Cisco Nexus Data Broker Configuration Guide, Release 3.9.2

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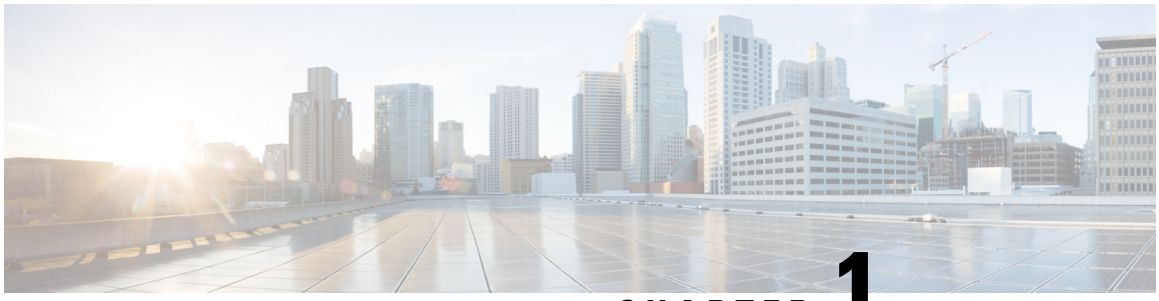


CHAPTER 1

Cisco Nexus Data Broker Overview

This chapter has an overview of the Cisco Nexus Data Broker. It also has details of the filename and interoperability matrices. See the prerequsites section for important details before configuring NDB.

This chapter contains the following sections:

About Cisco Nexus Data Broker

Visibility into application traffic has traditionally been important for infrastructure operations to maintain security, troubleshooting, and compliance and perform resource planning. With the technological advances and growth in cloud-based applications, it has become imperative to gain increased visibility into the network traffic. Traditional approaches to gain visibility into network traffic are expensive and rigid, making it difficult for managers of large-scale deployments.

Cisco Nexus Data Broker with Cisco Nexus Switches provides a software-defined, programmable solution to aggregate copies of network traffic using Switched Port Analyzer (SPAN) or network Test Access Point (TAP) for monitoring and visibility. As opposed to traditional network taps and monitoring solutions, this packet-brokering approach offers a simple, scalable and cost-effective solution that is well-suited for customers who need to monitor higher-volume and business-critical traffic for efficient use of security, compliance, and application performance monitoring tools.

With the flexibility to use a variety of Cisco Nexus Switches and the ability to interconnect them to form a scalable topology provides the ability to aggregate traffic from multiple input TAP or SPAN ports, and replicate and forward traffic to multiple monitoring tools which may be connected across different switches. Combining the use of Cisco plugin for OpenFlow and the Cisco NX-API agent to communicate to the switches, Cisco Nexus Data Broker provides advance features for traffic management.

Cisco Nexus Data Broker provides management support for multiple disjointed Cisco Nexus Data Broker networks. You can manage multiple Cisco Nexus Data Broker topologies that may be disjointed using the same application instance. For example, if you have 5 data centers and want to deploy an independent Cisco

Nexus Data Broker solution for each data center, you can manage all 5 independent deployments using a single application instance by creating a logical partition (network slice) for each monitoring network.

Starting with Cisco NDB release 3.6, when a new switch is discovered on NDB, the following connections are installed on the ISL interfaces:

- Default-Deny-ISL connection with Default-Deny-All, Default-Deny-MPLS, and Default-Deny-ARP filters. This connection is supported on all the types of switches in NXAPI mode.
- Default-Deny-ISL-ICMP connection with Default-Deny-ICMP and Default-Deny-ICMP-All filters. This connection is supported on 9200, 9300EX, 9300FX, 9500EX, and 9500FX switches in NXAPI mode.

All the ACLs related to the default filters are installed on the ISL interfaces of the new switch. By default, this feature is enabled for all the new ISL interfaces.

Note You can configure a maximum of 30 unique Port ACLs (PACLs) for the Cisco Nexus 9300 FX Platform.

Note Each PACL takes one label. If the same PACL is configured on multiple interfaces, the same label is shared. If each PACL has unique entries, the PACL labels are not shared, and the label limit is 30.

Note You can manage this feature using the mm.addDefaultISLDenyRules attribute in config.ini file. By default, themm.addDefaultISLDenyRules attribute is not be present in config.in file. To disable this feature, you need to add the mm.addDefaultISLDenyRules attribute to config.ini file ans set it to false and restart the device. For example:

```
mm.addDefaultISLDenyRules = false
```

Note A Cisco Nexus Data Broker instance can support either the OpenFlow or NX-API device configuration mode, it does not support both device types.

Note NDB does not capture STP/CDP packets for Nexus 3500 Series switches.

Note Starting with Cisco NDB release 3.6, Global ACLs are automatically added to all the interfaces on a device. By default, Global ACLs are enabled for a device. To manage Global ACLs, you need to add the configure.global.acls parameter in the config.ini file. Set the configure.global.acls parameter to *false* and restart the device to disable Global ACLs on the device.

Note Starting with Cisco NDB Release 3.6.2, you can now configure the inactivity timeout interval in NDB GUI instead of updating the *xnc/configuration/web.xml* file. By default, a user is logged out if the session is inactive for more than 10 minutes. You need to re-log in to the NDB to apply the new interval. For more information, see *Configuring Inactivity Timeout* section. .

Note Starting with Cisco Nexus Data Broker, Release 3.3:

- Advanced filtering based on TCP AND UDP flags is supported to filter the traffic.
- IPv6, QinQ, and UDF are supported for NX-OS I6 release platform.
- You can define a User Defined Filter (UDF) and use it while creating a filter for traffic management.
- Edit Priority field for the connections is configurable. By default, edit is enabled for the Cisco NDB administrator role.

Note Starting with Cisco NDB release 3.2.2, IPv6 addressing is supported in centralized mode. You can configure NDB to use either IPv6 addressing or both IPv4 and IPv6 addressing. Set `ipv6.strict` attribute in config.ini file to *true* to make NDB accessible only through IPv6 address. If you set the `ipv6.strict` attribute to *false*, you can access NDB through IPv4 or IPv6 address.

Note Starting with Cisco Nexus Data Broker Release 3.1, the user strings for Cisco Nexus Data Broker can contain alphanumeric characters including the following special characters: period (.), underscore (_), or hyphen (-) . These are the only special characters that are allowed in the user strings.

Note The hostname string for Cisco Nexus Data Broker can contain between 1 and 256 alphanumeric characters including the following special characters: period (.), underscore (_), or hyphen (-) . These are the only special characters that are allowed in the user strings.

Cisco Nexus Data Broker provides the following:

- Support for the OpenFlow mode or the NX-API mode of operation.

Note The OpenFlow mode and the NX-API mode are supported on both Cisco Nexus 3000 Series and Cisco Nexus 9000 Series switches. Cisco Nexus 9500, 9200, and 9300-EX switches support only NX-API mode of deployment. Cisco Nexus 3500 supports only Openflow mode of deployment. You can enable only one mode, either OpenFlow or NX-API mode, at a time.

You can enable only one mode, either OpenFlow or NX-API mode, at a time.

When using OpenFlow mode, NX-API is available for auxiliary configurations only, for example, Enabling Q-in-Q on the SPAN and TAP ports.

Cisco Nexus 9300-EX Series switches support only Cisco NX-OS Release 7.0(3)I5(1) and later releases.

The configuration that is supported in the AUX mode is:

- Pull and push of interface description
- Q-in-Q configuration
- Redirection
- Port Channel load balancing
- MPLS Stripping

Note Starting with Cisco Nexus 3000 Release 7.x, the NX-API configuration is supported on the following Cisco Nexus Series switches:

- Cisco Nexus 3172 switches
- Cisco Nexus 3132 switches
- Cisco Nexus 3164 switches
- Cisco Nexus 31128 switches
- Cisco Nexus 3232 switches
- Cisco Nexus 3264 switches
- Cisco Nexus 3100-V switches

- The features that are supported with the Cisco Nexus 9500 Series switches are:
  - The NX-API feature is supported. (OpenFlow is not supported.)
  - The MPLS strip feature is supported.
  - The label age CLI feature is not supported.
- Support for Layer-7 filtering for the HTTP traffic using the HTTP methods.
- Support for VLAN filtering.

- Support for MPLS tag stripping.
- A scalable topology for TAP and SPAN port aggregation.
- Support for Q-in-Q to tag input source TAP and SPAN ports.
- Symmetric load balancing.
- Rules for matching monitoring traffic based on Layer 1 through Layer 4 information.
- The ability to replicate and forward traffic to multiple monitoring tools.
- Time stamping using Precision Time Protocol (PTP).
- Packet truncation beyond a specified number of bytes to discard payload.
- Reaction to changes in the TAP/SPAN aggregation network states.
- Security features, such as role-based access control (RBAC), and integration with an external Active Directory using RADIUS, TACACS, or LDAP for authentication, authorization, and accounting (AAA) functions.
- End-to-end path visibility, including both port and flow level statistics for troubleshooting.
- Robust Representational State Transfer (REST) API and a web-based GUI for performing all functions
- Support for Cisco plugin for Open Flow, version 1.0
- Cisco Nexus Data Broker adds NX-API plugin to support Cisco Nexus 9000 Series switches as TAP/SPAN aggregation. The NX-API supports JSON-RPC, XML, and JSON. Cisco Nexus Data Broker interacts with Cisco Nexus 9000 Series using the NX-API in JSON message formats.
- Beginning with Cisco Nexus Data Broker, Release 3.1, Cisco Nexus Data Broker is certified with Cisco Nexus 9200 Series and Cisco Nexus 9300-EX Series switches.

  The following features are supported on the Cisco Nexus 9300-EX, -FX, -FX2 Series switches:

  - Symmetric Load Balancing
  - Q-in-Q
  - Switch Port Configuration
  - MPLS Stripping
  - BlockTx
  - Truncate

- Beginning with Cisco Nexus Data Broker, Release 3.1, Cisco Nexus Data Broker is shipped with a certificate for the HTTPS connection between the Cisco Nexus Data Broker and a browser. Now with this feature, you can change to a different certificate than the shipped certificate.

  The script **generateWebUIcertificate.sh** is available in the **xnc/configuration** folder. If you execute this script, it moves the shipped certificate to **old_keystore** and the new certificate is generated in **keystore**. On the next Cisco Nexus Data Broker restart, this new certificate is used.

With Cisco Nexus Data Broker, you can:

- Classify Switched Port Analyzer (SPAN) and Test Access Point (TAP) ports.

- Integrate with Cisco ACI through Cisco APIC to configure SPAN destinations and SPAN sessions.
- Add monitoring devices to capture traffic.
- Filter which traffic should be monitored.
- Redirect packets from a single or multiple SPAN or TAP ports to multiple monitoring devices through delivery ports.
- Restrict which users can view and modify the monitoring system.
- If Cisco Nexus 9000 Series switch is using 7.0(3)I4(1) or later version in NX-API mode and if a flow is installed using a VLAN filer, then the device goes through an IP access list and it does not match on the Layer 2 packet.
- Configure these additional features, depending upon the type of switch:
  - Enable MPLS Tag stripping.
  - Set VLAN ID on Cisco Nexus 3000 Series switches.
  - Symmetric load balancing on Cisco Nexus 3100 Series switches and Cisco Nexus 9000 Series switches.
  - Q-in-Q on Cisco Nexus 3000 Series switches, 3100 Series switches, and Cisco Nexus 9000 Series switches.
  - Timestamp tagging and packet truncation on Cisco Nexus 3500 Series switches.
  - You can now configure the **watchdog_timer** configuration parameter in the **config.ini** file. If the value of the parameter is set to 0, the watchdog timer functionality is not available. The value of 30 seconds is a minimum value of the parameter and if the value of the parameter is set to a value more the 30 seconds, the watchdog timer monitors the JAVA process for the configured time interval.

Prerequisites for Cisco Nexus Series Switches

Cisco Nexus Data Broker is supported on Cisco Nexus 3000, 3100, 3200, 3500, and 9000 series switches. Before you deploy the software, you must do the following:

- Ensure that you have administrative rights to log in to the switch.
- Verify that the management interface of the switch (mgmt0) has an IP address configured using the **show running-config interface mgmt0** command.
- Ensure that the switch is in Multiple Spanning Tree (MST) mode. You can use **spanning-tree mode mst** command to enable MST mode on a switch.
- Add the VLAN range in the database that is to be used in Cisco Nexus Data Broker for tap aggregation and inline monitoring redirection to support VLAN filtering. For example, the VLAN range is <1-3967>.
- Ensure that the spanning tree protocol is disabled for all the VLANs. You can use the **no spanning-tree vlan 1-3967** to disable spanning tree on all the VLANs.

- For the first NDB deployment with NXOS version 9.2(1), ensure that the **feature nxapi** and **nxapi http port 80** commands are configured on the NDB switch. If you upgrading NDB switch from NXOS version I7(x) to 9.2(1), the **feature nxapi** and **nxapi http port 80** configurations are not required.

For running the OpenFlow and NX-API mode on the Cisco Nexus Series switches, see the following pre-requisites.

Note The hardware command that is a pre-requisite for the IPv6 feature is **hardware access-list tcam region ipv6-ifacl 512 double-wide**.

Note The TCAM configurations are based on the type of filters required. You may configure multiple TCAM entries from a specific region based on the network requirement. For example, *ing-ifacl* is the TCAM region to cater MAC, IPv4, IPv6 filters in case of N93180YC-E. You may configure multiple TCAM from this region to fit more filtering ACL TCAM entries.

Device Models	OpenFlow Mode	NX-API Mode
Cisco Nexus 3000 Series switches	Enter the **# hardware profile openflow** command at the prompt.	
Cisco Nexus 3164Q switches	The OpenFlow mode is not supported on the Nexus 3164Q switches.	Enter the following commands at the prompt: • **# hardware profile tcam region qos 0** • **# hardware profile tcam region racl 0** • **# hardware profile tcam region vacl 0** • **# hardware profile tcam region ifacl 1024 double-wide** • **# hardware access-list tcam region mac-ifacl 512** • **#feature nxapi** • **#feature lldp**

Device Models	OpenFlow Mode	NX-API Mode
Cisco Nexus 3172 Series switches	Enter the **# hardware profile openflow** command at the prompt.	Use the **hardware profile mode tap-aggregation** [**l2drop**] CLI command to enable tap aggregation and to reserve entries in the interface table that are needed for VLAN tagging. The l2drop option drops non-IP traffic ingress on tap interfaces.
Cisco Nexus 3200 Series switches	Enter the **hardware access-list tcam region openflow 256** command at the prompt.	Enter the following commands at the prompt: • **# hardware access-list tcam region e-racl 0** • **# hardware access-list tcam region span 0** • **# hardware access-list tcam region redirect 0** • **# hardware access-list tcam region vpc-convergence 0** • **# hardware access-list tcam region racl-lite 256** • **# hardware access-list tcam region l3qos-intra-lite 0** • **# hardware access-list tcam region ifacl 256 double-wide** • **# hardware access-list tcam region mac-ifacl 512** • **# hardware access-list tcam region ipv6-ifacl 256** • **#feature nxapi** • **#feature lldp**
Cisco Nexus 3500 series switches	Enter either of the following commands at the prompt to configure OpenFlow TCAM: • **# hardware profile forwarding-mode openflow-hybrid** • **#hardware profile forwarding-mode openflow-only**	

Device Models	OpenFlow Mode	NX-API Mode
Cisco Nexus 9300 Series switches	Enter the **hardware access-list tcam region openflow 512 double-wide** command at the prompt to configure the MAC filters. For IPv4 and IPv6, enter the **hardware access-list tcam region openflow 512** command. **Note** IPv6 and IPv4 dual stack is not supported in I6 and I7.	Enter the following commands at the prompt: • **# hardware access-list tcam region qos 0** • **# hardware access-list tcam region vacl 0** • **# hardware access-list tcam region racl 0** • **# hardware access-list tcam region redirect 0** • **# hardware access-list tcam region vpc-convergence 0** • **#hardware access-list tcam region ifacl 1024 double-wide** • **# hardware access-list tcam region mac-ifacl 512** • **# hardware access-list tcam region ipv6-ifacl 512** • **#feature nxapi** • **#feature lldp**

Device Models	OpenFlow Mode	NX-API Mode
Cisco Nexus 9200, 9300-EX, 9336C-FX2, 93240YC-FX2, and N9K-C93360YC-FX2 switches	The OpenFlow mode is not supported on the 9200, 9300-EX, 9336C-FX2, 93240YC-FX2, and N9K-C93360YC-FX2 switches.	Enter the following commands at the prompt: • **#hardware access-list tcam region ing-l2-span-filter 0** (For Cisco Nexus 93108 series switch only) • **#hardware access-list tcam region ing-l3-span-filter 0** (For Cisco Nexus 93108 series switch only) • **# hardware access-list tcam region ing-racl 0** • **hardware access-list tcam region ing-l3-vlan-qos 0** • **# hardware access-list tcam region egr-racl 0** • **# hardware access-list tcam region ing-ifacl 1024** • **#feature nxapi** • **#feature lldp**
Cisco Nexus 9500-EX and 9500-FX Series switches (9504, 9508 and 9516)	The OpenFlow mode is not supported on the Cisco Nexus 9500-EX and 9500-FX Series switches.	Enter the following commands at the prompt: • **# hardware access-list tcam region ing-racl 0** • **# hardware access-list tcam region ing-l3-vlan-qos 0** • **# hardware access-list tcam region egr-racl 0** • **# hardware access-list tcam region ing-ifacl 1024** • **#feature nxapi** • **#hardware acl tap-agg** • **#feature lldp**

Supported Web Browsers

The following web browsers are supported for Cisco Nexus Data Broker:

- Firefox 45.x and later versions.
- Chrome 45.x and later versions.
- Internet Explorer 11 or later versions.
- Microsoft Edge 42 or later versions.

