Cisco Nexus Dashboard Fabric Controller (NDFC) Deployment Guide

Introduction

Cisco Nexus Dashboard Fabric Controller (NDFC), formerly known as Data Center Network Manager (DCNM), runs exclusively as an application service on top of Cisco Nexus Dashboard (ND). Nexus Dashboard uses Kubernetes at its core with customized extensions, creating a secure, scaled-out platform for microservices-based application deployment. Nexus Dashboard provides Active/Active HA (High Availability) for all applications running on top of that cluster.

The NDFC 12.1.3b release introduces several new features, notably pure IPv6 deployment and management capability. Prior ND releases supported pure IPv4 or dual-stack IPv4/IPv6 configurations for the cluster nodes. With release 3.0(1), ND now supports pure IPv4, pure IPv6, and/or dual stack IPv4/IPv6 configurations for the cluster nodes and services. These new deployment models are the focus of this paper.

Note: *The documentation set for this product strives to use bias-free language. For the purposes of this documentation set, bias-free is defined as language that does not imply discrimination based on age, disability, gender, racial identity, ethnic identity, sexual orientation, socioeconomic status, and intersectionality. Exceptions may be present in the documentation due to language that is hardcoded in the user interfaces of the product software, language used based on RFP documentation, or language that is used by a referenced third-party product.*

NDFC can be deployed to manage three fabric types—LAN, IPFM, and SAN. LAN stands for Local Area Network; NDFC supports two types of LAN fabrics —Brownfield deployments are applicable for existing fabrics, while Greenfield deployments are for new fabrics. For more information on LAN deployments, refer to the NDFC 12.1.3b Release Notes and Enhanced Classic LAN in Cisco NDFC. IPFM stands for IP Fabric for Media; the IPFM fabric feature is a specific type of LAN fabric, and it must be specifically enabled. For more information, refer to the NDFC 12.1.3 Deployment Guide. SAN stands for Storage Area Networking; NDFC provides complete lifecycle management and automation for Cisco MDS and Nexus Dashboard deployments, spanning SAN. For more information on SAN deployments, refer to Unlocking SAN Innovation with Cisco NDFC.

You can deploy NDFC on either a Physical Nexus Dashboard Cluster (pND) or a Virtual Nexus Dashboard cluster (vND). In either case, as a native microservices-based application, NDFC supports true scale-out. This means that simply adding extra nodes to the Nexus Dashboard cluster increases the system scale. The system requirements and qualified scale support depend on the Nexus Dashboard deployment model. Refer to the Networking Requirements section to validate NDFC verified scale information.

Networking with Nexus Dashboard

As an application that runs on top of the Cisco Nexus Dashboard, NDFC uses the networking interfaces of the Nexus Dashboard to manage, automate, configure, maintain, and monitor the Cisco Nexus and MDS family of switches. In this section, we will briefly review networking guidelines for the Nexus Dashboard cluster.

Each Nexus Dashboard node in a cluster has two interfaces, each in a different subnet:

- management interface
- data (also known as fabric) interface

Therefore, during deployment of the Nexus Dashboard cluster, you must provide two IP addresses/subnets for each node that will be part of the cluster. At the time of deployment, you may choose whether you want to deploy a single-node or 3-node Nexus Dashboard cluster. Single-node Nexus Dashboard cluster deployments support NDFC IP Fabric for Media and SAN Controller production deployments, and a LAN Controller lab deployment (<=25 switches). A minimum of three Nexus Dashboard nodes are required for all production NDFC LAN Controller deployments.

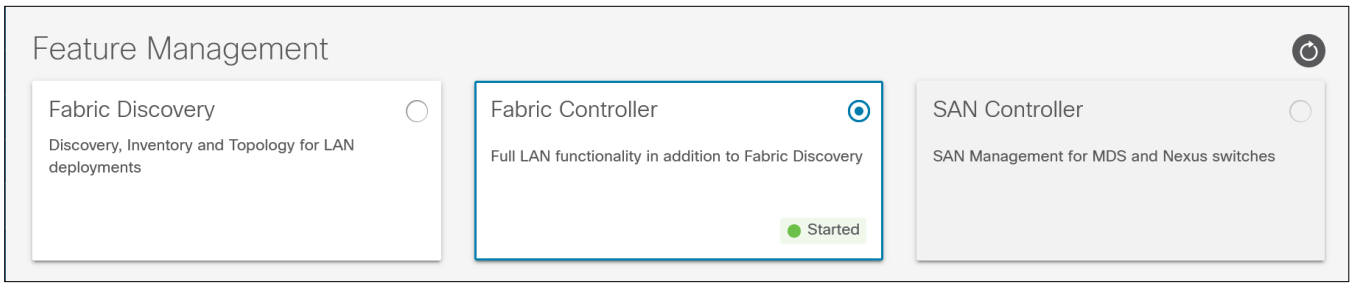


Figure 1: Feature Management

As the name implies, the Nexus Dashboard management interface connects to the management network, and it typically provides web/API access to the Nexus Dashboard cluster. The Nexus Dashboard data interface typically provides IP reachability to the physical data center network infrastructure.

This section describes the purpose and functionality of the networks as they are used by the Nexus Dashboard services.

Management Network

The management network is used for these functions:

- Accessing the Nexus Dashboard GUI (graphical user Interface).
- Accessing the Nexus Dashboard CLI (command-line interface) via SSH (Secure Shell).
- DNS (Domain Name System) and NTP (Network Time Protocol) communication.
- Nexus Dashboard firmware upload.
- Installing applications from the Cisco DC App Center (AppStore).
- Intersight device connection.

Data Network

The data network is used for these functions:

- Nexus Dashboard clustering.
- Application-to-application communication (SMTP (Simple Mail Transfer Protocol) and SNMP (Simple Network Management Protocol) forwarding).

Networking Requirements

- Two logical interfaces are required per Nexus Dashboard node:
  - bond1br (also known as Nexus Dashboard management interface).
  - bond0br (also known as Nexus Dashboard data interface).

- For enabling NDFC on a Nexus Dashboard cluster, the Nexus Dashboard management and data interfaces must be in different subnets. Therefore, a minimum of two IP subnets is required for deployment of such a cluster.
- Note: the capability to configure nodes within the cluster with either Layer 2 or Layer 3 adjacency was enabled in release 12.1.1e (NDFC on Nexus Dashboard Release 2.2.1h). For more information on Layer 3 reachability between cluster nodes, see Layer 3 Reachability between Cluster Nodes.
    - L2 vs L3 cluster deployments are not discussed in detail in this paper.
- NDFC can manage the switches in two ways: OOB or IB-management.
    - In-band management (IB) means that you connect to an IP address of the switch via one or more front-panel ports, often through SSH or Telnet. The address you connect to is often a loopback.
    - Out-of-band management (OOB) means that you connect to the mgmt0 interface of the switch, which always has an assigned IP address.
- Switch OOB reachability from NDFC, by default, is via the Nexus Dashboard management interface, so you need to ensure that it is connected to an infrastructure that provides access to the mgmt0 interface(s) of the switches.
    - Note: if desired, you can specify, via configuration, to use the data interface for OOB communication.
- Switch in-band reachability from NDFC must be via the Nexus Dashboard data interface. If switches are managed by NDFC via the switch front-panel port (SVI, loopback or equivalent), it is referred to as In-band management.
- All NDFC application pods use the default route that is associated with the Nexus Dashboard data interface. If desired, you may add static routes on the Nexus Dashboard to force connectivity through the management interface. This is done via the Nexus Dashboard System Settings workflow that is available on the Nexus Dashboard Admin Console.
- Connectivity between the Nexus Dashboard nodes is required on both networks with the following added round trip time (RTT) requirements:

Application	Connectivity	Maximum RTT
Nexus Dashboard Fabric Controller	Between Nodes	50 ms
	To Switches	200 ms

Table 1: NDFC RTT stats

Deployment Modes and Design for LAN Fabrics

The following sections provide information about deployment modes and design for LAN fabrics. The example assumes a Layer 2 ND cluster adjacency, but the general guidelines are also applicable at Layer 3 ND adjacency.

ND node IP assignment

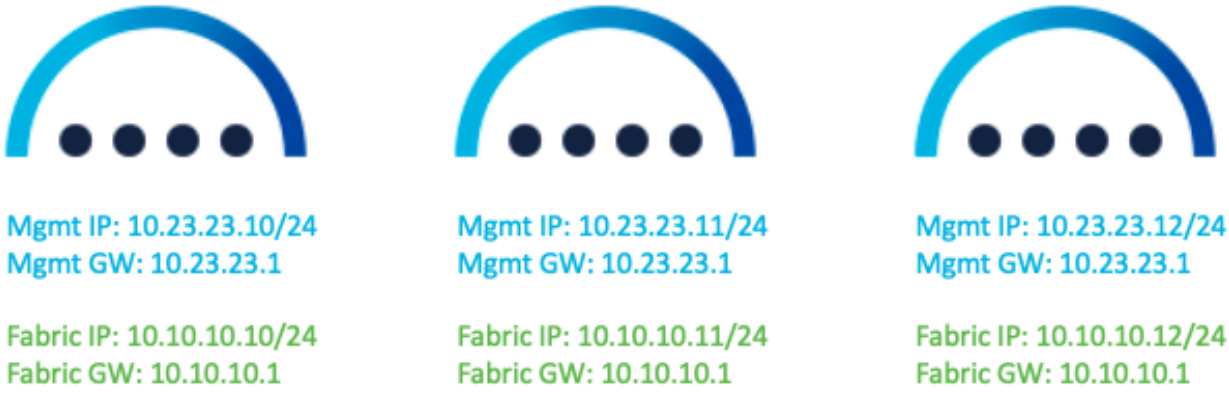


Figure 2: Nexus Dashboard Interface IP Addresses

Deploying NDFC on pND

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.

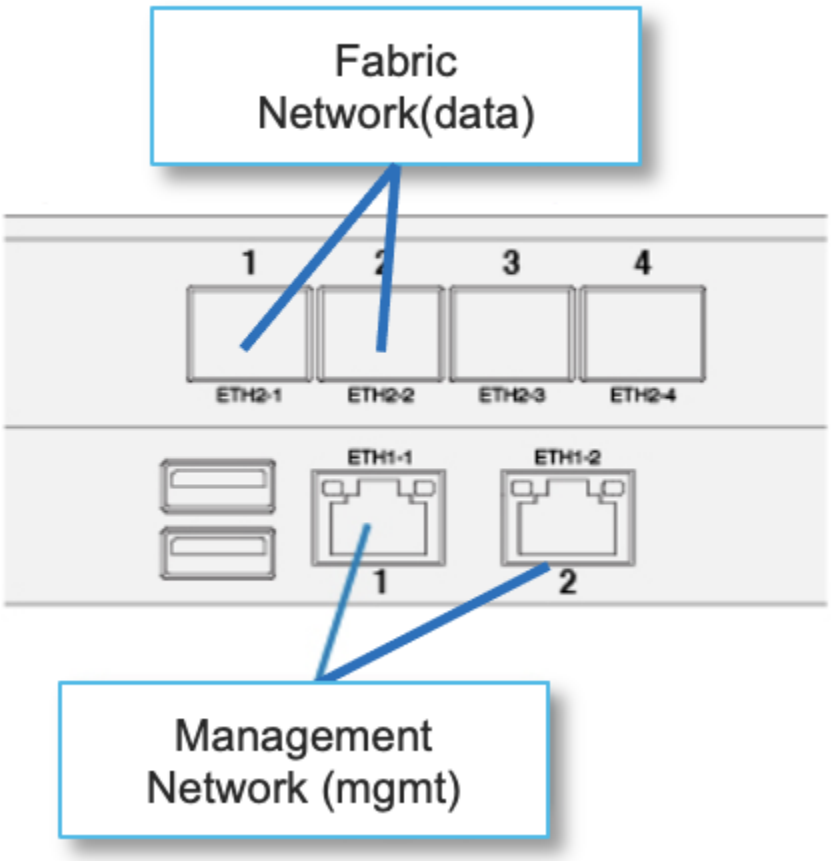


Figure 3: Physical Nexus Dashboard Interface Mapping

The interfaces are configured as Linux bonds—one for the data interfaces and one for the management interfaces—running in active-standby mode. All interfaces must be connected to individual host ports. Port-Channel or vPC links are not supported.

Deployment Model 1

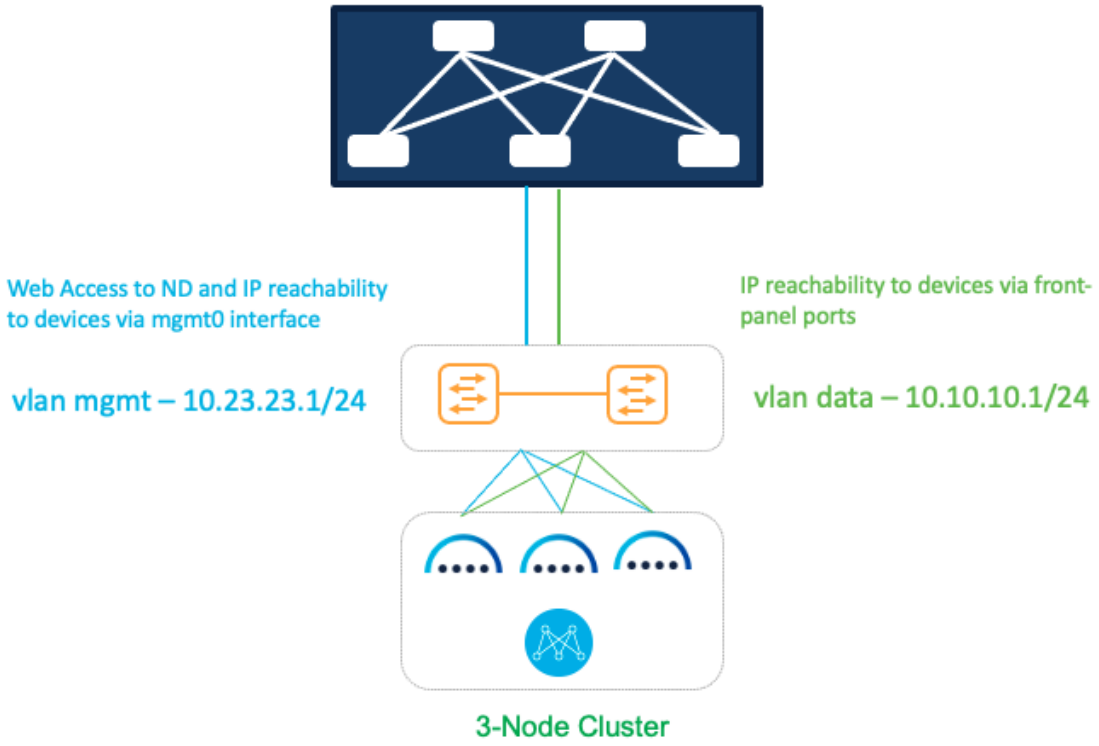


Figure 4: Deploying NDFC on pND Deployment Model 1

In this model, the Nexus Dashboard management and data interfaces are connected to a network infrastructure that provides reachability to the switch's mgmt0 interfaces and front-panel ports. The ND interfaces are connected to a pair of upstream switches in this setup.

Sample Configurations

On both uplink switches (marked as yellow) for Nexus Dashboard management-

```
Interface eth1/1, eth1/3, eth1/5
  switchport mode access
  switchport access vlan 23
```

On both uplink switches (marked as yellow) for Nexus Dashboard fabric-

```
Interface eth1/2,eth1/4,eth1/6
  switchport mode access
  switchport access vlan 10
```

OR

```
Interface eth1/2,eth1/4,eth1/6
  switchport mode trunk
  switchport trunk native vlan 10
```

```
  switchport trunk allowed vlan 10
```

OR

```
Interface eth1/2,eth1/4,eth1/6
  switchport mode trunk
  switchport trunk allowed vlan 10
```

Note for option 3 under “Nexus Dashboard fabric”: if the trunk native VLAN is not specified on the switch, you provide a VLAN tag of VLAN ID 10 during Nexus Dashboard installation and interface bootstrap.

Deployment Model 2

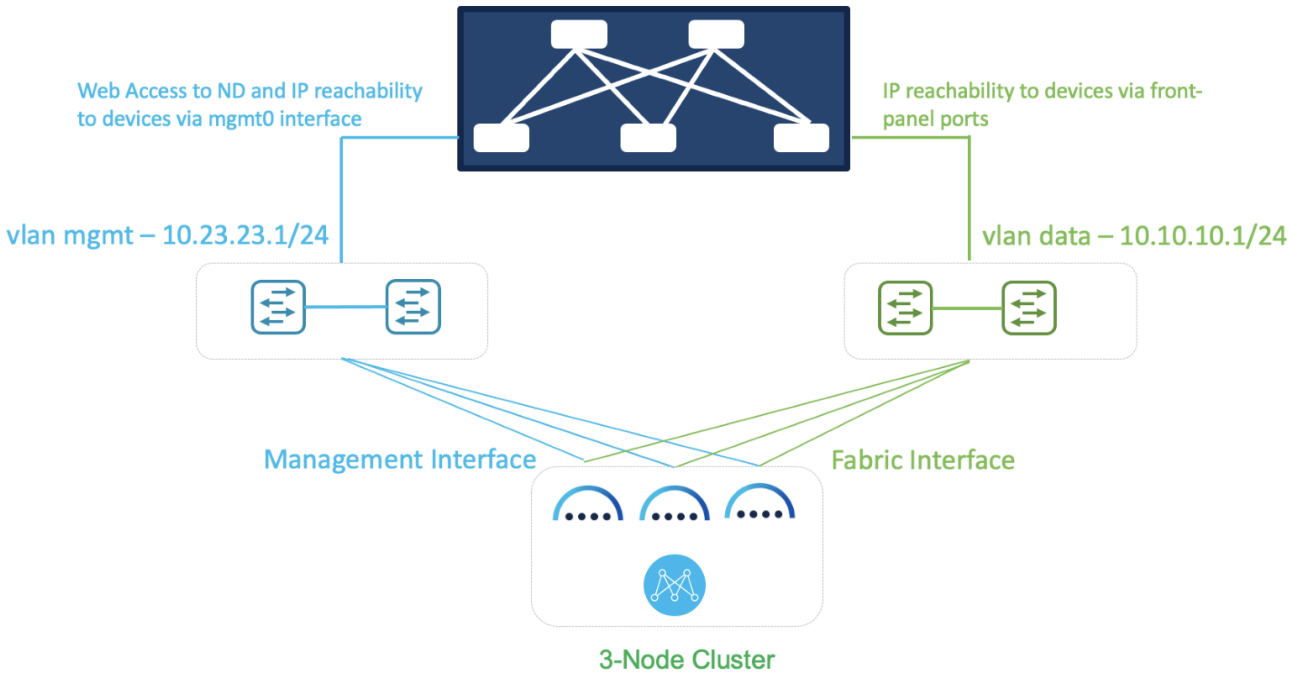


Figure 5: Deploying NDFC on pND Deployment Model 2

In this model, two separate network infrastructures provide access to the switch mgmt0 interfaces and front-panel ports. Consequently, the ND management and data interfaces are connected to those separate networks.

Sample Configurations

On both uplink switches (marked as blue) for Nexus Dashboard management-

```
Interface eth1/1-3
  switchport mode access
  switchport access vlan 23
```

On both uplink switches (marked as green) for Nexus Dashboard fabric-

```
Interface eth1/1-3
  switchport mode access
  switchport access vlan 10
```

OR

```
Interface eth1/1-3
  switchport mode trunk
  switchport trunk native vlan 10
  switchport trunk allowed vlan 10
```

OR

```
Interface eth1/1-3
  switchport mode trunk
  switchport trunk allowed vlan 10
```

Note: For option 3 under “Nexus Dashboard fabric,” without the trunk native VLAN specified on the switch, you must provide a VLAN tag of VLAN ID 10 during Nexus Dashboard installation and interface bootstrap.

Deploying NDFC on vND

A vND node can be deployed as an OVA in ESXi with or without a vCenter.

