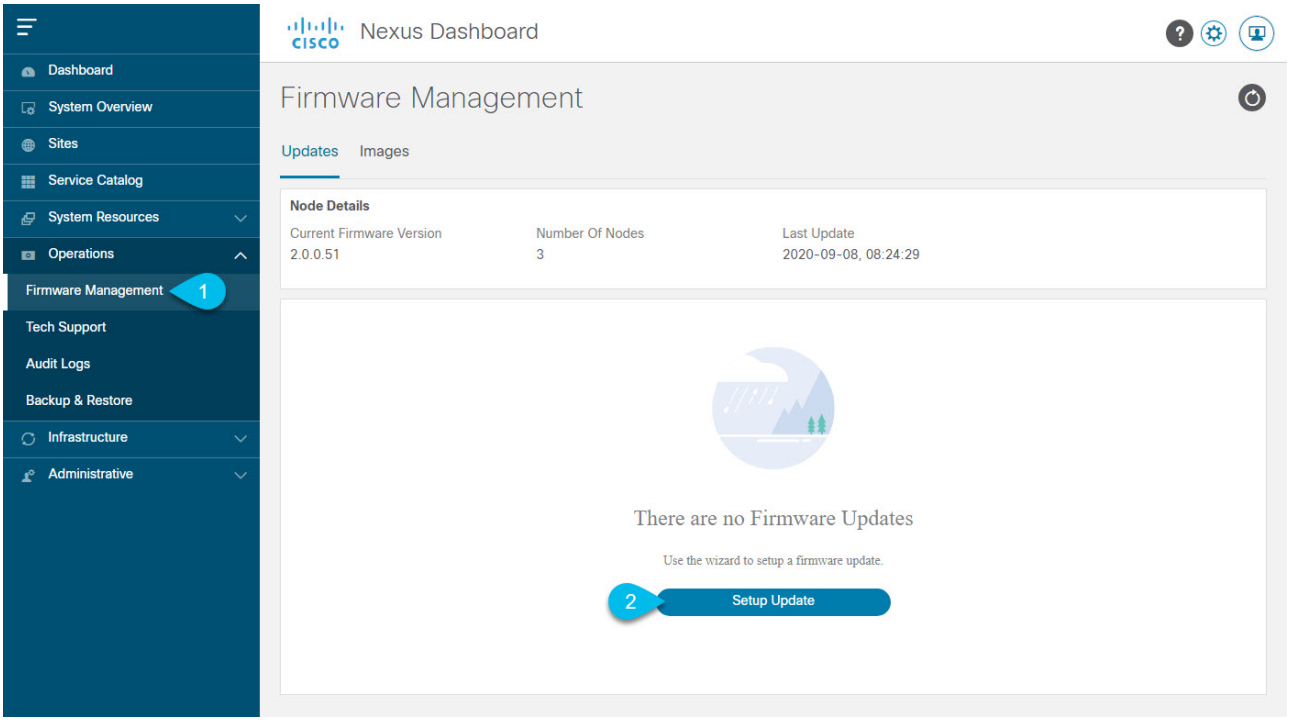
- Ensure that the master nodes and the cluster are healthy.
- Ensure that you have read the target release's *Release Notes* for any changes in behavior, guidelines, and issues that may affect your upgrade.

  The Release Notes documents are available at https://www.cisco.com/c/en/us/support/data-center-analytics/nexus-dashboard/products-release-notes-list.html.

- You must have the target image already uploaded to the Nexus Dashboard as described in Adding Images.
- You must not make any configuration changes to the cluster, such as adding worker or standby nodes, while the upgrade is in progress.

To upgrade your cluster:

1. Log in to your Nexus Dashboard GUI.
2. Initiate an update.



   a. From the left sidebar, select **Operations** > **Firmware Management**.

   b. In the main pane, select the **Updates** tab.

   c. Click **Setup Update**.

      If you have previously upgraded the cluster, the last upgrade's details will be displayed in this page instead of the **Setup Update** button. In this case, click the **Modify Details** button at the top right of the screen.

3. In the **Setup/Version Selection** screen, select the target version and click **Next** to proceed.

If you uploaded multiple images to your Nexus Dashboard, they will be listed here.

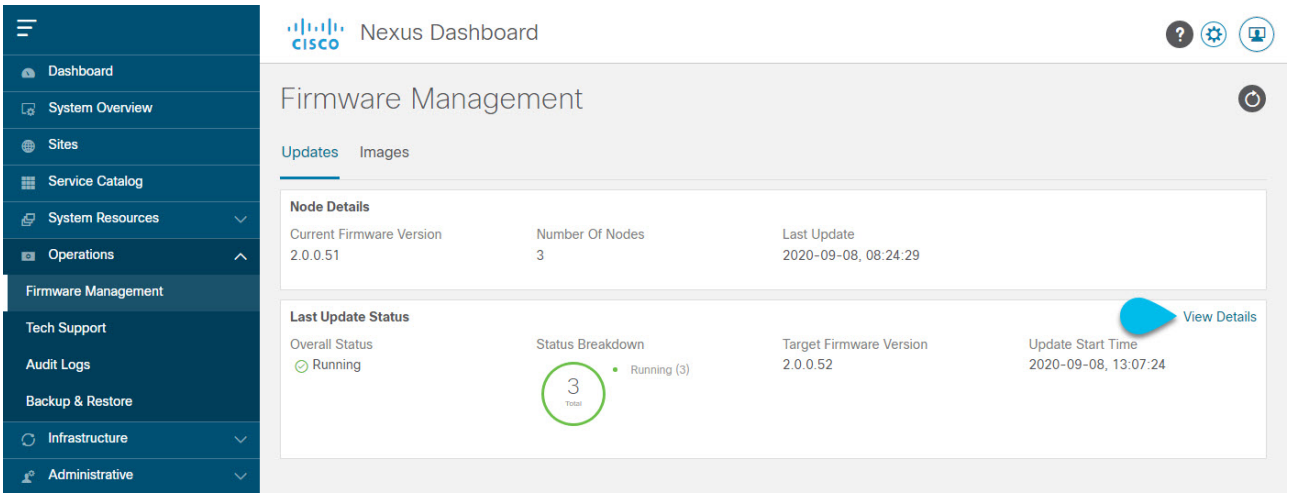
4. In the **Setup/Confirmation** screen, review the details of the update and click **Begin Install** to proceed.

   The screen will proceed to the **Install** tab and you will be able to see the progress of each node.

   The process can take up to 20 minutes and you can navigate away from this screen in the meantime.

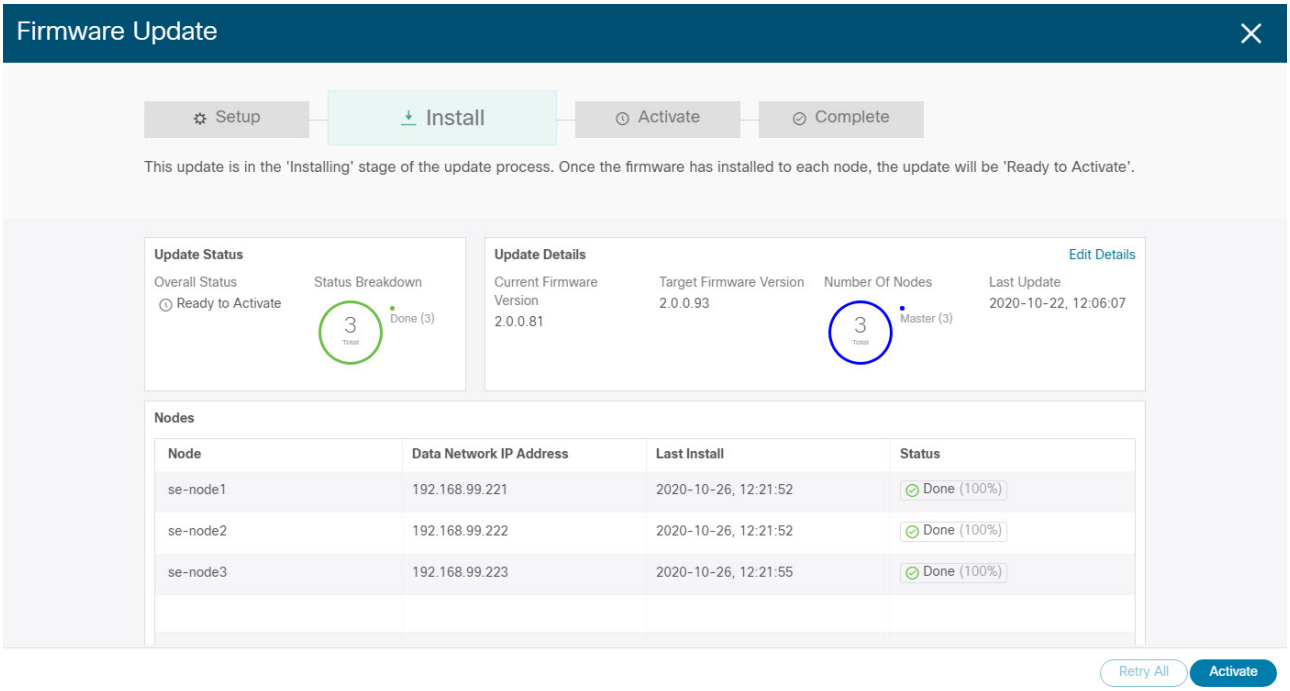
5. Wait for the image installation to complete.

   You can check the installation status by navigating back to **Operations** > **Firmware Management** screen and clicking **View Details** link in the **Last Status** tile.

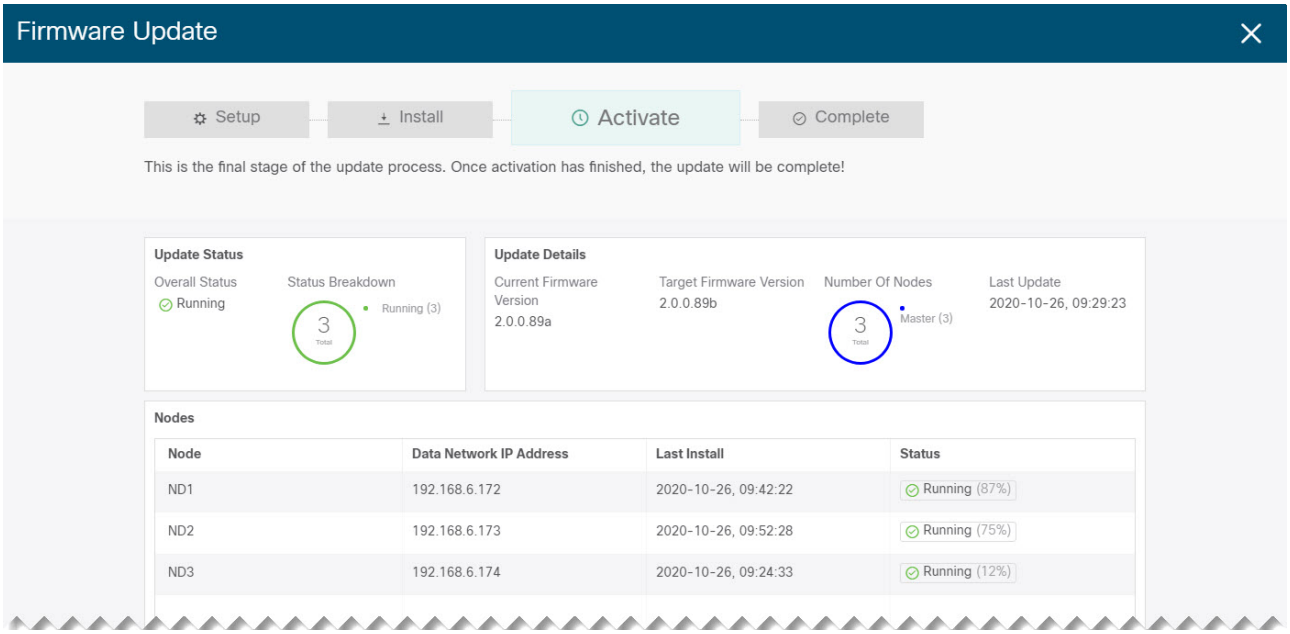


6. Click **Activate**.

   If you navigated away from the installation screen, navigate back to **Operations** > **Firmware Management** screen and click **View Details** link in the **Last Status** tile.



It may take up to 20 additional minute for all the cluster services to start and the GUI may become unavailable during this process. The page will automatically reload when the process is completed. You can track the activation process in the **Activate** screen as shown below.



Deleting Images

Nexus Dashboard will retain any firmware images that you upload to it. If at any time you want to remove any of the images (for example, from older upgrades), you can use the following steps:

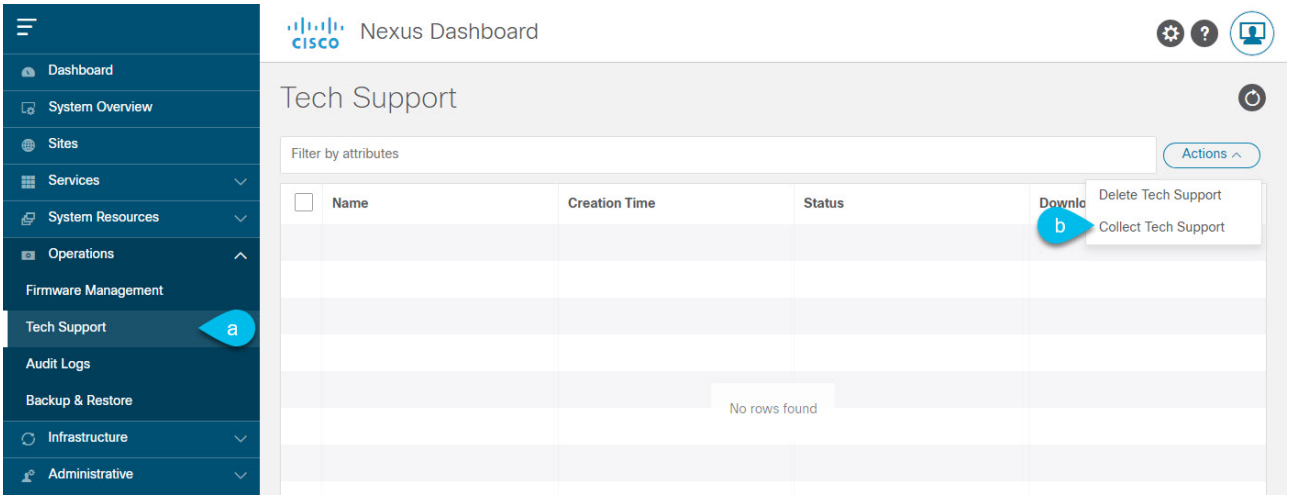
1. Log in to your Nexus Dashboard GUI.
2. From the left sidebar, select **Operations** > **Firmware Management**.
3. In the main pane, select the **Images** tab.
4. Select one or more images.
5. In top right of the main pane, click the **Actions** menu and select **Delete Image**.
6. In the **Confirm Delete** prompt, click **OK** to confirm.