Note JavaScript 1.5 or a later version must be enabled in your browser.

System Requirements

The following table lists the system requirements as per the deployment size for Cisco Nexus Data Broker 3.8.

Table 1: System Requirements per Deployment Size

Description	Small	Medium	Large
CPUs (virtual or physical)	6-core	12-core	18-core
Memory	8 GB RAM	16 GB RAM	24 GB RAM
Hard disk	Minimum of 40 GB of free space available on the partition on which the Cisco Nexus Data Broker software is installed.		
Operating System	A recent 64-bit Linux distribution that supports Java, preferably Ubuntu, Fedora, or Red Hat.		
Other	Java Virtual Machine 1.8 or later.		

Guidelines and Limitations for Nexus Data Broker

Cisco Nexus Data Broker runs in a Java Virtual Machine (JVM). As a Java-based application, Cisco Nexus Data Broker can run on any x86 server. For best results, we recommend the following:

- Java Virtual Machine 1.8.0_45 and higher.
- Python 2.7.3 and a higher version is required for the backup and restore script. This is also required to do the TLS configuration if Cisco Nexus Data Broker needs to use TLS for the device communication.
- A $JAVA_HOME environment variable in your profile that is set to the path of the JVM.

- JConsole and VisualVM that are both part of JDK are the recommended (but not required) additions for troubleshooting.
- During OpenFlow configuration for Cisco NXOS Release 7.0(3)I5(1) software image, virtual service ofa should not be installed and the following configuration should be used:

```
switch#
conf t
feature openflow
openflow
 switch 1 pipeline 201
 controller ipv4 10.16.206.162 port 6653 vrf management security none
 of-port interface ethernet1/1-30
```

  See the following link for further details on NXOS configuration for OpenFlow:http://www.cisco.com/c/en/us/td/docs/switches/datacenter/nexus/openflow/b_openflow_agent_nxos_1_3/Cisco_Plug_in_for_OpenFlow.html#reference_B6284F508CC6461B8EF30DCF870C809F
- You should not configure the same name for more than one switch in the topology to avoid unpredictable behavior in the link discovery by Cisco Nexus Data Broker.
- Starting with Cisco NDB Release 3.7, the following special characters are not allowed in description field for Port Definitions, Port Groups, Connections, Redirections, Monitoring Devices, and Service Nodes: Apostrophe (‘), Less Than (<), Greater Than (>), Double Quotation (“), Back Slash (\), Vertical Bar (|), and Question Mark (?).
- When the domain name is enabled in the switch, it does not reflect the change in the LLDP neighbors and the links get removed for that particular switch. The workaround for this issue is to disable the LLDP feature and then to enable it again by using **no feature lldp** and **feature lldp** CLI commands respectively.

Global Updates with Cisco Nexus Data Broker, Release 3.3

See the following global updates that are available with Cisco Nexus Data Broker, Release 3.3:

- The ports in the Graphical User Interface (GUI) are listed in a sorted order.
- A new field, **Row Count** is added in the GUI to display the rows in the multiples of 10, 25, 50, and 100.
- Cisco Nexus 92XX switches do not support the QnQ, you cannot use 92XX switches in the multi-switch environment.

Cisco Nexus Data Broker Software Release Filename Matrix

See the Cisco Nexus Data Broker software release filename matrix for more information on the software images:

Mode of Deployment	NXOS Image	Mode	File Name
Embedded	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	NXAPI	`ndb1000-sw-app-emb-i6-plus-k9-3.7.0.zip`
Embedded	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	OpenFlow	`ndb1000-sw-app-emb-i6-plus-k9-3.7.0.zip`
Embedded	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	NXAPI	`ndb1000-sw-app-emb-nxapi-3.7.0-k9.zip`
Embedded	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	Openflow	`ndb1000-sw-app-emb-3.7.0-ofa_mmemb-2.1.4-r2-nxos-SPA-k9.zip`

Mode of Deployment	NXOS Image	Mode	File Name
Embedded	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	Openflow	`ndb1000-sw-app-emb-3.7.0-ofa_mmemb-1.1.5-r3-n3000-SPA-k9.zip`
Centralized	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	NXAPI	`ndb1000-sw-app-k9-3.7.0.zip`
Centralized	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	OpenFlow	`ndb1000-sw-app-k9-3.7.0.zip`

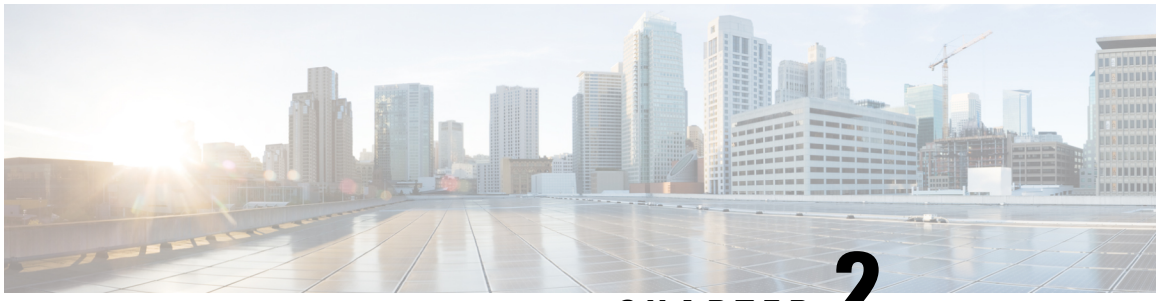
Nexus Data Broker Hardware and Software Interoperability Matrix

The following table lists the hardware and software ineteroperability matrix for Cisco NDB.

Note Cisco Nexus 9200 Series switches support only one switch deployment.

Nexus Switch Model(s)	Implementation Type	Supported NX-OS Versions	Open Flow Agent
Nexus 3048 / 3064 / 3172	OpenFlow	6.0(2)U6	1.1.5
Nexus 3048 / 3064 / 3172	OpenFlow	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	2.1.4
Nexus 3048 / 3064	NXAPI	6.0(2)U6(x), and 7.0(3)I4(1) to 7.0(3)I4(8b)	NA
Nexus 3172	NXAPI	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	NA
Nexus 3164	OpenFlow	Not Supported	Not Supported
Nexus 3164	NXAPI	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	NA
Nexus 3232	OpenFlow	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	2.1.4
Nexus 3232	NXAPI	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	NA
Nexus 3548	OpenFlow	6.0(2)A6(x) and 6.0(2)A8(x) I7(5) and I7(5a) (OF agent is not required) 7.0(3)I7(2) to 7.0(3)I7(7)	1.1.5
Nexus 3548	NXAPI	Not Supported	Not Supported
Nexus 92160 / 92304	OpenFlow	Not Supported	Not Supported
Nexus 92160 / 92304	NXAPI	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	NA
Nexus 9372 / 9396 / 93128	OpenFlow	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	2.1.4
Nexus 9372 / 9396 / 93128	NXAPI	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	NA
Nexus 93180LC-EX	OpenFlow	Not Supported	Not Supported
Nexus 93180LC-EX	NXAPI	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	NA
Nexus 93108TC-EX / 93180YC-EX	OpenFlow	Not Supported	Not Supported
Nexus 93108TC-EX / 93180YC-EX	NXAPI	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	NA

Nexus Switch Model(s)	Implementation Type	Supported NX-OS Versions	Open Flow Agent
Nexus 93108TC-FX / 93180YC-FX	OpenFlow	Not Supported	Not Supported
Nexus 93108TC-FX/ 93180YC-FX	NXAPI	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	NA
Nexus 9504 / 9508 / 9516	OpenFlow	Not Supported	Not Supported
Nexus 9504 / 9508 / 9516	NXAPI	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	NA
Nexus 31108TC-V / 31108PC-V	NXAPI	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	NA
Nexus 31108TC-V / 31108PC-V	OpenFlow	7.0(3)I4(1) to 7.0(3)I4(9), 7.0(3)I6(1), 7.0(3)I7(2) to 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4)	NA
Nexus 9336C-FX2 / 93240YC-FX2	NXAPI	7.0(3)I7(5), 7.0(3)I7(5a), 7.0(3)I7(6), 7.0(3)I7(7), 9.2(1) to 9.2(4), 9.3(1) to 9.3(4).	NA
Nexus C93360YC-FX2	NXAPI	9.3(1) to 9.3(4)	NA



CHAPTER 2

Managing TLS Certificate, KeyStore, and TrustStore Files

This chapter contains the following sections:

Generating TLS Self-Signed Certification Between NDB Server and NDB Switch for NXAPI

This section describes how to generate TLS self-signed certification between NDB server and NDB Switch. You need to generate certificates and keys for each switch to enable TLS. TLS communication between NDB switch and NDB server uses port 443 only.

Complete the following steps to generate TLS self-signed certification between NDB Server and NDB Switch for NXAPI:

Note You cannot configure a controller to communicate using port 80 after configuring TLS.

Generating Self-Signed Certificate and Key

This section describes how to generate self-signed certificate and key.

Before you begin

Ensure that you have domain name configured on the switch using **ip domain-name** command for each NDB switch that acts as the Fully Qualified Domain Name (FQDN) for the switch. For example:

```
conf t
ip domain-name cisco.com
hostname N9k-117
end
```

The FQDN for the switch is configured to N9K-117.cisco.com.

Step 1 Log in to the server.

Step 2 Generate the private key and self-signed certificate using the **openssl req** command.

Example:

```
docker@docker-virtual-machine:~/TLS$ openssl req -x509 -nodes -days 3650 -newkey rsa:2048 -out
sw1-ca.pem -outform PEM -keyout sw1-ca.key

Generating a 2048 bit RSA private key
...+++
.........................................+++
writing new private key to 'sw1-ca.key'
-----
You are about to be asked to enter information that will be incorporated into
your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [AU]:US
State or Province Name (full name) [Some-State]:CA
Locality Name (eg, city) []:SJ
Organization Name (eg, company) [Internet Widgits Pty Ltd]:cisco
Organizational Unit Name (eg, section) []:insbu
Common Name (e.g. server FQDN or YOUR name) []:N9K-117.cisco.com
Email Address []:myname@cisco.com
```

Note If you have multiple switches, generate the certificate file and private key for each switch.

This command creates a certificate file (sw1-ca.pem) and a private key (sw1-ca.key).

Step 3 Log in to the NDB switch.

Step 4 Copy the certificate file, sw1-ca.pem, and keyfile, sw1-ca.key, to the switch using the **copy** command.

Example:

```
N9K-117# copy scp://docker@10.16.206.250/home/docker/Mallik/TLS_CA_june_23/sw1-ca.pem bootflash:
Enter vrf (If no input, current vrf 'default' is considered): management
```

```
docker@10.16.206.250's password:
server.cer
                                                                    100% 4676
   4.6KB/s   00:00
Copy complete, now saving to disk (please wait)...

N9K-117# copy scp://docker@10.16.206.250/home/docker/Mallik/TLS_CA_june_23/sw1-ca.key bootflash:
Enter vrf (If no input, current vrf 'default' is considered): management

docker@10.16.206.250's password:
cert.key
                                                                    100%
Copy complete, now saving to disk (please wait)...
```

Note If you have multiple switches, repeat this step for all the switches.

Step 5 Configure the certificate file, sw1-ca.pem, and keyfile, sw1-ca.key in the switch using the **nxapi** command.

Example:

```
N9K-117 (config)# nxapi certificate httpskey keyfile bootflash:sw1-ca.key
Upload done. Please enable. Note cert and key must match.
N9K-117 (config)#
N9K-117 (config)# nxapi certificate httpscrt certfile bootflash:sw1-ca.pem
Upload done. Please enable. Note cert and key must match.
 N9K-117 (config)#
```

Note If you have multiple switches, configure the corresponding certificate and private key to each switch.

Step 6 Enable self-signed certificates on the switch using the **nxapi certificate** command.

Example:

```
N9K-117 (config)# nxapi certificate enable
N9K-117 (config)#
```

Note Ensure that there is no error while enabling self-signed certificates on the switch.

Step 7 Log in to the server.

Step 8 Copy and convert the sw1-ca.key and sw1-ca.pem files to .PEM format using the **copy** command.

Example:

```
cp sw1-ca.key sw1-ndb-privatekey.pem
cp sw1-ca.pem sw1-ndb-cert.pem
```

Step 9 Concatenate the private key and the certificate file using **cat** command.

Example:

```
docker@docker-virtual-machine:~/TLS$ cat sw1-ndb-privatekey.pem sw1-ndb-cert.pem > sw1-ndb.pem
```

Step 10 Convert the .pem file to .p12 file format using the **openssl** command. Enter the export password when prompted to create a password protected .p12 certificate file.

Example:

```
docker@docker-virtual-machine:~/TLS$openssl pkcs12 -export -out sw1-ndb.p12 -in sw1-ndb.pem
Enter Export Password: cisco123
Verifying - Enter Export Password: cisco123
```

```
Enter a password at the prompt. Use the same password that you entered in the previous Step (cisco123)
```

Step 11 Convert the sw1-ndb.p12 to a password protected Java KeyStore (tlsKeyStore) file using the **keytool** command. Use the jre/bin from the installed java directory.

Example:

```
docker@docker-virtual-machine:~/TLS$ ./(relativePath)/keytool -importkeystore -srckeystore sw1-ndb.p12
 -srcstoretype pkcs12 -destkeystore tlsKeyStore -deststoretype jks
Enter Destination Keystore password:cisco123
Re-enter new password:cisco123
Enter source keystore password:cisco123
Entry for alias 1 successfully imported.
Import command completed: 1 enteries successfully imported, 0 enteries failed or cancelled.
```

Note By default an alias named "1" is stored in tlsKeyStore for the first switch. If the NDB controller is managing multiple switches, repeat this step for all the switches.When you add the second switch, the utility allows you to rename the first switch alias and also provides a provision to rename alias for the second switch. Refer examples as shown below.

```
keytool -importkeystore -srckeystore sw2-ndb.p12 -srcstoretype pkcs12 -destkeystore
tlsKeyStore -deststoretype jks
keytool -importkeystore -srckeystore sw3-ndb.p12 -srcstoretype pkcs12 -destkeystore
tlsKeyStore -deststoretype jks
```

Step 12 List and verify content in the java tlsKeyStore using the **keytool** command.

Example:

```
docker@docker-virtual-machine:~/TLS$ keytool -list -v -keystore tlsKeyStore | more
```

What to do next

Proceed to the subsequent task, *Creating the TLS TrustStore File*.

Creating the TLS TrustStore File

TrustStore is created from the self-signed certificates that are generated for one or more switches. It holds certificates for one or more switches in the controller. This section describes how to create a Truststore using the self-signed certificate created in Generating Self-Signed Certificate and Key section. If you have multiple switches in the controller, each switch will have separate certificate file (For example, sw1-ndb-cert.pem, sw2-ndb-cert.pem)

Step 1 Log in to the server.