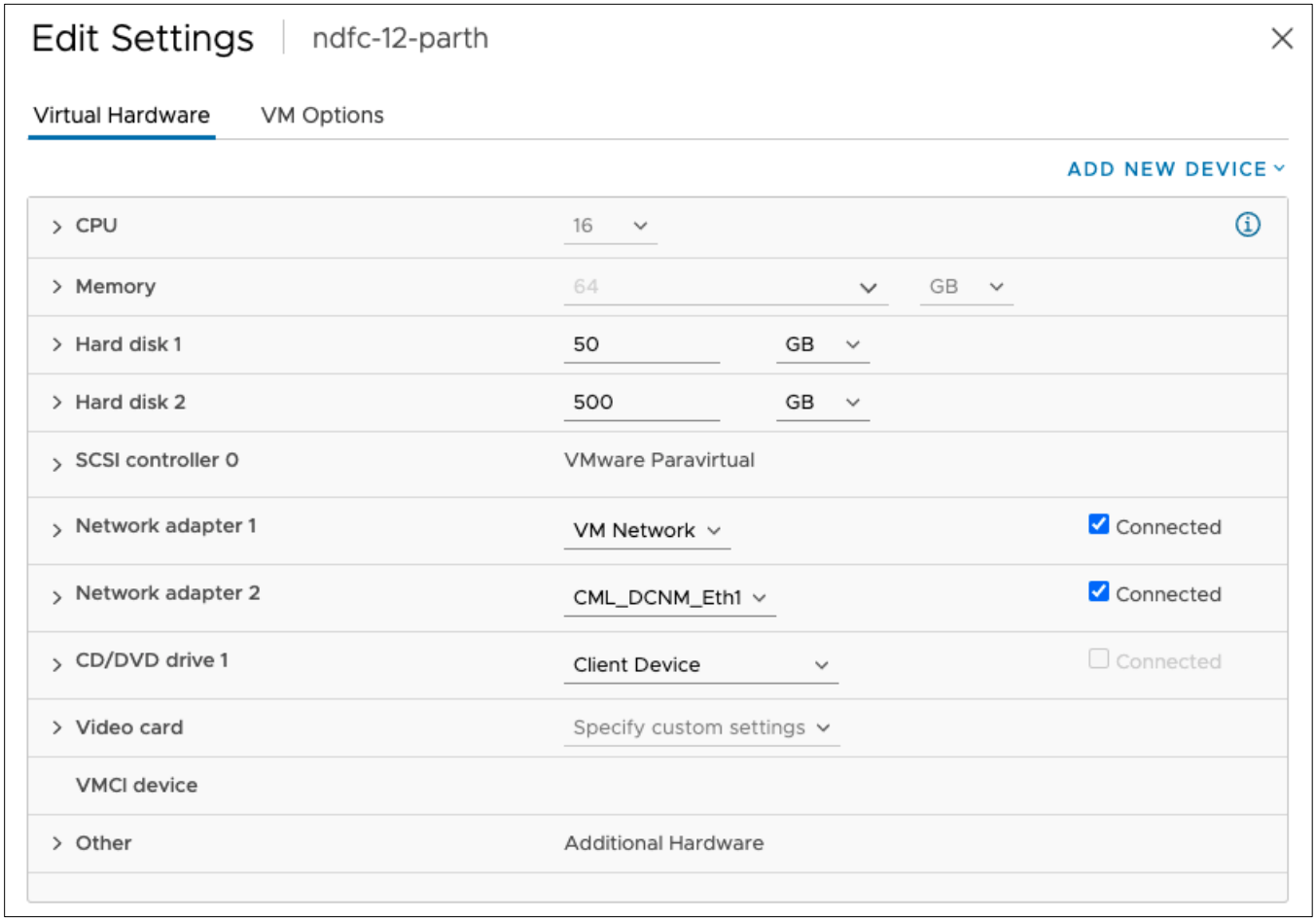


Figure 6: vND VM Settings

Deployment Model 1

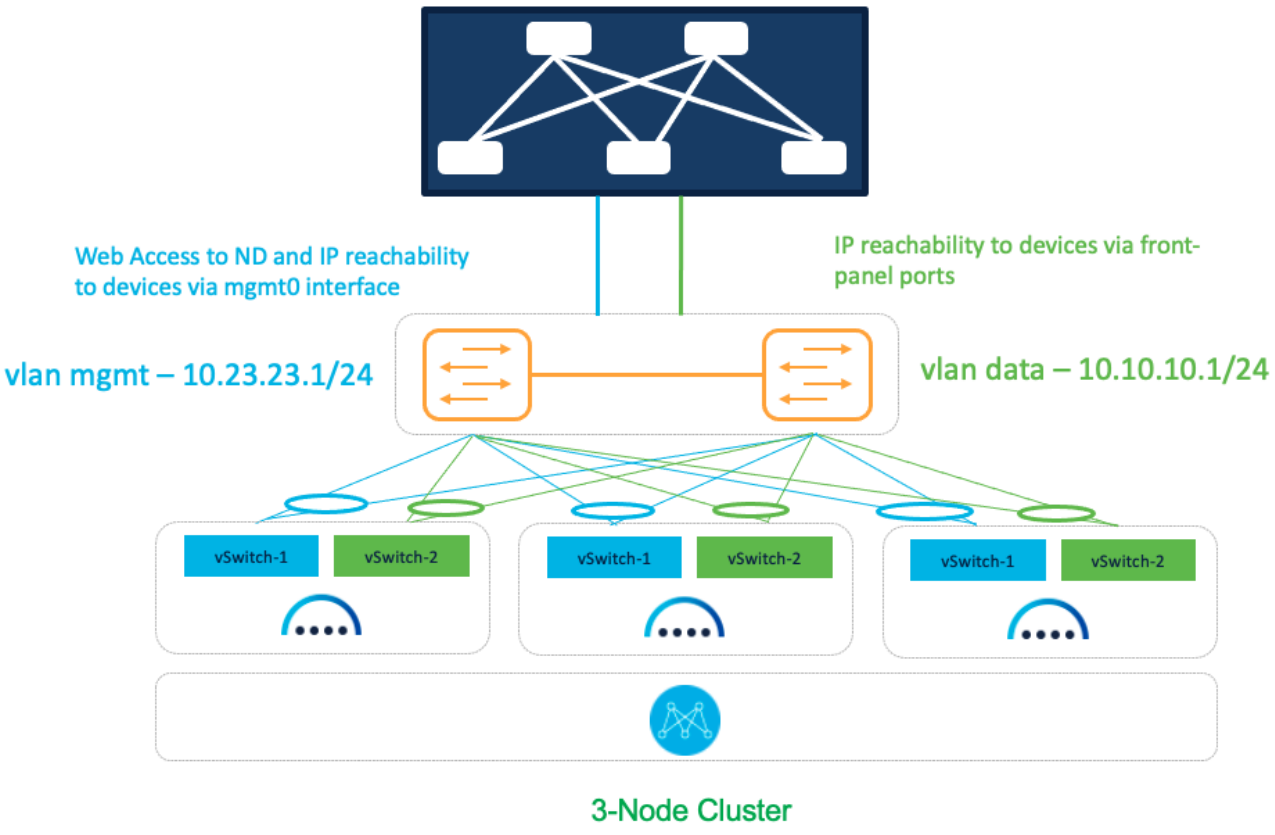


Figure 7: NDFC on vND Deployment Model 1

In this model, we are using a common set of switches that can provide IP reachability to the fabric switches via the Nexus Dashboard management and data interfaces. This infrastructure also uses separate ESXi uplinks for management and data traffic.

Sample Configurations

On both uplink switches (marked as yellow) for Nexus Dashboard management-

```
interface port-channel1
  switchport
  switchport mode trunk
  switchport trunk allowed vlan 23
  spanning-tree port type edge trunk
  mtu 9216
  vpc 1
interface Ethernet1/1
  description To-ESXi-vND1-mgmt
  switchport
  switchport mode trunk
  switchport trunk allowed vlan 23
  mtu 9216
```

```
  channel-group 1 mode active
  no shutdown
```

You must repeat the configuration for the remaining interface(s) attached to the server(s) hosting vND.

On both uplink switches (marked as yellow) for Nexus Dashboard fabric-

```
interface port-channel2
  switchport
  switchport mode trunk
  switchport trunk allowed vlan 10
  spanning-tree port type edge trunk
  mtu 9216
  vpc 2
interface Ethernet1/2
  description To-ESXi-vND1-fabric
  switchport
  switchport mode trunk
  switchport trunk allowed vlan 10
  mtu 9216
  channel-group 2 mode active
  no shutdown
```

You must repeat the configuration for the remaining interface(s) attached to the server(s) hosting vND.

Deployment Model 2

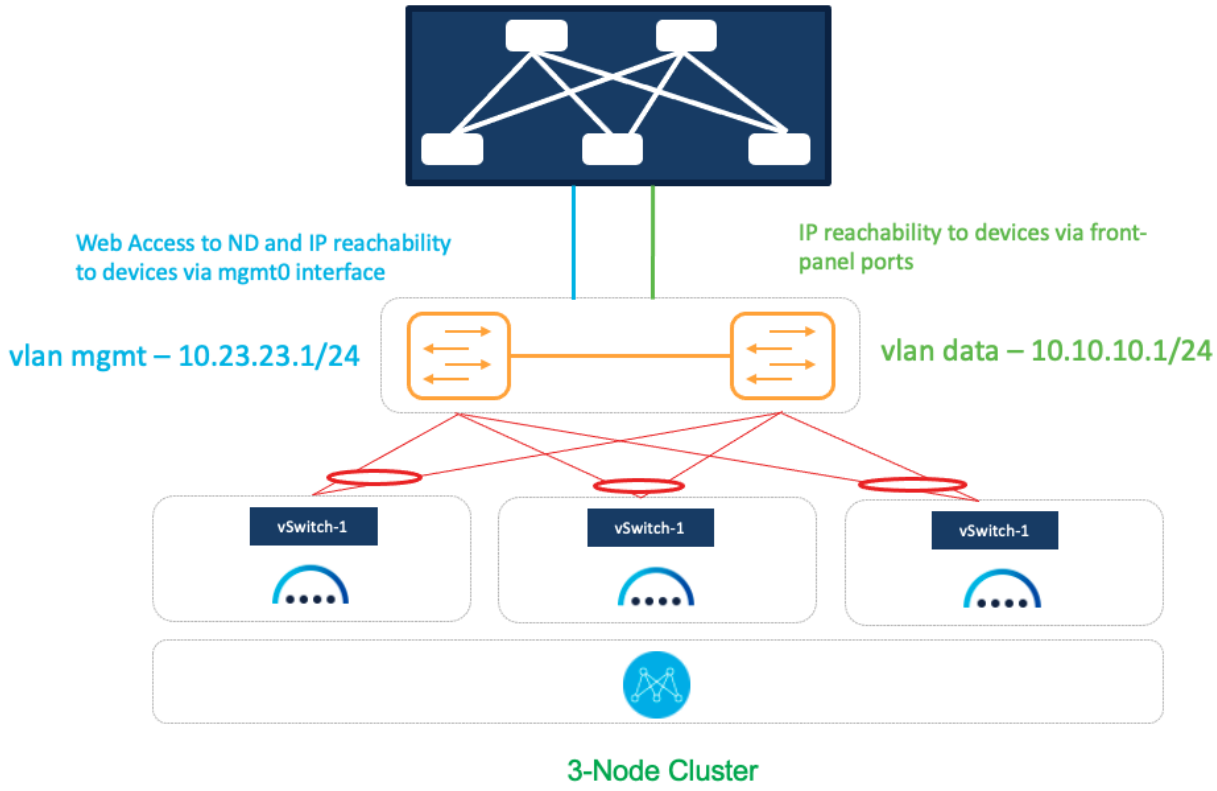


Figure 8: NDFC on vND Deployment Model 2

In this model, we are using a common set of switches that can provide IP reachability to the fabric switches via the Nexus Dashboard management and data interfaces. This infrastructure also uses shared ESXi uplinks for both management and data traffic.

On both uplink switches (marked as yellow) for Nexus Dashboard management and fabric-

```
interface port-channel1
  switchport
  switchport mode trunk
  switchport trunk allowed vlan 23, 10
  spanning-tree port type edge trunk
  mtu 9216
  vpc 1
interface Ethernet1/1
  description To-ESXi-vND1
  switchport
  switchport mode trunk
  switchport trunk allowed vlan 23, 10
  mtu 9216
  channel-group 1 mode active
  no shutdown
```

You must repeat the configuration for the remaining interface(s) attached to the server(s) hosting vND.

Deployment Model 3

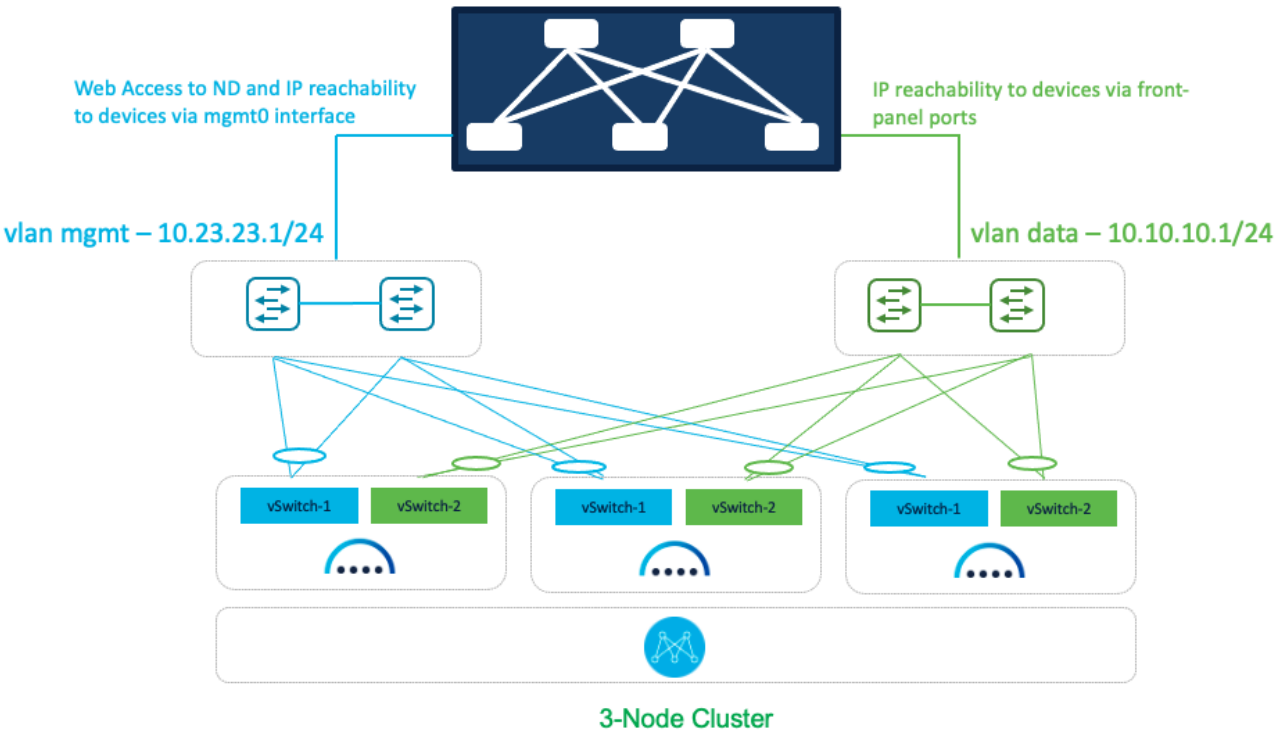


Figure 9: NDFC on vND Deployment Model 3

In this model, a dedicated pair of switches provides IP reachability to the fabric via the Nexus Dashboard management and data interfaces. This infrastructure also uses separate uplinks for management and data traffic.

Sample Configurations

On both uplink switches (marked as blue) for Nexus Dashboard management-

```
interface port-channel1
  switchport
  switchport mode trunk
  switchport trunk allowed vlan 23
  spanning-tree port type edge trunk
  mtu 9216
  vpc 1
interface Ethernet1/1
  description To-ESXi-vND1-mgmt
  switchport
  switchport mode trunk
  switchport trunk allowed vlan 23
  mtu 9216
```

```
  channel-group 1 mode active
  no shutdown
```

You must repeat the configuration for the remaining interface(s) attached to the server(s) hosting vND.

On both uplink switches (marked as green) for Nexus Dashboard fabric-

```
interface port-channel1
  switchport
  switchport mode trunk
  switchport trunk allowed vlan 10
  spanning-tree port type edge trunk
  mtu 9216
  vpc 1
interface Ethernet1/1
  description To-ESXi-vND1-fabric
  switchport
  switchport mode trunk
  switchport trunk allowed vlan 10
  mtu 9216
  channel-group 1 mode active
  no shutdown
```

You must repeat the configuration for the remaining interface(s) attached to the server(s) hosting vND.

Deployment Modes and Design for SAN Fabrics

When NDFC is enabled with the SAN Controller persona selected, the resulting application can then be employed for managing and monitoring SAN Fabrics. This includes the ability to enable SAN Insights for deep analytics via streaming telemetry. SAN fabrics typically comprise the Cisco MDS family of switches that support SAN traffic over the Fibre Channel. Recall that for NDFC SAN Controller deployments, both a single and a 3-node vND/pND deployment are supported. Refer to the NDFC Verified Scalability Guide for more details on the supported scale, especially with SAN Insights.

An important distinction to note about SAN deployments is that, in opposition to LAN and IPFM deployments, SAN management and data networks can be in the same subnet if desired by the user.

Deploying SAN Controller on pND

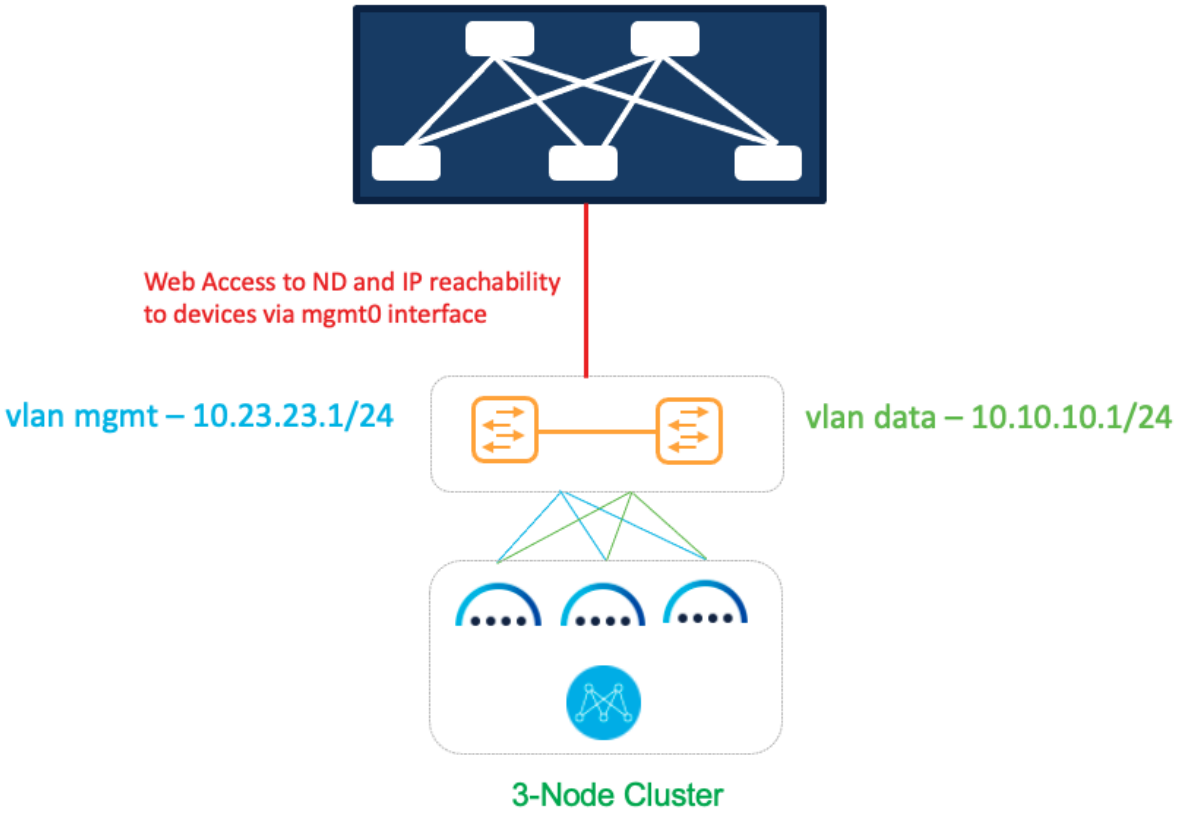


Figure 10: Deploying SAN Controller on pND

In this option, we are using a common set of switches that can provide IP reachability to fabric switches via the Nexus Dashboard management or data interfaces.