Tech Support

Tech support enables you to collect logs and activities in the system for further troubleshooting by Cisco TAC. Cisco Nexus Dashboard provides best-effort tech support collection and gives ability to download tech support for individual nodes, the whole cluster, or applications. Tech support files are hosted on the Cisco Nexus Dashboard and can be downloaded at any time.

To collect Tech Support information:

1. Log in to your Nexus Dashboard GUI.
2. Collect Tech Support.



a. From the left sidebar, select **Operations** > **Tech Support**.

b. In top right of the main pane, click the **Actions** menu and select **Collect Tech Support**.

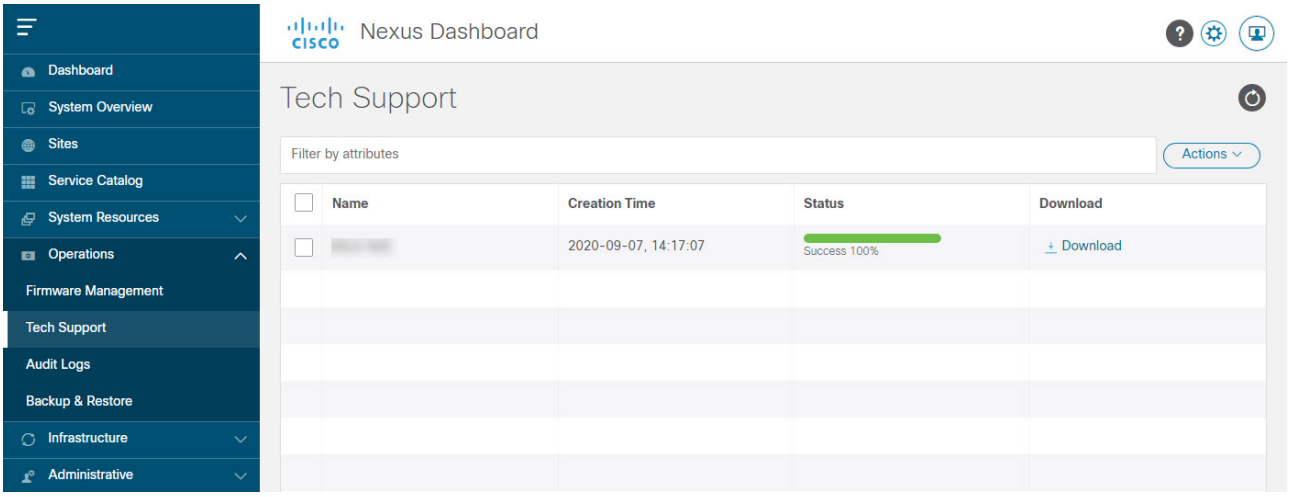
3. In the **Collect Tech Support** window that opens, provide a description.
4. From the **Namespace** dropdown, select the item for which you want to collect tech support information.
5. Click **Collect**.

   After you begin Tech Support collection, you can see the progress in the same screen.

   If for any reason the tech support collection process fails, you can also obtain the same information by logging into each node as the `rescue-user` and running one of the `acs techsupport collect` commands. For more information about specific `techsupport collect` command options, see Useful Commands.

6. Download the Tech Support archive.

   After the collection is finished, you can download the archive by clicking **Download** next it:



If you want to delete an existing Tech Support package, simply select it in the **Tech Support** screen and choose **Delete Tech Support** from the **Actions** menu.

Audit Logs

Nexus Dashboard audit logging is automatically enabled when you first deploy the cluster and captures the operational changes made by the users in the environment.

You can view the audit logs directly in the GUI by selecting **Operations** > **Audit Logs** from the main navigation menu.

Note that the logs are not sorted by default; you can sort the list by clicking on any of the column headings.

You can choose to filter the list using the **Filter by attributes** field and providing a specific attribute and value pair.

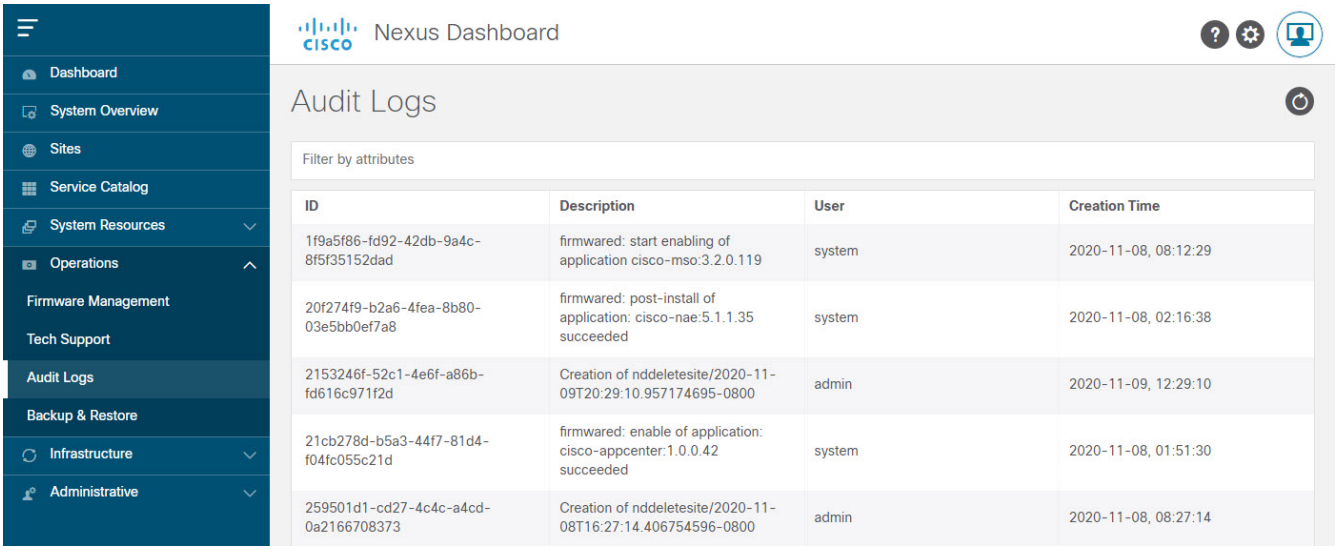


Figure 11. Audit Logs

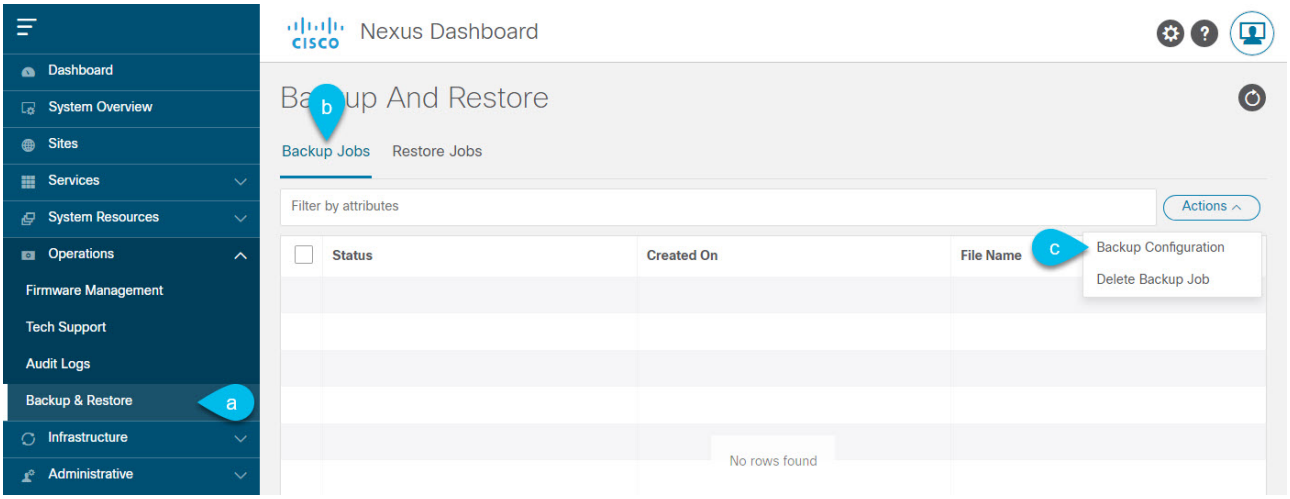
Additionally, to view detailed information about a specific entry, simply click the entry in the list to open the **Details** tab.

Back up and Restore

This section describes how to back up or restore Nexus Dashboard cluster configuration.

Creating Configuration Backups

1. Log in to your Nexus Dashboard GUI.
2. Start a back up.



a. From the left sidebar, select **Operations** > **Backup & Restore**.

b. In the main pane, select the **Backup Jobs** tab.

c. In top right of the main pane, click the **Actions** menu and select **Backup Configuration**.

3. In the **Backup Configuration** window that opens, provide the **Encryption Key** and the **File Name**.

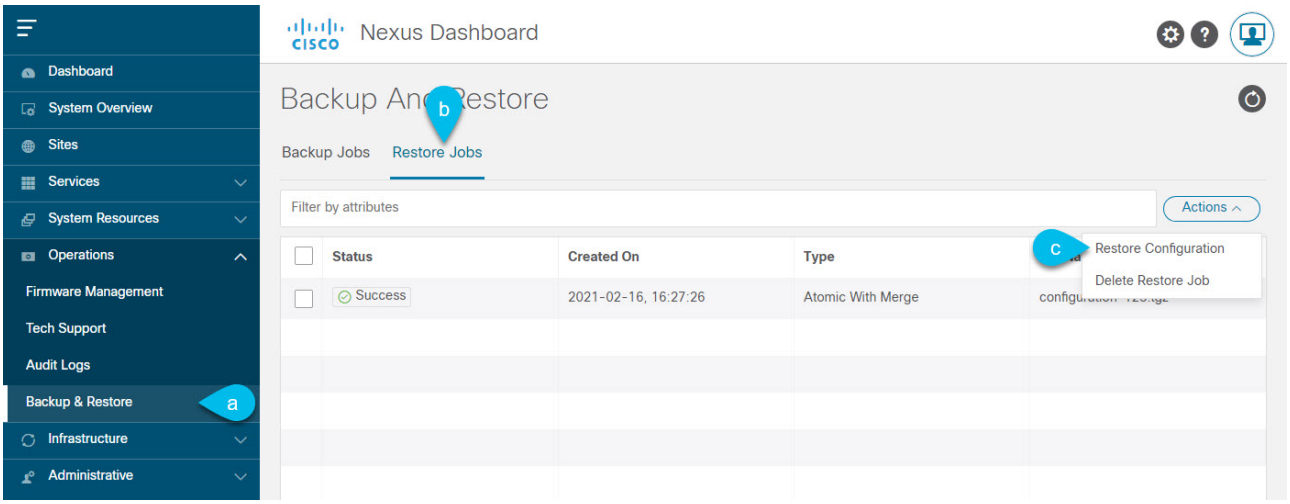
   The encryption key is used to encrypt the archive and must be at least 8 characters long.

4. Click **Download** to start the backup.

Cisco Nexus Dashboard does not store configuration backups or encryption keys, so you must download and maintain them outside the Nexus Dashboard cluster.

Restoring Configuration

1. Log in to your Nexus Dashboard GUI.
2. Begin restoring a configuration.



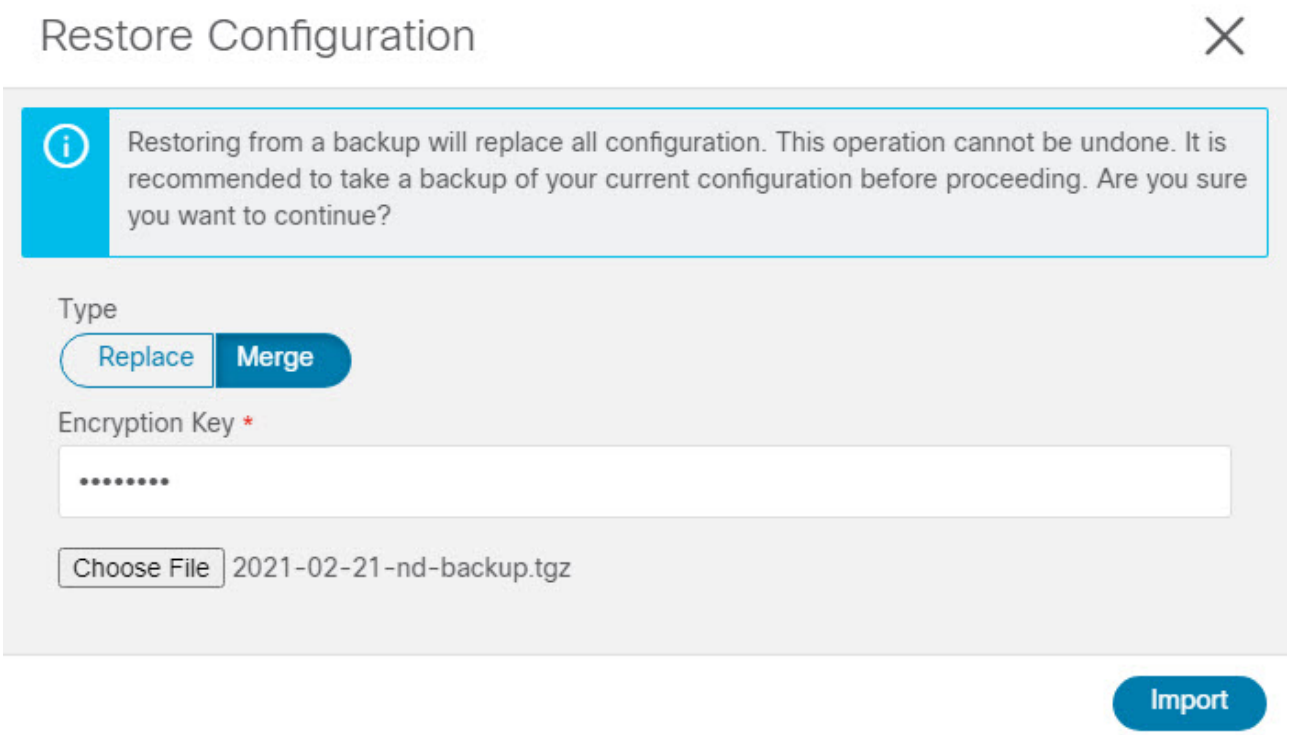
a. From the left sidebar, select **Operations** > **Backup & Restore**.

b. In the main pane, select the **Restore Jobs** tab.

c. In top right of the main pane, click the **Actions** menu and select **Restore Configuration**.