Step 2 Convert the certificate file (For example, sw1-ndb-cert.pem) to a Java TrustStore (tlsTrustStore) file using the **keytool** command. Enter a password when prompted to create a password protected Java TrustStore (tlsTrustStore) file. The password should be at least six characters. Use the jre/bin installed in the java directory.

Example:

```
docker@docker-virtual-machine:~/TLS$ ./(relativePath)/keytool -import -alias sw1 -file sw1-ndb-cert.pem
 -keystore tlsTrustStore -storetype jks
Enter Export Password: cisco123
Verifying - Enter Export Password: cisco123
```

```
Enter a password at the prompt. Use the same password that you entered in the previous Step (cisco123)
```

Note If a NDB controller manages multiple switches, repeat this step for all the switches to add all switch keys into the same TrustStore. For example:

```
docker@docker-virtual-machine:~/TLS$ keytool -import -alias sw2 -file sw2-ndb-cert.pem
-keystore tlsTrustStore
docker@docker-virtual-machine:~/TLS$ keytool -import -alias sw3 -file sw3-ndb-cert.pem
-keystore tlsTrustStore
// Here sw2 and sw3 are alias for switch 2 and switch 3 for identification purpose.
```

Step 3 List and verify keys for multiple switches in the same tlsTrustStore using the **keytool** command.

Example:

```
docker@docker-virtual-machine:~/TLS$ keytool -list -v -keystore tlsTrustStore | more
```

Starting NDB with TLS

To start NDB with TLS, complete these steps:

Step 1 Log in to the NDB server.

Step 2 Stop the NDB application, if running, using the **runndb.sh** command

Example:

```
 ./runndb.sh -stop
Controller with PID: 17426 -- Stopped!
```

Note When onboarding a device, ensure to provide the FQDN or IP address of the device, that was provided during the certificate generation for that device.

Step 3 Copy the tlsKeystore and tlsTruststore files that you created to configuration folder of NDB (ndb/configuration).

Example:

```
cp tlskeystore /root/ndb/configuration
cp tlsTrustStore /root/ndb/configuration
```

Step 4 Start the NDB application with TLS using the **runndb.sh** script.

Example:

```
./runndb.sh -tls -tlskeystore ./configuration/tlsKeyStore -tlstruststore ./configuration/tlsTrustStore
```

Example:

To start NDB with default username (admin) and a non-default password (for example, pwd123):

```
./runndb.sh -osgiPasswordSync -tls -tlskeystore ./configuration/tlsKeyStore -tlstruststore
./configuration/tlsTrustStore
If ndb password is changed, OSGi webconsole password needs to be changed.
To set non-default OSGi webconsole password, enter ndb Admin Password [default]:
 (Type the non-default password which was set)
```

Note To disable TLS, run the **./runndb.sh -notls** command. To disable TLS and start NDB, run the **./runndb.sh -notls -start** command. Before disabling TLS, ensure to *stop* NDB. After TLS is disabled, the port number for the devices connected to the NDB server should be changed to 80.

Starting NDB with TLS Using the GUI

Use this procedure to start TLS between the NDB device and NDB controller. Beginning with Release 3.9.2, you can upload the TLS files using the NDB GUI. This procedure is applicable for self-signed and third party certificates.

Before you begin

Prerequisites:

- Generate the certificate and key
- Create the tlsTrustStore and tlsKeyStore files

Step 1 Log in to the NDB GUI.

Step 2 Navigate to **Administration** > **System** > **TLS**.

Step 3 Click the **Upload/ Update TLS** button to upload the generated TrustStore and KeyStore files.

Step 4 Enter the following details in the displayed **Upload/ Update TLS** window.

Field	Description
Upload or Local Path	Select the radio button to define the path from where the TrustStore and KeyStore files will be uploaded/ updated. If you select **Upload**, then you can upload the files stored on your laptop/ computer. If you select **Local Path**, then you can upload the files by specifying the path where the files are stored on a server.
Upload Keystore(when you select the **Upload** option)	
File Upload	Enter the path for the file.
Password	Enter the password for accessing the tlsKeyStore.
Upload Truststore(when you select the **Upload** option)	
File Upload	Enter the path for the file.
Password	Enter the password for accessing the tlsTrustStore.
Upload Keystore(when you select the **Local Path** option)	
Local path with filename	Enter the path for the file.

Field	Description
Password	Enter the password for accessing the tlsKeyStore.
Upload Truststore(when you select the **Local Path** option)	
Local path with filename	Enter the path for the file.
Password	Enter the password for accessing the tlsTrustStore.

Step 5 Click **Upload**.

After the upload is successful, the Status column indicates *Uploaded* (in green) for the Keystore and Truststore files.

You can now add the device (for which the TLS has been enabled) using port 443. See *Adding a Device* section for the detailed procedure.

Disabling TLS Using the GUI

Use this procedure to disable TLS. This procedure is applicable for self-signed and third party certificates.

Step 1 Log in to the NDB GUI.

Step 2 Navigate to **Administration** > **System** > **TLS**.

Step 3 Click the **Disable TLS** button to disable TLS between NDB devices and NDB controller.

A warning message is displayed indicating that the KeyStore and TrustStore files will be deleted. Click **Yes** to continue.

After disabling, the Status column indicates *TLS Not Enabled* (in gray) for the Keystore and Truststore files.

Configuring TLS KeyStore and TrustStore Passwords on Nexus Dashboard Data Broker

You need to configure TLS KeyStore and TrustStore passwords to enable Nexus Dashboard Data Broker to read password protected TLS KeyStore and TrustStore files. To configure TLS KeyStore and TrustStore passwords on Nexus Dashboard Data Broker , complete these steps:

Step 1 Log in to the Nexus Dashboard Data Broker server.

Step 2 Navigate to bin directory.

Example:

```
cd ndb/bin
```

Step 3 Configure the TLS KeyStore and TrustStore passwords using the **ndb config-keystore-passwords** command.

Example:

```
./ndb config-keystore-passwords --user admin --password admin --url https://ip-address_localhost:8443
 --verbose --prompt --keystore-password keystore_password --truststore-password truststore_password
Please enter your password: <enter the NDB GUI admin password>
```

In case Nexus Dashboard Data Broker is configured with AAA (Tacacs/LDAP/Radius), and if the above command, **ndb config-keystore-passwords** fails, and you see a *401 unauthorized* error, then:

a. Go to `ndb` or `xnc` directory.

b. Stop the Nexus Dashboard Data Broker server using `./runndb.sh -stop`.

c. Enable the flag `enable.LocalUser.Authentication` by changing the value from *false* to *true* in the Nexus Dashboard Data Broker **config.ini** file.

d. Start the Nexus Dashboard Data Broker server using `./runndb.sh -start`.

e. Run the **ndb config-keystore-passwords** command again.

Note In a HA environment, you need to run the above procedure for all the Nexus Dashboard Data Broker servers in the cluster.

After the TLS is enabled on Nexus Dashboard Data Broker , all the connections between Nexus Dashboard Data Broker server and Nexus Dashboard Data Broker switch are established using port 443. Ensure that you change device connections in Nexus Dashboard Data Broker to use port 443.

Up on successfully completing these steps, you can add nexus switch in the controller using port 443. Use FQDN of the switch to add the device to the Nexus Dashboard Data Broker controller.

You can verify the Certificate information using the WebUI Sandbox of the switch.

Generating TLS 3rd Party Certification Between NDB Server and NDB Switch for NXAPI

This section describes how to generate TLS 3rd party certification between NDB server and NDB Switch. You need to request for a separate certificate and key for each switch in you network. TLS communication between NDB switch and NDB server uses port 443 only.

Complete the following steps to generate TLS 3rd party certification between NDB Server and NDB Switch for NXAPI:

- Obtaining Certificates from a Certification Authority
- Creating TLS Keystore and Truststore Files for NDDB Controller
- Starting NDB with TLS
- Configuring TLS KeyStore and TrustStore Passwords on Nexus Dashboard Data Broker

Note Complete all the steps under both the sections to ensure successful communication between the controller and the switch over TLS.

Obtaining Certificates from a Certification Authority

You can obtain certificate from a Certification Authority (CA) in two ways. You can either directly approach a CA for both the private key and certificate. The CA will generate a private key on your behalf along with the certificate that contains the public key with issuing CA's signature.

In the other approach, you can generate a private key using tools such as openssl and generate a Certificate Signing Request (CSR) to a certificate issuing authority. The CA generates the certificates with public key using the user identity information from CSR.

Before you begin

Ensure that you have domain name configured in the switch using **ip domain-name** command for each NDB switch that acts as the Fully Qualified Domain Name (FQDN) for the switch. For example:

```
conf t
ip domain-name cisco.com
hostname N9k-117
end
```

The FQDN for the switch is configured to N9K-117.cisco.com.

Step 1 Log in to the server.

Step 2 Generate the private key (cert.key) and certificate signing request (cert.req) using openssl command.

Note If you have multiple switches, generate the certificate file and private key for each switch.

Example:

```
docker@docker-virtual-machine:~/Mallik/TLS_CA$ openssl req -newkey rsa:2048 -sha256 -keyout cert.key
 -keyform PEM -out cert.req -outform PEM

Generating a 2048 bit RSA private key
...............+++
.....................+++
writing new private key to 'cert.key'
Enter PEM pass phrase:                          cisco123
Verifying - Enter PEM pass phrase:     cisco123
-----
You are about to be asked to enter information that will be incorporated into your certificate
request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [GB]:US
State or Province Name (full name) [Berkshire]:CA
Locality Name (eg, city) [Newbury]:SJ
Organization Name (eg, company) [My Company Ltd]:cisco
Organizational Unit Name (eg, section) []:insbu
Common Name (eg, your name or your server's hostname) []:N9K-117.cisco.com
Email Address []:myname@cisco.com

Please enter the following 'extra' attributes
to be sent with your certificate request
A challenge password []:  cisco123
An optional company name []: cisco123
```

```
docker@docker-virtual-machine: # ls
cert.key  cert.req
```

Step 3 Verify the CSR using the openssl command.

Example:

```
docker@docker-virtual-machine:~/Mallik/TLS_CA$ openssl req -noout -text -in cert.req
```

Step 4 The private key is generated with a security passphrase. You may need to unencrypt the private key. To remove the passphrase from the private key, use the openssl command.

Example:

```
docker@docker-virtual-machine:~/Mk/TLS_CA$ ls
cert.key  cert.req
docker@docker-virtual-machine:~/Mk/TLS_CA$cp cert.key  cert.keybkp
docker@docker-virtual-machine:~/Mk/TLS_CA$ rm cert.key
docker@docker-virtual-machine:~/Mk/TLS_CA$ openssl rsa -in cert.keybkp -out cert.key

Enter pass phrase for cert.keybkp: cisco123
```

Note Repeat this step to remove passphrase from private keys for all the switches.

Note Depending on the tier of the CA you choose, you can get up to three certificates (certificate chain) for each CSR. This means you get three certificates (root, intermediate and domain) from CA for each NDB switch. You need to check with CA to identify each type of certificate. Certificate naming convention might be different for different certifying authorities. For example: test-root-ca-2048.cer (root), test-ssl-ca.cer (intermediate), N9K-117.cisco.com.cer (domain).

Certificates are mostly shared in .PEM file format.

The cert.req file data needs to be submitted to 3rd party certification authority. Follow the relevant procedures and get the three (certificate) files.

Step 5 Create a single certificate file from the three certificate files using the **cat** command. The concatenation should be done in the following order, domain certificate, root certificate, and intermediate certificate. Syntax for **cat** command: *cat domain certificateroot certificateintermediate certificate* > *server.cer*.

Example:

```
$cat N9K-117.cisco.com.cer test-root-ca-2048.cer test-ssl-ca.cer > server.cer
```

Step 6 Edit the newly created server.cer file to separate the concatenated END and BEGIN lines. Do not delete anything in the file.

Example:

```
-----END CERTIFICATE----------BEGIN CERTIFICATE-----


////// Modify the above line like this by adding a line feed between the two.
-----END CERTIFICATE-----
-----BEGIN CERTIFICATE-----
```

Note Repeat this step all the switches.

Step 7 Log into the NDB switch.

Step 8 Copy the private key (cert.key) and the certificate from CA (server.cer) to the switch using the copy command.

Example:

```
N9K-117# copy scp://docker@10.16.206.250/home/docker/Mallik/TLS_CA_june_23/server.cer bootflash:
Enter vrf (If no input, current vrf 'default' is considered): management
docker@10.16.206.250's password:
server.cer
                                                100% 4676     4.6KB/s   00:00
Copy complete, now saving to disk (please wait)...

N9K-117# copy scp://docker@10.16.206.250/home/docker/Mallik/TLS_CA_june_23/cert.key bootflash:
Enter vrf (If no input, current vrf 'default' is considered): management
docker@10.16.206.250's password:
cert.key
                                              100%
Copy complete, now saving to disk (please wait)...
```

Note Repeat this step for all the switches.

Step 9 Configure the certificate file, sw1-ca.pem, and keyfile, sw1-ca.key in the switch using the **nxapi** command.

Example:

```
N9K-117 (config)# nxapi certificate httpskey keyfile bootflash:cert.key
Upload done. Please enable. Note cert and key must match.
N9K-117 (config)#
N9K-117 (config)# nxapi certificate httpscrt certfile bootflash:server.cer
Upload done. Please enable. Note cert and key must match.
 N9K-117 (config)#
```

Note If you have multiple switches, configure the corresponding certificate and private key to each switch.

Step 10 Enable self-signed certificates on the switch using the **nxapi certificate** command.

Example:

```
N9K-117 (config)# nxapi certificate enable
N9K-117 (config)#
```

Note Ensure that there is no error while enabling self-signed certificates on the switch.

Creating TLS Keystore and Truststore Files for NDDB Controller

NDDB uses certificates and keys to secure communication between switches. It stores the keys and certificates in keystores. These files are stored as tlsTruststore and tlsKeystore files in NDDB. Complete the following steps to generate the Java tlsKeyStore and tlsTrustStore files for NDDB Controller:

Step 1 Copy the cert.key and server.cer created in the *Obtaining Certificates from a Certification Authority* section into the current directory (TLS). Select the certificate and key files for a single switch. These files were earlier generated for all the switches connecting to the controller. Using the server.cer and cert.key for the current switch, create the TLS KeyStore File.

If multiple switches are connected, repeat this step for each switch separately.

Step 2 Copy and convert the server.cer and cert.key files to .PEM format using the **copy** command.

Example:

```
cp cert.key sw1-ndb-privatekey.pem
cp server.cer sw1-ndb-cert.pem
```

Step 3 Concatenate the private key (sw1-ndb-privatekey.pem) and certificate file (sw1-ndb-cert.pem) into a single .PEM file using the **cat** command.

Example:

```
cat sw1-ndb-privatekey.pem sw1-ndb-cert.pem > sw1-ndb.pem
```

Step 4 Convert the .PEM file to .P12 format using the **openssl** command. Enter the export password when prompted. The password must contain at least 6 characters, for example, cisco123. The sw1-ndb.pem file is converted to a password-protected sw1-ndb.p12 file.

Example:

```
docker@docker-virtual-machine:~/TLS$openssl pkcs12 -export -out sw1-ndb.p12 -in sw1-ndb.pem
Enter Export Password: cisco123
Verifying - Enter Export Password: cisco123
Enter a password at the prompt. Use the same password that you entered in the previous Step (cisco123)
```

Step 5 Convert the sw1-ndb.p12 to a password protected Java KeyStore (tlsKeyStore) file using the **keytool** command. This command converts the sw1-ndb.p12 file to a password-protected tlsKeyStore file.

Example:

```
docker@docker-virtual-machine:~/TLS$ keytool -importkeystore -srckeystore sw1-ndb.p12 -srcstoretype
 pkcs12 -destkeystore tlsKeyStore -deststoretype jks
Enter Destination Keystore password:cisco123
```

Note By default an alias named "1" is stored in tlsKeyStore for the first switch. If the NDB controller is managing multiple switches, repeat this step for all the switches. When you add the second switch, the utility allows you to rename the first switch alias and also provides a provision to rename alias for the new switch. For example, see below.

```
keytool -importkeystore -srckeystore sw2-ndb.p12 -srcstoretype pkcs12 -destkeystore
tlsKeyStore -deststoretype jks
keytool -importkeystore -srckeystore sw3-ndb.p12 -srcstoretype pkcs12 -destkeystore
tlsKeyStore -deststoretype jks
```

Step 6 List and verify content in the java tlsKeyStore using the keytool command.