Sample configurations

On both uplink switches (marked as yellow) for Nexus Dashboard management-

```
Interface eth1/1, eth1/3, eth1/5
  switchport mode access
  switchport access 23
```

On both uplink switches (marked as yellow) for Nexus Dashboard fabric-

```
Interface eth1/2,eth1/4,eth1/6
  switchport mode access
  switchport access vlan 10
```

OR

```
Interface eth1/2,eth1/4,eth1/6
  switchport mode trunk
  switchport trunk native vlan 10
  switchport trunk allowed vlan 10
```

OR

```
Interface eth1/2,eth1/4,eth1/6
```

```
  switchport mode trunk
  switchport trunk allowed vlan 10
```

For the last option without the trunk native VLAN, provide VLAN ID 10 as the VLAN tag during Nexus Dashboard installation and interface bootstrap (as shown in Figure 3) from the Networking Requirements section.

Deploying SAN Controller on vND

Deployment Option 1

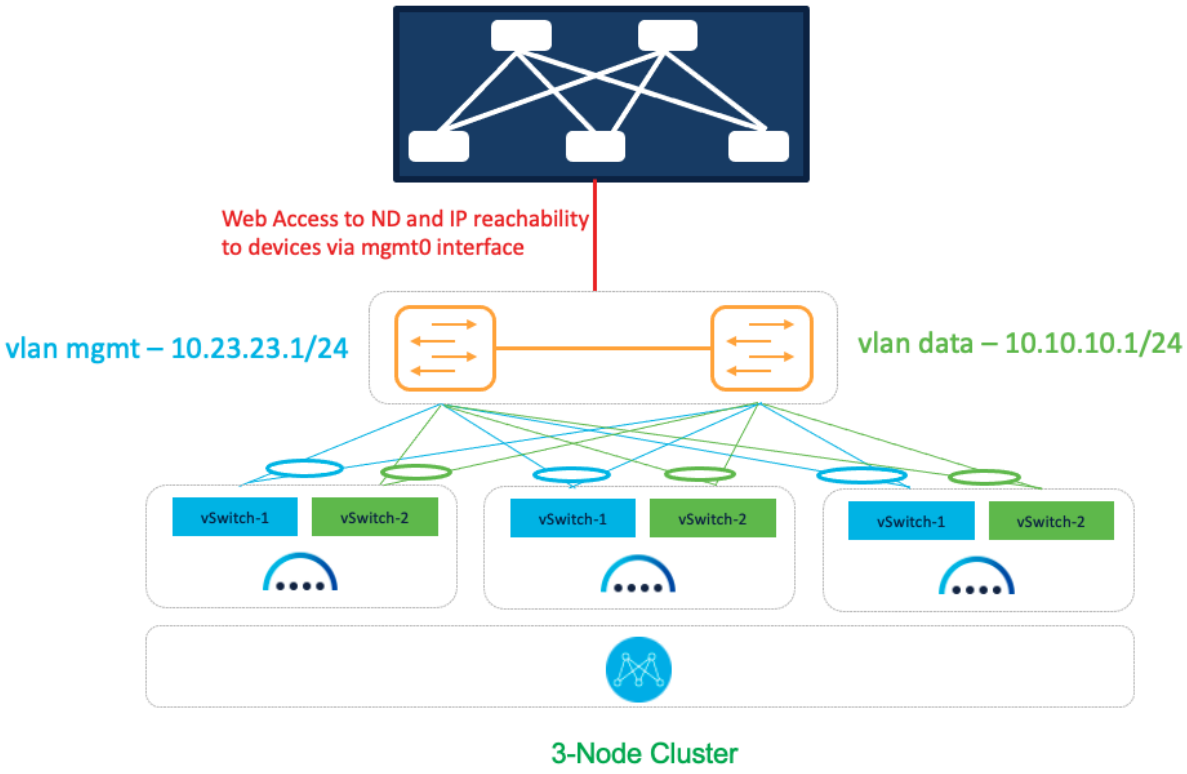


Figure 11: SAN Controller on vND Deployment Option 1

In this option, we are using a common set of switches that can provide IP reachability to the fabric switches via the Nexus Dashboard management or data interfaces. It also uses separate uplinks for management and data traffic.

Sample Configurations

On both uplink switches (marked as yellow) for Nexus Dashboard management-

```
interface port-channel1
  switchport
  switchport mode trunk
  switchport trunk allowed vlan 23
  spanning-tree port type edge trunk
  mtu 9216
  vpc 1
interface Ethernet1/1
```

```
  description To-ESXi-vND1-mgmt
  switchport
  switchport mode trunk
  switchport trunk allowed vlan 23
  mtu 9216
  channel-group 1 mode on
  no shutdown
```

You must repeat the configuration for the remaining interfaces that are attached to servers hosting vND.

On both uplink switches (marked as yellow) for Nexus Dashboard fabric-

```
interface port-channel2
  switchport
  switchport mode trunk
  switchport trunk allowed vlan 10
  spanning-tree port type edge trunk
  mtu 9216
  vpc 2
interface Ethernet1/2
  description To-ESXi-vND1-fabric
  switchport
  switchport mode trunk
  switchport trunk allowed vlan 10
  mtu 9216
  channel-group 2 mode on
  no shutdown
```

You must repeat the configuration for the remaining interfaces that are attached to servers hosting vND.

Deployment Option 2

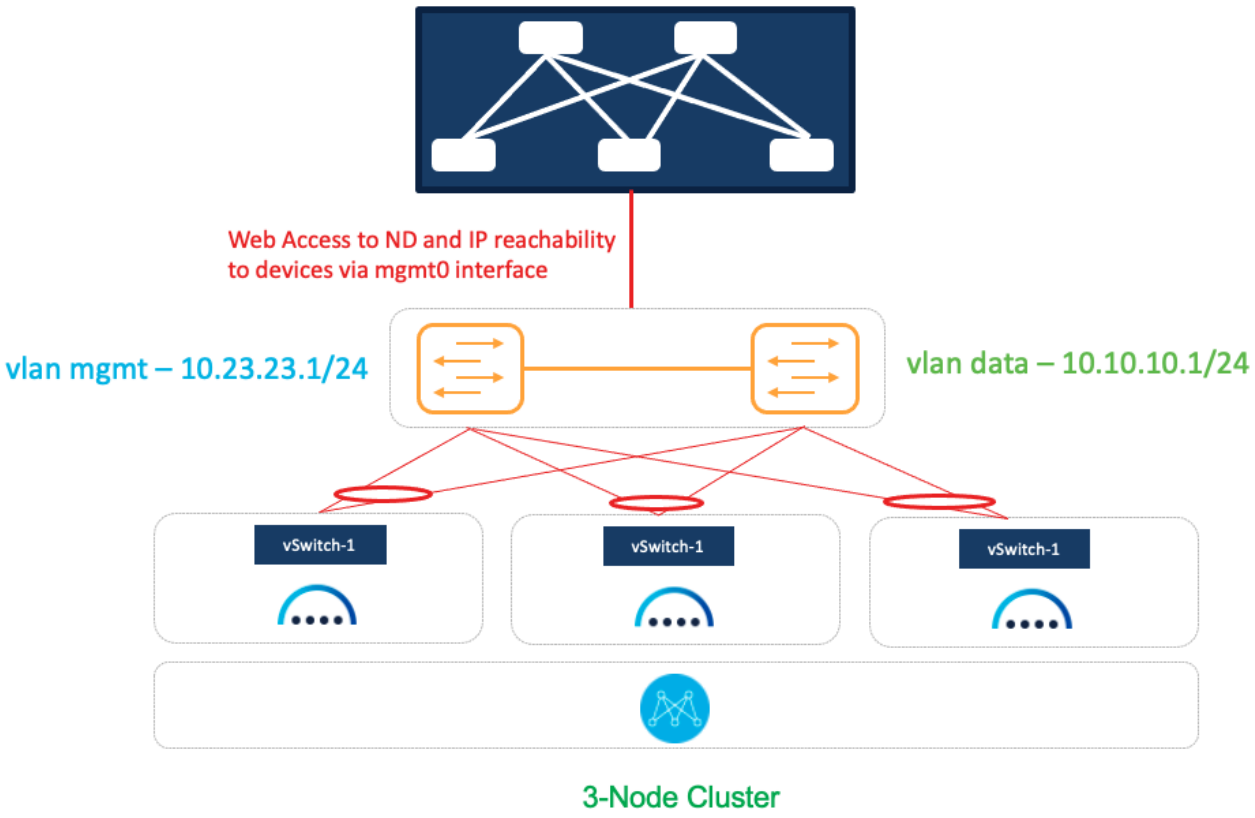


Figure 12: SAN Controller on vND Deployment Option 2

In this option, we are using a common set of switches that can provide IP reachability to fabric switches via the Nexus Dashboard management or data interfaces. It also uses shared uplinks for both management and data traffic.

On both uplink switches (marked as yellow) for Nexus Dashboard management and fabric-

```
interface port-channel1
  switchport
  switchport mode trunk
  switchport trunk allowed vlan 23, 10
  spanning-tree port type edge trunk
  mtu 9216
  vpc 1
interface Ethernet1/1
  description To-ESXi-vND1
  switchport
  switchport mode trunk
  switchport trunk allowed vlan 23, 10
  mtu 9216
  channel-group 1 mode on
  no shutdown
```

You must repeat the configuration for the remaining interfaces that are attached to servers hosting vND.

Deployment Mode Options:

The NDFC 12.1.3b release introduces IPv6-only deployment and management capability for the cluster nodes and services. This release also continues to support dual-stack deployment and management.

When defining IP deployment guidelines, it is important to note that all nodes/networks in the cluster MUST have uniform IP configuration—that is, pure IPv4, pure IPv6, or dual-stack IPv4/IPv6. Additionally, the deployment mode MUST be set at the time of initial Nexus Dashboard configuration. If you want to change the deployment mode at any point in time after initial deployment, a clean install is required.

To access NDFC, first deploy Nexus Dashboard, either on pND or vND (as demonstrated above). Once the individual nodes have been configured, navigate to the node's management IP address to access the cluster configuration user interface.

- Example: if your management IP is 192.168.10.3/24 (with a default gateway of 192.168.10.1), use https://192.168.10.3.
- If you are configuring a 3-node cluster, you can navigate to any of the three management IPs you have configured—you will import the others into the fabric during cluster configuration.

This section covers how to specify the deployment mode (IPv4, IPv6 or dual stack) after you've deployed all nodes and have loaded the cluster configuration user interface. For further information on general Nexus Dashboard installation, refer to the Nexus Dashboard deployment guide.

For all deployment models, the following information is required on the "Cluster details" page:

- NTP Host
- DNS Provider IP Address
- Proxy server
- Note: the NTP host and DNS provider IP address must be in the same deployment mode as the management and data addresses—that is, IPv4 for pure IPv4 or IPv6 for pure IPv6. For dual stack deployments, you can pick which mode you would like to use for NTP and DNS.

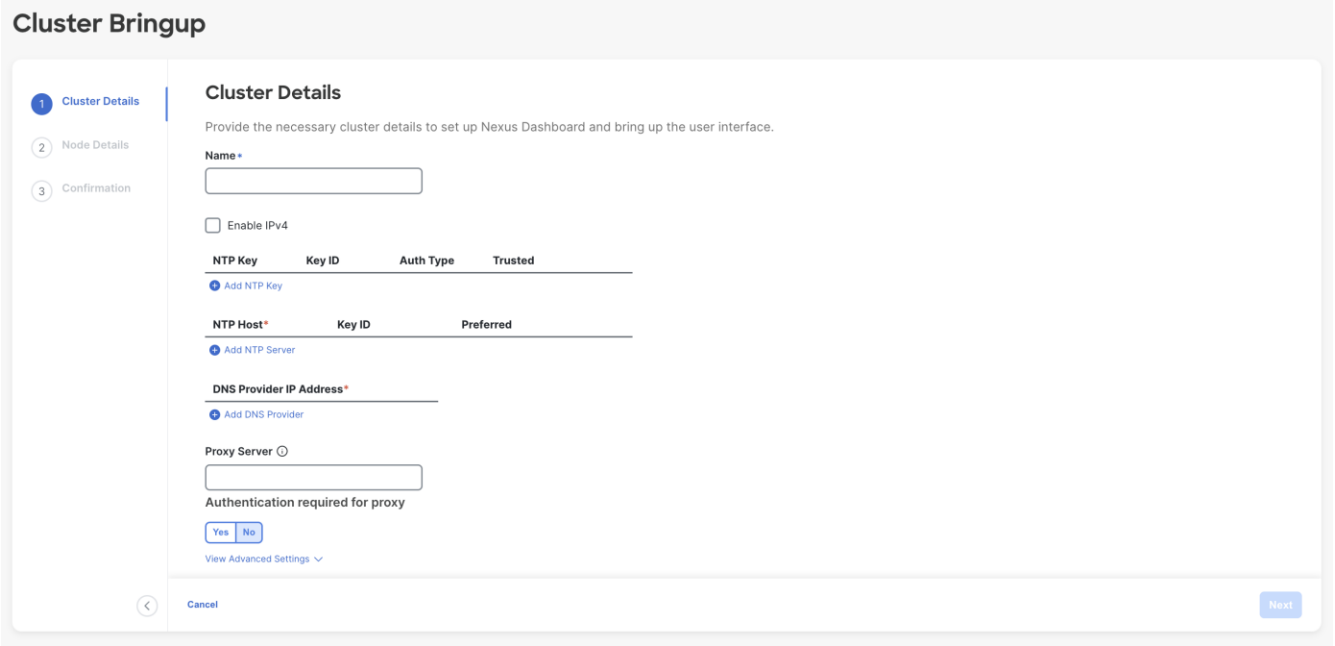
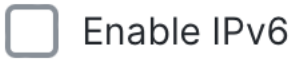
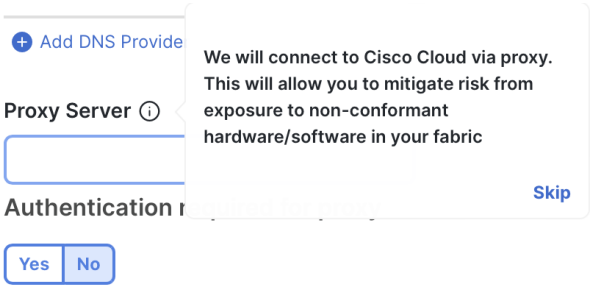


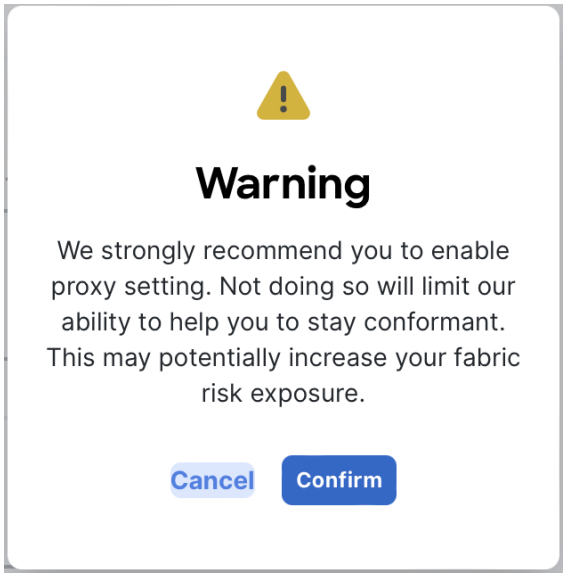
Figure 13: Nexus Dashboard Web Installer– Cluster Details UI

- In the above environment, the initial management IPs were IPv6 addresses—therefore, you have the option to “Enable IPv4” (which would create a dual-stack environment).
  - Note: if your initial configuration was in IPv4, you have the option to “Enable IPv6” for dual-stack.



- To skip proxy server configuration, click the encircled “i” icon next to “Proxy server” and select “skip.” A warning comes up that you can either “confirm” or “cancel.”





- Note: It is best practice to configure a proxy, if one is available.

Pure IPv4

To deploy a pure IPv4 NDFC configuration, use IPv4 management addresses in the initial Nexus Dashboard node creation process.

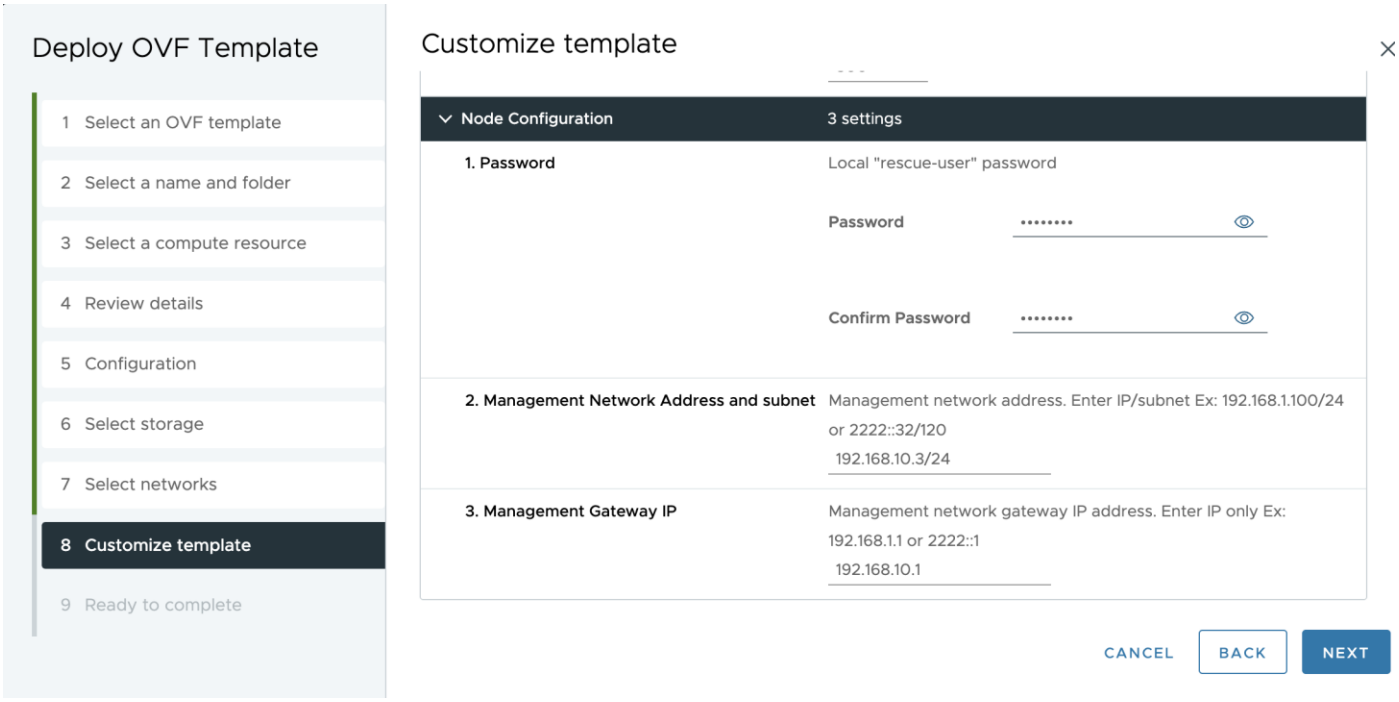


Figure 14: Nexus Dashboard vND IPv4 Deployment

Then, when you access the Cluster Bringup section, do not check “Enable IPv6.” Instead, for a 3-node cluster, follow these steps:

- Input the NTP, DNS, and proxy information as described in the previous section. Do not enable IPv6. Click “Next.” NTP and DNS addresses should be IPv4.
- Configure the Nexus Dashboard data interface of your ND node by clicking the “**Edit**” (pen icon) button.
- Enter the Nexus Dashboard data network and default gateway for IP access to NDFC in-band management.
    - If connected via a trunk interface, also include the VLAN ID.