   You do not need to select one of the listed backups. You will be asked to upload the configuration backup file in the next screen.

3. Provide the details.



   a. Choose **Type**.

      You can choose to either `Replace` the existing configuration with the back up or `Merge` them.

   b. Provide the **Encryption Key**.

      This must be the same encryption key that you used when creating the backup.

   c. Click **Choose File** and select the backup file.

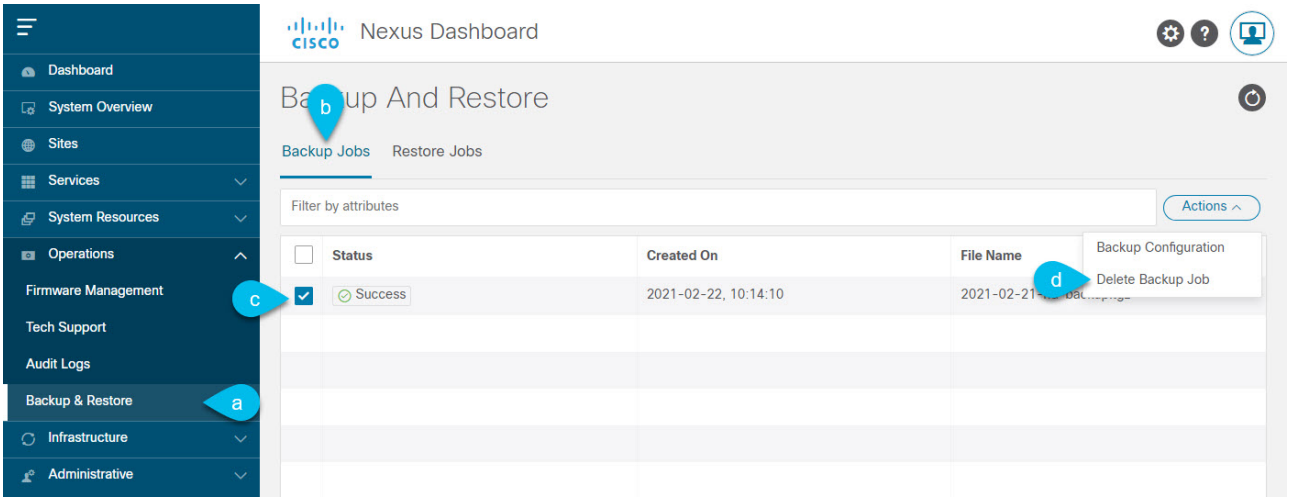
      Cisco Nexus Dashboard does not store configuration backups, so you must upload the backup file before restoring it

      The file must be in `.tgz` or `tar.gz` format.

4. Click **Import** to start the restore procedure.

Deleting Configuration Backups

1. Log in to your Nexus Dashboard GUI.
2. Delete one or more existing backup files.



a. From the left sidebar, select **Operations** > **Backup & Restore**.

b. In the main pane, select the **Backup Jobs** tab.

c. Select one or more entries in the list.

d. In top right of the main pane, click the **Actions** menu and select **Delete Backup Job**.

Infrastructure Management

Cluster Configuration

The cluster configuration GUI screen allows you to configure a number of options specific to the Nexus Dashboard cluster and its nodes.

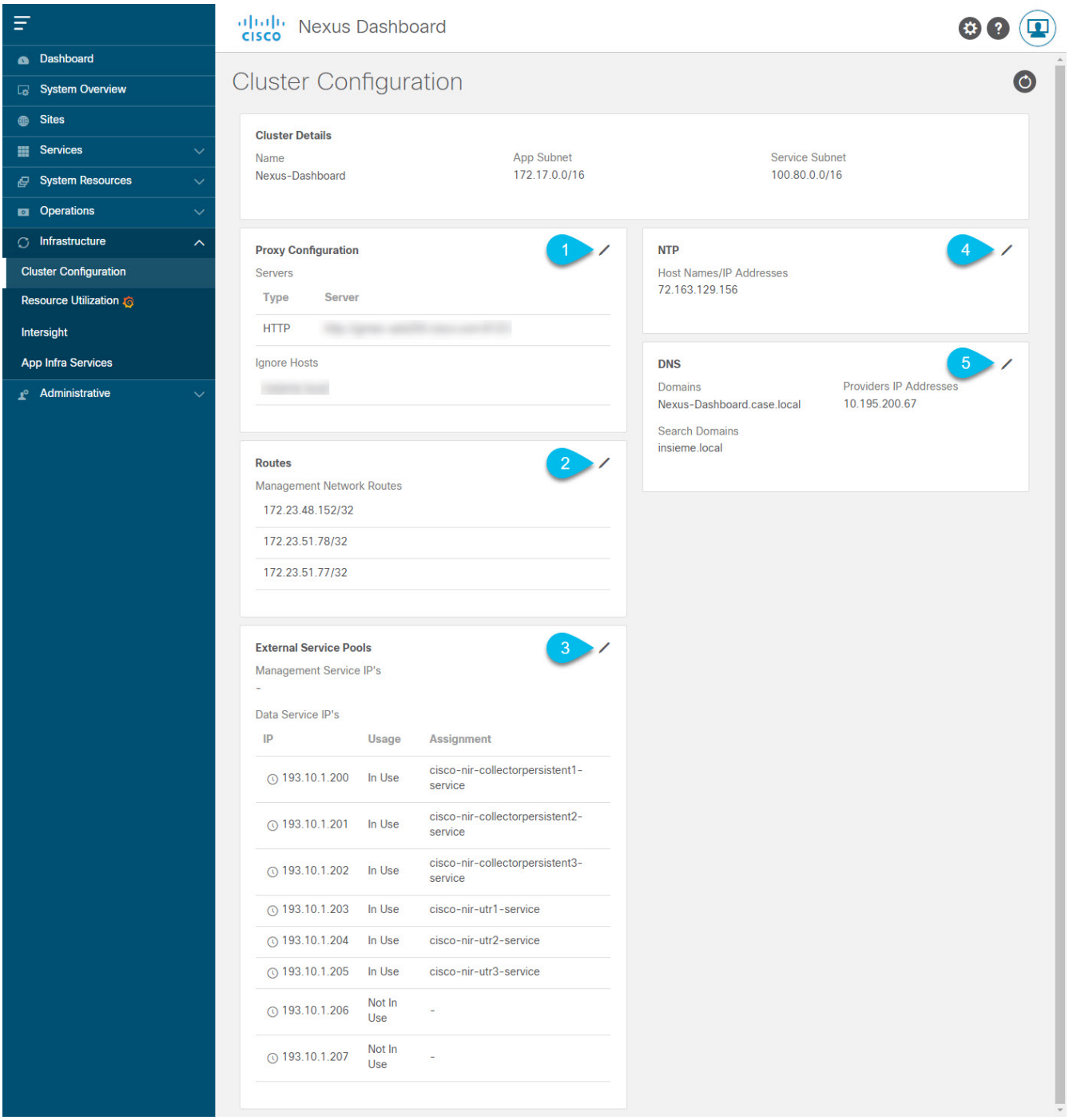


Figure 12. Cluster Configuration

This screen will also display information about any issues that may be present in your Nexus Dashboard cluster.

Only IPv4 addresses are supported for any of the following cluster configuration IP settings.

1. To configure a proxy for the Nexus Dashboard, click the **Edit** icon in the **Proxy Configuration** tile.

   In certain deployment scenarios, such as with a combination of on-premises and cloud sites and the Nexus Dashboard cluster deployed inside a corporate network, you may have to access the internet and the cloud sites through a proxy.

   To add a proxy server:

   a. Click +**Add Server** in the proxy configuration window.

      Then specify the server's IP address, port, and protocol.

   b. If the server requires login credentials, enable the **Username and Password** knob and provide the **Username** and **Password**.

   c. If you want to add one or more hosts with a direct connection to the Nexus Dashboard, click **Add Ingore Host** and provide the list of IP address with which the cluster will communicate directly bypassing the proxy.

2. To add one or more Management Network or Data Network routes, click the **Edit** icon in the **Routes** tile.

   Here you can define static routes for the management or data interfaces. For example, adding `10.195.216.0/21` as a Data Network route will cause all traffic destined to that subnet to transit out of the data network interface.

   - To add a management network route, click **Add Management Network Routes** and provide the destination subnet.
   - To add a data network route, click **Add Data Network Routes** and provide the destination subnet.

3. To add one or more External Service Pools, click the **Edit** icon in the **External Service Pools** tile.

   This allows you to provide persistent IP addresses for applications that require to retain the same IP addresses even in case it is relocated to a different Nexus Dashboard node.

   Applications like Nexus Insights require some services (such as SNMP trap, syslog, SAN Insights, and others) to stream data from the switches in your fabrics to the application. An IP address is configured on the switches for this purpose. Typically, if the IP address changes when the application is relocated, the application services will reconfigure the new IP address on the switches.

   In order to avoid this IP reconfiguration impact on the fabric switches, the application can request that the services IP addresses are preserved, in which case you will need to define a set of IP addresses which can be assigned to the application for this purpose.

If an application requires persistent IP addresses, you will not be able to enable that application in the Nexus Dashboard until enough IP addresses are defined as described below.

This feature is supported for Nexus Insights, Release 5.1 with DCNM fabrics only.

In the **External Service Pools** screen that opens, you can click one of the **+Add IP Address** buttons to add one or more IP addresses for the management or data networks. Note that you must add individual IP addresses one by one; adding a range of IP addresses is not supported.

The IP addresses you add for management services must be part of the management subnet and the IP addresses for data services must be part of the data subnet.

You can also remove any previously defined IPs, but you will not be able to remove any IPs that are currently in use by application services.

4. To configure NTP settings, click the **Edit** icon in the **NTP** tile.

   By default, the NTP server that you configured when deploying the Nexus Dashboard cluster is listed here.

   You can provide additional NTP servers by clicking **+Add NTP Server**.

   You can remove existing NTP server by clicking the **Delete** icon next to it. Keep in mind that at least one NTP server must be configured in your cluster.

5. To configure DNS* settings, click the **Edit** icon in the **DNS** tile.

   By default, the DNS server and search domain that you configured when deploying the Nexus Dashboard cluster are listed here.

   You can provide additional DNS servers and search domains by clicking **+Add a Provider** or **+Add a Search Domain** respectively.

   You can remove existing DNS server by clicking the **Delete** icon next to it.

App Infra Services

The **App Infra Services** screen displays information about the infrastructure services running in your Nexus Dashboard. It also allows you to restart the services in order to select a different service **Deployment Profile** best suitable for your deployment scenario, such combination of applications and fabric sizes.

Note that the Infra services deployment profiles are different from the application deployment profiles, which you select when you first enable or upgrade the application in the Nexus Dashboard GUI, as described in Enabling Applications. Consult your application's documentation for more information on the available deployment profiles specific to that application.

When you first deploy or upgrade Nexus Dashboard, each Infra service is configured with the most common default deployment profile. However, you will need to change one or more services based

on your specific deployment scenario as shown in the following table before installing any applications:

Deployment Scenario	elasticsearch profile	elasticsearch-nir profile	kafka profile
<50 switches and <10,000 flows	`small`	`small`	`standard`
>51 switches and/or >10,000 flows	`standard`	`default`	`large`

To change the deployment profile for a service:

1. Select the service you want to restart.

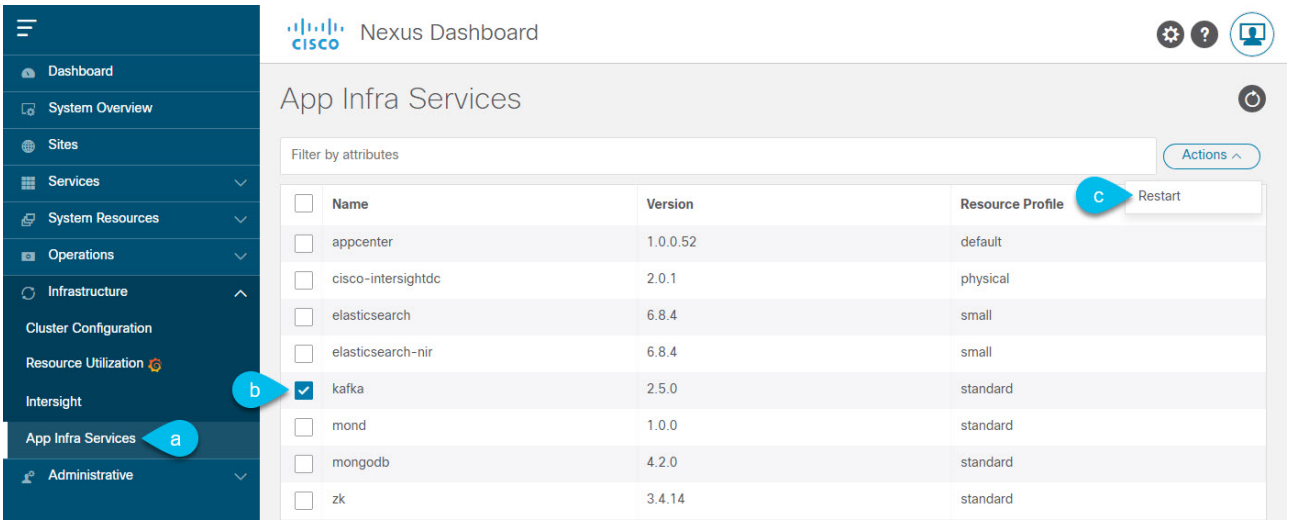


Figure 13. App Infra Service Restart

   a. Navigate to the **App Infra Services** screen.

   b. Select a service you want to restart.

   c. From the **Actions** menu, choose **Restart**.