Example:

```
docker@docker-virtual-machine:~/TLS$ keytool -list -v -keystore tlsKeyStore | more
```

Step 7 Convert the certificate file (sw1-ndb-cert.pem) to a Java TrustStore (tlsTrustStore) file using the **keytool** command. Enter a password when prompted to create a password protected Java TrustStore (tlsTrustStore) file. The password should be at least six characters.

Example:

```
docker@docker-virtual-machine:~/TLS$ keytool -import -alias sw1 -file sw1-ndb-cert.pem -keystore
tlsTrustStore -storetype jks
Enter keystore password: cisco123
Re-enter new password: cisco123
Owner: EMAILADDRESS=myname@cisco.com, CN=localhost, OU=insbu, O=cisco, L=SJ, ST=CA, C=US
Issuer: EMAILADDRESS=myname@cisco.com, CN=localhost, OU=insbu, O=cisco, L=SJ, ST=CA, C=US
Serial number: c557f668a0dd2ca5
Valid from: Thu Jun 15 05:43:48 IST 2017 until: Sun Jun 13 05:43:48 IST 2027
Certificate fingerprints:
MD5: C2:7B:9E:26:31:7A:74:25:55:DF:A7:91:C9:5D:20:A3
SHA1: 3C:DF:66:96:72:12:CE:81:DB:AB:58:30:60:E7:CC:04:4D:DF:6D:B2
```

```
SHA256: DD:FB:3D:71:B4:B8:9E:CE:97:A3:E4:2D:D3:B6:90:CD:76:A8:5F:84:77:78:BE:49:6C:04:01:84:62:2C:2F:EB
Signature algorithm name: SHA256withRSA
Version: 3

Extensions:

#1: ObjectId: 2.5.29.35 Criticality=false
AuthorityKeyIdentifier [
KeyIdentifier [
0000: 0D B3 CF 81 66 4A 33 4E EF 86 7E 26 C3 50 9B 73 ....fJ3N...&.P.s
0010: 38 EF DF 40 8..@
]
]

#2: ObjectId: 2.5.29.19 Criticality=false
BasicConstraints:[
CA:true
PathLen:2147483647
]

#3: ObjectId: 2.5.29.14 Criticality=false
SubjectKeyIdentifier [
KeyIdentifier [
0000: 0D B3 CF 81 66 4A 33 4E EF 86 7E 26 C3 50 9B 73 ....fJ3N...&.P.s
0010: 38 EF DF 40 8..@
]
]

Trust this certificate? [no]: yes
Certificate was added to keystore
```

Note If a NDB controller manages multiple switches, repeat this step for all the switches to add all switch keys into the same TrustStore. For example:

```
keytool -import -alias sw2 -file sw2-ndb-cert.pem -keystore tlsTrustStore
keytool -import -alias sw3 -file sw3-ndb-cert.pem -keystore tlsTrustStore
```

Step 8 List and verify keys for multiple switches in the same tlsTrustStore using the keytool command.

Example:

```
docker@docker-virtual-machine:~/TLS$ keytool -list -v -keystore tlsTrustStore | more
```

Starting NDB with TLS

To start NDB with TLS, complete these steps:

Step 1 Log in to the NDB server.

Step 2 Stop the NDB application, if running, using the **runndb.sh** command

Example:

```
 ./runndb.sh -stop
Controller with PID: 17426 -- Stopped!
```

Note When onboarding a device, ensure to provide the FQDN or IP address of the device, that was provided during the certificate generation for that device.

Step 3 Copy the tlsKeystore and tlsTruststore files that you created to configuration folder of NDB (ndb/configuration).

Example:

```
cp tlskeystore /root/ndb/configuration
cp tlsTrustStore /root/ndb/configuration
```

Step 4 Start the NDB application with TLS using the **runndb.sh** script.

Example:

```
./runndb.sh -tls -tlskeystore ./configuration/tlsKeyStore -tlstruststore ./configuration/tlsTrustStore
```

Example:

To start NDB with default username (admin) and a non-default password (for example, pwd123):

```
./runndb.sh -osgiPasswordSync -tls -tlskeystore ./configuration/tlsKeyStore -tlstruststore
./configuration/tlsTrustStore
If ndb password is changed, OSGi webconsole password needs to be changed.
To set non-default OSGi webconsole password, enter ndb Admin Password [default]:
 (Type the non-default password which was set)
```

Note To disable TLS, run the **./runndb.sh -notls** command. To disable TLS and start NDB, run the **./runndb.sh -notls -start** command. Before disabling TLS, ensure to *stop* NDB. After TLS is disabled, the port number for the devices connected to the NDB server should be changed to 80.

Starting NDB with TLS Using the GUI

Use this procedure to start TLS between the NDB device and NDB controller. Beginning with Release 3.9.2, you can upload the TLS files using the NDB GUI. This procedure is applicable for self-signed and third party certificates.

Before you begin

Prerequisites:

- Generate the certificate and key
- Create the tlsTrustStore and tlsKeyStore files

Step 1 Log in to the NDB GUI.

Step 2 Navigate to **Administration** > **System** > **TLS**.

Step 3 Click the **Upload/ Update TLS** button to upload the generated TrustStore and KeyStore files.

Step 4 Enter the following details in the displayed **Upload/ Update TLS** window.

Field	Description
Upload or Local Path	Select the radio button to define the path from where the TrustStore and KeyStore files will be uploaded/ updated. If you select **Upload**, then you can upload the files stored on your laptop/ computer. If you select **Local Path**, then you can upload the files by specifying the path where the files are stored on a server.
Upload Keystore(when you select the **Upload** option)	
File Upload	Enter the path for the file.
Password	Enter the password for accessing the tlsKeyStore.
Upload Truststore(when you select the **Upload** option)	
File Upload	Enter the path for the file.
Password	Enter the password for accessing the tlsTrustStore.
Upload Keystore(when you select the **Local Path** option)	
Local path with filename	Enter the path for the file.
Password	Enter the password for accessing the tlsKeyStore.
Upload Truststore(when you select the **Local Path** option)	
Local path with filename	Enter the path for the file.
Password	Enter the password for accessing the tlsTrustStore.

Step 5 Click **Upload**.

After the upload is successful, the Status column indicates *Uploaded* (in green) for the Keystore and Truststore files.

You can now add the device (for which the TLS has been enabled) using port 443. See *Adding a Device* section for the detailed procedure.

Disabling TLS Using the GUI

Use this procedure to disable TLS. This procedure is applicable for self-signed and third party certificates.

Step 1 Log in to the NDB GUI.

Step 2 Navigate to **Administration** > **System** > **TLS**.

Step 3 Click the **Disable TLS** button to disable TLS between NDB devices and NDB controller.

A warning message is displayed indicating that the KeyStore and TrustStore files will be deleted. Click **Yes** to continue.

After disabling, the Status column indicates *TLS Not Enabled* (in gray) for the Keystore and Truststore files.

Configuring TLS KeyStore and TrustStore Passwords on Nexus Dashboard Data Broker

You need to configure TLS KeyStore and TrustStore passwords to enable Nexus Dashboard Data Broker to read password protected TLS KeyStore and TrustStore files. To configure TLS KeyStore and TrustStore passwords on Nexus Dashboard Data Broker , complete these steps:

Step 1 Log in to the Nexus Dashboard Data Broker server.

Step 2 Navigate to bin directory.

Example:

```
cd ndb/bin
```

Step 3 Configure the TLS KeyStore and TrustStore passwords using the **ndb config-keystore-passwords** command.

Example:

```
./ndb config-keystore-passwords --user admin --password admin --url https://ip-address_localhost:8443
 --verbose --prompt --keystore-password keystore_password --truststore-password truststore_password
Please enter your password: <enter the NDB GUI admin password>
```

In case Nexus Dashboard Data Broker is configured with AAA (Tacacs/LDAP/Radius), and if the above command, **ndb config-keystore-passwords** fails, and you see a *401 unauthorized* error, then:

a. Go to `ndb` or `xnc` directory.

b. Stop the Nexus Dashboard Data Broker server using `./runndb.sh -stop`.

c. Enable the flag `enable.LocalUser.Authentication` by changing the value from *false* to *true* in the Nexus Dashboard Data Broker **config.ini** file.

d. Start the Nexus Dashboard Data Broker server using `./runndb.sh -start`.

e. Run the **ndb config-keystore-passwords** command again.

Note In a HA environment, you need to run the above procedure for all the Nexus Dashboard Data Broker servers in the cluster.

After the TLS is enabled on Nexus Dashboard Data Broker , all the connections between Nexus Dashboard Data Broker server and Nexus Dashboard Data Broker switch are established using port 443. Ensure that you change device connections in Nexus Dashboard Data Broker to use port 443.

Up on successfully completing these steps, you can add nexus switch in the controller using port 443. Use FQDN of the switch to add the device to the Nexus Dashboard Data Broker controller.

You can verify the Certificate information using the WebUI Sandbox of the switch.

Generating TLS Self-Signed Certification Between NDB Server and NDB Switch for OpenFlow

Complete the following steps to generate TLS self-signed certification between NDB Server and NDB Switch for OpenFlow:

Step 1 Create a TLS directory using the **mkdir directory_name** and navigate to the new directory.

Example:

```
[]# mkdir -p TLS
[]# cd TLS
```

Step 2 Create 3 directories under mypersonalca folder for CA system.

Example:

```
[]# mkdir -p mypersonalca/certs
[]# mkdir -p mypersonalca/private
[]# mkdir -p mypersonalca/crl
```

Step 3 Initialize the serial file using the **echo** command. The serial file and the index.txt file are used by the CA to maintain its database of the certificate files.

Example:

```
[]# echo "01" > mypersonalca/serial
```

Step 4 Initialize the index file using the **touch** command.

Example:

```
[]# touch mypersonalca/index.txt
```

Step 5 Create a CA configuration file and configure the alt_names section with relevant IP Addresses.

Example:

```
[ ca ]
default_ca = mypersonalca
[ mypersonalca ]
#
# WARNING: if you change that, change the default_keyfile in the [req] section below too
# Where everything is kept
dir = ./mypersonalca
# Where the issued certs are kept
certs = $dir/certs
# Where the issued crl are kept
crl_dir = $dir/crl
# database index file
database = $dir/index.txt
# default place for new certs
new_certs_dir = $dir/certs
#
# The CA certificate
```

```
certificate = $dir/certs/ca.pem
# The current serial number
serial = $dir/serial
# The current CRL
crl = $dir/crl/crl.pem
# WARNING: if you change that, change the default_keyfile in the [req] section below too
# The private key
private_key = $dir/private/ca.key
# private random number file
RANDFILE = $dir/private/.rand
# The extentions to add to the cert
x509_extensions = usr_cert
# how long to certify for
default_days = 365
# how long before next CRL
default_crl_days= 30
# which md to use; people in comments indicated to use sha1 here
default_md = sha1
# keep passed DN ordering
preserve = no
# Section names
policy = mypolicy
x509_extensions = certificate_extensions
[ mypolicy ]
# Use the supplied information
commonName = supplied
stateOrProvinceName = optional
countryName = optional
emailAddress = optional
organizationName = optional
organizationalUnitName = optional
[ certificate_extensions ]
# The signed certificate cannot be used as CA
basicConstraints = CA:false
[ req ]
# same as private_key
default_keyfile = ./mypersonalca/private/ca.key
# Which hash to use
default_md = sha1
# No prompts
prompt = no
# This is for CA
subjectKeyIdentifier=hash
authorityKeyIdentifier=keyid:always,issuer
string_mask = utf8only
basicConstraints = CA:true
distinguished_name = root_ca_distinguished_name
x509_extensions = root_ca_extensions
[ root_ca_distinguished_name ]
commonName = Controller
stateOrProvinceName = Mass
countryName = US
emailAddress = root_ca_userid@cisco.com
organizationName = Cisco
[ root_ca_extensions ]
basicConstraints = CA:true
```

Step 6 Generate the TLS private key, certificate, and Certification Authority (CA) files using the **openssl req** command. The TLS private key is created in PEM format with a key length of 2048 bits and the CA file.

Example:

```
openssl req -x509 -nodes -days 3650 -newkey rsa:2048 -out mypersonalca/certs/ca.pem -outform PEM
-keyout mypersonalca/private/ca.key
```

```
Generating a 2048 bit RSA private key
.............+++
...............................+++
writing new private key to 'mypersonalca/private/ca.key'
-----
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [AU]:US
State or Province Name (full name) [Some-State]:Mass
Locality Name (eg, city) []:San
Organization Name (eg, company) [Internet Widgits Pty Ltd]:Cisco
Organizational Unit Name (eg, section) []:NDB
Common Name (e.g. server FQDN or YOUR name) []:Controller
Email Address []:masavanu@cisco.com
```

Note This step generates the TLS private key in PEM format with a key length of 2048 bits, and the CA file.

Step 7 Generate the certificate key and certificate request files, using the **openssl req** command.

Example:

```
openssl req -newkey rsa:2048 -keyout cert.key -keyform PEM -out cert.req -outform PEMGenerating
 a 2048 bit RSA private key
Generating a 2048 bit RSA private key
.......................................+++
........+++
writing new private key to 'cert.key'
Enter PEM pass phrase:(Enter pwd123 here)
Verifying - Enter PEM pass phrase:(Enter pwd123 here)
-----
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [AU]:US
State or Province Name (full name) [Some-State]:Mass
Locality Name (eg, city) []:San
Organization Name (eg, company) [Internet Widgits Pty Ltd]:Cisco
Organizational Unit Name (eg, section) []:NDB
Common Name (e.g. server FQDN or YOUR name) []:Controller
Email Address []:masavanu@cisco.com
Please enter the following 'extra' attributes
to be sent with your certificate request
A challenge password []:pwd123
An optional company name []:
```

Note This step generates the controller key (cert.key) and certificate request (cert.req) files in PEM format.

Step 8 Generate the certificate file, using the **openssl ca** command.

Example:

```
openssl ca -batch -notext -in cert.req -out cert.pem -config ca.cnf
Using configuration from ca.cnf
Check that the request matches the signature
Signature ok
The Subject's Distinguished Name is as follows
countryName :PRINTABLE:'US'
stateOrProvinceName :ASN.1 12:'Mass'
localityName :ASN.1 12:'San'
organizationName :ASN.1 12:'Cisco'
organizationalUnitName:ASN.1 12:'NDB'
commonName :ASN.1 12:'Controller'
emailAddress :IA5STRING:'masavanu@cisco.com'
Certificate is to be certified until May 17 02:59:40 2017 GMT (365 days)
Write out database with 1 new entries
Data Base Updated
```

Note This step generates the certificate (cert.pem) file in PEM format using the certificate request (cert.req) and the certificate configuration (ca.cnf) files.

Step 9 Configure the Cryptographic Keys on the Switch.