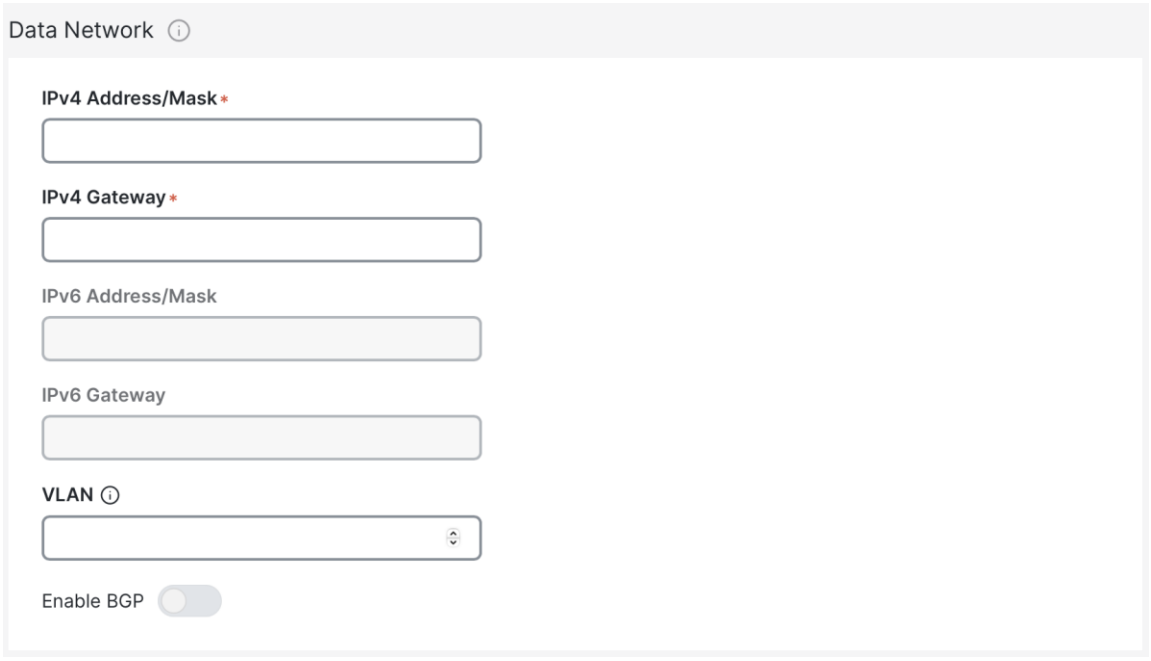
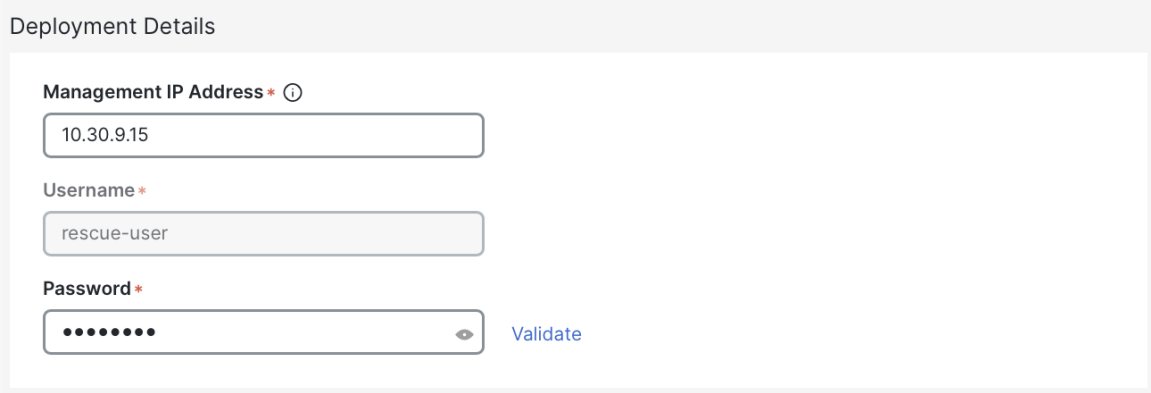
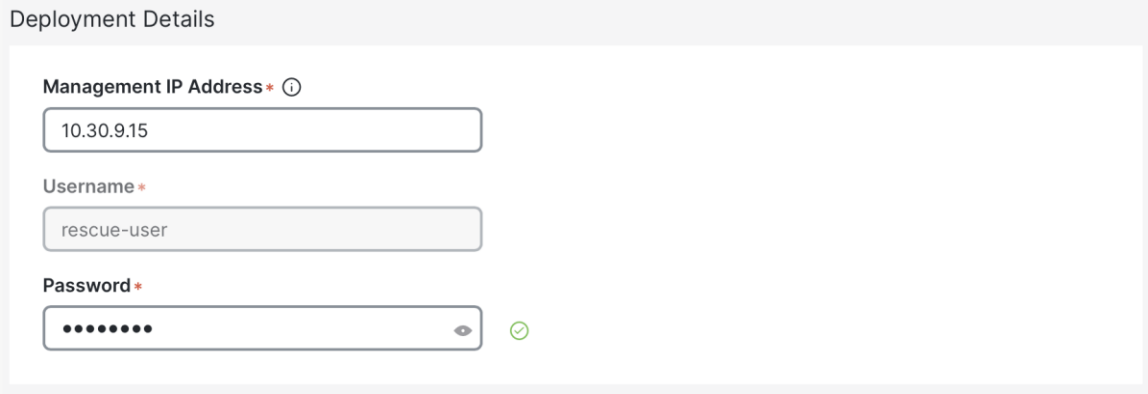


Figure 15: Nexus Dashboard Web Installer– Data Network UI in Cluster Details

- Input the other nodes in the fabric (if configuring a 3-node):
    - Select the “Add Node” option.
    - Under “Deployment Details,” input the management IP address and password that you configured when initially deploying node 2 of your 3-node cluster. Validate the information.



- If the information is validated, a green checkmark appears in place of “validate,” and the management network IP/mask and default gateway you configured are imported directly.



- Add the data network IP/mask and gateway, as with the previous node.
- Repeat the above steps for node 3.
- When all nodes have been added (as in the sample screenshot below), click “Next” to review the information and “Configure” to start the bootstrap.

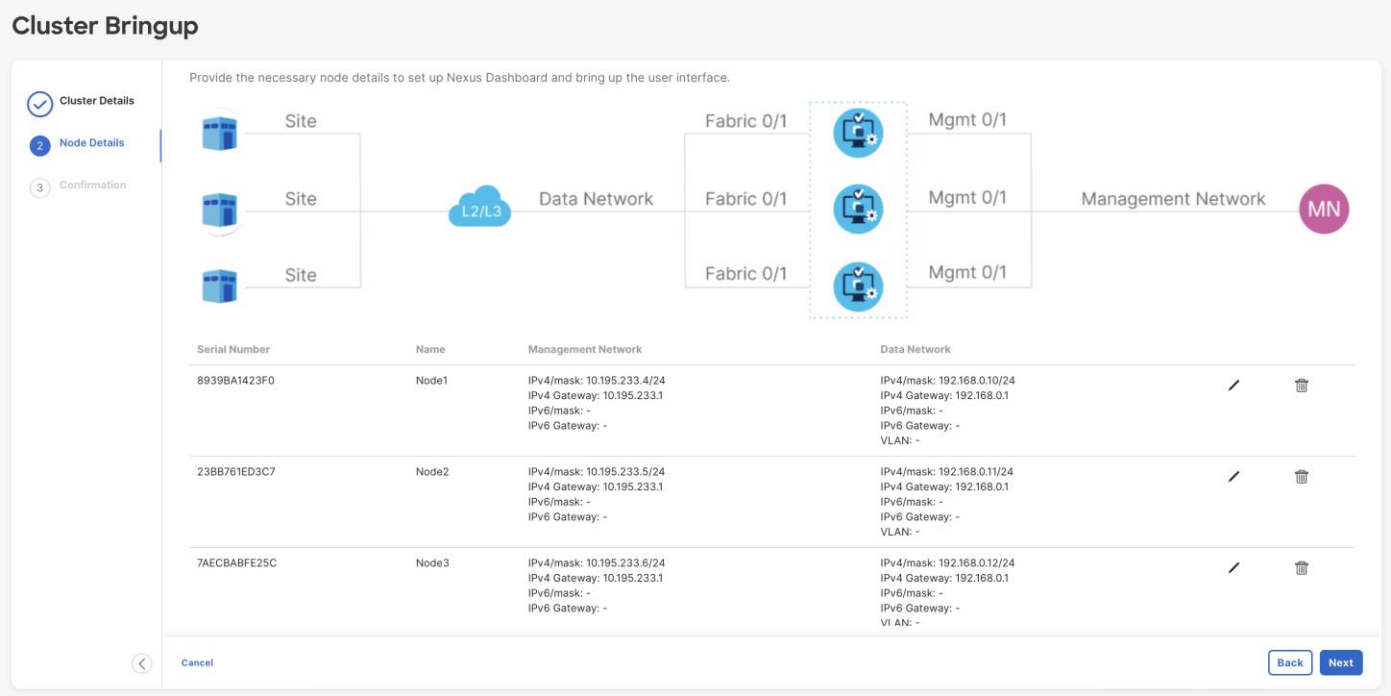


Figure 16: Nexus Dashboard Web Installer– 3-Node Cluster

Figure 1. Nexus Dashboard Web Installer–3-Node Cluster

Dual-Stack

Dual-stack means that both IPv4-based and IPv6-based fabrics are supported in the network. This can be enabled on both pND and vND. All core services including authentication domains, DNS, NTP, and PTP are usable in dual-stack mode.

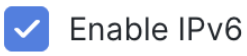
As mentioned above, note that dual-stack cannot be implemented through an upgrade. If your environment has either a pure IPv4 or pure IPv6 configuration already deployed, you will have to do a clean install and enable both deployment models during the initial cluster configuration.

During initial node bring-up, you can configure either IPv4 or IPv6 addresses for the nodes' management network, but you MUST provide both types of IPs during the cluster bootstrap workflow. Mixed configurations, such as an IPv4 data network and dual-stack management network, are not supported.

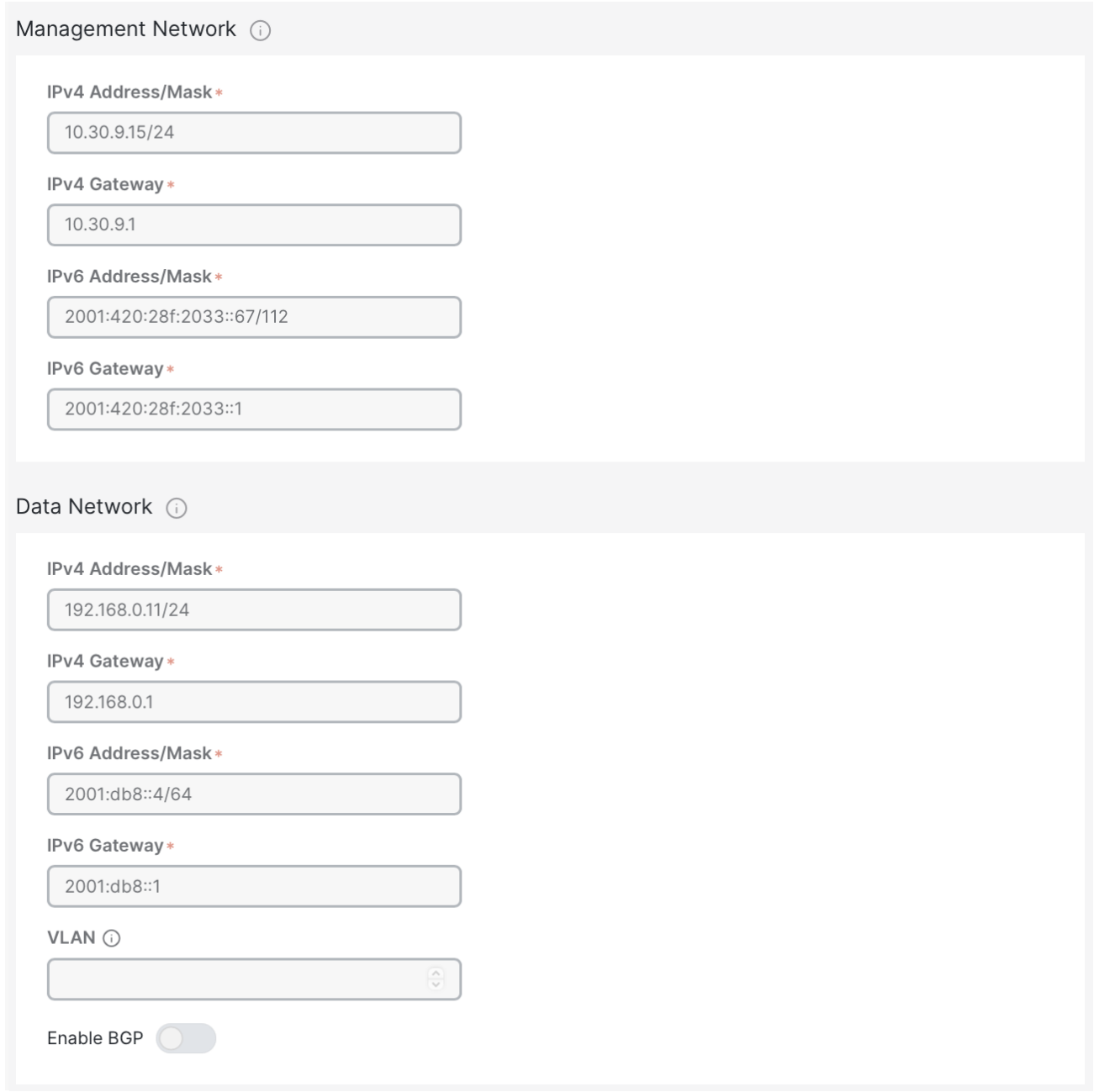
- Note: regardless of whether you choose to initially provide an IPv4 or IPv6 management IP address, you will use this address to access the cluster bootstrap workflow. Once the system has bootstrapped, Nexus Dashboard will be accessible through both the IPv4 and/or IPv6 management IP address(es).

Full configuration steps are below, assuming an initial IPv4 setup and an "Enable IPv6" selection option:

- Input the NTP, DNS, and proxy info as described in the previous section. NTP and DNS addresses can be either IPv4 or IPv6.
- Click “Enable IPv6” (or “Enable IPv4,” if your initial configuration was in IPv6) to deploy as dual stack. The wording for this option will depend on what kind of address you used for the initial management IP(s).



- Configure the Nexus Dashboard data interface by clicking the “**Edit**” (pen icon) button.
- Under “Management Network,” input the required IPv4 and IPv6 address/masks and default gateways.
- Under “Data Network,” input the required IPv4 and IPv6 address/masks and default gateways.



- If connected via a trunk interface, also include the VLAN ID.

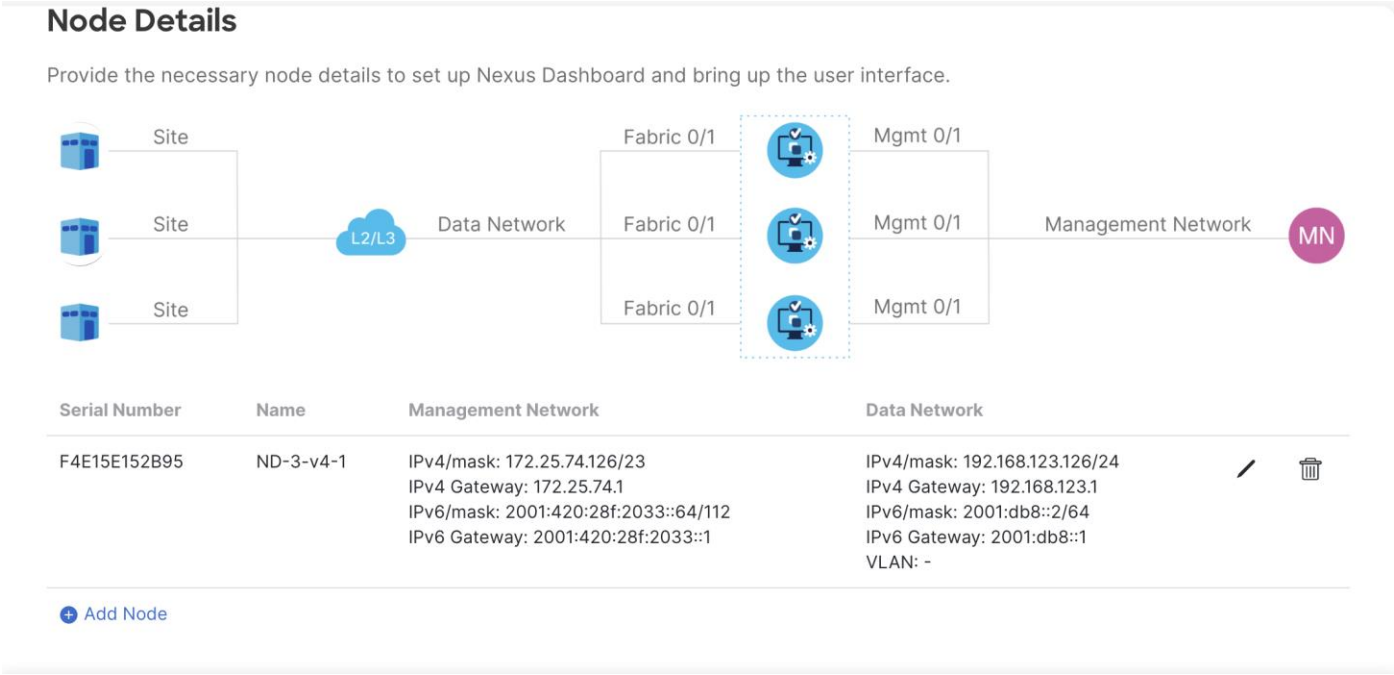
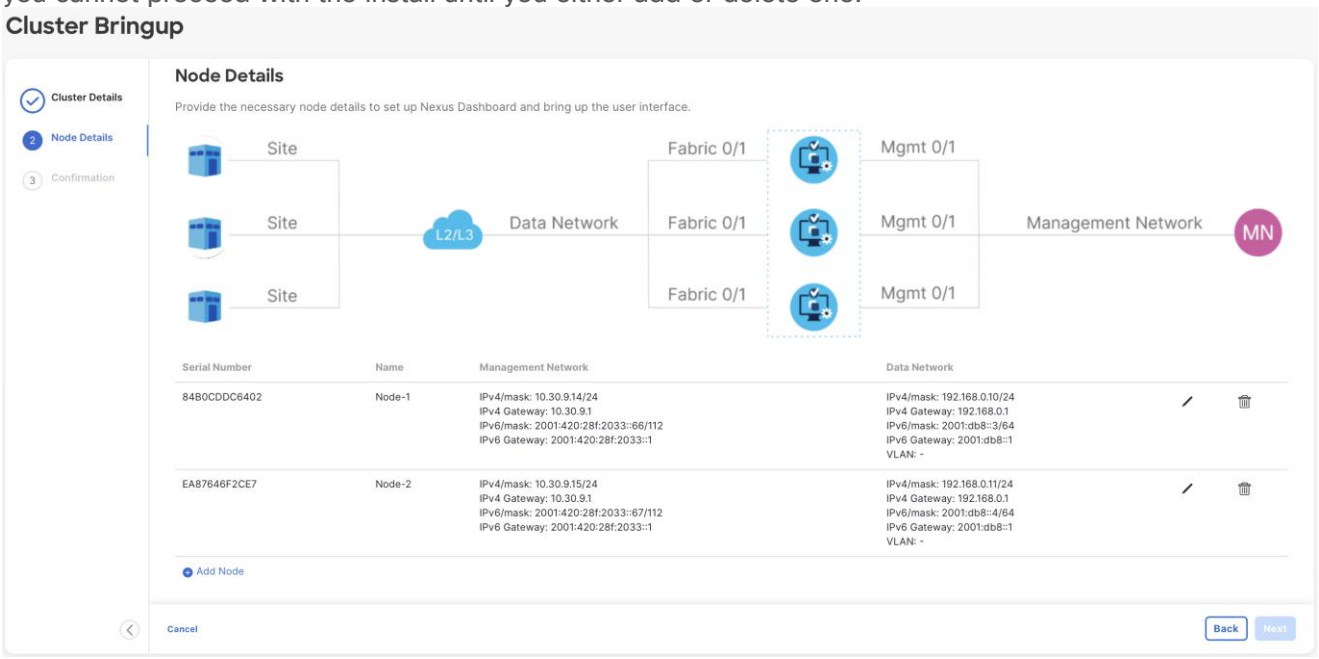


Figure 17: Nexus Dashboard Web Installer– Dual-Stack 1-Node Cluster

- Input the other fabric nodes, using the same steps as above with the following additions:
    - Select the “Add Node” option.
    - Under “deployment details,” use the management IP address and password you configured when initially deploying node 2 of your 3-node cluster. Validate this information.
    - After the management IP has been auto-populated, input the IPv6 address/mask and default gateway.
    - Under “Data Network,” input both an IPv4 and IPv6 address/mask and default gateways.
    - Repeat the above steps for node 3.
    - When all nodes have been added, click “Next” to review the information and “Configure” to start the bootstrap.