2. Select a different deployment profile if necessary and restart the service.

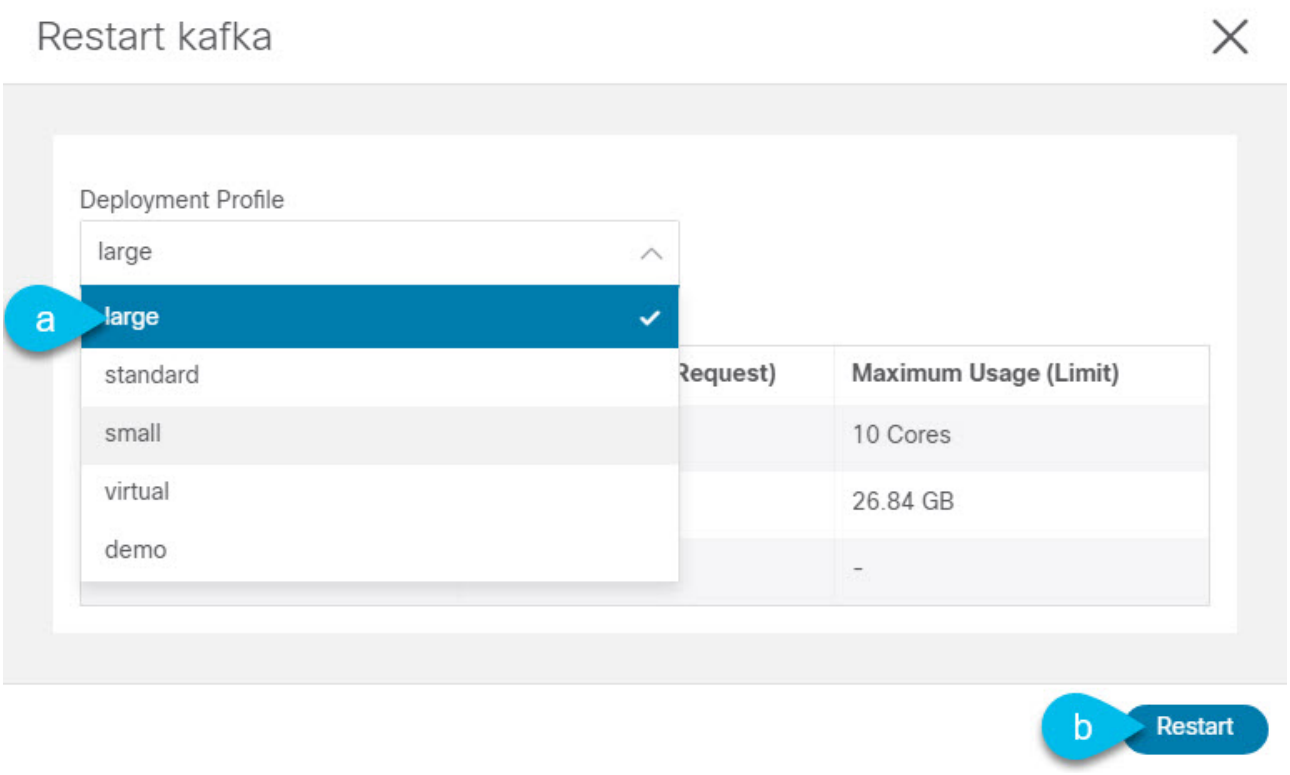


Figure 14. App Infra Service Profile

a. From the **Deployment Profile** dropdown, select the profile appropriate for your deployment.

> In some cases you may not be able to change the profile of a service if the application that requires that profile is still installed. For example, if you set the `kafka` service deployment profile to `large` and install the Nexus Insights application, you will not be able to change the service's profile back to `standard` until you uninstall the Nexus Insights application. Note that uninstalling the application would also delete any collected application data, such as software and hardware telemetry.

b. Click **Restart**.

Deploying Additional Nodes

Initial cluster deployment is described in *Nexus Nexus Dashboard Deployment Guide*. The following sections describe how to scale your cluster with additional nodes, such as `worker` nodes used for horizontal scaling of the cluster and `standby` node used for easy failover and cluster recovery.

After you deploy an additional node, you can register and add it to the cluster based on its role:

- For more information about `worker` nodes, see Managing Worker Nodes
- For more information about `standby` nodes, see Managing Standby Nodes

Prerequisites and Guidelines

Before deploying additional nodes, you must:

- Have reviewed and completed the general prerequisites described in the Cisco Nexus Dashboard Overview, especially the network and fabric connectivity sections.
- Ensure you are using the correct hardware.

  The physical appliance form factor is supported on the original Nexus Dashboard hardware only. The following table lists the PID and specifications of the physical appliance server:

  Table 2. Supported Hardware

PID	Hardware
SE-NODE-G2	• UCS C220 M5 Chassis • 2x 10 core 2.2G Intel Xeon Silver CPU • 4x 25G Virtual Interface Card 1455 • 4x 2.4TB HDDs 400GB SSD 1.2TB NVMe drive • 256 GB of RAM • 1050W power supply

  The above hardware supports Nexus Dashboard software only. If any other operating system is installed, the node can no longer be used as a Nexus Dashboard node.

- Ensure that you are running a supported version of Cisco Integrated Management Controller (CIMC).

  Recommended version: CIMC, Release 4.1(2b).

  Minimum supported version: CIMC, Release 4.0(1a).

- Have the physical server racked and connected as described in *Nexus Dashboard Hardware Installation Guide*.
- Ensure the hardware is running the same Nexus Dashboard release as your existing cluster.

  If the new node is running an earlier release, you must manually upgrade to the current release, as described in Manual Upgrades.

  If for any reason you are unable to run the manual upgrade, you can reinstall the software, as described in Re-Imaging Nodes.

Managing Worker Nodes

You can add up to 4 worker nodes to an existing 3-node cluster for horizontal scaling to enable

application co-hosting.

For additional information about application co-hosting and cluster sizing, see the [Overview] section of this document.

Adding Worker Nodes

This section describes how to add a worker node to your cluster to enable horizontal scaling

Before you begin

- Ensure that the existing master nodes and the cluster are healthy.
- You must have the node prepared as described in Deploying Additional Nodes.
- Ensure that the node you are adding is powered on.
- Ensure that you have the new node's CIMC IP address and login information.

  You will need to use the CIMC information to add the new node using the Nexus Dashboard GUI.

To add a worker node:

1. Log in to the Cisco Nexus Dashboard GUI.
2. From the left sidebar, select **System Resources** > **Nodes**.
3. In the main pane, select **Actions** > **Add**.

   The **Add New Node** screen opens.
4. In the **Add New Node** screen, provide the node information.
   a. Provide the node's CIMC IP address and login information, then click **Verify**.

      The server's serial number will be populated.

   b. Provide the **Data Network** IP address and gateway.
   c. Provide the **Management Network** IP address and gateway.
   d. From the **Role** dropdown, select `Worker`.
5. Click **Save** to add the node.

   The configuration will be pushed to the node and the node will be added to the list in the GUI.

   Note that the node's status will remain unregistered and you will need to register the new node to finish adding it to the cluster, as described in the next step.
6. In the **Status** column of the new node, click **Register**.

   The node's information will be populated based on what you provided in the previous step.
7. Click **Save** to finish registering the node.

   The node's status will change from `unregistered` to `discovering` to `active` as it goes through the

discovery and registration process

8. If you are running Nexus Insights or Network Assurance Engine application, disable and re-enable the application.

   After you add the new worker node, you must disable and re-enable the application for its services to be properly distributed to the new node.

Deleting a Worker node

Before you begin

- Ensure that the master nodes and the cluster are healthy.

To delete an existing worker node:

1. Log in to the Cisco Nexus Dashboard GUI.
2. From the left sidebar, select **System Resources** > **Nodes**.
3. Select the checkbox next to the worker node you want to delete.
4. From the **Actions** menu, choose **Delete** to delete the node.

Managing Standby Nodes

You can add up to two standby nodes, which you can use to quickly restore the cluster functionality in case one or more master nodes fail by replacing the failed master node with the standby node.

Standby nodes are similar to worker nodes in deployment, initial configuration, and upgrades. However, unlike worker nodes, the cluster will not use the standby nodes for any workloads.

The following two cases are supported:

- Single master node failure

  You can use the UI to convert the standby node into a new master node.

- Two master nodes failure

  You will need to perform manual failover of one of the nodes to restore cluster functionality. Then fail over the second node using standard procedure.

Adding Standby Nodes

This section describes how to add a standby node to your cluster for easy cluster recover in case of a master node failure.

Before you begin

- Ensure that the existing master nodes and the cluster are healthy.
- You must have the node prepared as described in Deploying Additional Nodes.

- Ensure that the node you are adding is powered on.
- Ensure that you have the new node's CIMC IP address and login information.

  You will need to use the CIMC information to add the new node using the Nexus Dashboard GUI.

To add a standby node:

1. Log in to the Cisco Nexus Dashboard GUI.
2. From the left sidebar, select **System Resources** > **Nodes**.
3. In the main pane, select **Actions** > **Add**.

   The **Add New Node** screen opens.
4. In the **Add New Node** screen, provide the node information.
   a. Provide the node's CIMC IP address and login information, then click **Verify**.

      The server's serial number will be populated.

   b. Provide the **Data Network** IP address and gateway.
   c. Provide the **Management Network** IP address and gateway.
   d. From the **Role** dropdown, select `Standby`.
5. Click **Save** to add the node.

   The configuration will be pushed to the node and the node will be added to the list in the GUI.

   Note that the node's status will remain unregistered and you will need to register the new node to finish adding it to the cluster, as described in the next step.
6. In the **Status** column of the new node, click **Register**.

   The node's information will be populated based on what you provided in the previous step.
7. Click **Save** to finish registering the node.

   The node's status will change from `unregistered` to `discovering` to `active` as it goes through the discovery and registration process

Replacing Single Master Node with Standby Node

This section describes failover using a pre-configured `standby` node. If your cluster does not have a standby node, follow the steps described in Replacing Single Master Node without Standby Node instead.

Before you begin

- Ensure that at least 2 master nodes are healthy.

  If two of the master nodes are unavailable, you will need to manually restore the cluster as described in [Replacing Two Master Nodes without Standby Node]

- You must have set up and configured the `standby` nodes as described in Adding Standby Nodes.
- Ensure that the master node you want to replace is powered off.

To failover a single master node:

1. Log in to the Cisco Nexus Dashboard GUI.
2. From the left sidebar, select **System Resources** > **Nodes**.
3. Select the checkbox next to the `Inactive` master node that you want to replace.
4. From the **Actions** menu, choose **Failover**.
5. In the **Fail Over** window that opens, select a standby node from the dropdown.
6. Click **Save** to complete the failover.

   The failed master node will be removed from the list and replaced by the standby node you selected. The status will remain `Inactive` while the services are being restored to the new master node.

   It can take up to 10 minutes for all services to be restored, at which point the new master node's status will change to `Active`.

Replacing Two Master Nodes with Standby Nodes

This section describes failover using a pre-configured standby node. If your cluster does not have a standby node, follow the steps described in [Replacing Two Master Nodes without Standby Node] instead.

If only one of your master nodes failed, you can use the GUI to replace it with a standby node as described in Replacing Single Master Node with Standby Node.

However, when two master nodes are unavailable, the entire cluster is put into read-only mode. In this case, most operations including the UI are disabled and no changes can be made to the cluster. This section describes how to fail over one of the failed master nodes to a standby node to recover the cluster and restore normal operations, at which point you can recover the second master node using the normal procedure.

Before you begin

- Ensure that the master nodes you want to replace are powered off.
- You must have set up and configured the `standby` nodes as described in Adding Standby Nodes.

To fail over two master nodes:

1. Log in to the remaining master node via CLI as `rescue-user`.
2. Execute the failover command.

   In the following command, replace `<node1-data-ip>` and `<node2-data-ip>` with the data network IP addresses of the failed nodes:

```
# acs failover --failedIP <node1-data-ip> --failedIP <node2-data-ip>
```

Even though only the first node is failed over, the second failed node you provide is required internally to recover the cluster.

By default, the healthy master node will automatically pick an available standby node and fail over the first failed node you provide (`<node1-data-ip>`) to it.

If you would like to provide a specific standby node, you can add `<standby-node-data-ip>` to the above command:

```
# acs failover --failedIP <node1-data-ip> --failedIP <node2-data-ip> \
  --standbyIP <standby-node1-data-ip>
```

3. Confirm that you want to proceed.

```
Warning: Failover can be a disruptive operation and should only be performed as
last resort option to recover cluster from disasters using standby where two master
nodes have lost their state due to hardware faults.
Proceed? (y/n): y
```

The master node will copy the configuration state to the standby node and both nodes will restart. It may take up to 30 minutes for the nodes to come up and the cluster to be restored. You can check the progress by navigating to the master node's UI.

1. After the cluster is back up, fail over the second failed master node.

   At this point, you can use the standard procedure described in Replacing Single Master Node with Standby Node.

Deleting Standby Nodes

Before you begin

- Ensure that the master nodes and the cluster are healthy.

To delete an existing standby node:

1. Log in to the Cisco Nexus Dashboard GUI.
2. From the left sidebar, select **System Resources** > **Nodes**.
3. Select the checkbox next to the standby node you want to delete.
4. From the **Actions** menu, choose **Delete** to delete the node.