Example:

```
switch(config)# ip domain-name domain-name
//Configures the domain name for the switch
switch(config)# crypto key generate rsa label myKey2 exportable modulus 2048
//Generates the cryptographic key.
switch(config)# crypto ca trustpoint myCA
//Enters the trustpoint configuration mode and installs the trustpoint file on the switch
switch(config-trustpoint)# rsakeypair myKey2
//Installs the key files on the switch
switch(config-trustpoint)# exit
//Exits trustpoint configuration mode
switch# show crypto ca trustpoints
//(Optional) Verifies creation of the trustpoint files.
switch# show crypto key mypubkey rsa
//(Optional) Verifies creation of the key files.
cat mypersonalca/certs/ca.pem
//Displays the certificate file on the machine hosting the generated TLS certificates
switch(config)# crypto ca authenticate myCA
-----BEGIN CERTIFICATE----------
-----END CERTIFICATE-----
END OF INPUT:
Fingerprint(s): SHA1
Fingerprint=56:0F:56:85:6A:07:A1:44:6C:F4:4C:45:CF:CC:BA:47:22:17:1D:93
Do you accept this certificate [yes/no]:yes

switch(config)# crypto ca enroll myCA
//Generates the certificate request on the switch

Create the certificate request ..
Create a challenge password. You will need to verbally provide this
```

```
password to the CA Administrator in order to revoke your certificate.
For security reasons your password will not be saved in the configuration.
Please make a note of it.
Password:pwd123
The subject name in the certificate will be the name of the switch.
Include the switch serial number in the subject name [yes/no]:no
Include an IP address in the subject name [yes/no]:no
Include the Alternate Subject Name  [yes/no]:no
The certificate request will be displayed...
-----BEGIN CERTIFICATE REQUEST-----
.....
-----END CERTIFICATE REQUEST-----
openssl ca -in n3k-cert.req -out newcert.pem -config ./ca.cnf
//Copies the certificate request from the switch to the file n3k-cert.req on your Linux machine,
and then uses it to generate the switch certificate.
Using configuration from ./ca.cnf
Check that the request matches the signature
Signature ok
The Subject's Distinguished Name is as follows
commonName :PRINTABLE:'ndb-3172-4.cisco.com'
Certificate is to be certified until May 17 04:27:57 2017 GMT (365 days)
Sign the certificate [y/n]:y
out of 1 certificate requests certified, commit [y/n]y
Write out database with 1 new entries
Data Base Updated

cat newcert.pem
//Copies the certificate (newcert.pem) to the switch

switch(config)# crypto ca import myCA certificate
switch(config)# crypto ca import myCA certificate
input (cut & paste) certificate in PEM format:

switch# show crypto ca certificates
//Displays the certificates on the switch
```

Step 10 Enable the TLS OpenFlow Switches

Example:

```
switch(config)# openflow
//Enters OpenFlow agent configuration mode on the switch.
switch(config-ofa)# switch 1
//Enters OpenFlow agent configuration mode for switch 1.
switch(config-ofa)# tls trust-point local myCA remote myCA
//Enables TLS certificate authority on the switch.
switch(config-ofa-switch)# pipeline{201/203}
//Configures the pipeline
switch(config-ofa-switch)#controller ipv4 {A.B.C.D} port 6653 vrf management security tls
//Enables TLS for OpenFlow switches
```

Step 11 Create the TLS KeyStore File

Example:

```
cp cert.key xnc-privatekey.pem
//Copy cert.key to xnc-privatekey.pem
cp cert.pem xnc-cert.pem
```

```
//Copy cert.pem to xnc-cert.pem under TLS folder
cat xnc-privatekey.pem xnc-cert.pem > xnc.pem
Creates the xnc.pem file, which contains the private key and certificate.

openssl pkcs12 -export -out xnc.p12 -in xnc.pem
//Convert the PEM file xnc.pem file to the file xnc.p12
Enter a password at the prompt
The xnc.pem file is converted to a password-protected .p12 file.
openssl pkcs12 -export -out xnc.p12 -in xnc.pem
Enter pass phrase for xnc.pem:(enter pass phrase as pwd123)
Enter Export Password:(Enter Export password as pwd123)
Verifying - Enter Export Password:(Enter as pwd123)
```

Step 12 Convert the xnc.p12 file to password protected TLS KeyStore

Example:

```
keytool -importkeystore -srckeystore xnc.p12 -srcstoretype pkcs12 -destkeystore tlsKeyStore
-deststoretype jks
Enter destination keystore password: (Enter pwd123)
Re-enter new password: (Enter pwd123)
Enter source keystore password: (Enter pwd123)
Entry for alias 1 successfully imported.
Import command completed: 1 entries successfully imported, 0 entries failed or
 cancelled
```

Step 13 Enter the TLS KeyStore password.

Step 14 Create the TLS TrustStore File.

Example:

```
cp mypersonalca/certs/ca.pem sw-cacert.pem
//Copies the mypersonalca/certs/ca.pem file to sw-cacert.pem
keytool -import -alias swca1 -file sw-cacert.pem -keystore tlsTrustStore
Enter keystore password: (Enter pwd123)
Re-enter new password: (Enter pwd123)
Owner: EMAILADDRESS=masavanu@cisco.com, CN=Controller, OU=NDB, O=Cisco, L=San,
 ST=Mass, C=US
Issuer: EMAILADDRESS=masavanu@cisco.com, CN=Controller, OU=NDB, O=Cisco, L=San,
 ST=Mass, C=US
Serial number: d764c5b1e5e6b531
Valid from: Mon May 16 22:49:13 EDT 2016 until: Thu May 14 22:49:13 EDT 2026
Certificate fingerprints:
MD5: BD:C8:21:13:D0:7F:ED:A4:B4:FA:97:9A:D0:EA:12:78
SHA1: 56:0F:56:85:6A:07:A1:44:6C:F4:4C:45:CF:CC:BA:47:22:17:1D:93
SHA256:
09:32:74:12:BF:56:04:07:42:8C:D8:1B:78:AD:7A:40:0D:51:AA:56:91:B1:1A:18:90:6A:A5:A0:44:04:6A:EC
Signature algorithm name: SHA256withRSA
Version: 3
Extensions:
#1: ObjectId: 2.5.29.35 Criticality=false
AuthorityKeyIdentifier [
KeyIdentifier [
0000: 78 C5 2B 09 7F AF EC 86 FE 50 EA 6C 8A 56 B3 BE x.+......P.l.V..
0010: BE F2 97 98 ....
]
]
```

```
#2: ObjectId: 2.5.29.19 Criticality=false
BasicConstraints:[
CA:true
PathLen:2147483647
]
#3: ObjectId: 2.5.29.14 Criticality=false
SubjectKeyIdentifier [
KeyIdentifier [
0000: 78 C5 2B 09 7F AF EC 86 FE 50 EA 6C 8A 56 B3 BE x.+......P.l.V..
0010: BE F2 97 98 ....
]
]
Trust this certificate [no]: yes
Certificate was added to keystore
```

Note The sw-cacert.pem file is converted into a password-protected Java TrustStore (tlsTrustStore) file.

Starting the NDB Application with TLS Enabled

Complete the following steps to start NDB application with TLS enabled.

Before you begin

Copy TLS Truststore and TLS Keystore files created under TLS folder to the configuration directory of Cisco Nexus Data Broker.

Step 1 Start the NDB application using the **runxnc.sh** script.

Example:

```
./runxnc.sh -tls -tlskeystore ./configuration/tlsKeyStore -tlstruststore ./configuration/tlsTrustStore
```

Example:

To start NDB with default username (admin) and a non-default password (for example, pwd123):

```
./runxnc.sh -osgiPasswordSync -tls -tlskeystore ./configuration/tlsKeyStore -tlstruststore
./configuration/tlsTrustStore
If XNC password is changed, OSGi webconsole password needs to be changed,
to set non-default OSGi webconsole password Enter XNC Admin Password [default]:
(Type the non-default password which was set)
```

Example:

To start NDB with default username (admin) and password (admin):

```
./runxnc.sh -tls -tlskeystore ./configuration/tlsKeyStore -tlstruststore ./configuration/tlsTrustStore
```

Step 2 Configure the TLS KeyStore and TrustStore passwords in Cisco NDB. You need to configure TLS KeyStore and TrustStore Passwords to enable NDB to read the password-protected TLS KeyStore and TrustStore files.

Example:

```
xnc/bin directory# ./xnc config-keystore-passwords --user admin --password admin --url
```

```
https://NDB_URL:8443
--verbose --prompt --keystore-password pwd123 --truststore-password pwd123
```

If the TLS KeyStore and TrustStore passwords configuration fails with `Failed to connect to the controller`, you need to change the protocol to HTTP.

```
./xnc config-keystore-passwords --user admin --password admin --url https://localhost:8443 --verbose
 --prompt --keystore-password pwd123 --truststore-password pwd123
[Info] Sending request: https://10.16.206.189:8443/controller/osgi/system/console/vmstat
---- REQUEST HEADERS ----
GET https://10.16.206.189:8443/controller/osgi/system/console/vmstat HTTP/1.1
-------------------------
[Error] Failed to connect to the controller at "https://10.16.206.189:8443". Controller may not be
running.
javax.net.ssl.SSLHandshakeException: java.security.cert.CertificateException:
No subject alternative names present
at sun.security.ssl.Alerts.getSSLException(Alerts.java:192)
at sun.security.ssl.SSLSocketImpl.fatal(SSLSocketImpl.java:1949)
at sun.security.ssl.Handshaker.fatalSE(Handshaker.java:302)
at sun.security.ssl.Handshaker.fatalSE(Handshaker.java:296)
at sun.security.ssl.ClientHandshaker.serverCertificate(ClientHandshaker.java:1509)
at sun.security.ssl.ClientHandshaker.processMessage(ClientHandshaker.java:216)
at sun.security.ssl.Handshaker.processLoop(Handshaker.java:979)
at sun.security.ssl.Handshaker.process_record(Handshaker.java:914)
at sun.security.ssl.SSLSocketImpl.readRecord(SSLSocketImpl.java:1062)
at sun.security.ssl.SSLSocketImpl.performInitialHandshake(SSLSocketImpl.java:1375)
at sun.security.ssl.SSLSocketImpl.startHandshake(SSLSocketImpl.java:1403)
at sun.security.ssl.SSLSocketImpl.startHandshake(SSLSocketImpl.java:1387)
at sun.net.www.protocol.https.HttpsClient.afterConnect(HttpsClient.java:559)
at
sun.net.www.protocol.https.AbstractDelegateHttpsURLConnection.connect(AbstractDelegateHttpsURLConnection.java:185)

at sun.net.www.protocol.http.HttpURLConnection.getInputStream0(HttpURLConnection.java:1513)
at sun.net.www.protocol.http.HttpURLConnection.getInputStream(HttpURLConnection.java:1441)
at java.net.HttpURLConnection.getResponseCode(HttpURLConnection.java:480)
at sun.net.www.protocol.https.HttpsURLConnectionImpl.getResponseCode(HttpsURLConnectionImpl.java:338)

at com.cisco.csdn.cli.online.HttpClient$HttpResponse.<init>(HttpClient.java:191)
at com.cisco.csdn.cli.online.HttpClient.sendRequest(HttpClient.java:108)
at com.cisco.csdn.cli.online.HttpClient.get(HttpClient.java:92)
at com.cisco.csdn.cli.online.OnlineCommand.isRunning(OnlineCommand.java:88)
at
com.cisco.csdn.cli.online.ConfigKeyStorePasswordCommand.processCommand(ConfigKeyStorePasswordCommand.java:46)

at com.cisco.csdn.cli.Cli.processCommand(Cli.java:70)
at com.cisco.csdn.cli.Main.main(Main.java:33)
Caused by: java.security.cert.CertificateException: No subject alternative names present
at sun.security.util.HostnameChecker.matchIP(HostnameChecker.java:144)
at sun.security.util.HostnameChecker.match(HostnameChecker.java:93)
at sun.security.ssl.X509TrustManagerImpl.checkIdentity(X509TrustManagerImpl.java:455)
at sun.security.ssl.X509TrustManagerImpl.checkIdentity(X509TrustManagerImpl.java:436)
at sun.security.ssl.X509TrustManagerImpl.checkTrusted(X509TrustManagerImpl.java:200)
at sun.security.ssl.X509TrustManagerImpl.checkServerTrusted(X509TrustManagerImpl.java:124)
at sun.security.ssl.ClientHandshaker.serverCertificate(ClientHandshaker.java:1491)
... 20 more

//Change the protocol to HTTP.
./xnc config-keystore-passwords --user admin --password admin --url http://localhost:8080
--verbose --prompt --keystore-password pwd123 --truststore-password pwd123
```

Note Ensure that the tlsKeyStore and tlsTrustStore files are located in the configuration directory under xnc where the NDB.zip file is extracted.

Generating TLS Self-Signed Certification Between WebUI Browser and NDB Server

You can secure communication between a Web browser and NDB server running in centralized mode using self-signed certificates. This section describes how to generate a self-signed certificate to secure communication between a WebUI browser and NDB application. By default Cisco NDB is shipped with default certificate which is issued to Cisco NDB and issued by Cisco NDB with default validity. You can use the **generateWebUIcertificate.sh** script under configuration folder to create self-signed certificates. For Cisco NDB releases 3.5 and earlier, these certificates are valid for 6 months. Starting with Cisco NDB release 3.6, default validity of a certificate is 6 months but you can configure the validity of a certificate.

Note You can create self-signed TLS certificates for NDB in Centralized mode only.

- Generating TLS Self-Signed Certification Between WebUI Browser and NDB Server Running in Centralized Mode

Generating TLS Self-Signed Certification Between WebUI Browser and NDB Server Running in Centralized Environment

Complete the following steps to generate TLS self-signed certification between WebUI Browser and NDB Server running in Centralized mode:

Step 1 Log into the NDB server and change the current directory `\ndb\configuration`.

Example:

```
[root@RHEL-VM-NDB-ACI]# cd \ndb\configuration
```

Step 2 Generate the TLS self-signed certificate using the **generateWebUIcertificate.sh** script.

Example:

```
[root@RHEL-VM-NDB-ACI configuration]# ./generateWebUIcertificate.sh

**********************************
Entor Fully qualified domain name :
**********************************
NDB-browser This can be FQDN of the NDB java application as well
**************************
Enter Organizational unit :
**************************
INSBU
```

```
********************
Enter Organization :
********************
cisco
****************
Enter Location :
****************
SJ
*************
Enter State :
*************
CA
***************
Enter Country :
***************
USA
***************
Enter keypass :
***************
cisco123
*****************
Enter storepass :
*****************
cisco123
************************************
Enter the validity in number of days :
************************************
365  in NDB 3.5 this script will let you to specify the certificate validity.
*********************************************************************************************************************************
Below process will rename the existing key file to <old_keystore>, will generate
 a new key file. Do you want to continue (y/n) ?
*********************************************************************************************************************************
y
******************************
Self-Signed Certificate Created
******************************
Alias name: cisco
Creation date: Jan 6, 2019
Entry type: PrivateKeyEntry
Certificate chain length: 1
Certificate[1]:
Owner: CN=NDB-browser, OU=INSBU, O=cisco, L=SJ, ST=CA, C=USA
Issuer: CN=NDB-browser, OU=INSBU, O=cisco, L=SJ, ST=CA, C=USA
Serial number: b404be5
Valid from: Sun Jan 06 20:22:05 PST 2019 until: Mon Jan 06 20:22:05 PST 2020
Certificate fingerprints:
         MD5:  71:07:F6:4E:57:6A:08:3A:AD:06:32:B3:6C:5F:8F:52
         SHA1: 04:08:B9:D5:B7:EB:ED:E0:F9:22:49:14:FA:C6:09:39:22:32:43:A2
         SHA256:
34:D9:EB:34:0A:52:D1:4A:DD:F1:8B:14:D0:84:E4:1C:57:8B:2B:99:9B:E5:A1:4C:C7:8C:CD:AE:24:31:49:75
```

```
         Signature algorithm name: SHA256withRSA
         Version: 3

Extensions:

#1: ObjectId: 2.5.29.14 Criticality=false
SubjectKeyIdentifier [
KeyIdentifier [
0000: 63 8A 92 8F 6F 0F 45 BD   EE 55 C5 A8 99 3B F6 F7  c...o.E..U...;..
0010: AC FA 4A 21                                        ..J!
]
]

*******************************
Displayed the generated keystore
*******************************
************************************************
Configured the keystore details on tomcat-server.xml
************************************************
*********************************************************************************************
The newly generated key will used on next NDB restart. Do you want to restart NDB
 now (y/n) ?
*********************************************************************************************
y
Doesn't seem any Controller daemon is currently running
Running controller in background with PID: 13573, to connect to it please SSH to
 this host on port 2400
NDB GUI can be accessed using below URL:
[https://10.16.206.160:8443]
[https://[fe80::250:56ff:fe90:b764]:8443]
[https://10.16.206.159:8443]
[https://192.168.1.123:8443]
[https://[fe80::250:56ff:fe90:9c79]:8443]

*************
NDB Restarted
*************
```

Note The **generateWebUIcertificate.sh** script reloads the NDB application to ensure that the browser starts using this certificate when we access NDB java application from the browser.

Step 3 Decode the generated certificate using the **keytool -list -v -keystore keystore_Name** command. Enter the store password when prompted.