- Note: if you make a mistake during your initial configuration, you must re-validate the management IP and password. Click the “**Edit**” (pen icon) button on the node that you want to amend, input the management IP and password, and re-validate for full edit access.

- Note: you can only deploy Nexus Dashboard as a 1- or 3-node cluster. If you deploy two nodes, you cannot proceed with the install until you either add or delete one.



Pure IPv6

IPv6 deployments are supported on physical and virtual form-factors. When initially configuring the node(s), IPv6 management IP address(es) (and default gateway(s)) must be supplied. Once the nodes are up, these are the addresses that are used to log into the UI and continue the cluster bootstrap process. IPv6 addresses are also required for the data network and gateway, as well as NTP and DNS.

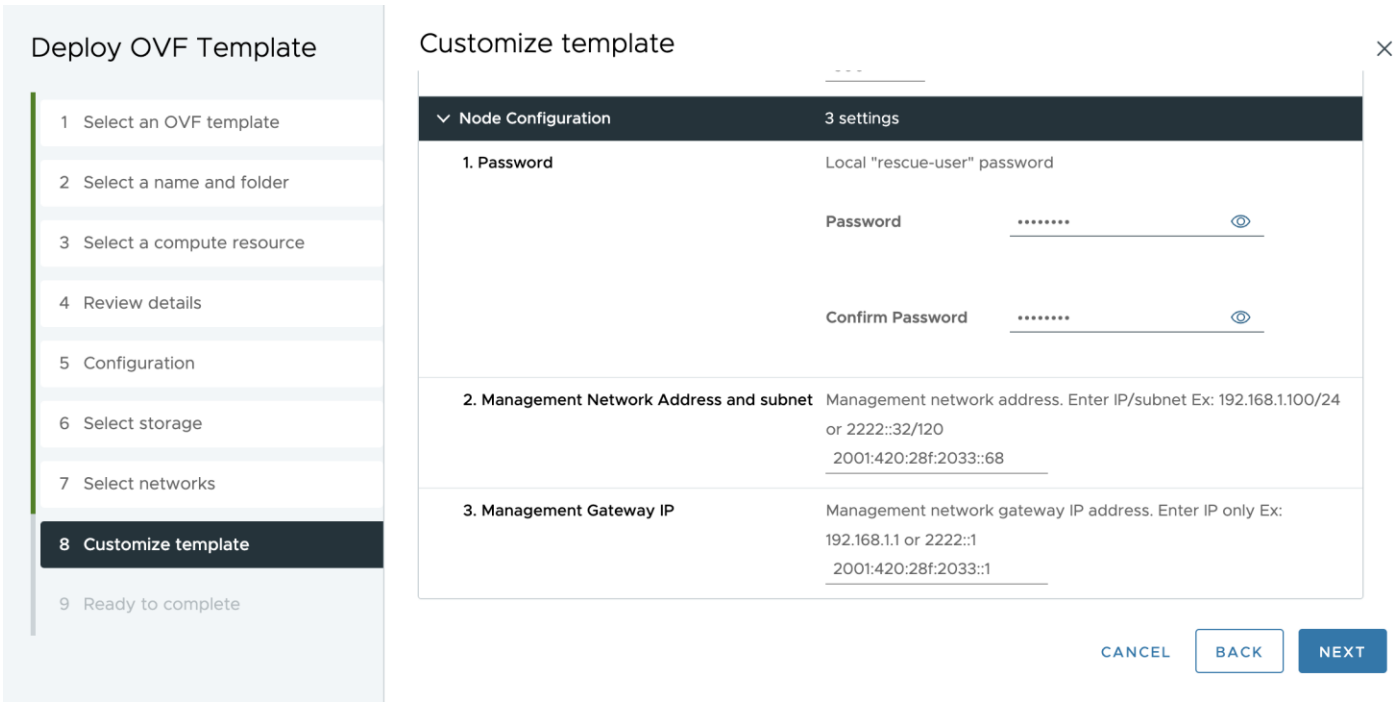


Figure 18: Nexus Dashboard vND IPv6 Deployment

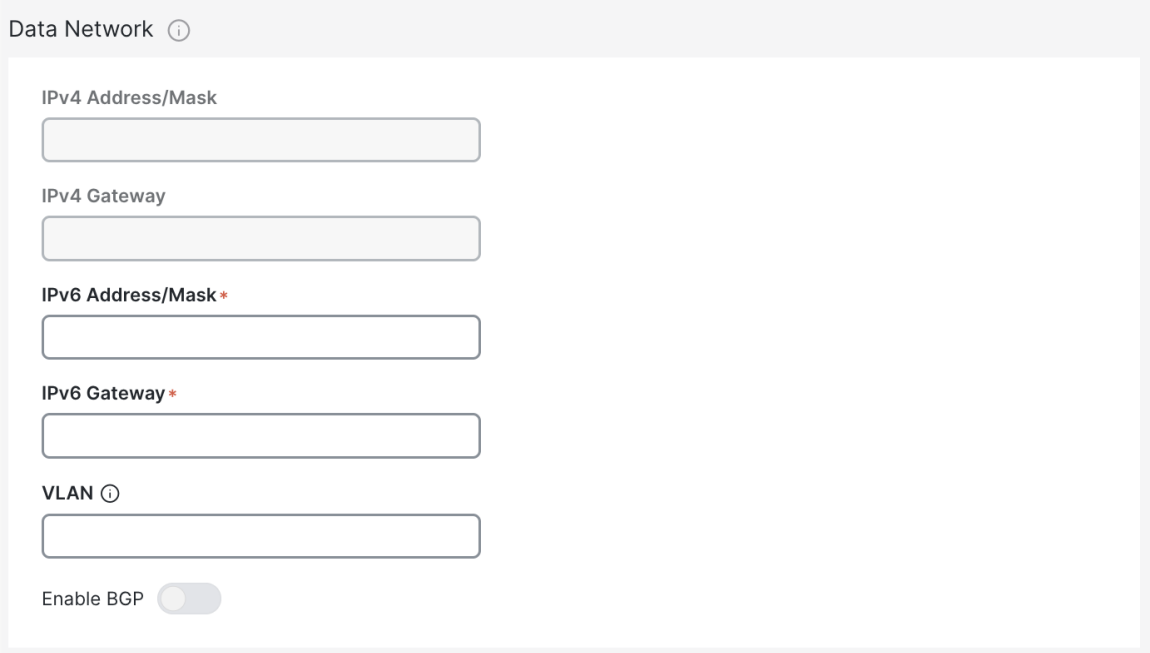
Note that during the cluster bootstrap process, you will see an option to enable IPv4—if you select to do so, your configuration will be dual-stack. If you do not enable IPv4, the system works in pure IPv6 mode.

As mentioned above regarding dual-stack, once the ND cluster has been deployed, the operational mode cannot be changed. If you would like to enable dual-stack, a new cluster deployment is required.

Full configuration steps are below:

- Input the NTP, DNS, and proxy info as described in the previous section. NTP and DNS addresses should be IPv6. Do not enable IPv4.
- Configure the Nexus Dashboard data interface by clicking the “**Edit**” (pen icon) button.
- Under “Data Network,” input the IPv6 address/mask and default gateway.

- If connected via a trunk interface, also include the VLAN ID.



- Input the other fabric nodes, using the same steps as above with the following changes:
    - Select the “Add Node” option.
    - Under “deployment details,” use the management IP address and password that you configured when initially deploying node 2 of your 3-node cluster. Validate this information.
    - If validated, the management network IP/mask and default gateway that you configured are imported directly.
    - Under “Data Network,” input the IPv6 address/mask and default gateway, as with the previous node.
    - Repeat the above steps for node 3.

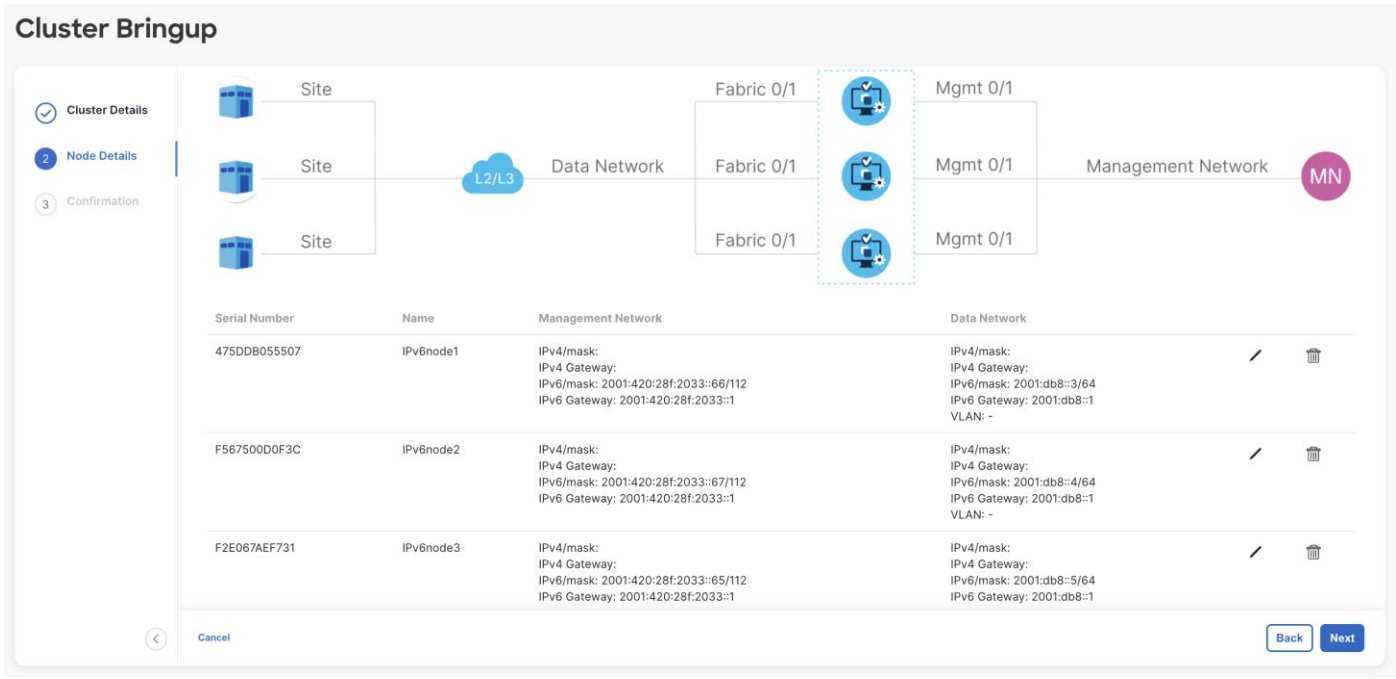


Figure 19: Nexus Dashboard Web Installer– IPv6 3-Node Cluster

- When all nodes have been added (as in the sample screenshot above), click “Next” to review the information and “Configure” to start the bootstrap (as in the screenshot below).

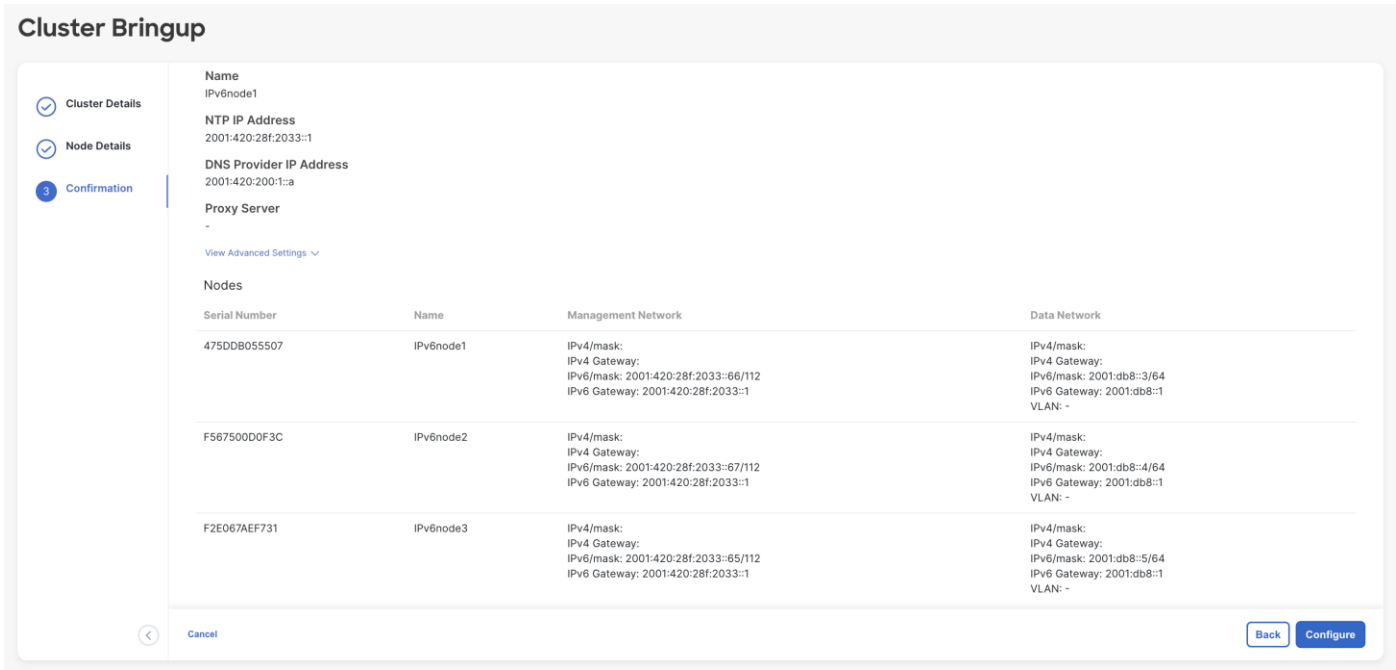


Figure 20: Nexus Dashboard Web Installer– IPv6 3-Node Cluster

Installing NDFC on ND:

When you load Nexus Dashboard for the first time after bootstrapping, you see the “Journey: Getting Started” page. You have the option to install NDFC during step 5, “Manage Services.” Alternatively, you can navigate directly to this option by going to “**Operate > Sites > App Store**.”

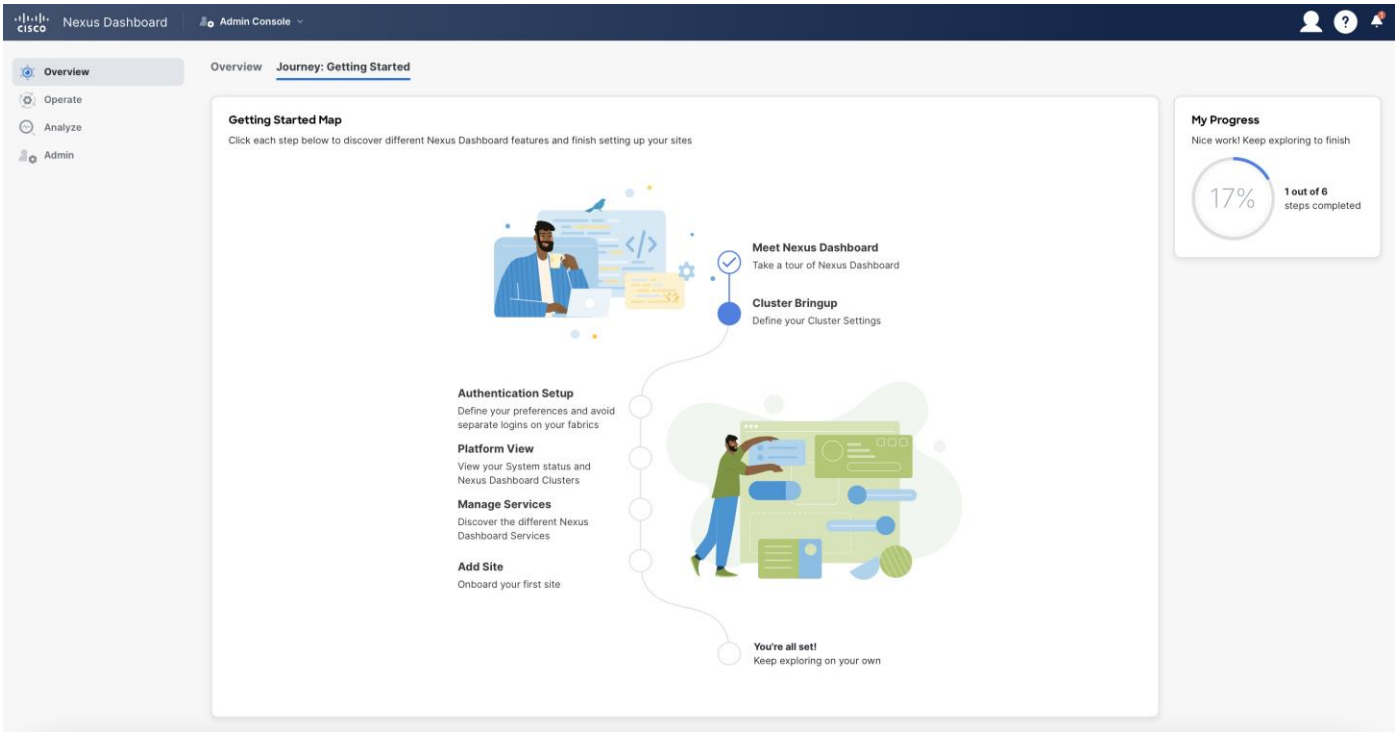


Figure 21: Nexus Dashboard Journey

The App Store gives you six service options to install on top of your Nexus Dashboard cluster. When you click “Install,” a pop-up terms and conditions window comes up. Once you accept the terms and

conditions, the download begins.