Administrative

Authentication

You can choose how the users logging into the Nexus Dashboard GUI are authenticated. This release supports local authentication as well as LDAP, RADIUS, and TACACS remote authentication servers.

If configuring external authentication servers:

- You must configure each user on the remote authentication servers.
- All LDAP configurations are case sensitive.

  For example, if you have `OU=Cisco Users` on the LDAP server and `OU=cisco users` on the Nexus Dashboard, the authentication will not work.

- For LDAP configurations, we recommend using `CiscoAVPair` as the attribute string. If, for any reason, you are unable to use an Object ID `1.3.6.1.4.1.9.22.1`, an additional Object IDs `1.3.6.1.4.1.9.2742.1-5` can also be used in the LDAP server.

  Alternatively, instead of configuring the Cisco AVPair values for each user, you can create LDAP group maps in the Nexus Dashboard.

- Single sign-on (SSO) between the Nexus Dashboard, sites, and applications is available for remote users only.

Configuring Remote Authentication Server

When configuring the remote authentication server for the Nexus Dashboard users, you must add a custom attribute-value (AV) pair, specifying the username and the roles assigned to them.

The user roles and their permissions are the same as for the local users you would configure directly in the Nexus Dashboard GUI as described in Users.

The following table lists the Nexus Dashboard user roles and the AV pair you would use to define the roles on a remote authentication server, such as LDAP.

User Role	AV Pair Value
Administrator	`admin`
User Manager	`aaa`
Dashboard User	`app-user`
Site Administrator (Dashboard role)	`site-admin`
Site Manager (App role)	`config-manager`
Policy Manager (App role)	`site-policy`
Tenant Manager (App role)	`tenant-policy`

The AV pair string format differs when configuring a read-write role, read-only role, or a

combination of read-write and read-only roles for a specific user. A typical string includes the domain, followed by the read-write roles separated from the read-only roles using the slash (/) character; individual roles are separated by the pipe (|) character:

```
shell:domains=<domain>/<writeRole1>|<writeRole2>/<readRole1>|<readRole2>
```

In this release, only the `all` domain is supported and is required for consistency with the APIC AV pair format in order to support the single sign-on (SSO) feature.

For example, the following string illustrates how to assign the `Tenant Manager` and `Policy Manager` roles to a user, while still allowing them to see objects visible to the `User Manager` users:

```
shell:domains=all/tenant-policy|site-policy/aaa
```

Note that if you want to configure only the read-only or only read-write permissions for a user, you must still include the slash (/) character. The following examples show how to set just the read-write or read-only access to the objects available to `Site Administrator` role:

- Read-only: `shell:domains=all//site-admin`
- Read-write: `shell:domains=all/site-admin/`

Adding LDAP as Remote Authentication Provider

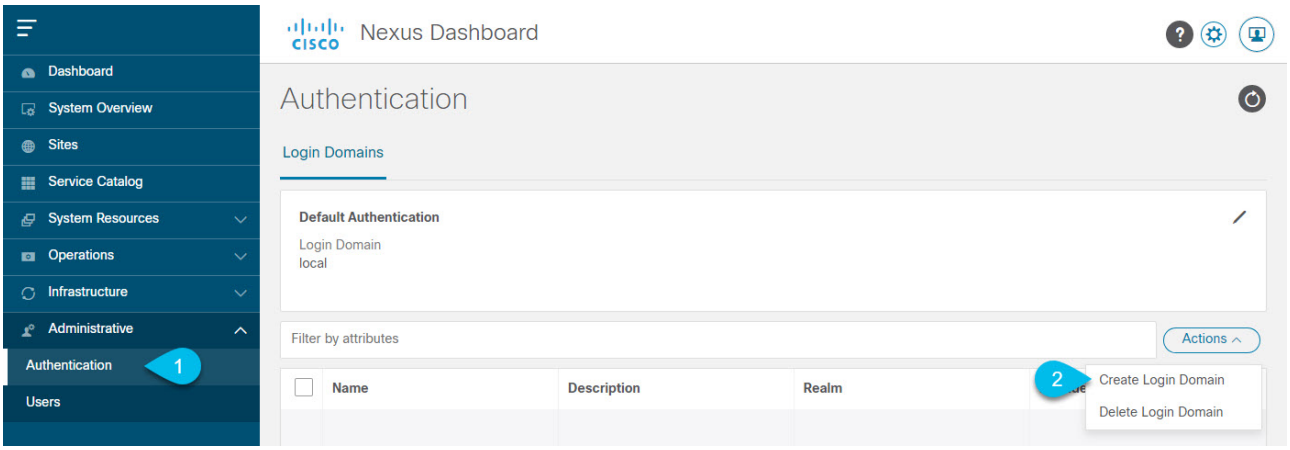
Before you begin

- You must have at least one user already configured on the LDAP server as described in Configuring Remote Authentication Server.

  You will need to use an existing user for end-to-end verification of LDAP configuration settings.

To add an LDAP remote authentication provider:

1. Log in to your Nexus Dashboard GUI.
2. Add an authentication domain.



a. From the left sidebar, select **Administrative** > **Authentication**.
b. In top right of the main pane, click the **Actions** menu and select **Create Login Domain**.

3. In the **Create Login Domain** screen that opens, provide domain details.
   a. Provide the **Name** for the domain.
   b. (Optional) Provide its **Description**.
   c. From the **Realm** dropdown, select `Ldap`.
   d. Then click **+Add Provider** to add a remote authentication server.

      The **Add Provider** window opens.

4. Provide the remote authentication server details.
   a. Provide the **Hostname** or **IP Address** of the server.
   b. (Optional) Provide the **Description** of the server.
   c. Provide the **Port** number.

      The default port is `389` for LDAP.

   d. Provide the **Base DN** and **Bind DN**.

      The Base DN and Bind DN depend on how your LDAP server is configured. You can get the Base DN and Bind DN values from the distinguished name of the user created on the LDAP server.

      Base DN is the point from which the server will search for users. For example, `DC=nd,DC=local`.

      Bind DN is the credentials used to authenticate against the server. For example, `CN=admin, CN=Users,DC=nd,DC=local`.

   e. Provide and confirm the **Key**.

      This is the password for your Bind DN user. Anonymous bind is not supported, so you must provide a valid value in these fields.

   f. Specify the **Timeout** and number of **Retries** for connecting to the authentication server.
   g. Provide the **LDAP Attribute** field for determining group membership and roles.

      The following two options are supported:

      - `ciscoAVPair` (default) — used for LDAP servers configured with Cisco AVPair attributes for user roles.
      - `memberOf` — used for LDAP servers configured with LDAP group maps. Adding a group map is described in a following step.

   h. (Optional) Enable **SSL** for LDAP communication.

      If you enable SSL, you must also provide the **SSL Certificate** and the **SSL Certificate**

Validation type:

- `Permissive`: Accept a certificate signed by any certificate authority (CA) and use it for encryption.
- `Strict`: Verify the entire certificate chain before using it.

i. (Optional) Enable **Server Monitoring**.

If you choose to enable monitoring, you must also provide the **Username** and **Password** for it.

j. In the **Validation** fields, provide a **Username** and **Password** of a user already configured on the LDAP server you are adding.

Nexus Dashboard will use this user to verify the end-to-end authentication to ensure that the settings you provided are valid.

k. Click **Save** to complete provider configuration.

l. Repeat this step for any additional LDAP authentication servers you want to use with this domain.

5. (Optional) Enable and configure **LDAP Group Map Rules**.

If you want to authenticate your LDAP users using Cisco AV pair strings, skip this step.

a. In the **LDAP Auth Choice**, select `LDAP Group Map Rules`.

b. Click **Add LDAP Group Map Rule**.

The **Add LDAP Group Map Rule** window opens.

c. Provide the **Group DN** for the group.

d. Select one or more **Roles** for the group.

e. Click **Save** to save the group configuration.

f. Repeat this step for any additional LDAP groups.

6. Click **Create** to finish adding the domain.

Adding Radius or TACACS as Remote Authentication Provider

Before you begin

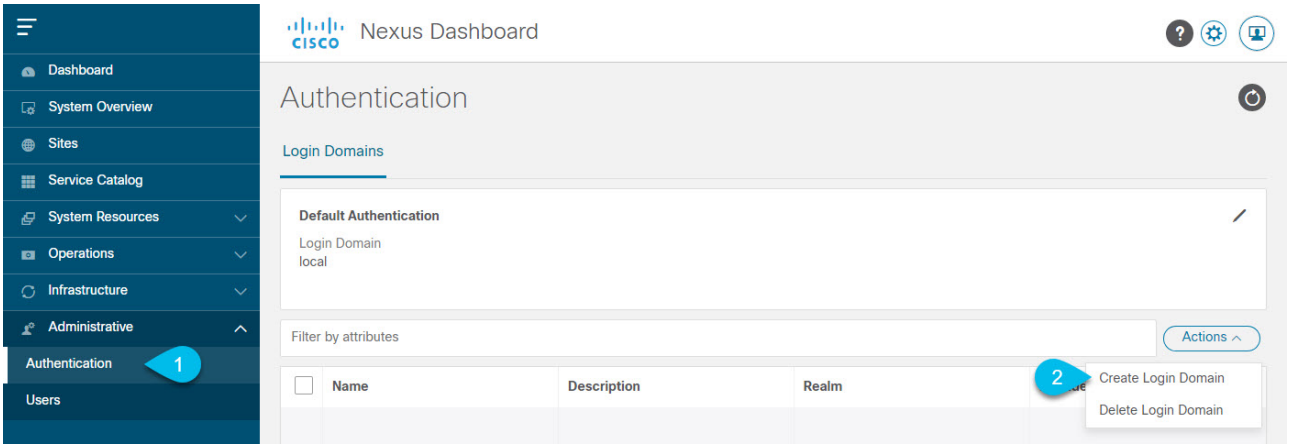
- You must have at least one user already configured on the remote authentication server as described in Configuring Remote Authentication Server.

You will need to use an existing user for end-to-end verification of the provider configuration settings.

To add a Radius or TACACS remote authentication provider:

1. Log in to your Nexus Dashboard GUI.

2. Add an authentication domain.



   a. From the left sidebar, select **Administrative** > **Authentication**.

   b. In top right of the main pane, click the **Actions** menu and select **Create Login Domain**.

3. In the **Create Login Domain** screen that opens, provide domain details.

   a. Provide the **Name** for the domain.

   b. (Optional) Provide its **Description**.

   c. From the **Realm** dropdown, select `Radius` or `Tacacs`.

   d. Then click **+Add Provider** to add a remote authentication server.

      The **Add Provider** window opens.

4. Provide the remote authentication server details.

   a. Provide the **Hostame** or **IP Address** of the server.

   b. (Optional) Provide the **Description** of the server.

   c. Choose **Authorization Protocol** used by the server.

      You can choose `PAP`, `CHAP`, or `MS-CHAP`.

   d. Provide the **Port** number.

      The default port is `1812` for RADIUS and `49` for TACACS

   e. Provide and confirm the **Key**.

      This is the password used for connecting to the provider server.

   f. (Optional) Choose whether you want to enable **Server Monitoring**.

      If you choose to enable monitoring, you must also provide the **Username** and **Password** for it.

   g. In the **Validation** fields, provide a **Username** and **Password** of a user already configured on the remote server you are adding.

      Nexus Dashboard will use this user to verify the end-to-end authentication to ensure that

the settings you provided are valid.

h. Click **Save** to complete provider configuration.

i. Repeat this step for any additional remote authentication servers.

5. Click **Create** to finish adding the domain.

Editing Remote Authentication Domains

If you want to make changes to a domain you have created:

1. Log in to your Nexus Dashboard GUI.
2. From the left sidebar, select **Administrative** > **Authentication**.
3. Double-click the domain you want to edit in the list.

   The domain's details screen opens.

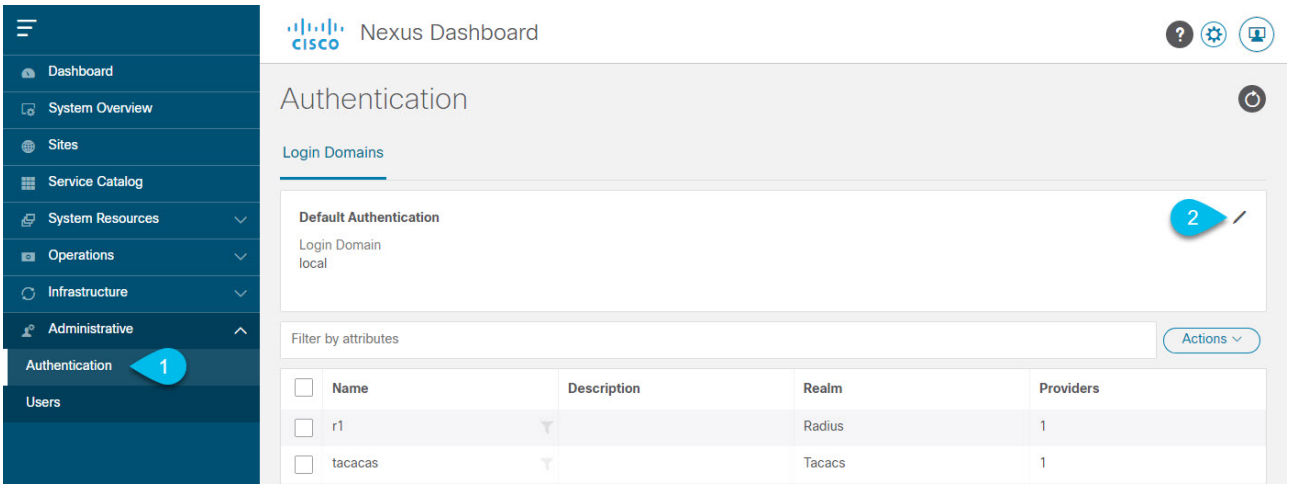
4. In the top right of the screen, click the **Edit** icon.

   You cannot change the name and the type of the authentication domain, but you can make changes to the description and provider configuration.

   If you make any changes to the login domain, including simply updating the description, you must re-enter the `key` for all existing providers.