Example:

```
[root@RHEL-VM-NDB-ACI configuration]# keytool -list -v -keystore keystore
Enter keystore password:

Keystore type: JKS
Keystore provider: SUN

Your keystore contains 1 entry

Alias name: cisco
```

```
Creation date: Jul 6, 2019
Entry type: PrivateKeyEntry
Certificate chain length: 1
Certificate[1]:
Owner: CN=NDB-browser, OU=INSBU, O=cisco, L=SJ, ST=CA, C=USA
Issuer: CN=NDB-browser, OU=INSBU, O=cisco, L=SJ, ST=CA, C=USA
Serial number: b404be5
Valid from: Sun Jan 06 20:22:05 PST 2019 until: Mon Jan 06 20:22:05 PST 2020
Certificate fingerprints:
         MD5:  71:07:F6:4E:57:6A:08:3A:AD:06:32:B3:6C:5F:8F:52
         SHA1: 04:08:B9:D5:B7:EB:ED:E0:F9:22:49:14:FA:C6:09:39:22:32:43:A2
         SHA256:
34:D9:EB:34:0A:52:D1:4A:DD:F1:8B:14:D0:84:E4:1C:57:8B:2B:99:9B:E5:A1:4C:C7:8C:CD:AE:24:31:49:75
         Signature algorithm name: SHA256withRSA
         Version: 3

Extensions:

#1: ObjectId: 2.5.29.14 Criticality=false
SubjectKeyIdentifier [
KeyIdentifier [
0000: 63 8A 92 8F 6F 0F 45 BD   EE 55 C5 A8 99 3B F6 F7  c...o.E..U...;..
0010: AC FA 4A 21                                        ..J!
]
]

*******************************************
*******************************************
```

Step 4 The self-signed certificates are generated in JKS format which is not compatible with the browsers. Hence, you need to convert these certificates into PKCS12 format before importing the certificate in the browser. Complete the following steps to convert JKS format certificate to PKCS12 format. Convert JKS format certificate into PKCS12 format using the **keytool** command.

Note Ensure that you keep a copy of the original certificates before proceeding with the conversion.

Example:

```
keytool -importkeystore -srckeystore keystore -srcstorepass cisco123 -srckeypass cisco123 -destkeystore
keystore.p12 -deststoretype PKCS12 -srcalias cisco -deststorepass cisco123 -destkeypass cisco123
```

Note The inputs in the **keytool** command should match the inputs provided during UI certificate generation.

Note The resulting certificate file (keystore.p12) is in PKSC12 format.

Step 5 Add this certificate to Trusted Root certificate store on the browser. See help for respective Web browsers about how to add the certificate to the Trusted Root certificate store.

Generating TLS Self-Signed Certification Between Web Browser and NDB Server Running in Embedded Mode

You can generate TLS self-signed certification between a Web browser and NDB server running in Embedded mode in the Guestshell Environment.

Generating TLS Self-Signed Certificate Between Web Browser and NDB Server Running in Embedded Mode Using Guest Shell Environment

To generate TLS self-signed certificate between Web browser and NDB server running in embedded mode using Guest Shell environment, complete the following steps.

Step 1 Connect to Guest Shell using **guestshell** command.

Example:

```
N9K-C93108TC-EX-108# guestshell
[admin@guestshell ~]$
[admin@guestshell ~]$
```

Step 2 Change the current directory to `\ndb\configuration`.

Example:

```
[admin@guestshell ~]$ cd \ndb\configuration
```

Step 3 Generate the TLS self-signed certificate using the `/home/admin/ndb/configuration/generateWebUIcertificate.sh` script.

Example:

```
[root@RHEL-VM-NDB-ACI configuration]# ./generateWebUIcertificate.sh

**********************************
Entor Fully qualified domain name :
**********************************
NDB-browser This can be FQDN of the NDB java application as well
**************************
Enter Organizational unit :
**************************
INSBU
********************
Enter Organization :
********************
cisco
****************
Enter Location :
****************
SJ
*************
Enter State :
*************
CA
***************
Enter Country :
***************
USA
***************
Enter keypass :
***************
cisco123
```

```
*****************
Enter storepass :
******************
cisco123
************************************
Enter the validity in number of days :
************************************
365  in NDB 3.5 this script will let you to specify the certificate validity.
*************************************************************************************************************
Below process will rename the existing key file to <old_keystore>, will generate
 a new key file. Do you want to continue (y/n) ?
*************************************************************************************************************
y
******************************
Self-Signed Certificate Created
******************************
Alias name: cisco
Creation date: Jan 6, 2019
Entry type: PrivateKeyEntry
Certificate chain length: 1
Certificate[1]:
Owner: CN=NDB-browser, OU=INSBU, O=cisco, L=SJ, ST=CA, C=USA
Issuer: CN=NDB-browser, OU=INSBU, O=cisco, L=SJ, ST=CA, C=USA
Serial number: b404be5
Valid from: Sun Jan 06 20:22:05 PST 2019 until: Mon Jan 06 20:22:05 PST 2020
Certificate fingerprints:
         MD5:  71:07:F6:4E:57:6A:08:3A:AD:06:32:B3:6C:5F:8F:52
         SHA1: 04:08:B9:D5:B7:EB:ED:E0:F9:22:49:14:FA:C6:09:39:22:32:43:A2
         SHA256:
34:D9:EB:34:0A:52:D1:4A:DD:F1:8B:14:D0:84:E4:1C:57:8B:2B:99:9B:E5:A1:4C:C7:8C:CD:AE:24:31:49:75

         Signature algorithm name: SHA256withRSA
         Version: 3

Extensions:

#1: ObjectId: 2.5.29.14 Criticality=false
SubjectKeyIdentifier [
KeyIdentifier [
0000: 63 8A 92 8F 6F 0F 45 BD   EE 55 C5 A8 99 3B F6 F7  c...o.E..U...;..
0010: AC FA 4A 21                                        ..J!
]
]

******************************
Displayed the generated keystore
******************************
*************************************************
Configured the keystore details on jetty-ssl-context.xml
*************************************************
*************************************************************************************************
```

```
The newly generated key will used on next NDB restart. Do you want to restart NDB
 now (y/n) ?
********************************************************************************************
n
*************
The newly generated key will be used on the next NDB restart.
*************
```

Note Manually reboot guestshell using the **guestshell reboot** command to ensure that the browser starts using this certificate when you access NDB java application from the browser.

Step 4 Decode the generated certificate using the **keytool -list -v -keystore keystore_Name** command. Enter the store password when prompted.

Example:

```
[root@RHEL-VM-NDB-ACI configuration]#  keytool -list -v -keystore keystore
Enter keystore password:

Keystore type: JKS
Keystore provider: SUN

Your keystore contains 1 entry

Alias name: cisco
Creation date: Jul 6, 2019
Entry type: PrivateKeyEntry
Certificate chain length: 1
Certificate[1]:
Owner: CN=NDB-browser, OU=INSBU, O=cisco, L=SJ, ST=CA, C=USA
Issuer: CN=NDB-browser, OU=INSBU, O=cisco, L=SJ, ST=CA, C=USA
Serial number: b404be5
Valid from: Sun Jan 06 20:22:05 PST 2019 until: Mon Jan 06 20:22:05 PST 2020
Certificate fingerprints:
         MD5:  71:07:F6:4E:57:6A:08:3A:AD:06:32:B3:6C:5F:8F:52
         SHA1: 04:08:B9:D5:B7:EB:ED:E0:F9:22:49:14:FA:C6:09:39:22:32:43:A2
         SHA256:
34:D9:EB:34:0A:52:D1:4A:DD:F1:8B:14:D0:84:E4:1C:57:8B:2B:99:9B:E5:A1:4C:C7:8C:CD:AE:24:31:49:75
         Signature algorithm name: SHA256withRSA
         Version: 3

Extensions:

#1: ObjectId: 2.5.29.14 Criticality=false
SubjectKeyIdentifier [
KeyIdentifier [
0000: 63 8A 92 8F 6F 0F 45 BD   EE 55 C5 A8 99 3B F6 F7  c...o.E..U...;..
0010: AC FA 4A 21                                        ..J!
]
]

*******************************************
*******************************************
```

Step 5 The self-signed certificates are generated in JKS format which is not compatible with the browsers. You need to convert these certificates into PKCS12 format before importing the certificate in the browser. Complete the following steps to convert JKS format certificate to PKCS12 format. Convert JKS format certificate into PKCS12 format using the **keytool** command.

Note Ensure that you keep a copy of the original certificates before proceeding with the conversion.

Example:

```
keytool -importkeystore -srckeystore keystore -srcstorepass cisco123 -srckeypass cisco123 -destkeystore
keystore.p12 -deststoretype PKCS12 -srcalias cisco -deststorepass cisco123 -destkeypass cisco123
```

Note The inputs in the **keytool** command should match the inputs provided during UI certificate generation.

Note The resulting certificate file (keystore.p12) is in PKSC12 format.

Step 6 Upload the CA certificate into Trusted Root certificate store of Web browser. See help for respective Web browsers about how to add the certificate to the Trusted Root certificate store. Use the password that you created while creating the certificate when prompted while uploading the certificate to the Web browser.

Step 7 Restart the Guest Shell to restart the NDB.

Generating TLS Self-Signed Certificate Between Web Browser and NDB Server Running in Embedded Mode Using OVA Environment

To generate TLS self-signed certificate between Web browser and NDB server running in embedded mode using OVA environment, complete the following steps.

Step 1 Connect to virtual service console using the **virtual-service connect** command.

Example:

```
N3K-3172# virtual-service connect name ova console
Connecting to virtual-service.  Exit using ^c^c^c
Entering character mode
Escape character is '^]'.
root@N3K-3172:~#
root@N3K-3172:~#
```

Step 2 Change current directory to `/xnclite/xnc/configuration`.

Example:

```
root@ N9396TX-116:~# cd /xnclite/xnc/configuration
root@ N9396TX-116:/xnclite/xnc/configuration#
```

Step 3 Edit the `generateWebUIcertificate.sh` script. Update the Keytool attribute in the file(two instances) with the NDB OVA JRE path.

Example:

```
cmd1=echo /usr/lib/jvm/i586-wrs-jre/bin/keytool -genkey -noprompt -trustcacerts -keyalg RSA -alias
cisco -dname  "CN=$CN, OU=$OU, O=$O, L=$L, ST=$ST, C=$C" -keypass $Keypass -keystore $eig -storepass
 $Storepass -validity $validityVal


cmd2=echo /usr/lib/jvm/i586-wrs-jre/bin/keytool -alias cisco -list -v -keystore keystore -storepass
 $Storepass;
```

Step 4 Set Java home path using the **export** command.

Example:

```
export JAVA_HOME='/usr/lib/jvm/i586-wrs-jre'
```

Step 5 Generate the TLS self-signed certificate using the `/home/admin/xnc/configuration/generateWebUIcertificate.sh` script.

Example:

```
[root@RHEL-VM-NDB-ACI configuration]# ./generateWebUIcertificate.sh

**********************************
Entor Fully qualified domain name :
**********************************
NDB-browser This can be FQDN of the NDB java application as well
**************************
Enter Organizational unit :
**************************
INSBU
********************
Enter Organization :
********************
cisco
****************
Enter Location :
****************
SJ
*************
Enter State :
*************
CA
***************
Enter Country :
***************
USA
***************
Enter keypass :
***************
cisco123
*****************
Enter storepass :
*****************
cisco123
************************************
Enter the validity in number of days :
************************************
365  in NDB 3.5 this script will let you to specify the certificate validity.
*************************************************************************************************************************
Below process will rename the existing key file to <old_keystore>, will generate
 a new key file. Do you want to continue (y/n) ?
*************************************************************************************************************************
y
******************************
Self-Signed Certificate Created
******************************
Alias name: cisco
```

```
Creation date: Jan 6, 2019
Entry type: PrivateKeyEntry
Certificate chain length: 1
Certificate[1]:
Owner: CN=NDB-browser, OU=INSBU, O=cisco, L=SJ, ST=CA, C=USA
Issuer: CN=NDB-browser, OU=INSBU, O=cisco, L=SJ, ST=CA, C=USA
Serial number: b404be5
Valid from: Sun Jan 06 20:22:05 PST 2019 until: Mon Jan 06 20:22:05 PST 2020
Certificate fingerprints:
         MD5:  71:07:F6:4E:57:6A:08:3A:AD:06:32:B3:6C:5F:8F:52
         SHA1: 04:08:B9:D5:B7:EB:ED:E0:F9:22:49:14:FA:C6:09:39:22:32:43:A2
         SHA256:
34:D9:EB:34:0A:52:D1:4A:DD:F1:8B:14:D0:84:E4:1C:57:8B:2B:99:9B:E5:A1:4C:C7:8C:CD:AE:24:31:49:75

         Signature algorithm name: SHA256withRSA
         Version: 3

Extensions:

#1: ObjectId: 2.5.29.14 Criticality=false
SubjectKeyIdentifier [
KeyIdentifier [
0000: 63 8A 92 8F 6F 0F 45 BD   EE 55 C5 A8 99 3B F6 F7  c...o.E..U...;..
0010: AC FA 4A 21                                        ..J!
]
]

*******************************
Displayed the generated keystore
*******************************
*************************************************
Configured the keystore details on tomcat-server.xml
*************************************************
*****************************************************************************************
The newly generated key will used on next NDB restart. Do you want to restart NDB
 now (y/n) ?
*****************************************************************************************
y
Doesn't seem any Controller daemon is currently running
Running controller in background with PID: 13573, to connect to it please SSH to
 this host on port 2400
NDB GUI can be accessed using below URL:
[https://10.16.206.160:8443]
[https://[fe80::250:56ff:fe90:b764]:8443]
[https://10.16.206.159:8443]
[https://192.168.1.123:8443]
[https://[fe80::250:56ff:fe90:9c79]:8443]

*************
```

```
NDB Restarted
*************
```

Note The **generateWebUIcertificate.sh** script reloads the NDB application to ensure that the browser starts using this certificate when we access NDB java application from the browser.

Step 6 Decode the generated certificate using the **keytool -list -v -keystore keystore_Name** command. Enter the store password when prompted.

Example:

```
[root@RHEL-VM-NDB-ACI configuration]# /usr/lib/jvm/i586-wrs-jre/bin/keytool -list -v -keystore keystore
Enter keystore password:

Keystore type: JKS
Keystore provider: SUN

Your keystore contains 1 entry

Alias name: cisco
Creation date: Jul 6, 2019
Entry type: PrivateKeyEntry
Certificate chain length: 1
Certificate[1]:
Owner: CN=NDB-browser, OU=INSBU, O=cisco, L=SJ, ST=CA, C=USA
Issuer: CN=NDB-browser, OU=INSBU, O=cisco, L=SJ, ST=CA, C=USA
Serial number: b404be5
Valid from: Sun Jan 06 20:22:05 PST 2019 until: Mon Jan 06 20:22:05 PST 2020
Certificate fingerprints:
         MD5:  71:07:F6:4E:57:6A:08:3A:AD:06:32:B3:6C:5F:8F:52
         SHA1: 04:08:B9:D5:B7:EB:ED:E0:F9:22:49:14:FA:C6:09:39:22:32:43:A2
         SHA256:
34:D9:EB:34:0A:52:D1:4A:DD:F1:8B:14:D0:84:E4:1C:57:8B:2B:99:9B:E5:A1:4C:C7:8C:CD:AE:24:31:49:75
         Signature algorithm name: SHA256withRSA
         Version: 3

Extensions:

#1: ObjectId: 2.5.29.14 Criticality=false
SubjectKeyIdentifier [
KeyIdentifier [
0000: 63 8A 92 8F 6F 0F 45 BD   EE 55 C5 A8 99 3B F6 F7  c...o.E..U...;..
0010: AC FA 4A 21                                        ..J!
]
]

*******************************************
*******************************************
```

Step 7 Convert the ndb-server-xnc.p12 to a password protected Java KeyStore (ndb-server-keystore) file using the **keytool** command. This command converts the sw1-xnc.p12 file to a password-protected ndb-server-keystore file. Create a new password for the destination JKS store and enter the source keystore password when prompted.

Example:

```
root@ N9396TX-116:/xnclite/xnc/configuration# /usr/lib/jvm/i586-wrs-jre/bin/keytool keytool
-importkeystore -srckeystore keystore -srcstorepass cisco123 -srckeypass cisco123 -destkeystore
keystore.p12 -deststoretype PKCS12 -srcalias cisco -deststorepass cisco123 -destkeypass cisco123

Entry for alias 1 successfully imported.
Import command completed:  1 entries successfully imported, 0 entries failed or cancelled
```

Note This command creates final self-signed certificate (keystore.p12) in PKCS12 format.