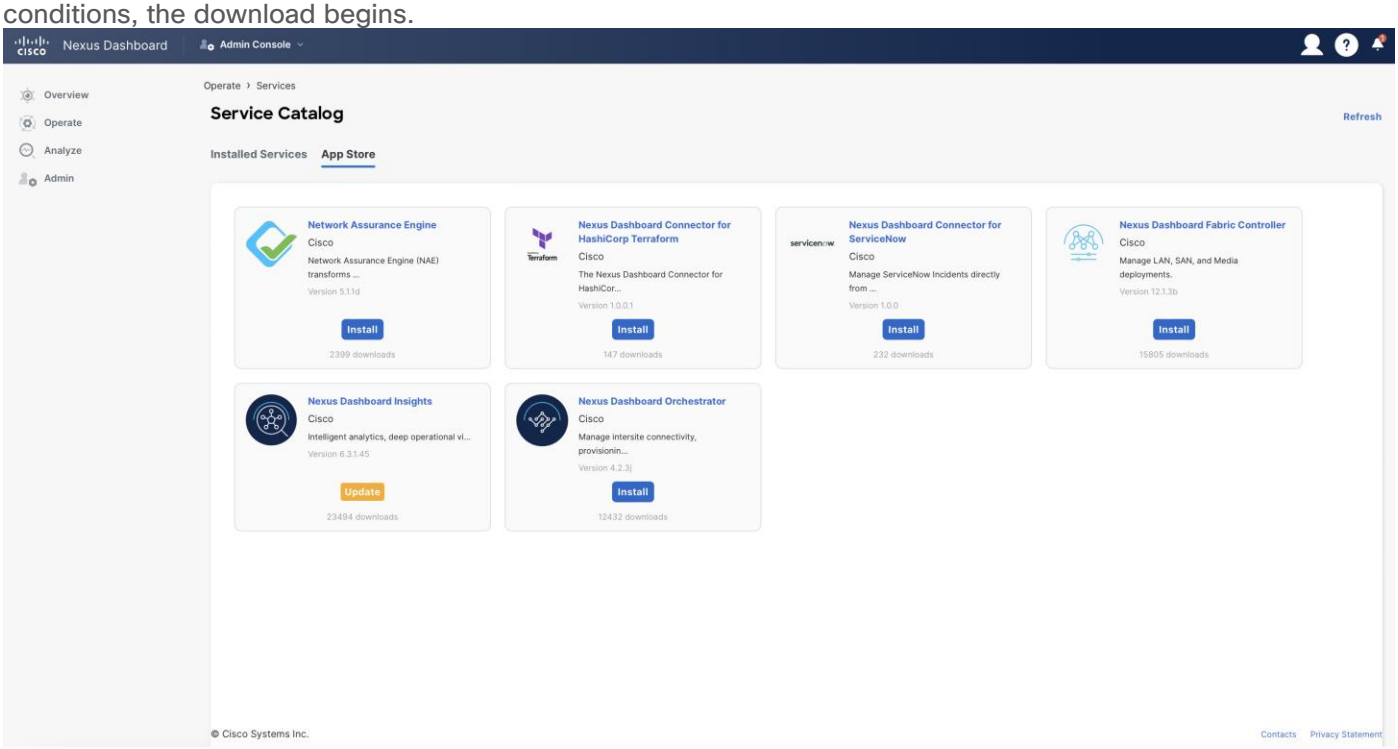


Figure 22: Nexus Dashboard Service Catalog

You can track the progress of the download under the “Installed Services” tab.

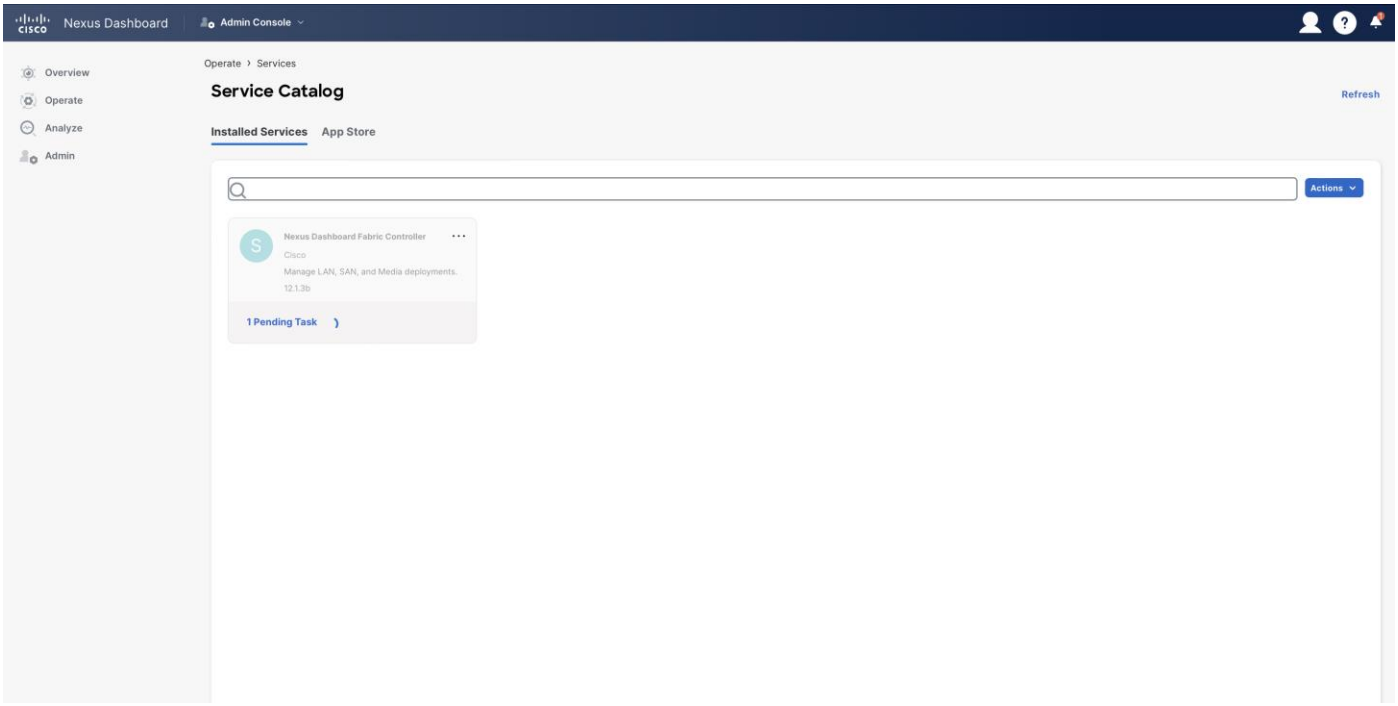


Figure 23: Nexus Dashboard Fabric Controller– Initial Installation in Progress

Once NDFC has been installed, you must enable it separately. If you have navigated away from the Service Catalog, you can re-access it by navigating through “**Operate > Services > Installed Services**.”

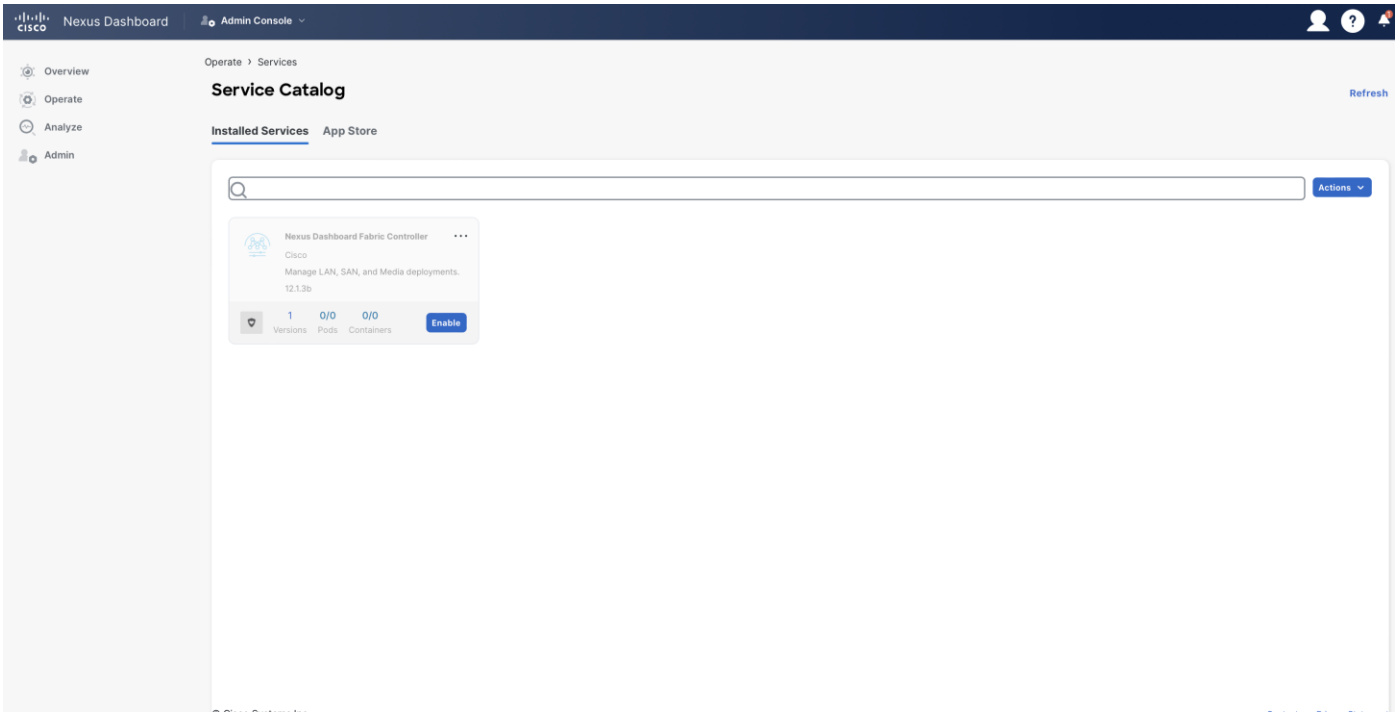


Figure 24: Nexus Dashboard Fabric Controller– Ready for Enablement

You can track the progress of NDFC's enablement by clicking on the pending task.

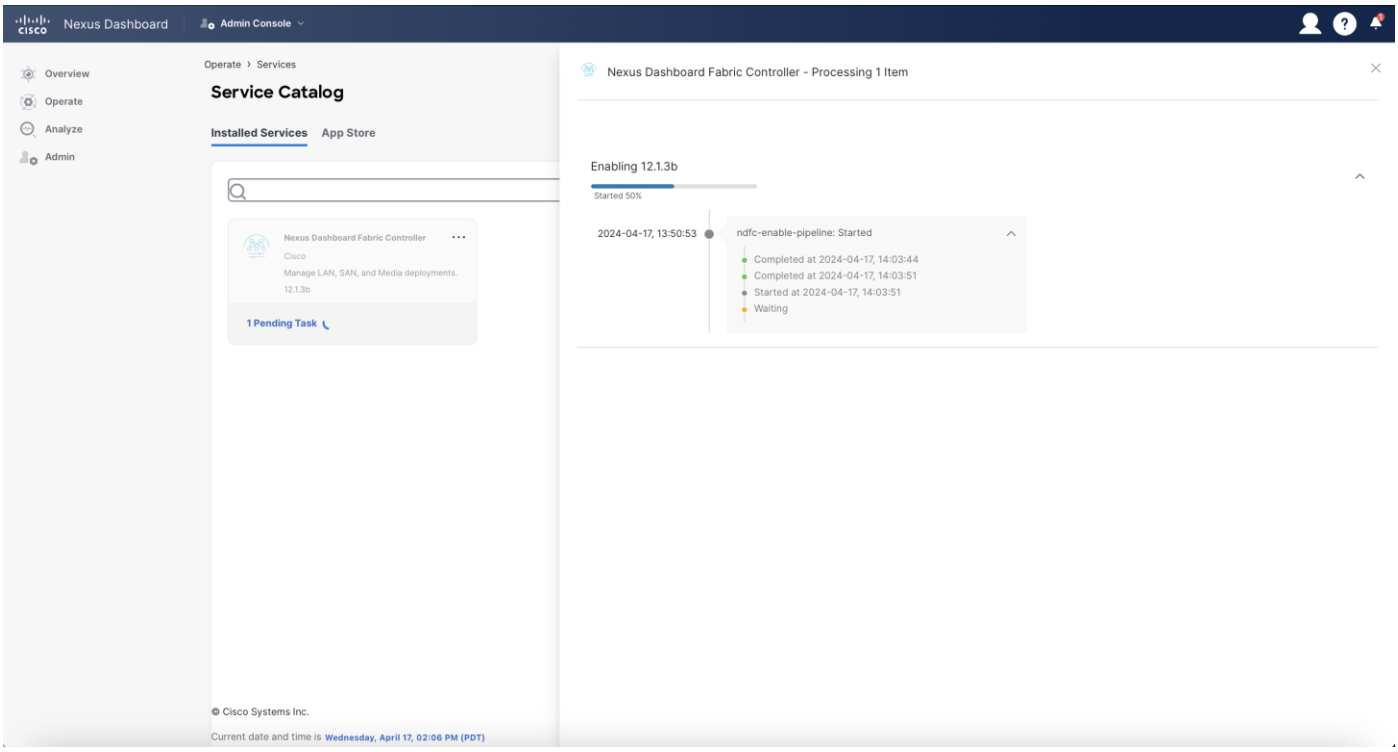


Figure 25: Nexus Dashboard Fabric Controller– Enablement Progress

Once NDFC is successfully enabled, your "Installed Services" page looks like the below example.

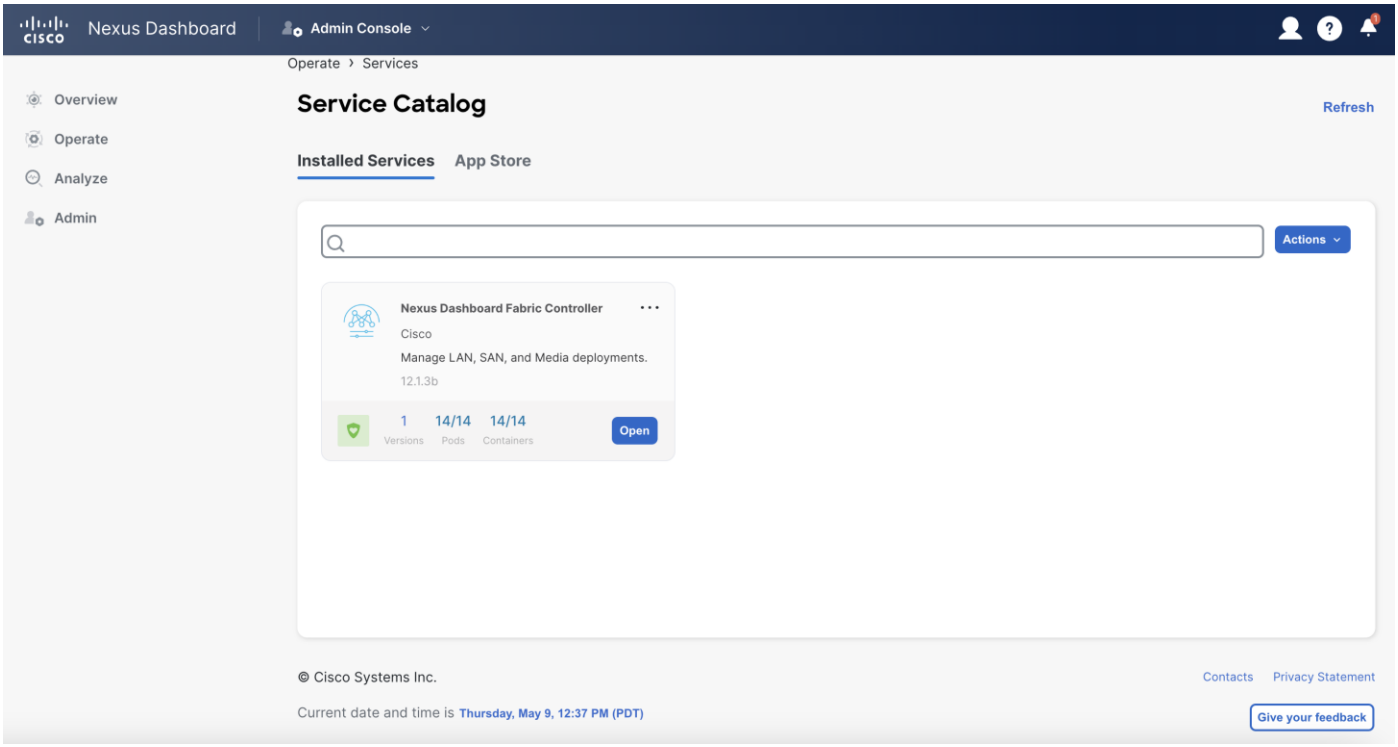


Figure 26: Nexus Dashboard Fabric Controller– Installed

When you click “Open,” you see a “What’s new in 12.3.1b” pop-up window, and then a prerequisites guideline pop-up window appears.