Choosing Default Authentication Domain

1. Log in to your Nexus Dashboard GUI.
2. Choose the default login domain.



a. From the left sidebar, select **Administrative** > **Authentication**.

b. In top right of the **Default Authentication** tile, click the **Edit** icon.

   The **Default Authentication** window opens.

3. In the **Default Authentication** that opens, choose the **Login Domain** from the dropdown.

Deleting Remote Authentication Domains

1. Log in to your Nexus Dashboard GUI.
2. From the left sidebar, select **Administrative** > **Authentication**.
3. Select one or more domains from the list.
4. In top right of the main pane, click the **Actions** menu and select **Delete Login Domain**.
5. In the **Confirm Delete** prompt, click **OK** to confirm.

Users

The **Users** GUI page allows you to view and manage all users that have access to the Nexus Dashboard.

The **Local** tab displays all local users while the **Remote** tab displays users that are configured on the remote authentication servers you have added as described in the Authentication section.

Roles and Permissions

Cisco Nexus Dashboard allows access according to a user's roles defined by role-based access control (RBAC). Roles are used in both local and external authentication and apply to either the Nexus Dashboard or the applications running in it. The following user roles are available in Nexus Dashboard:

- `Administrator` — allows access to all objects and configurations.
- `User Manager` — allows access to users and authentication configurations.
- `Dashboard User` — allows access only to the Dashboard view and launching applications; does not allow any changes to the Nexus Dashboard configurations.
- `Site Administrator` — allows access to configurations related to the sites on-boarding and configuration.
- `Site Manager` — allows application user to manage the sites used by that application.
- `Policy Manager` — allows application user to view policy objects.
- `Tenant Manager` — allows application user to view tenants.

Each role above is associated with a set of permissions, which in turn are used to show relevant and hide irrelevant elements from the user's view in the GUI. For example, the following figure shows GUI screen as seen by a user with `User Manager` and `Site Administrator` permissions only with other categories unavailable:

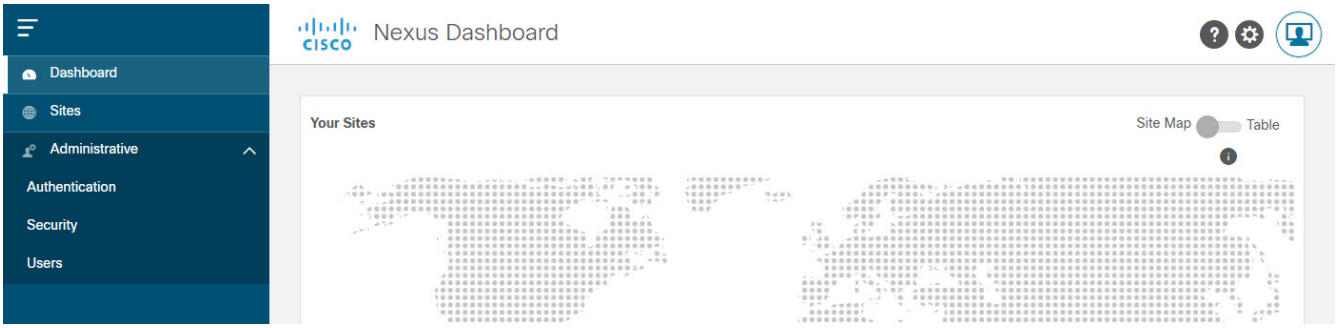


Figure 15. Role-Based GUI Access

Depending on the permissions you set for the user, the UI will display only the objects and settings the user is allowed to access.

The same roles can be configured on a remote authentication server and the server can be used to authenticate the Nexus Dashboard users. Additional details about remote authentication are available in the Authentication section.

Adding Local Users

1. Log in to your Nexus Dashboard GUI.
2. Create a new local user.
    a. From the left sidebar, select **Administrative** > **Users**.
    b. In top right of the main pane, click the **Actions** menu and select **Create Local User**.
3. In the **Create Local User** screen that opens, provide user details.
    a. Provide the **User ID** that will be used for loggin in.
    b. Provide and confirm the initial **Password**.
    c. Provide the **First Name**, **Last Name**, and **Email Address** for the user.
    d. Choose the user's **Roles** and **Privileges**.

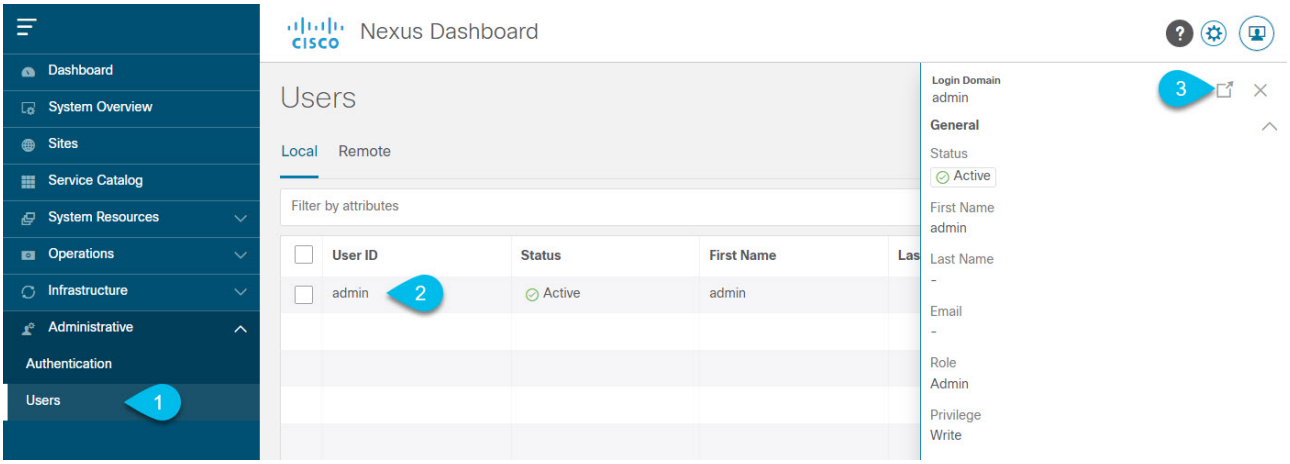
        You can select one or more roles for each user. The available roles and their permissions are described in Roles and Permissions.

        For all of the user roles you select, you can choose to enable read-only or read-write access. In case of read-only access, the user will be able to view the objects and settings allowed by their user **Role** but unable to make any changes to them.

    e. Click **Create** to save the user.

Editing Local Users

1. Log in to your Nexus Dashboard GUI.
2. Open user details screen.



a. From the left sidebar, select **Administrative** > **Users**.

b. In the main pane, click on the user's name.

c. In the details pane that opens, click the **Details** icon.

3. In the <***user-name***> details screen that opens, click the **Edit** icon.

4. In the **Edit User** screen that opens, update the settings as necessary.

Cisco Intersight

Cisco Intersight is a Software-as-a-Service (SaaS) infrastructure management platform that is augmented by other intelligent systems. It provides global management of the Cisco Unified Computing System (Cisco UCS) and Cisco HyperFlex hyperconverged infrastructure, Cisco APIC, and other platforms including Cisco Nexus Dashboard.

Data center apps, such as Cisco Nexus Insights, connect to the Cisco Intersight portal through a Device Connector that is embedded in the management controller of each system, in this case your Nexus Dashboard platform. Device Connector provides a secure way for the connected devices to send information and receive control instructions from the Cisco Intersight portal, using a secure internet connection.

When an Intersight-enabled device or application starts, the Device Connector starts at boot by default and attempts to connect to the cloud service. If the **Auto Update** option is enabled, the Device Connector is automatically updated to the latest version through a refresh by the Intersight service when you connect to Cisco Intersight. For more information on the **Auto Update** option, see Configuring Device Connector Settings.

For additional information on Cisco Intersight, see https://www.intersight.com/help/getting_started.

If you upgraded from Application Services Engine and your Intersight device connector is claimed with a proxy configured, you will need to re-configure the proxy in the **Cluster Configuration** screen. For more information, see Cluster Configuration.

Configuring Device Connector Settings

Devices are connected to the Cisco Intersight portal through a Device Connector, which provides a secure way for the connected devices to send information and receive control instructions from the Cisco Intersight portal.

All device connectors must properly resolve `svc.intersight.com` and allow outbound initiated HTTPS connections on port `443`. If a proxy is required for an HTTPS connection, you must configure the proxy settings in your Nexus Dashboard.

This section describes how to configure the basic Device Connector settings.

1. Log in to your Nexus Dashboard GUI.
2. From the left sidebar, select **Infrastructure** > **Intersight**.
3. In the top right of the main pane, click **Settings**.
4. Click the **General** tab to configure basic options.
    a. Use the **Device Connector** knob to enable or disable the Device Connector.

        This enables you to claim the device and leverage the capabilities of Intersight. If it is disabled, no communication is allowed to Cisco Intersight.

b. In the **Access Mode** area, choose whether to allow Intersight the capability to make changes to this device.

   - `Allow Control` (default) — enables you to perform full read or write operations from the cloud based on the features available in Cisco Intersight.
   - `Read-only` — ensures that no changes are made to this device from Cisco Intersight.

     For example, actions such as upgrading firmware or a profile deployment will not be allowed in read-only mode. However, the actions depend on the features available for a particular system.

c. Use the **Auto Update** knob to enable automatic Device Connector updates.

   We recommend that you enable automatic updates so that the system automatically updates the Device Connector software. When enabled, the Device Connector will automatically upgrade its image whenever there is any upgrade push from Intersight.

   If you disable the automatic updates, you will be asked to manually update the software when new releases become available. Note that if the Device Connector is out-of-date, it may be unable to connect to Cisco Intersight.

5. Click **Save** to save the changes.
6. Click the **Certificate Manager** tab if you want to import additional certificates.

   By default, the device connector trusts only the built-in certificate. If the device connector establishes a TLS connection and a server sends a certificate that does not match the built-in certificate, the device connector terminates TLS connections because it cannot determine if the server is a trusted device.

   You can choose to upload additional certificates by clicking the **Import** button in this screen. The imported certificates must be in the `.pem` (base64 encoded) format. After a certificate is successfully imported, it is listed in the list of **Trusted Certificates** and if the certificate is correct, it is shown in the **In-Use** column.

   You can click the **View** icon at the end of the certificate's row to view its details such as name, issue and expiration dates.

Target Claim

This section describes how to claim the Nexus Dashboard platform as a device for Cisco Intersight.

Before you begin

You must have configured the Intersight Device Connector as described in Configuring Device Connector Settings.

To claim the device:

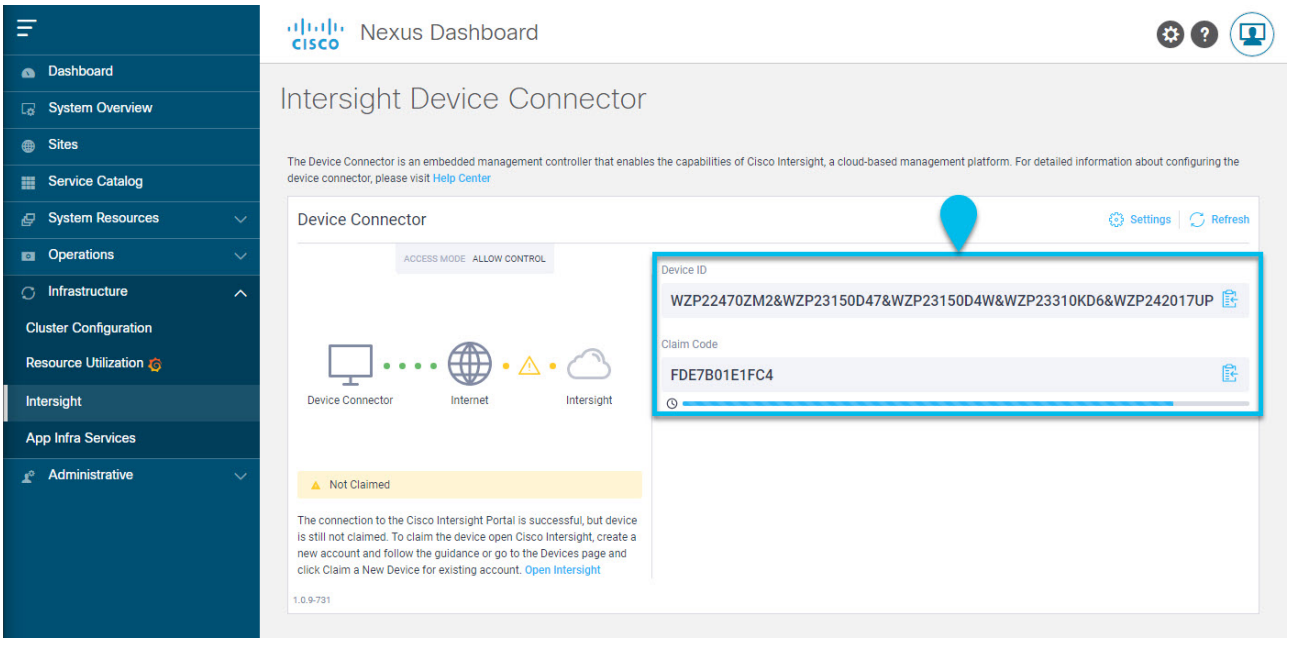
1. Log in to your Nexus Dashboard GUI.
2. From the left sidebar, select **Infrastructure** > **Intersight**.

3. Check whether the Device Connector is already configured.
    - If you see a green dotted line connecting **Internet** to **Intersight** in the **Device Connector** page and the text **Claimed**, then your Intersight Device Connector is already configured and connected to the Intersight cloud service, and the device is claimed. In this case, you can skip the rest of this section.
    - If you see a red dotted line connecting to **Internet** in the **Device Connector** page, you must configure a proxy for your Nexus Dashboard cluster to be able to access the Internet, as described in Cluster Configuration before continuing with the rest of this section.
    - If you see a yellow dotted line and a caution icon connecting **Internet** to **Intersight** in the **Device Connector** page and the text **Not Claimed**, then your Intersight Device Connector is not yet configured and connected to the Intersight service, and the device is not yet claimed. Follow these procedures to configure the Intersight Device Connector and connect to the Intersight cloud service, and claim the device. In this case, proceed with the rest of the steps to configure the device.
4. If necessary, update the device connector software.