Step 8 Upload the self-signed certificate into Trusted Root certificate store of your Web browser. See help for respective Web browsers about how to add a certificate to the Trusted Root certificate store. Use the password that you used while creating the certificate when prompted while uploading the certificate to the Web browser.

Step 9 Deactivate and activate the virtual service to restart the NDB.

Generating TLS 3rd Party Certification Between WebUI Browser and NDB Server

You can secure communication between a Web browser and NDB server running in centralized mode. This section describes how to generate CA certificates, convert the certificates into JKS format, and upload the certificates into a Web browser. To generate a CA certificate, you need to generate a Certificate Signing Request (CSR) and send it to a Certificate issuing authority (CA). You can use an open source tool to generate a CSR.

- Generating TLS 3rd Party Certification Between WebUI Browser and NDB Server Running in Centralized Mode

Generating TLS 3rd Party Certification Between WebUI Browser and NDB Server Running in Centralized Mode

Complete these steps to generate TLS 3rd party certification between WebUI browser and NDB server running in centralized mode:

Step 1 Generate Certificate Signing Request (CSR) using the **openssl req** command.

Example:

```
[root@NDB-server ~]# openssl req -newkey rsa:2048 -sha256 -keyout ndb-server.key -keyform PEM -out
 ndb-server.req -outform PEM
Generating a 2048 bit RSA private key
...+++
.....................................................+++
writing new private key to 'ndb-server.key'
Enter PEM pass phrase:  cisco123
Verifying - Enter PEM pass phrase:  cisco123
-----
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [GB]:US
```

```
State or Province Name (full name) [Berkshire]:CA
Locality Name (eg, city) [Newbury]:SJ
Organization Name (eg, company) [My Company Ltd]:cisco
Organizational Unit Name (eg, section) []:insbu
Common Name (eg, your name or your server's hostname) []:ndb-server.cisco.com
Email Address []:chburra@cisco.com

Please enter the following 'extra' attributes
to be sent with your certificate request
A challenge password []:cisco123
An optional company name []:cisco123


[root@NDB-server ~]# ls
ndb-server.req   ndb-server.key
```

Note The ndb-server.req (CSR) file is submitted to the certificate issuing authority (CA).

Note You need to use the same information when exporting the CA provided certificate into browser. The CSR file, cert.req, is submitted to CA.

Step 2 To verify or view the CSR request, use the **openssl req** command.

Example:

```
[root@NDB-server ~]# openssl req -noout -text -in ndb-server.req
Certificate Request:
    Data:
        Version: 0 (0x0)
        Subject: C=US, ST=CA, L=SJ, O=cisco, OU=insbu,
CN=ndb-server.cisco.com/emailAddress=chburra@cisco.com
        Subject Public Key Info:
            Public Key Algorithm: rsaEncryption
            RSA Public Key: (2048 bit)
                Modulus (2048 bit):
                    00:b5:30:75:e8:c8:5f:05:3b:0e:4f:aa:00:d9:64:
                    8d:bf:b2:80:20:56:c3:be:b0:4c:e0:52:e5:be:d8:
                    d2:74:85:4e:8a:ba:d3:1e:30:76:bf:e5:de:7d:51:
                    11:79:8e:bc:96:38:7a:23:5a:26:31:50:50:fa:29:
                    44:ab:56:b6:0d:41:38:ba:d1:d5:b4:e3:ba:a3:6c:
                    4a:35:73:27:d9:fd:5c:4b:21:85:1a:f9:4d:b0:9e:
                    f3:ae:ce:49:98:ef:a2:f8:11:ab:bd:7e:64:ee:68:
                    68:19:6e:8f:3c:54:30:0f:28:01:13:b0:3d:34:b8:
                    f9:f5:cc:4a:84:d8:e5:d2:27:47:cc:83:76:92:ad:
                    92:62:f3:a3:35:be:14:ce:38:af:2a:c5:2e:fa:b8:
                    31:6b:71:cd:56:00:1f:0d:cc:b0:f8:fc:b0:52:91:
                    f8:9c:cf:45:13:c9:b5:86:fa:30:dd:88:78:01:15:
                    fb:5c:c9:6f:5b:b7:80:28:6c:86:54:c0:f2:5f:35:
                    70:82:49:5c:79:1c:f2:23:dd:50:d5:47:12:37:a3:
                    3f:f9:1d:90:8f:c0:e8:18:09:2e:66:8d:c3:72:17:
                    7f:7d:27:da:b1:cc:26:2d:8c:6b:ee:c5:e8:b5:78:
                    31:7c:bb:ba:6d:2c:e5:a3:29:7e:c1:4a:93:19:ed:
                    9a:e7
```

```
            Exponent: 65537 (0x10001)
        Attributes:
            unstructuredName         :cisco123
            challengePassword        :cisco123
    Signature Algorithm: sha256WithRSAEncryption
        9c:9a:51:e0:1d:e4:0b:8f:c1:c6:f5:e0:d2:f6:30:0e:18:af:
        a7:b2:a4:4a:57:d7:07:44:cd:9c:fa:2d:0e:8b:c9:31:5b:16:
        6b:84:42:0b:ed:06:5c:ed:30:d8:9b:ee:5d:79:f4:8a:e3:52:
        3c:b3:4a:eb:6c:22:a2:f4:35:80:28:3a:67:62:7f:5f:dc:80:
        e0:74:f0:3c:39:26:39:3a:76:6a:6a:98:e9:68:f9:b7:58:bf:
        e7:44:2e:e7:73:0a:9c:62:28:b2:c6:09:41:81:b2:53:46:14:
        e6:e4:dc:ca:90:81:5a:5e:dc:1b:dc:36:2c:86:5f:37:29:4c:
        b0:ee:85:2b:34:f2:82:8a:d4:fc:a0:ce:10:e4:44:4e:d0:7a:
        37:6d:3e:f9:ff:a1:19:8c:db:06:bf:be:87:57:a1:cb:05:15:
        0b:9f:6c:8b:c2:ad:22:25:10:f0:4d:0f:4d:b7:be:71:87:f7:
        85:24:e7:2d:f9:59:86:1a:b7:88:57:16:93:31:1f:d7:e5:07:
        42:77:00:f9:ac:44:3b:6c:35:0f:80:5d:00:6f:ea:be:fe:e7:
        28:53:0c:6b:5f:0c:76:bf:8c:a7:60:57:63:05:06:ff:ac:3d:
        f1:63:54:d0:d0:13:44:b1:e9:53:6b:32:11:e2:83:26:04:f5:
        23:67:6b:de
```

Step 3 The private key, ndb-server.key, is secured with the passphrase. You need to unencrypt the certificate private key. Unencrypt the private key using the **openssl rsa** command.

Example:

```
[root@NDB-server ~]# cp ndb-server.key  ndb-server.keybkp
[root@NDB-server ~]# rm ndb-server.key
 [root@NDB-server ~]# openssl rsa -in ndb-server.keybkp -out ndb-server.key
Enter pass phrase for ndb-server.keybkp: cisco123
writing RSA key
```

Note The ndb-server.req file data needs to be submitted to 3rd party certification authority. Follow the relevant procedures and get the certificate files.

Depending on the tier of the CA you choose, you can get up to three certificates (certificate chain) for each CSR. This means you get three certificates (root, intermediate and domain) from CA for each NDB switch. You need to check with CA to identify each type of certificate. Certificate naming convention might be different for different certifying authorities. For example: qvrca2.cer (root), hydsslg2.cer (intermediate), ndb-server.cisco.com-39891.cer (domain).

Certificates are mostly shared in .PEM file format.

Step 4 Create a single certificate file from the three certificate files using the cat command. The concatenation should be done in the following order, domain certificate, root certificate, and intermediate certificate. Syntax for cat command: **cat** *domain certificate root certificate intermediate certificate > ndb-server.cer*.

Example:

```
[root@NDB-server ~]# cat ndb-server.cisco.com-39891.cer qvrca.cer hydsslg2.cer > ndb-server.cer
```

Step 5 Edit the newly created server.cer file to separate the concatenated END and BEGIN lines. Do not delete anything in the file.

Example:

```
-----END CERTIFICATE----------BEGIN CERTIFICATE-----


////// Modify the above line like this by adding a line feed between the two.
-----END CERTIFICATE-----
-----BEGIN CERTIFICATE-----
```

Step 6 Create the TLS NDB Server Keystore file using the ndb-server.cer and ndb-server.key files. Copy the files to switch using the copy command.

Example:

```
cp ndb-server.key ndb-server-ndb-privatekey.pem
      cp ndb-server.cer ndb-server-ndb-cert.pem
```

Step 7 Combine the private key and certificate file into a single .PEM file using the cat command.

Example:

```
cat ndb-server-ndb-privatekey.pem  ndb-server-ndb-cert.pem > ndb-server-ndb.pem
```

Step 8 CA provides certificates in PEM format and extension of the certificate is .pem. You need to convert the PEM format certificate to PKCS12 format. Convert the PEM file, ndb-server-ndb.pem, to .P12 file format using the **openssl pkcs12** command. Enter the export password when prompted. The password must contain at least 6 characters, for example, cisco123. The ndb-server-ndb.pem file is converted to a password-protected ndb-server-ndb.p12 file.

Example:

```
[root@NDB-server ~]# openssl pkcs12 -export -out ndb-server-ndb.p12 -in ndb-server-ndb.pem
Enter Export Password:□cisco123
Verifying - Enter Export Password:□cisco123
```

Step 9 Convert the ndb-server-ndb.p12 to a password protected Java KeyStore (ndb-server-keystore) file using the **keytool** command. This command converts the sw1-ndb.p12 file to a password-protected ndb-server-keystore file. Create a new password for the destination JKS store and enter the source keystore password when prompted.

Example:

```
[root@NDB-server ~]# .(relativePath)/keytool -importkeystore -srckeystore ndb-server-ndb.p12
-srcstoretype pkcs12 -destkeystore ndb-server-keystore -deststoretype jks
Enter destination keystore password:□cisco123
Re-enter new password:□cisco123
Enter source keystore password:--cisco123
Entry for alias 1 successfully imported.
Import command completed:  1 entries successfully imported, 0 entries failed or
 cancelled
[root@NDB-server ~]#
```

Step 10 List and verify content in the java tlsKeyStore using the **keytool** command.

Example:

```
[root@NDB-server ~]#.(relativePath)/keytool -list -v -keystore ndb-server-keystore
```

Step 11 Copy the ndb-server-keystore file to the */ndb/configuration* folder.

Step 12 Configure `jetty-ssl-context.xml` (stored in */ndb/configuration/*etc) with key store password that was provided while generating the certificate. You can use VI editor and edit the following lines with KeyStorePath, KeyStorePassword, TrustStorePath, TrustStorePassword.

Example:

```
<Set name="KeyStorePath"><Property name="jetty.base" default="." />/<Property
```

```
name="jetty.sslContext.keyStorePath" deprecated="jetty.keystore"
default="configuration/ndb-server-keystore"/></Set>
<Set name="KeyStorePassword"><Property name="jetty.sslContext.keyStorePassword"
deprecated="jetty.keystore.password" default="cisco123"/></Set>

<Set name="KeyManagerPassword"><Property name="jetty.sslContext.keyManagerPassword"
deprecated="jetty.keymanager.password" default="cisco123"/></Set>
<Set name="TrustStorePath"><Property name="jetty.base" default="." />/<Property
name="jetty.sslContext.trustStorePath" deprecated="jetty.truststore"
default="configuration/ndb-server-keystore"/></Set>

<Set name="TrustStorePassword"><Property name="jetty.sslContext.trustStorePassword"
deprecated="jetty.truststore.password" default="cisco123"/></Set>
```

Step 13 Restart the NDB.

Step 14 Upload the CA certificate into Trusted Root certificate store of Web browser. See help for respective Web browsers about how to add the certificate to the Trusted Root certificate store. Use the password that you created while creating the certificate when prompted while uploading the certificate to the Web browser.

Generating TLS 3rd Party Certification Between Web Browser and NDB Server Running in Embedded Mode

You can generate TLS 3rd party certificate between Web browser and NDB server running in embedded mode for the Guestshell Environment.

Generating TLS 3rd Party Certificate Between Web Browser and NDB Server Running in Embedded Mode Using Guest Shell Environment

To generate TLS 3rd party certificate between Web browser and NDB server running in embedded mode using guest shell environment, complete the following steps.

Step 1 Enable bash-shell feature on the switch using the feature command.

Example:

```
N9396TX-116(config)# feature bash-shell
```

Step 2 Enter bash-shell mode on the switch using the run command.

Example:

```
N9396TX-116(config)# run bash
bash-4.2$
```

Step 3 Generate Certificate Signing Request (CSR) using the **openssl req** command. Enter the required information when prompted.

Example:

```
bash-4.2$ openssl req -newkey rsa:2048 -sha256 -keyout ndb-server.key -keyform PEM -out ndb-server.req
 -outform PEM
Generating a 2048 bit RSA private key
...+++
.............................................+++
writing new private key to 'ndb-server.key'
```

```
Enter PEM pass phrase:  cisco123
Verifying - Enter PEM pass phrase:  cisco123
-----
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [GB]:US
State or Province Name (full name) [Berkshire]:CA
Locality Name (eg, city) [Newbury]:SJ
Organization Name (eg, company) [My Company Ltd]:cisco
Organizational Unit Name (eg, section) []:insbu
Common Name (eg, your name or your server's hostname) []:ndb-server.cisco.com
Email Address []:chburra@cisco.com

Please enter the following 'extra' attributes
to be sent with your certificate request
A challenge password []:cisco123
An optional company name []:cisco123



bash-4.2$ ls

ndb-server.req   ndb-server.key
```

Note The openssl command creates a privsate key, ndb-server.key, and a certificate signing request file, ndb-server.req. The ndb-server.req (CSR) file is submitted to the certificate issuing authority (CA).

Note You need to use the same information when exporting the CA provided certificate into browser. The CSR file, cert.req, is submitted to CA.

Step 4 To view the content or verify the CSR request, use the **openssl req** command.

Example:

```
bash-4.2$ openssl req -noout -text -in ndb-server.req
Certificate Request:
    Data:
        Version: 0 (0x0)
        Subject: C=US, ST=CA, L=SJ, O=cisco, OU=insbu,
CN=ndb-server.cisco.com/emailAddress=chburra@cisco.com
        Subject Public Key Info:
            Public Key Algorithm: rsaEncryption
            RSA Public Key: (2048 bit)
                Modulus (2048 bit):
                    00:b5:30:75:e8:c8:5f:05:3b:0e:4f:aa:00:d9:64:
                    8d:bf:b2:80:20:56:c3:be:b0:4c:e0:52:e5:be:d8:
                    d2:74:85:4e:8a:ba:d3:1e:30:76:bf:e5:de:7d:51:
                    11:79:8e:bc:96:38:7a:23:5a:26:31:50:50:fa:29:
                    44:ab:56:b6:0d:41:38:ba:d1:d5:b4:e3:ba:a3:6c:
                    4a:35:73:27:d9:fd:5c:4b:21:85:1a:f9:4d:b0:9e:
                    f3:ae:ce:49:98:ef:a2:f8:11:ab:bd:7e:64:ee:68:
                    68:19:6e:8f:3c:54:30:0f:28:01:13:b0:3d:34:b8:
                    f9:f5:cc:4a:84:d8:e5:d2:27:47:cc:83:76:92:ad:
                    92:62:f3:a3:35:be:14:ce:38:af:2a:c5:2e:fa:b8:
                    31:6b:71:cd:56:00:1f:0d:cc:b0:f8:fc:b0:52:91:
                    f8:9c:cf:45:13:c9:b5:86:fa:30:dd:88:78:01:15:
                    fb:5c:c9:6f:5b:b7:80:28:6c:86:54:c0:f2:5f:35:
                    70:82:49:5c:79:1c:f2:23:dd:50:d5:47:12:37:a3:
```

```
                    3f:f9:1d:90:8f:c0:e8:18:09:2e:66:8d:c3:72:17:
                    7f:7d:27:da:b1:cc:26:2d:8c:6b:ee:c5:e8:b5:78:
                    31:7c:bb:ba:6d:2c:e5:a3:29:7e:c1:4a:93:19:ed:
                    9a:e7
                Exponent: 65537 (0x10001)
        Attributes:
            unstructuredName         :cisco123
            challengePassword        :cisco123
    Signature Algorithm: sha256WithRSAEncryption
        9c:9a:51:e0:1d:e4:0b:8f:c1:c6:f5:e0:d2:f6:30:0e:18:af:
        a7:b2:a4:4a:57:d7:07:44:cd:9c:fa:2d:0e:8b:c9:31:5b:16:
        6b:84:42:0b:ed:06:5c:ed:30:d8:9b:ee:5d:79:f4:8a:e3:52:
        3c:b3:4a:eb:6c:22:a2:f4:35:80:28:3a:67:62:7f:5f:dc:80:
        e0:74:f0:3c:39:26:39:3a:76:6a:6a:98:e9:68:f9:b7:58:bf:
        e7:44:2e:e7:73:0a:9c:62:28:b2:c6:09:41:81:b2:53:46:14:
        e6:e4:dc:ca:90:81:5a:5e:dc:1b:dc:36:2c:86:5f:37:29:4c:
        b0:ee:85:2b:34:f2:82:8a:d4:fc:a0:ce:10:e4:44:4e:d0:7a:
        37:6d:3e:f9:ff:a1:19:8c:db:06:bf:be:87:57:a1:cb:05:15:
        0b:9f:6c:8b:c2:ad:22:25:10:f0:4d:0f:4d:b7:be:71:87:f7:
        85:24:e7:2d:f9:59:86:1a:b7:88:57:16:93:31:1f:d7:e5:07:
        42:77:00:f9:ac:44:3b:6c:35:0f:80:5d:00:6f:ea:be:fe:e7:
        28:53:0c:6b:5f:0c:76:bf:8c:a7:60:57:63:05:06:ff:ac:3d:
        f1:63:54:d0:d0:13:44:b1:e9:53:6b:32:11:e2:83:26:04:f5:
        23:67:6b:de
```

Step 5 The private key, ndb-server.key, is secured with the passphrase. You need to unencrypt the certificate private key. Unencrypt the private key using the **openssl rsa** command.