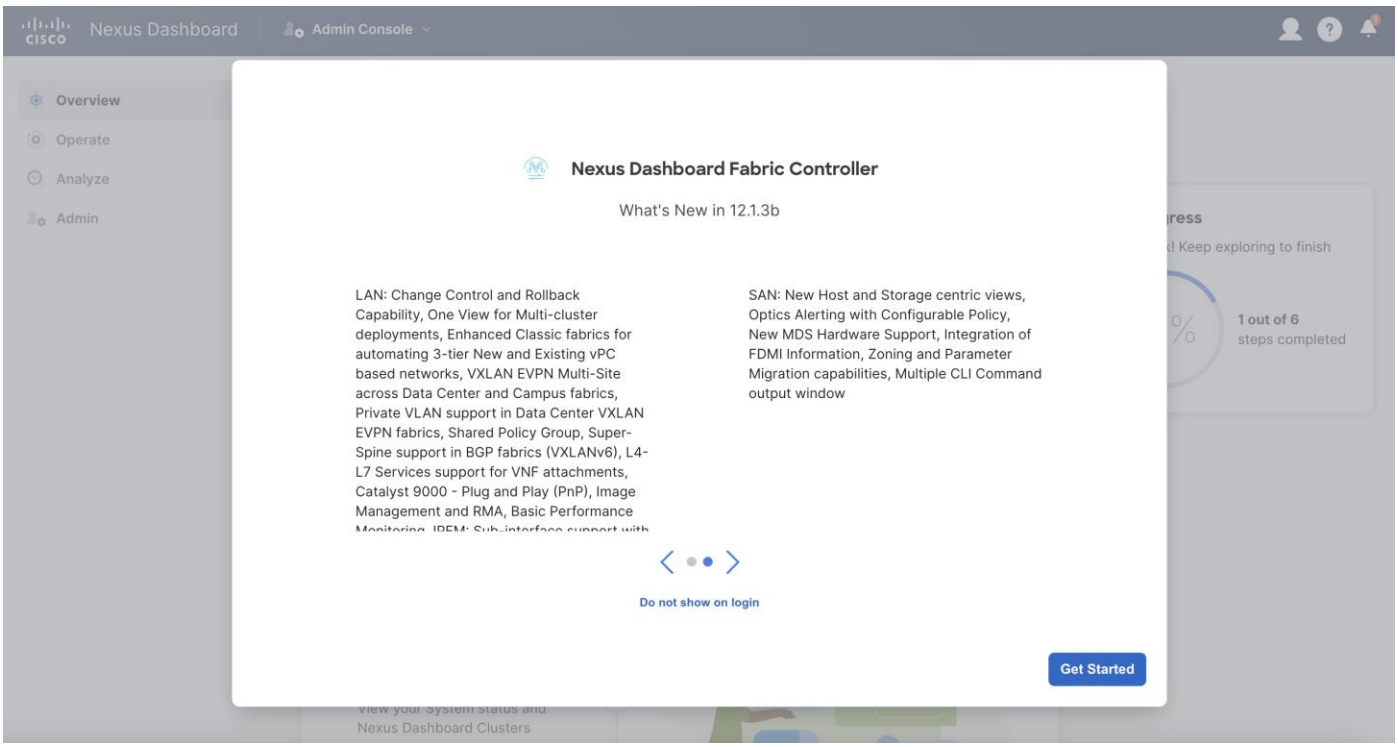


Figure 27: Nexus Dashboard Fabric Controller Updates Guide

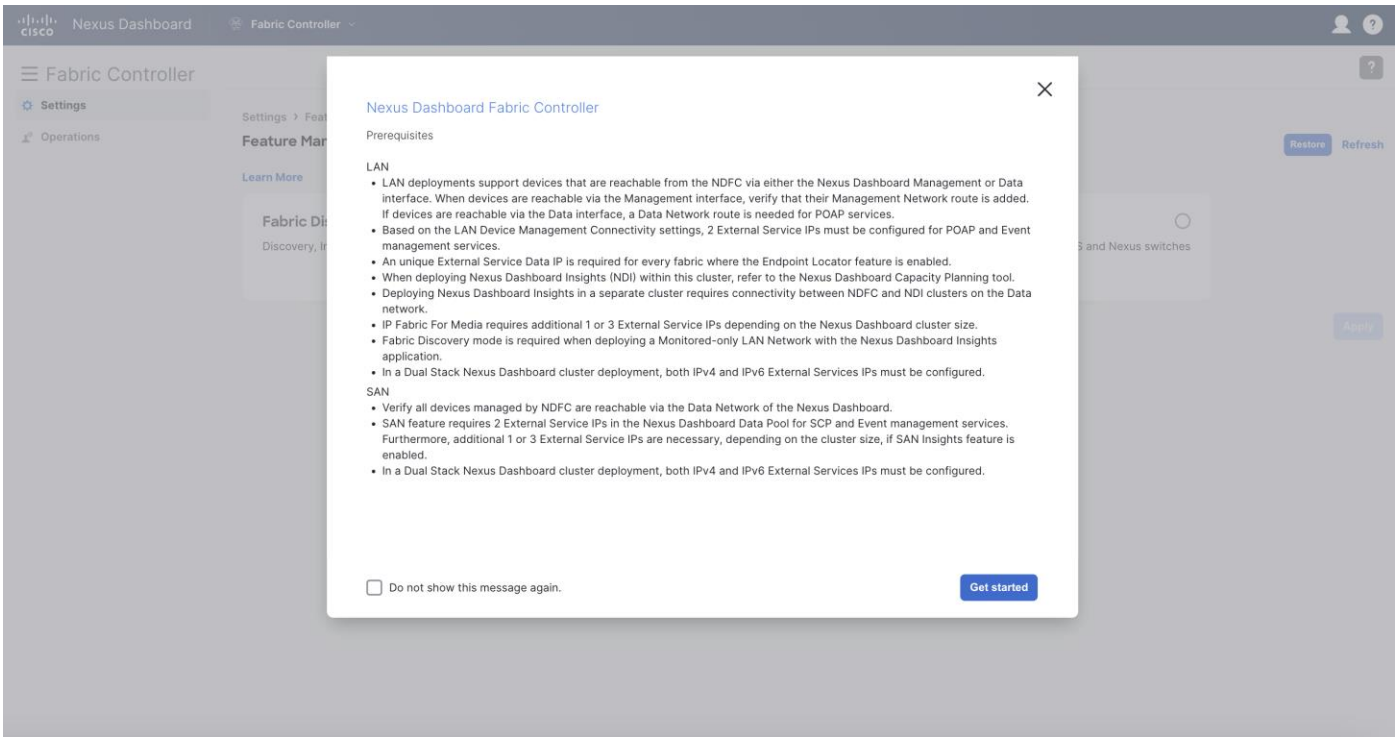


Figure 28: Nexus Dashboard Fabric Controller Prerequisites

At this stage, you select your NDFC instance's feature management mode—Fabric Discovery, Fabric Controller, or SAN Controller. Fabric Discovery is a lightweight version of NDFC; when enabled, it supports inventory discovery and monitoring only (NOT configuration or provisioning). This option helps minimize resource utilization and further customize NDFC, but if you require configuration or provisioning capability, select Fabric Controller as your feature management mode. The SAN controller is for MDS and Nexus Switch use cases.

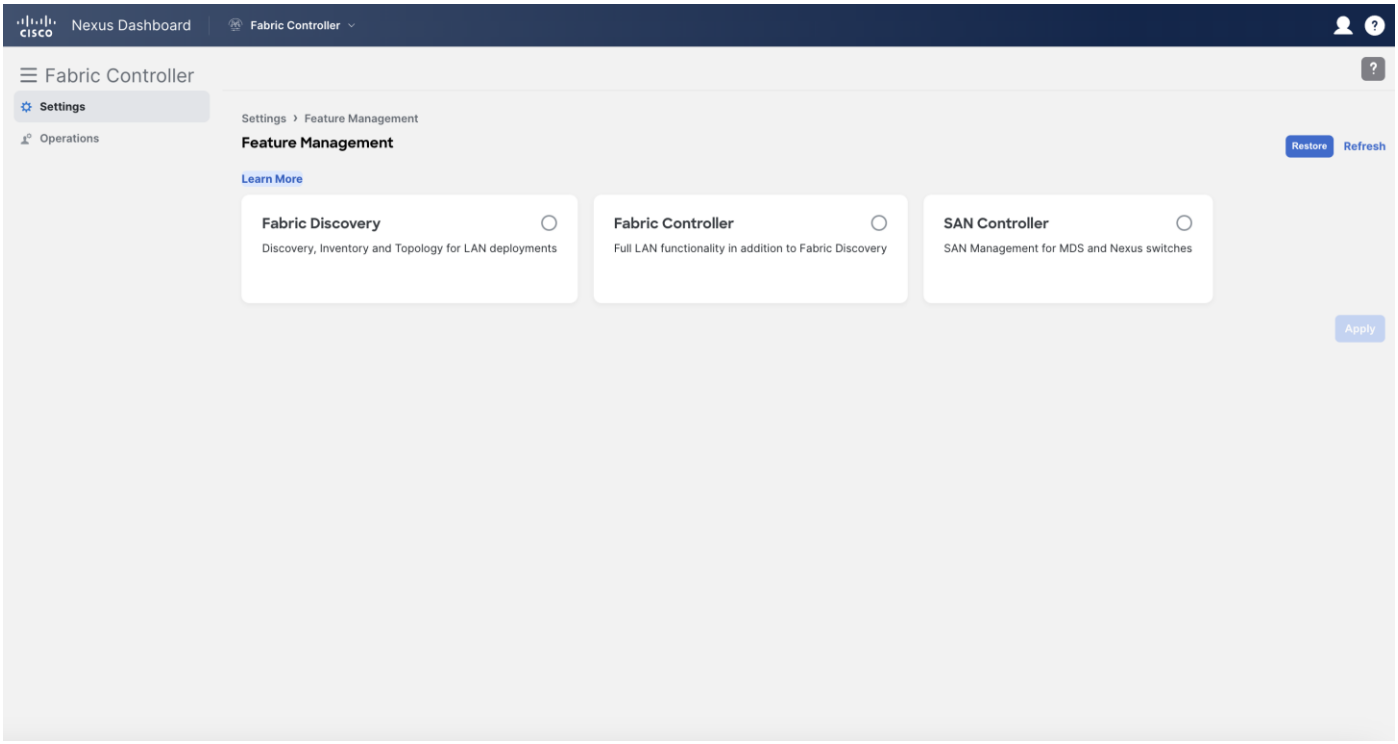


Figure 29: Nexus Dashboard Fabric Controller Feature Management Options

If you elect for a full fabric controller, you have the option to enable specific features from the start.

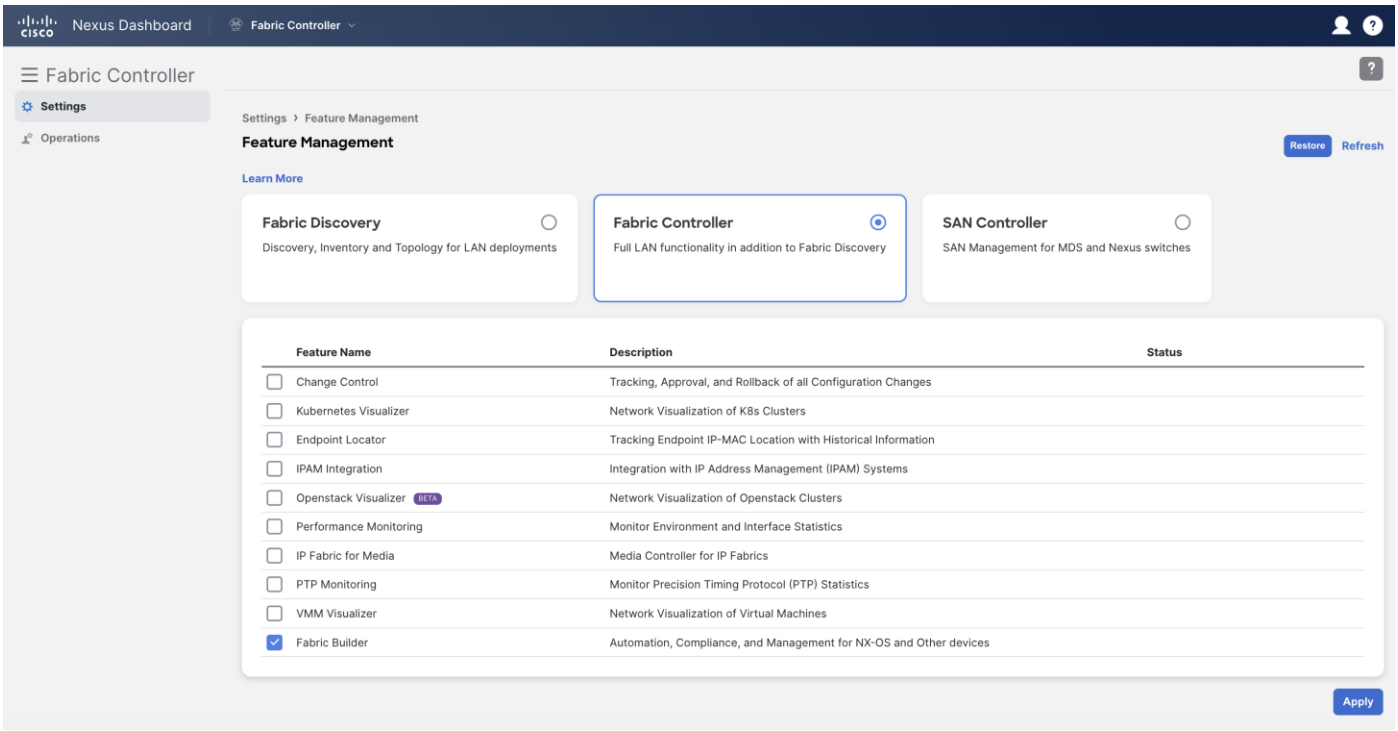


Figure 30: Nexus Dashboard Fabric Controller Customization Options

Once you have selected the appropriate feature management mode, select “apply” to finish configuring your NDFC instance. For more information on NDFC modes and features, refer to the NDFC 12 Data Sheet.

Persistent IP Requirements for NDFC

Persistent IP addresses, also known as external service IP addresses, are required for pods/services in NDFC that require sticky IP addresses. In other words, pods that are provisioned with a persistent IP retain their IP address even if they are re-provisioned (either on the same Nexus Dashboard node or a different Nexus Dashboard node within the same Nexus Dashboard cluster). Persistent IP addresses are required because switches may be configured with a certain NDFC service as a destination (e.g., SNMP trap destination). For these use cases, a failure of the Nexus Dashboard node hosting the corresponding service/pod should not lead to a switch configuration change. For uninterrupted service, the associated service/pod must be respawned somewhere else in the Nexus Dashboard cluster (usually in another node) so that the pod/service IP remains the same.

Examples of persistent IP addresses include the following:

- SNMP Trap/Syslog Receiver.
- POAP/SCP.
- EPL (Endpoint Locator).
- PMN (for IPFM deployments).
- SAN.

Since the Nexus Dashboard nodes are typically Layer 2-adjacent, from a network reachability point of view, nothing else is required for traffic to be redirected to the new location of that destination service/pod. Note that with the introduction of Layer 3 reachability for an ND cluster hosting NDFC, eBGP is employed to dynamically advertise the updated location of the service following a node failure. Consequently, from a network reachability point of view, as soon as the pod has been re-deployed in the new location, service resumes without any user intervention.

External service IP addresses are configured under Nexus Dashboard cluster configuration. The usage of persistent IP addresses is based on what features are enabled on NDFC, the deployment model, and the way NDFC connects to the switches. Based on your specific use case, you may need IP addresses in the Nexus Dashboard management pool, data pool, or both.

For virtual Nexus Dashboard deployments, enable (or accept) promiscuous mode on the port groups associated with the Nexus Dashboard management and/or data vNICs where IP stickiness is required. The persistent IP addresses are given to the PODs (examples include an SNMP trap/syslog receiver, Endpoint Locator instance per fabric, SAN Insights receiver, etc.). Every POD in Kubernetes can have multiple virtual interfaces. Specifically for IP stickiness, an additional virtual interface is associated with the pod that is allocated an appropriate free IP from the appropriate external service IP pool.

The vNIC has its own unique MAC address that is different from the MAC addresses associated with the vND's virtual vNICs. Moreover, all communication to and from the pods towards an external switch goes out of the same bond interface for north-to-south traffic flows. The data vNIC maps to the bond0 (also known as bond0br) interface and the management vNIC maps to the bond1 (also known as bond1br) interface. By default, the VMware system checks if the traffic flows out of a particular vNIC are matched with the source-MAC associated with the vNIC. In the case of NDFC, the traffic flows are sourced with the persistent IP address and associated MAC of the given pods. Therefore, you must enable the required settings on the VMware side.

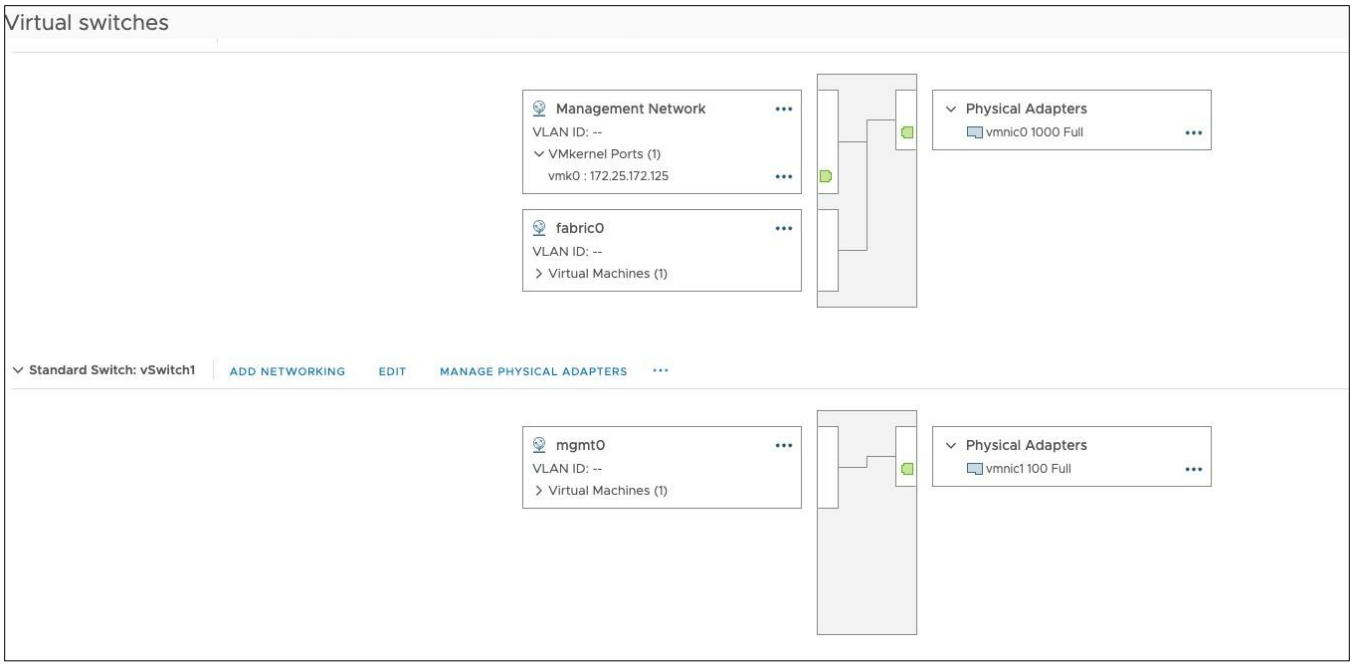


Figure 31: vSphere Network Setup

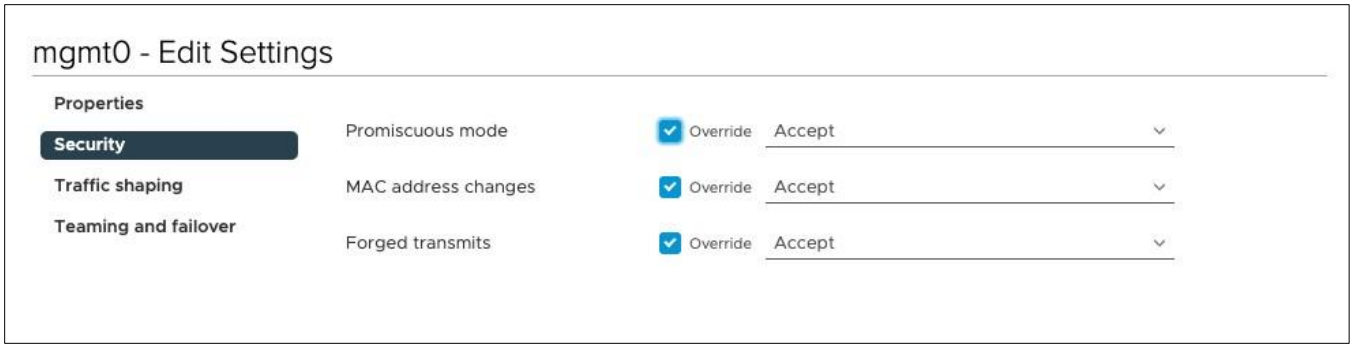


Figure 32: vSphere mgmt0 Network Settings

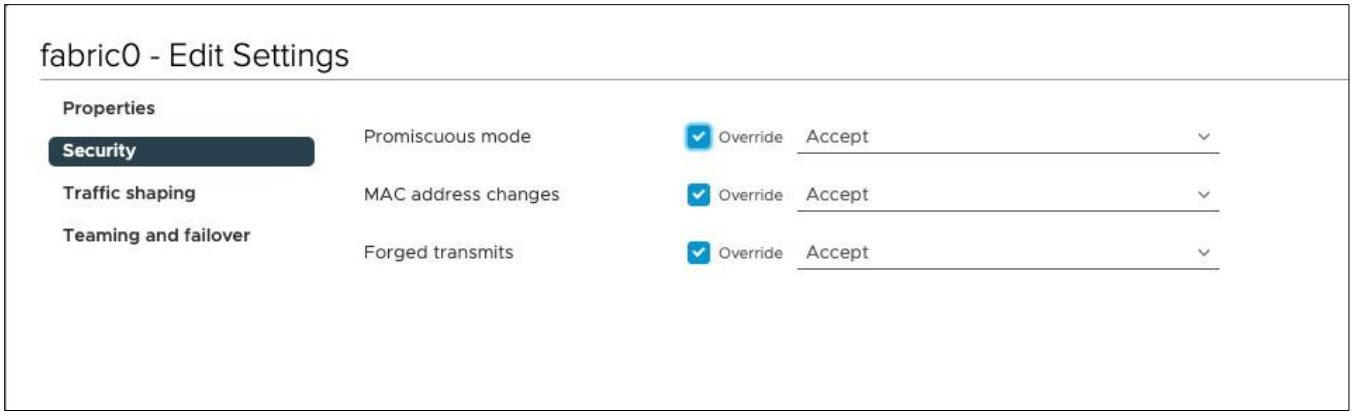
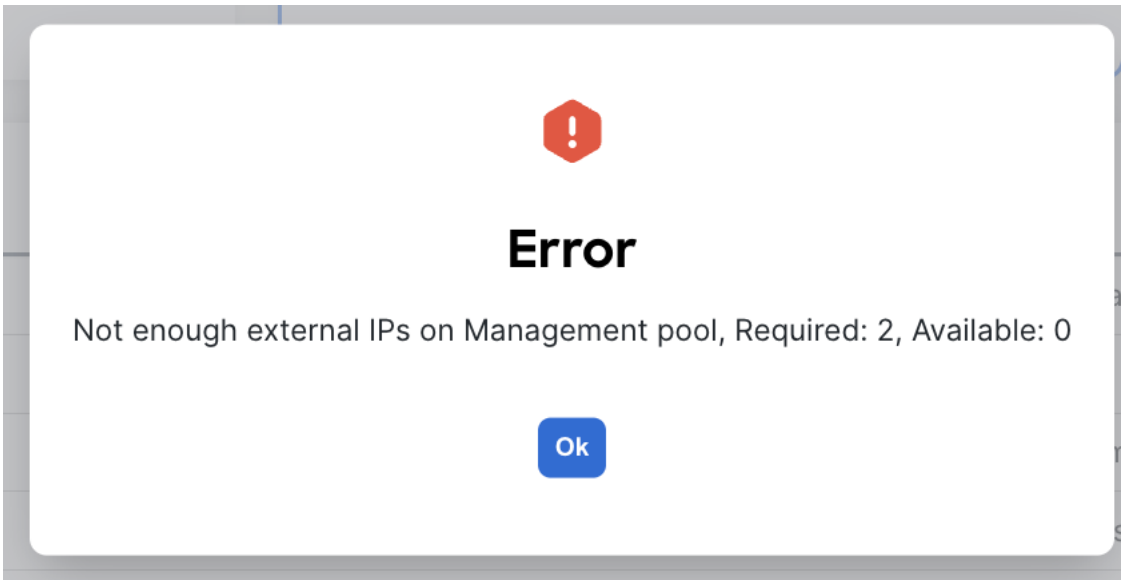


Figure 33: vSphere fabric0 Settings

Note: You are not able to activate an NDFC feature if appropriate persistent IP addresses are not available. NDFC has a precheck that confirms that enough free external service IP addresses are configured on the Nexus Dashboard in the corresponding pool before a feature that has such a requirement can be enabled.