    If there is a new Device Connector software version available and you do not have the **Auto Update** option enabled, you will see a message at the top of the screen informing you that Device Connector has important updates available. Enabling the auto-update feature is described in Configuring Device Connector Settings.

    To manually update the Device Connector, click the **Update Now** link.

5. Note down the `Device ID` and `Claim Code` listed on the Nexus Dashboard's **Intersight** page.



6. Log into the Cisco Intersight cloud site at https://www.intersight.com.
7. Follow the instructions described in the Target Claim section of the Intersight documentation to claim the device.

    After the device is claimed in Intersight, you should see green dotted lines connecting **Internet** to **Intersight** in your Nexus Dashboard's **Device Connector** page along with the text **Claimed**.

You may need to click **Refresh** in top right of the page to update the latest status.

Unclaiming the Device

To unclaim the Nexus Dashboard as a device from Intersight:

1. Log in to your Nexus Dashboard GUI.
2. From the left sidebar, select **Infrastructure** > **Intersight**.
3. In the main pane, click **Unclaim**.

Troubleshooting

Useful Commands

You can log in to any of the cluster nodes as `rescue-user` for a limited access to system data. You can use the following commands to perform various operations in Cisco Nexus Dashboard.

Cluster Troubleshooting:

- `acs health` — displays cluster health information and any existing issues.
- `acs cluster config` — displays cluster configuration.
- `acs cluster masters` — displays master nodes configuration.
- `acs cluster workers` — displays worker nodes configuration.
- `acs cluster standbys` — displays standby nodes configuration.
- `acs techsupport collect -s system` — collects Infra tech support information.
- `acs techsupport collect -s cisco-mso` — collects Multi-Site Orchestrator application tech support information.
- `acs techsupport collect -s cisco-nir` — collects Nexus Insights application tech support information.
- `acs techsupport collect -s cisco-nae` — collects Network Assurance Engine application tech support information.
- `acs techsupport collect -s cisco-appcenter` — collects App Store Nexus Insights application tech support information.
- `acs version` — returns the Nexus Dashboard version.

Resetting Devices:

- `acs reboot` — reboots the node.
- `acs reboot clean` — removes all data for Nexus Dashboard and applications, but preserves the Nexus Dashboard bootstrap configuration and pod images.

  When you first bring up your Nexus Dashboard cluster, initial deployment process installs all required pod images. Retaining pod images will speed up cluster bring up after reboot.

- `acs reboot clean-wipe` — removes all data for Nexus Dashboard and applications including application images, but preserves the Nexus Dashboard bootstrap configuration.

  When the cluster boots up again, pod images will be re-installed.

- `acs reboot factory-reset` — removes all data for Nexus Dashboard and applications including cluster bootstrap configuration, but preserves application images.

  When you first bring up your Nexus Dashboard cluster, initial deployment process installs all required pod images. Retaining pod images will speed up cluster bring up.

- `acs reboot factory-wipe` — removes all data for Nexus Dashboard and applications, including

application images and cluster bootstrap configuration.

When the cluster boots up again, the pod images will be re-installed.

System and Connectivity Troubleshooting:

- The `/logs` directory is mounted into the `rescue-user` container and can be inspected with standard tools.
- `ping` command is supported with most options.
- `ip` command supports a read-only subset of commands, including `ip addr show` and `ip route show`.
- `kubectl` command can be used to support read-only kubectl commands.
- `esctl` command invokes a custom utility that allows you to get debug information about the Elasticsearch service.

  The following arguments are supported:

  - `esctl help` — returns usage information and available arguments described below.
  - `esctl get nodes` — returns Elasticsearch cluster's nodes information

```
$ esctl get nodes
ip             heap.percent ram.percent   [...]   node.role master name
172.17.251.227           24          41   [...]   mdi       *      es-data-1
172.17.251.243           21          39   [...]   mdi       -      es-data-2
172.17.251.154           22          35   [...]   mdi       -      es-data-0
```

  - `esctl get health` — returns Elasticsearch cluster's health information

```
$ esctl get health
{
  "cluster_name" : "elasticsearch",
  "status" : "green",
  "timed_out" : false,
  "number_of_nodes" : 3,
  "number_of_data_nodes" : 3,
  "active_primary_shards" : 169,
  "active_shards" : 498,
  "relocating_shards" : 0,
  "initializing_shards" : 0,
  "unassigned_shards" : 0,
  "delayed_unassigned_shards" : 0,
  "number_of_pending_tasks" : 0,
  "number_of_in_flight_fetch" : 0,
  "task_max_waiting_in_queue_millis" : 0,
  "active_shards_percent_as_number" : 100.0
}
```

- `esctl get indices` — returns information about which indices exist in the cluster, number of docs inside and docs deleted, and the size of the index store.

  ```
  $ esctl get indices
  health status index                                          ...
  green  open   cisco_nir-enrich_appdynamicsdb-2021.03.26      ...
  green  open   cisco_nir-svcstatsdb                           ...
  green  open   cisco_nir-operdb                               ...
  ...
  ```

- `esctl get allocexplain` — provides explanations for shard allocations in the cluster and for any corresponding failures.
- `esctl get shards` — returns information about shards and to which nodes they belong.

There are two different instances of Elasticsearch service that can be running in your Nexus Dashboard:

- `elasticsearch` — Elasticsearch used by most applications running in your Nexus Dashboard.

  This is the service for which `esctl` command provides information by default.

- `elasticsearch-nir` — Elasticsearch used specifically by the Network Insights application. This service starts when the Network Insights application is enabled.

  You can use the `--name=elasticsearch-nir` argument to have the `esctl` command display information about this instance, for example:

  ```
  $ esctl --name=elasticsearch-nir get health
  ```

Application Information:

- `acs apps instances` command displays all applications running on the cluster.
- `acs apps actions` command displays the history operations done on the applications, such as installations, upgrades, or deletions.

Manual Upgrades

We recommend using the procedure described in Firmware Management (Cluster Upgrades) section to upgrade your cluster.

However, if for you want to perform a manual upgrade of each node, for example in case the GUI upgrade did not succeed, you can use the following steps instead:

1. Log in to one of the nodes as `rescue-user`.
2. Copy the upgrade ISO image file into the `/tmp` directory on the node.
3. Start the upgrade.

```
# acs installer update -f /tmp/nd-dk9.2.0.2a.iso
Warning: This command will initiate node update to new version.
Proceed? (y/n): y
Update in Progress ... Do not press Ctrl^C
```

4. Wait for the upgrade to complete.

```
Update succeeded, reboot your host
```

5. Reboot the node.

```
# acs reboot
This command will restart this device, Proceed? (y/n): y
```

6. Verify the node is healthy.

```
# acs health
All components are healthy
```

7. After the first node is successfully upgraded, repeat the steps on the other two nodes in turn.

You must update one node at a time; no more than a single node should be unavailable at any time.

8. Once all nodes are up with new version and healthy, run post-upgrade tasks.

   You can run the following command on all nodes in parallel.

```
# acs installer post-update
Warning: This command will run the post-update scripts. Proceed? (y/n): y
Update in Progress ... Do not press Ctrl^C
Post-update succeeded
```

Re-Imaging Nodes

When you first receive the Nexus Dashboard physical hardware, it comes preloaded with the software image. If you simply want to configure the existing software, skip this section and proceed to Managing Worker Nodes or Managing Standby Nodes.

If you are looking to manually upgrade the node to the latest software version, follow the instructions in Manual Upgrades instead.

This section describes how to redeploy the software stack on the Nexus Dashboard hardware. You

may need to use the following steps in case of a catastrophic failure where you are no longer able to access the server's operating system or GUI.

Before You Begin

- You must be able to connect to the server's CIMC using the Serial over LAN (SoL) port, so ensure that you have the server's CIMC IP address and an SSH client.

  Detailed information about CIMC configuration is available at https://www.cisco.com/c/en/us/support/servers-unified-computing/ucs-c-series-integrated-management-controller/products-installation-and-configuration-guides-list.html

- Ensure that you are running a supported version of Cisco Integrated Management Controller (CIMC).
  - Recommended version: CIMC, Release 4.1(3b).
  - Minimum supported version: CIMC, Release 4.0(1a).

To re-install the Nexus Dashboard software:

1. Download the Cisco Nexus Dashboard image.
   a. Browse to the Nexus Dashboard page and download the image.

      https://www.cisco.com/c/en/us/support/data-center-analytics/nexus-dashboard/series.html

   b. Click the `Downloads` tab.
   c. Choose the Nexus Dashboard version you want to download.
   d. Download the Cisco Nexus Dashboard image (nd-dk9.<version>.iso).
   e. Host the image in a web server in your enviornment

      You will need to provide an `http` URL when mounting the image.

2. Deploy the ISO to the server.

   This step requires you to connect to the server's CIMC. Detailed information about CIMC configuration is available at https://www.cisco.com/c/en/us/support/servers-unified-computing/ucs-c-series-integrated-management-controller/products-installation-and-configuration-guides-list.html.

   a. SSH into the server's CIMC.
   b. Connect to the virtual media.

      ```
      C220-WZP21510DHS# scope vmedia
      C220-WZP21510DHS /vmedia #
      ```

   c. Map the Nexus Dashboard image you downloaded to the `CIMC-Mapped vDVD`.

```
C220-WZP21510DHS /vmedia # map-www image http://<ip-address>/<path> <image>
```

For example:

```
C220-WZP21510DHS /vmedia # map-www image http://172.31.131.47/images nd-
dk9.2.0.1.iso
```

d. Verify that the image is mounted.

```
C220-WZP21510DHS /vmedia # show mappings
Volume  Map-Status  Drive-Type  Remote-Share   Remote-File       Mount-Type
------- ----------- ----------- -------------- ----------------- --------
image   OK          CD          [<ip>/<path>]  nd-dk9.2.0.1.iso  www
```

e. Reboot the server and connect to its console.

```
C220-WZP23150D4C /vmedia # exit
C220-WZP23150D4C# scope chassis
C220-WZP23150D4C /chassis # power cycle
C220-WZP23150D4C /chassis # exit
C220-WZP23150D4C# connect host
CISCO Serial Over LAN:
Press Ctrl+x to Exit the session
```

f. Select the boot device.

Watch the boot process until you see the following message:

```
Press <F2> Setup, <F6> Boot Menu, <F7> Diagnostics, <F8> Cisco IMC
Configuration, <F12> Network Boot
```

Then press F6 and select the virtual media device where you mounted the image (`Cisco CIMC-Mapped vDVD1`):

```
/-----------------------------------\
| Please select boot device: |
|-----------------------------------|
| (Bus 05 Dev 00)PCI RAID Adapter |
| UNIGEN PHF16H0CM1-DTE PMAP |
| Cisco vKVM-Mapped vHDD1.22 |
| Cisco CIMC-Mapped vHDD1.22 |
| Cisco vKVM-Mapped vDVD1.22 |
| Cisco CIMC-Mapped vDVD1.22 |
| Cisco vKVM-Mapped vFDD1.22 |
| UEFI: Built-in EFI Shell |
| IBA GE Slot 0100 v1585 |
| IBA GE Slot 0101 v1585 |
| Enter Setup |
|-----------------------------------|
| ^ and v to move selection |
| ENTER to select boot device |
| ESC to boot using defaults |
\-----------------------------------/
```

g. Configure the networking.

   When the server first boots, you will see the following output:

```
+ '[' -z http://172.31.131.47/nd-dk9.2.0.1.iso ']'
++ awk -F '/|:' '{print $4}'
+ urlip=172.31.131.47
+ '[' -z 172.31.131.47 ']'
+ break
+ '[' -n http://172.31.131.47/nd-dk9.2.0.1.iso ']'
+ set +e
+ configured=0
+ '[' 0 -eq 0 ']'
+ echo 'Configuring network interface'
Configuring network interface
+ echo 'type static, dhcp, bash for a shell to configure networking, or url to
re-enter the url: '
type static, dhcp, bash for a shell to configure networking, or url to re-enter
the url:
+ read -p '? ' ntype
? static ①
+ case $ntype in
+ configure_static
+ echo 'Available interfaces'
Available interfaces
+ ls -l /sys/class/net
total 0
lrwxrwxrwx. 1 root root 0 Apr 26 01:21 eno1 ->
../../devices/pci0000:3a/0000:3a:00.0/0000:3b:00.0/net/eno1
lrwxrwxrwx. 1 root root 0 Apr 26 01:21 eno2 ->
../../devices/pci0000:3a/0000:3a:00.0/0000:3b:00.1/net/eno2
lrwxrwxrwx. 1 root root 0 Apr 26 01:21 eno5 ->
../../devices/pci0000:5d/0000:5d:00.0/0000:5e:00.0/0000:5f:01.0/0000:61:00.0/000
0:62:00.0/0000:63:00.0/net/eno5
lrwxrwxrwx. 1 root root 0 Apr 26 01:21 eno6 ->
../../devices/pci0000:5d/0000:5d:00.0/0000:5e:00.0/0000:5f:01.0/0000:61:00.0/000
0:62:00.0/0000:63:00.1/net/eno6
lrwxrwxrwx. 1 root root 0 Apr 26 01:21 lo -> ../../devices/virtual/net/lo
+ read -p 'Interface to configure: ' interface
Interface to configure: eno1  ②
+ read -p 'address: ' addr
address: 172.23.53.59/21  ③
+ read -p 'gateway: ' gw
gateway: 172.23.48.1  ④
+ ip addr add 172.23.53.59/23 dev eno1
+ ip link set eno1 up
+ ip route add default via 172.23.48.1
RTNETLINK answers: Network is unreachable
++ seq 1 2
+ for count in '$(seq 1 2)'
+ ping -c 1 172.31.131.47
```

① For IP address, enter `dchp` if there is a DHCP server in your environment or `static`.

② For the interface, enter the first management port (`eno1`).

③ If you chose `static`, provide the IP address for the connection.

④ If you chose `static`, provide the gateway for the connection.

3. After the server boots from the provided image, select the only available installation option.

   It may take up to 20 minutes for the installation process to complete.

   After the image is deployed, you can add the node to your cluster as described in Managing Worker Nodes or Managing Standby Nodes.