Depending on the specific use case and the selected interface for communicating with the switch's mgmt0 interfaces, the persistent IP addresses must be associated with the ND management interface or data interface.



Cisco NDFC Release 12.1.2e introduced the capability for NDFC to be run on top of a virtual Nexus Dashboard (vND) instance with promiscuous mode **disabled** on port groups that are associated with Nexus Dashboard interfaces where External Service IP addresses are specified. It is recommended to disable promiscuous mode for the port groups after upgrading to ND 2.3.1/NDFC 12.1.2, in case customers are upgrading from a previous version. Recall that vND comprises a management interface and a data interface. By default, for LAN deployments, two external service IP addresses are required for the Nexus Dashboard management interface subnet. Similarly, by default, for SAN deployments, two external service IP addresses are required for the Nexus Dashboard data interface subnet.

Note: Disabling promiscuous mode is supported from Cisco Nexus Dashboard Release 2.3.1c.

Note: You can disable promiscuous mode when Nexus Dashboard nodes are Layer 3-adjacent to the data network, BGP is configured, and fabric switches are reachable through the data interface.

Note: You can now disable promiscuous mode even when Nexus Dashboard interfaces are Layer-2 adjacent on the management and data networks.

Note: Default option for promiscuous mode on VMware ESXi environments is **Reject**, meaning promiscuous mode is disabled.

Configuring Persistent IP Addresses

To configure the Persistent IP addresses (also known as External Service IP) perform the following steps:

Step 1. Navigate to **Nexus Dashboard Admin console**.

Step 2. Click on the **System Settings** tab.

Step 3. Stay under the **General** tab and scroll down to **External Service pools**.

Step 4. Based on the deployment model and use-case, edit the **External Service Pools** and associate the persistent IP addresses to the management or data interfaces.

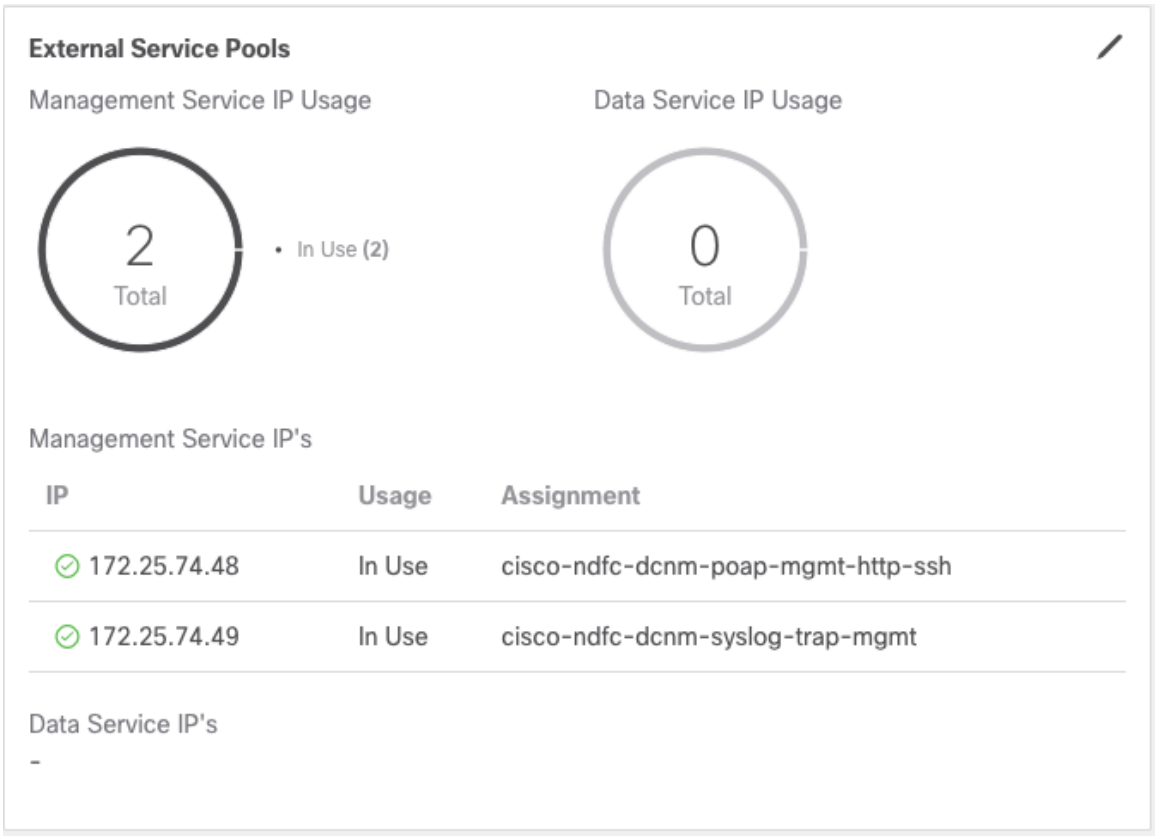


Figure 34: Nexus Dashboard Persistent IPs in Management Pool for LAN Deployments.

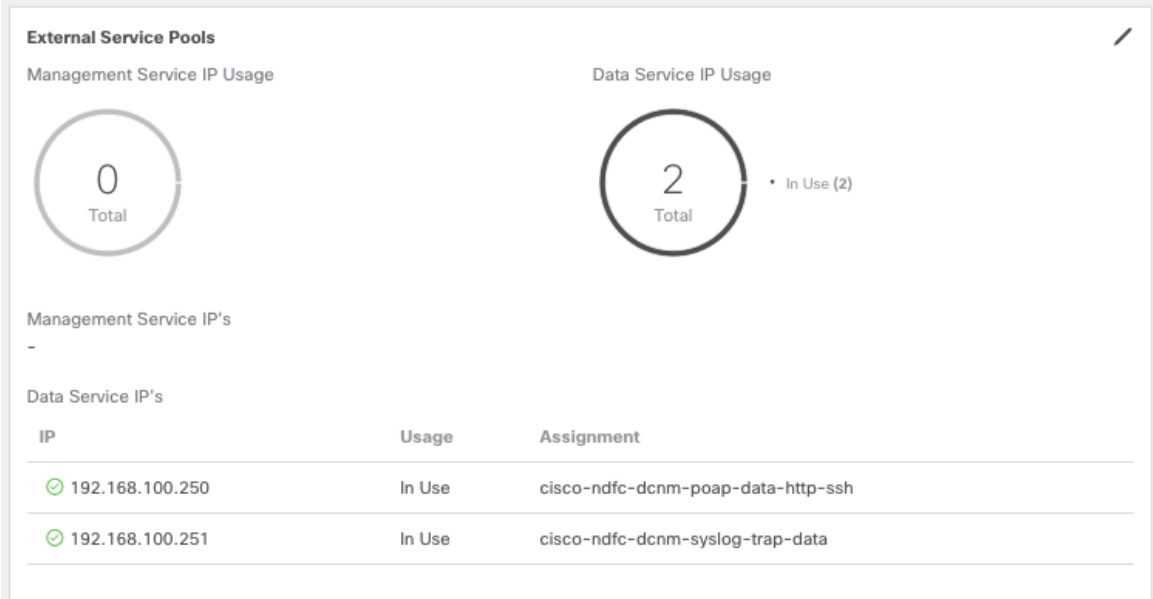


Figure 35: Nexus Dashboard Persistent IPs in Data Pool for LAN Deployments.

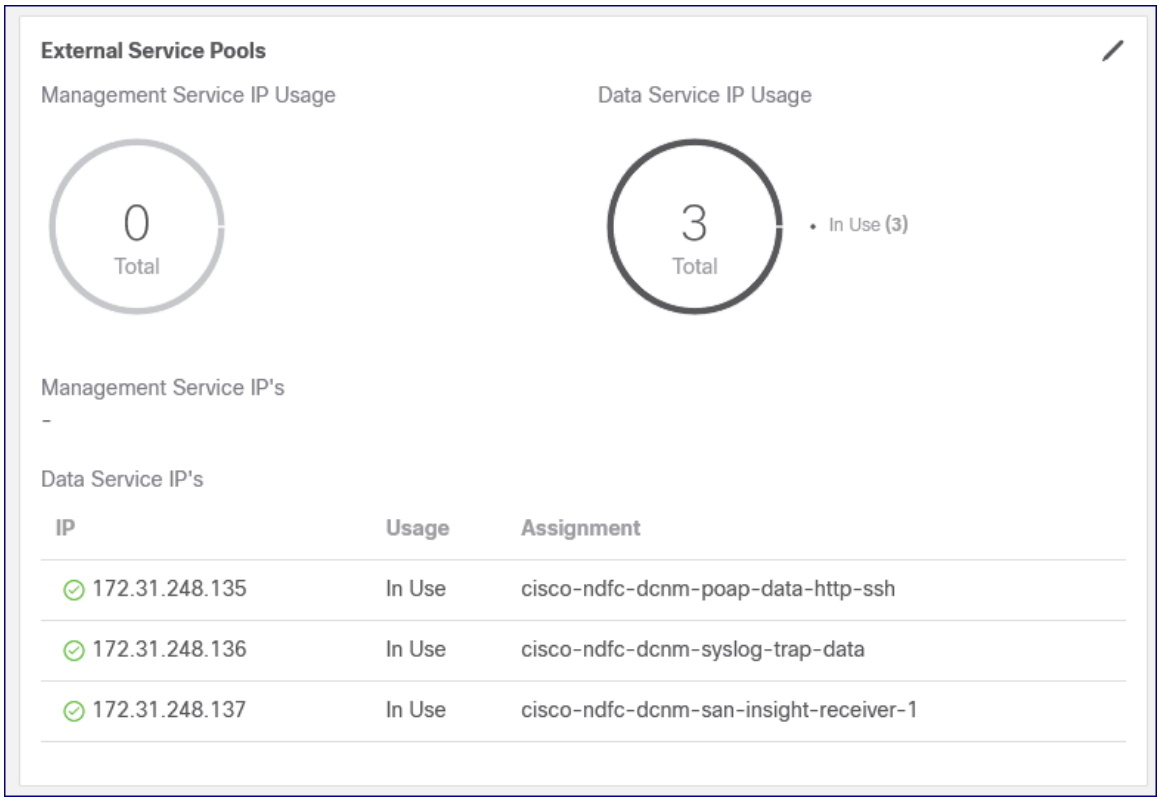


Figure 36: Nexus Dashboard Persistent IPs in Data Pool for SAN Deployments.

As with the above deployment section, your persistent IP addresses need to match your selected IP version—that is, an IPv4 deployment requires IPv4 addresses, and an IPv6 deployment requires IPv6 addresses. If you have a dual-stack deployment, you must provide both IPv4 and IPv6 addresses as persistent IPs.

As a reminder, if you use the ND data interface to communicate with the switch's mgmt0 interfaces before assigning any persistent IP addresses, you must also override the default global server settings for LAN Device Management Connectivity. To do this, navigate to the NDFC server settings, go to the **Admin** tab, and specify data in the **LAN Device Management Connectivity** field.

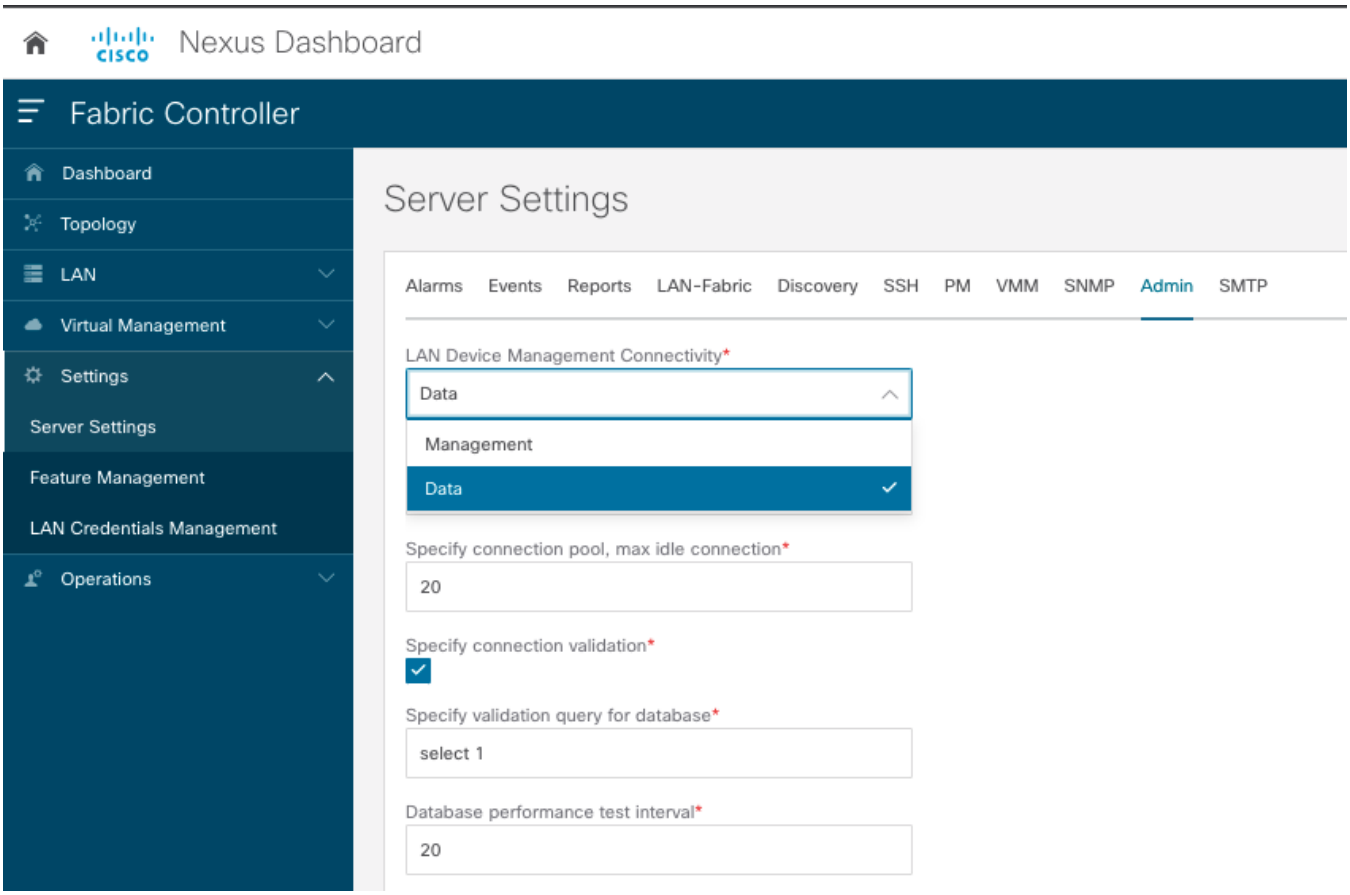


Figure 37: Server Settings for LAN Device Management

For SAN deployments, recall that all NDFC SAN controller-to-device reachability is over the Nexus Dashboard data interface. Therefore, the requirements are the same as above: two free IP addresses are required in the Nexus Dashboard External Service Data IP Pool. Additionally, one IP address per cluster node is required to receive SAN Insights streaming data.

Conclusion

Cisco Nexus Dashboard Controller (NDFC) 12.1.3b introduces pure-IPv6 deployment and management capability, in addition to the preexisting pure-IPv4 and dual-stack options. The cluster's operational mode must be specified during the initial Nexus Dashboard deployment, and it must have uniform IP configuration. If you want to change your cluster's operational mode (for example, from pure IPv4 to dual-stack) after initial configuration, a clean install is required.

A single-node ND cluster deployment supports an NDFC LAN Controller lab deployment (≤25 switches), while a minimum of three ND nodes is required for all NDFC LAN Controller production deployments. Once you have deployed your Nexus Dashboard nodes and bootstrapped your cluster configuration, you then have the option to configure your persistent IP addresses, download and enable NDFC on your ND instance, select its feature management capability, and begin taking advantage of its many functionalities.

Glossary

NDFC: Nexus Dashboard Fabric Controller.

HA: High Availability.

BGP: Border Gateway Protocol.

vND: Virtual Nexus Dashboard Cluster.

pND: Physical Nexus Dashboard Cluster.

GUI: Graphical User Interface.

CLI: Command Line Interface.

DNS: Domain Name System.

NTP: Network Time Protocol.

SMTP: Simple Mail Transfer Protocol.

SNMP: Simple Network Management Protocol.

SVI: Switched Virtual Interface.

VRF: Virtual Routing and Forwarding.

PMN/PTP telemetry: Private Mobile Networks/Precision Time Protocol

OOB: Out-of-Band

IB: In-Band

SCP POAP: Secure Copy Protocol PowerOn Auto Provisioning.

SNMP Trap: Simple Network Management Protocol Trap.

DHCP: Dynamic Host Configuration Protocol.

vPC: virtual Port Channel.

SAN: Storage Area Networking.

EPL: Endpoint Locator.

IPFM: IP Fabric for Media.

Additional Information

Additional documentation about Cisco Nexus Dashboard and Cisco Nexus Fabric Controller and related topics can be found at the sites listed here.

Nexus Dashboard

ND 3.0.1 Deployment Guide: https://www.cisco.com/c/en/us/td/docs/dcn/nd/3x/deployment/cisco-nexus-dashboard-deployment-guide-301.html

ND 3.0.1 User Content: https://www.cisco.com/c/en/us/td/docs/dcn/nd/3x/collections/nd-user-content-301.html

Nexus Dashboard Fabric Controller

NDFC 12.1.3b Release Notes: https://www.cisco.com/c/en/us/td/docs/dcn/ndfc/1213/release-notes/cisco-ndfc-release-notes-1213.html

Compatibility Matrix: https://www.cisco.com/c/dam/en/us/td/docs/Website/datacenter/dcnm-compatibility/index.html

NDFC 12.1.3b Scalability Guide: https://www.cisco.com/c/en/us/td/docs/dcn/ndfc/1213/verified-scalability/cisco-ndfc-verified-scalability-1213.html

NDFC Configuration Guide Library: https://www.cisco.com/c/en/us/support/cloud-systems-management/prime-data-center-network-manager/products-installation-and-configuration-guides-list.html

Legal Information