AppStore Errors

When attempting to access the **Service Catalog** > **AppStore** tab in the Nexus Dashboard GUI, you may encounter the following error:

```
{
  "error": "There was a problem proxying the request"
}
```

Cause

When a master node where the AppStore service is running fails, it may take up to 5 minutes for the AppStore services to relocate to another master node

Resolution

Simply wait for the services to recover and refresh the page.

Factory Reset

You can reset the whole cluster by running the following command on each node:

```
# acs reboot factory-reset
```

Doing this will lose all cluster configuration and applications and you will need to rebuild the cluster.

Re-Adding Same Master Node to Physical Cluster

This section describes how to re-add a master node to a physical cluster if it was accidentally removed via configuration reset (such as `acs reboot factory-reset`) or vMedia re-install.

If you have a standby node in your cluster, simply convert the standby into a master node as described in Replacing Single Master Node with Standby Node and then add the old master node as a new standby node as described in Adding Standby Nodes.

If you need to completely replace (RMA) a master node due to hardware failure and do not have a standby node available, follow the procedure described in [Replacing Nodes without Standby Node] instead.

If you want to re-add the same master node to the cluster, you will need to create a bootstrap config JSON string and provide it during the node's initial configuration stage as described below.

1. Obtain the required cluster nodes information.
   a. Log in to one of the master nodes that are still part of the cluster as `rescue-user`.
   b. Run `acs cluster masters` command.
   c. Note down all the information about the cluster nodes.
2. Generate password hash string for the `rescue-user` password.

   On any Linux-based system with Python installed, run the following command replacing `mypassword\!` with your cluster's `rescue-user` password. Note that special characters must be escaped with a backslash (`\`).

   ```
   # python -c "import crypt; print(crypt.crypt('mypassword\!',
   crypt.mksalt(crypt.METHOD_SHA256)))"
   $5$/BFriAeT6mpDYjIw$wEePXl/H7lCoHA3/XOcSqcXShLX2hQ0Ml5.hDBKoZ5A
   ```

   Copy the password hash string, which you will use for the configuration JSON in the next step.

3. Construct the bootstrap JSON string.

   In the following example, replace all variables between `<` and `>` with information relevant to your cluster and its nodes:

   For the master node that you are re-adding, ensure that `"self": true` is set. In the example below, `<node3>` is being re-added.

   ```
   {
       "nodes": [{
               "hostName": "<node1-hostname>",
               "serialNumber": "<node1-serial>",
               "passwordHash": "<password-hash-string>",
               "clusterLeader": true,
               "role": "Master",
               "managementNetwork": {
                   "ipSubnet": "<node1-mgmt-ip>/<node1-mgmt-netmask>",
                   "gateway": "<node1-mgmt-gateway>"
               },
               "dataNetwork": {
                   "ipSubnet": "<node1-data-ip>/<node1-data-netmask>",
                   "gateway": "<node1-data-gateway>",
                   "vlan": <node1-data-vlan>
               },
   ```

```
            "self": false
        },
        {
            "hostName": "<node2-hostname>",
            "serialNumber": "<node2-serial>",
            "passwordHash": "<password-hash-string>",
            "clusterLeader": false,
            "role": "Master",
            "managementNetwork": {
                "ipSubnet": "<node2-mgmt-ip>/<node2-mgmt-netmask>",
                "gateway": "<node2-mgmt-gateway>"
            },
            "dataNetwork": {
                "ipSubnet": "<node2-data-ip>/<node2-data-netmask>",
                "gateway": "<node2-data-gateway>",
                "vlan": <node2-data-vlan>
            },
            "self": false
        },
        {
            "hostName": "<node3-hostname>",
            "serialNumber": "<node3-serial>",
            "passwordHash": "<password-hash-string>",
            "clusterLeader": false,
            "role": "Master",
            "managementNetwork": {
                "ipSubnet": "<node3-mgmt-ip>/<node3-mgmt-netmask>",
                "gateway": "<node3-data-gateway>"
            },
            "dataNetwork": {
                "ipSubnet": "<node3-data-ip>/<node3-data-netmask>",
                "gateway": "<node3-data-gateway>",
                "vlan": <node3-data-vlan>
            },
            "self": true
        }
    ],
    "clusterConfig": {
        "name": "<cluster-name>",
        "ntpServers": ["<ntp-server-ip>"],
        "nameServers": ["<dns-server-ip>"],
        "appNetwork": "100.20.0.1/16",
        "serviceNetwork": "100.30.0.0/16}"
    }
}
```

4. Ensure the JSON is formatted as a single-line string.

   For example:

```
{"nodes":[{"hostName":"sn1","serialNumber":"WZP23390GLM","passwordHash":"$5$/BFriAe
T6mpDYjIw$wEePXl/H7lCoHA3/XOcSqcXShLX2hQ0Ml5.hDBKoZ5A","clusterLeader":true,"role":
"Master","managementNetwork":{"ipSubnet":"162.11.169.77/21","gateway":"162.11.168.1
"},"dataNetwork":{"ipSubnet":"100.10.10.11/24","gateway":"100.10.10.1","vlan":100},
"self":false},{"hostName":"sn2","serialNumber":"WZP23380ZXV","passwordHash":"$5$/BF
riAeT6mpDYjIw$wEePXl/H7lCoHA3/XOcSqcXShLX2hQ0Ml5.hDBKoZ5A","clusterLeader":false,"r
ole":"Master","managementNetwork":{"ipSubnet":"162.11.169.79/21","gateway":"162.11.
168.1"},"dataNetwork":{"ipSubnet":"100.10.10.12/24","gateway":"100.10.10.1","vlan":
100},"self":false},{"hostName":"sn3","serialNumber":"WZP23480T1S","passwordHash":"$
5$/BFriAeT6mpDYjIw$wEePXl/H7lCoHA3/XOcSqcXShLX2hQ0Ml5.hDBKoZ5A","clusterLeader":fal
se,"role":"Master","managementNetwork":{"ipSubnet":"162.11.169.81/21","gateway":"16
2.11.168.1"},"dataNetwork":{"ipSubnet":"100.10.10.13/24","gateway":"100.10.10.1","v
lan":100},"self":true}],"clusterConfig":{"name":"SN","ntpServers":["171.68.38.65"],
"nameServers":["10.195.200.67"],"appNetwork":"100.20.0.1/16","serviceNetwork":"100.
30.0.0/16"}}
```


We recommend verifying that the single-line JSON string is properly formatted before proceeding to the next step. You can verify the JSON file using the following command on any Linux-based system, replacing `bootstrap.json` with the filename containing the string:

```
# python -c 'import json, sys; print(json.dumps(json.load(open(sys.argv[1]))))'
bootstrap.json
```

5. Bootstrap the master node you want to re-add to the cluster.

   a. SSH in to the node's CIMC.

   b. Run `connect host` command to connect to the host's console.

      You should see the following output:

      ```
      cimc# connect host
      CISCO Serial Over LAN:
      Press Ctrl+x to Exit the session

      Welcome to Nexus Dashboard 2.0.2a
      Press Enter to manually bootstrap your first master node...
      ```

      Ensure that the screen is at the `Press Enter to manually bootstrap your first master node..` message. If you have already pressed a key and are being prompted to enter a password, press `Ctrl-d` to reset the bootstrap process.

   a. Paste the JSON string immediately after the `Press Enter to manually bootstrap your first master node..` message, then press Enter.

      You should see the following messages:

```
Welcome to Nexus Dashboard 2.0.2a
Press Enter to manually bootstrap your first master node...
<twork":"100.20.0.1/16","serviceNetwork":"100.30.0.0/16"}}
Applying JSON payload to config

System configured successfully

Login with rescue-user & issue acidiag health to check cluster status
```

It will take a few minute for the services to come up and the cluster to recover.

6. SSH in to the node you just configured as `rescue-user` and run `acs health` command to verify that the node was successfully re-added to the cluster.

Replacing Virtual Nodes

This section describes how to recover from a master node failure in a VMware ESX virtual Nexus Dashboard cluster. The procedure involves deploying a brand new Nexus Dashboard node in VMware ESX and joining it as a master node to the remaining cluster.

1. Ensure that the failed node's VM is powered down.
2. Log in to one of the healthy nodes and obtain a debug token.

   After you log in as `rescue-user`, run the following command and note down the token:

   ```
   $ acs debug-token
   09GZ1PMB8CML
   ```

   The token expires and is refreshed every 30 minutes, so ensure to retrieve it when you are ready to deploy the new node.

3. Bring up a new Nexus Dashboard node in VMware ESX.

   You can use the same exact procedure you used to bring up 2nd and 3rd node of the original cluster, as described in Deploying in VMware ESX.

   Ensure that you use the same exact network configuration settings as you used for the failed node.

   When providing the cluster information, select the **Download Config From Peers** option and provide the debug token you generated in the previous step.

4. Power on the new node's VM and wait for it to boot up.
5. Log in to the new node and join it to the cluster.

   After you log in as `rescue-user`, run the following command using the debug token from one of the healthy nodes:

```
$ acs node-join -passphrase 09GZ1PMB8CML
```

The token expires and is refreshed every 30 minutes, so you may need to regenerate a token from one of the other nodes if more than 30 minutes have passed since you deployed the new VM.

It may take up to 20 minutes for the node to finish configuration and rejoin the cluster.

Replacing Physical Nodes Without Standby Node (RMA)

This section describes how to recover from one or two master node failures in a physical Nexus Dashboard cluster without standby nodes. The RMA procedure is for hardware issues that require it to be physically replaced; if the node is simply in a bad software state, you can use the `acs reboot clean` commands instead.

Replacing Single Master Node without Standby Node

If your cluster has a standby node configured, we recommend using the steps described in Replacing Single Master Node with Standby Node instead.

Before you begin

- Ensure that at least 2 master nodes are healthy.

  If two of the master nodes are unavailable, you will need to manually restore the cluster as described in Replacing Two Master Nodes with Standby Nodes

- Ensure that the master node you want to replace is powered off.
- You must have the new node prepared as described in Deploying Additional Nodes.
- Ensure that you have the same CIMC IP address and login information on the new node as you configured for the failed node.

  The remaining master node will use the CIMC information to restore configuration to the new node.

- Ensure that the new node is powered on and note down its serial number.

To replace a single failed master node:

1. Log in to your Nexus Dashboard GUI using the management IP of one of the other `master` nodes.
2. From the left sidebar, select **System Resources** > **Nodes**.
3. In the nodes list, find the **Serial** number of the node you want to replace and ensure that the node's **Status** shows `Inactive`.
4. In the Nexus Dashboard's **Nodes** screen, select the inactive node by clicking the checkbox next to it.

5. From the **Actions** menu, select **Replace**.
6. In the **New Serial Number** field, provide the serial number of the new node and click **Replace**.

   After the process is completed, you will see the serial number of the old node updated to the new node's serial number and the status will change to `Active` once the new master has successfully joined the cluster.

Replacing Two Master Nodes without Standby Nodes

If your cluster has a standby node configured, we recommend using the steps described in [Replacing Two Master Nodes with Standby Node] instead.

Because the cluster requires at least two master nodes to be available, you cannot simply add another master. Instead, you must restore the cluster configuration from the remaining healthy node to the two new nodes.

Before you begin

- Ensure that the master nodes you want to replace are powered off and note down their serial numbers and network configuration.

  You will need to provide the failed nodes' serial numbers, data network, and management network information during the recovery process.

- You must have the new nodes prepared as described in Deploying Additional Nodes.
- Ensure that the new nodes are running the same Nexus Dashboard software version as the remaining healthy node.
- Ensure that you have the same CIMC IP addresses and login information on the new nodes as you configured for the failed nodes.

  The remaining master node will use the CIMC information to restore configuration to the new node.

- Ensure that the new nodes are powered on and note down their serial numbers.

  You will need to provide the new nodes' serial numbers during the recovery process.

To replace two failed master nodes:

1. Power on the two new master nodes and note down the serial numbers of the new nodes.
2. Log in to your remaining healthy master node as `rescue-user` and run the recovery command.

   In the following command, provide the serial numbers of the two failed nodes and two new nodes as well as the same network configuration parameters as you used for the two failed nodes:

   The backslash (`\`) character indicates continuation of the same command, do not enter this character as you enter the entire command.

```
acs rma --oldSerial WZP22140ZLP --newSerial WZP23390GLM \
        --cimcIP 10.10.1.10 --cimcUser admin --cimcPassword <password> \
        --mgmtSubnet 10.10.1.11/24 --mgmtGateway 10.10.1.1 \
        --dataSubnet 100.11.11.11/24 --dataGateway 100.11.11.1 --dataVlan 201 \
        --oldSerial WZP22470ZLR --newSerial WZP23380ZXV \
        --cimcIP 10.10.1.12 --cimcUser admin --cimcPassword <password> \
        --mgmtSubnet 10.10.1.13/24 --mgmtGateway 10.10.1.1 \
        --dataSubnet  100.12.12.12/24 --dataGateway 100.12.12.1 --dataVlan 202
```

3. Wait for the nodes to come up and the cluster to recover.

   Depending on the number of applications installed in the cluster, it may take 20-60 minutes for the cluster to recover.

1. Verify that the cluster is healthy.
   a. Log in to your Nexus Dashboard GUI using the management IP of one of the master nodes.
   b. From the left sidebar, select **System Resources** > **Nodes**.
   c. Verify that all nodes are listed as `Active`

Replacing Worker Nodes

When replacing a failed work node, you simply delete the `Inactive` node from the GUI and then deploy a brand new worker node as you typically would.

Before You begin

- Ensure that the worker node you want to replace is powered off.

To replace a failed worker node:

1. Log in to your Nexus Dashboard GUI.
2. From the left sidebar, select **System Resources** > **Nodes**.
3. In the nodes list, find the **Serial** number of the node you want to replace and ensure that the node's **Status** shows `Inactive`.
4. Select the inactive node by clicking the checkbox next to it.
5. From the **Actions** menu, select **Delete**.

   This will remove the node from the list.

6. Power on the new node and add it as a new `worker` node to the cluster as described in Managing Worker Nodes.

   Use the same configuration parameters as you used to set up the old node.