Example:

```
bash-4.2$ cp ndb-server.key  ndb-server.keybkp
bash-4.2$ rm ndb-server.key
bash-4.2$ openssl rsa -in ndb-server.keybkp -out ndb-server.key
Enter pass phrase for ndb-server.keybkp: cisco123
writing RSA key
```

Note Depending on the tier of the CA you choose, you can get up to three certificates (certificate chain) for each CSR. This means you get three certificates (root, intermediate and domain) from CA for each NDB switch. You need to check with CA to identify each type of certificate. Certificate naming convention might be different for different certifying authorities. For example: qvrca2.cer (root), hydsslg2.cer (intermediate), ndb-server.cisco.com-39891.cer (domain).

Certificates are mostly shared in .PEM file format.

Step 6 Create a single certificate file from the three certificate files using the cat command. The concatenation should be done in the following order, domain certificate, root certificate, and intermediate certificate. Syntax for cat command: **cat** *domain certificate root certificate intermediate certificate > ndb-server.cer*.

Example:

```
bash-4.2$ cat ndb-server.cisco.com-39891.cer qvrca.cer hydsslg2.cer > ndb-server.cer
```

Step 7 Edit the newly created server.cer file to separate the concatenated END and BEGIN lines. Do not delete anything in the file.

Example:

```
-----END CERTIFICATE----------BEGIN CERTIFICATE-----


////// Modify the above line like this by adding a line feed between the two.
-----END CERTIFICATE-----
-----BEGIN CERTIFICATE-----
```

Step 8 Create the TLS NDB Server Keystore file using the ndb-server.cer and ndb-server.key files. Copy the files to switch using the **copy** command.

Example:

```
cp ndb-server.key ndb-server-ndb-privatekey.pem
      cp ndb-server.cer ndb-server-ndb-cert.pem
```

Step 9 Combine the private key and certificate file into a single .PEM file using the **cat** command.

Example:

```
cat ndb-server-ndb-privatekey.pem  ndb-server-ndb-cert.pem > ndb-server-ndb.pem
```

Step 10 CA provides certificates in PEM format and extension of the certificate is .pem. You need to convert the PEM format certificate to PKCS12 format. Convert the PEM file, ndb-server-ndb.pem, to .P12 file format using the **openssl pkcs12** command. Enter the export password when prompted. The password must contain at least 6 characters, for example, cisco123. The ndb-server-ndb.pem file is converted to a password-protected ndb-server-ndb.p12 file.

Example:

```
bash-4.2$ openssl pkcs12 -export -out ndb-server-ndb.p12 -in ndb-server-ndb.pem
Enter Export Password:□cisco123
Verifying - Enter Export Password:□cisco123
```

Step 11 Copy the certificate file to the NDB configuration folder.

Example:

```
bash-4.2$ sudo cp ndb-server-ndb.p12
/isan/vdc_1/virtual-instance/guestshell+/rootfs/usr/bin/ndb/configuration/
```

Step 12 Exit the bash shell mode using the **exit** command.

Example:

```
bash-4.2$ exit
exit
N9396TX-116#
```

Step 13 Connect to guest shell using guestshell command.

Example:

```
N9396TX-116# guestshell
[admin@guestshell ~]$
```

Step 14 Change current directory to `ndb/configuration`.

Example:

```
[admin@guestshell ~]$ cd ndb/configuration
```

Step 15 Convert the ndb-server-ndb.p12 to a password protected Java KeyStore (ndb-server-keystore) file using the **keytool** command. This command converts the ndb-server-ndb.p12 file to a password-protected ndb-server-keystore file. Create a new password for the destination JKS store and enter the source keystore password when prompted.

Example:

```
[admin@guestshell configuration]$ keytool -importkeystore -srckeystore ndb-server-ndb.p12
-srcstoretype pkcs12 -destkeystore ndb-server-keystore -deststoretype jks
Enter destination keystore password: □cisco123
Re-enter new password: □cisco123
Enter source keystore password: □cisco123
Entry for alias 1 successfully imported.
```

```
Import command completed:  1 entries successfully imported, 0 entries failed or cancelled
```

Step 16 List and verify content in the java tlsKeyStore using the **keytool** command.

Example:

```
[admin@guestshell configuration]$ keytool -list -v -keystore ndb-server-keystore
```

Step 17 Configure `jetty-ssl-context.xml` (stored in ndb/etc folder) with key store password that was provided while generating the certificate. You can use VI editor and edit the following lines with keystore and keystorepass.

Example:

```
<Set name="KeyStorePath"><Property name="jetty.base" default="." />/<Property
name="jetty.sslContext.keyStorePath" deprecated="jetty.keystore"
default="configuration/ndb-server-keystore"/></Set>
<Set name="KeyStorePassword"><Property name="jetty.sslContext.keyStorePassword"
deprecated="jetty.keystore.password" default="cisco123"/></Set>

<Set name="KeyManagerPassword"><Property name="jetty.sslContext.keyManagerPassword"
deprecated="jetty.keymanager.password" default="cisco123"/></Set>

<Set name="TrustStorePath"><Property name="jetty.base" default="." />/<Property
name="jetty.sslContext.trustStorePath" deprecated="jetty.truststore"
default="configuration/ndb-server-keystore"/></Set>

<Set name="TrustStorePassword"><Property name="jetty.sslContext.trustStorePassword"
deprecated="jetty.truststore.password" default="cisco123"/></Set>
```

Step 18 Upload the CA certificate into Trusted Root certificate store of Web browser. See help for respective Web browsers about how to add the certificate to the Trusted Root certificate store. Use the password that you created while creating the certificate when prompted while uploading the certificate to the Web browser.

Step 19 Restart NDB.

Generating TLS 3rd Party Certificate Between Web Browser and NDB Server Running in Embedded Mode Using OVA Environment

To generate TLS 3rd party certificate between Web browser and NDB server running in embedded mode using OVA environment, complete the following steps.

Step 1 Enable bash-shell feature on the switch using the feature command.

Example:

```
N9396TX-116(config)# feature bash-shell
```

Step 2 Enter bash-shell mode on the switch using the run command.

Example:

```
N9396TX-116(config)# run bash
bash-4.2$
```

Step 3 Generate Certificate Signing Request (CSR) using the **openssl req** command. Enter the required information when prompted.

Example:

```
bash-4.2$ openssl req -newkey rsa:2048 -sha256 -keyout ndb-server.key -keyform PEM -out ndb-server.req
 -outform PEM
Generating a 2048 bit RSA private key
...+++
.............................................+++
writing new private key to 'ndb-server.key'
Enter PEM pass phrase:  cisco123
Verifying - Enter PEM pass phrase:  cisco123
-----
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [GB]:US
State or Province Name (full name) [Berkshire]:CA
Locality Name (eg, city) [Newbury]:SJ
Organization Name (eg, company) [My Company Ltd]:cisco
Organizational Unit Name (eg, section) []:insbu
Common Name (eg, your name or your server's hostname) []:ndb-server.cisco.com
Email Address []:chburra@cisco.com

Please enter the following 'extra' attributes
to be sent with your certificate request
A challenge password []:cisco123
An optional company name []:cisco123



bash-4.2$ ls

ndb-server.req   ndb-server.key
```

Note The openssl command creates a private key, ndb-server.key, and a certificate signing request file, ndb-server.req. The ndb-server.req (CSR) file is submitted to the certificate issuing authority (CA).

Note You need to use the same information when exporting the CA provided certificate into browser. The CSR file, cert.req, is submitted to CA.

Step 4 To view the content or verify the CSR request, use the **openssl req** command.

Example:

```
bash-4.2$ openssl req -noout -text -in ndb-server.req
Certificate Request:
    Data:
        Version: 0 (0x0)
        Subject: C=US, ST=CA, L=SJ, O=cisco, OU=insbu,
CN=ndb-server.cisco.com/emailAddress=chburra@cisco.com
        Subject Public Key Info:
            Public Key Algorithm: rsaEncryption
            RSA Public Key: (2048 bit)
                Modulus (2048 bit):
                    00:b5:30:75:e8:c8:5f:05:3b:0e:4f:aa:00:d9:64:
                    8d:bf:b2:80:20:56:c3:be:b0:4c:e0:52:e5:be:d8:
                    d2:74:85:4e:8a:ba:d3:1e:30:76:bf:e5:de:7d:51:
                    11:79:8e:bc:96:38:7a:23:5a:26:31:50:50:fa:29:
                    44:ab:56:b6:0d:41:38:ba:d1:d5:b4:e3:ba:a3:6c:
                    4a:35:73:27:d9:fd:5c:4b:21:85:1a:f9:4d:b0:9e:
                    f3:ae:ce:49:98:ef:a2:f8:11:ab:bd:7e:64:ee:68:
                    68:19:6e:8f:3c:54:30:0f:28:01:13:b0:3d:34:b8:
```

```
                    f9:f5:cc:4a:84:d8:e5:d2:27:47:cc:83:76:92:ad:
                    92:62:f3:a3:35:be:14:ce:38:af:2a:c5:2e:fa:b8:
                    31:6b:71:cd:56:00:1f:0d:cc:b0:f8:fc:b0:52:91:
                    f8:9c:cf:45:13:c9:b5:86:fa:30:dd:88:78:01:15:
                    fb:5c:c9:6f:5b:b7:80:28:6c:86:54:c0:f2:5f:35:
                    70:82:49:5c:79:1c:f2:23:dd:50:d5:47:12:37:a3:
                    3f:f9:1d:90:8f:c0:e8:18:09:2e:66:8d:c3:72:17:
                    7f:7d:27:da:b1:cc:26:2d:8c:6b:ee:c5:e8:b5:78:
                    31:7c:bb:ba:6d:2c:e5:a3:29:7e:c1:4a:93:19:ed:
                    9a:e7
                Exponent: 65537 (0x10001)
        Attributes:
            unstructuredName         :cisco123
            challengePassword        :cisco123
    Signature Algorithm: sha256WithRSAEncryption
        9c:9a:51:e0:1d:e4:0b:8f:c1:c6:f5:e0:d2:f6:30:0e:18:af:
        a7:b2:a4:4a:57:d7:07:44:cd:9c:fa:2d:0e:8b:c9:31:5b:16:
        6b:84:42:0b:ed:06:5c:ed:30:d8:9b:ee:5d:79:f4:8a:e3:52:
        3c:b3:4a:eb:6c:22:a2:f4:35:80:28:3a:67:62:7f:5f:dc:80:
        e0:74:f0:3c:39:26:39:3a:76:6a:6a:98:e9:68:f9:b7:58:bf:
        e7:44:2e:e7:73:0a:9c:62:28:b2:c6:09:41:81:b2:53:46:14:
        e6:e4:dc:ca:90:81:5a:5e:dc:1b:dc:36:2c:86:5f:37:29:4c:
        b0:ee:85:2b:34:f2:82:8a:d4:fc:a0:ce:10:e4:44:4e:d0:7a:
        37:6d:3e:f9:ff:a1:19:8c:db:06:bf:be:87:57:a1:cb:05:15:
        0b:9f:6c:8b:c2:ad:22:25:10:f0:4d:0f:4d:b7:be:71:87:f7:
        85:24:e7:2d:f9:59:86:1a:b7:88:57:16:93:31:1f:d7:e5:07:
        42:77:00:f9:ac:44:3b:6c:35:0f:80:5d:00:6f:ea:be:fe:e7:
        28:53:0c:6b:5f:0c:76:bf:8c:a7:60:57:63:05:06:ff:ac:3d:
        f1:63:54:d0:d0:13:44:b1:e9:53:6b:32:11:e2:83:26:04:f5:
        23:67:6b:de
```

Step 5 The private key, ndb-server.key, is secured with the passphrase. You need to unencrypt the certificate private key. Unencrypt the private key using the **openssl rsa** command.

Example:

```
bash-4.2$ cp ndb-server.key  ndb-server.keybkp
bash-4.2$ rm ndb-server.key
bash-4.2$ openssl rsa -in ndb-server.keybkp -out ndb-server.key
Enter pass phrase for ndb-server.keybkp: cisco123
writing RSA key
```

Note Depending on the tier of the CA you choose, you can get up to three certificates (certificate chain) for each CSR. This means you get three certificates (root, intermediate and domain) from CA for each NDB switch. You need to check with CA to identify each type of certificate. Certificate naming convention might be different for different certifying authorities. For example: qvrca2.cer (root), hydsslg2.cer (intermediate), ndb-server.cisco.com-39891.cer (domain).

Certificates are mostly shared in .PEM file format.

Step 6 Create a single certificate file from the three certificate files using the cat command. The concatenation should be done in the following order, domain certificate, root certificate, and intermediate certificate. Syntax for cat command: **cat** *domain certificate root certificate intermediate certificate > ndb-server.cer*.

Example:

```
bash-4.2$ cat ndb-server.cisco.com-39891.cer qvrca.cer hydsslg2.cer > ndb-server.cer
```

Step 7 Edit the newly created server.cer file to separate the concatenated END and BEGIN lines. Do not delete anything in the file.

Example:

```
-----END CERTIFICATE----------BEGIN CERTIFICATE-----


////// Modify the above line like this by adding a line feed between the two.
-----END CERTIFICATE-----
-----BEGIN CERTIFICATE-----
```

Step 8 Create the TLS NDB Server Keystore file using the ndb-server.cer and ndb-server.key files. Copy the files to switch using the **copy** command.

Example:

```
cp ndb-server.key ndb-server-xnc-privatekey.pem
      cp ndb-server.cer ndb-server-xnc-cert.pem
```

Step 9 Combine the private key and certificate file into a single .PEM file using the **cat** command.

Example:

```
cat ndb-server-xnc-privatekey.pem  ndb-server-xnc-cert.pem > ndb-server-xnc.pem
```

Step 10 CA provides certificates in PEM format and extension of the certificate is .pem. You need to convert the PEM format certificate to PKCS12 format. Convert the PEM file, ndb-server-xnc.pem, to .P12 file format using the **openssl pkcs12** command. Enter the export password when prompted. The password must contain at least 6 characters, for example, cisco123. The ndb-server-xnc.pem file is converted to a password-protected ndb-server-xnc.p12 file.

Example:

```
bash-4.2$ openssl pkcs12 -export -out ndb-server-xnc.p12 -in ndb-server-xnc.pem
Enter Export Password:□cisco123
Verifying - Enter Export Password:□cisco123
```

Step 11 Copy the certificate file to the NDB configuration folder.

Example:

```
bash-4.2$ cp ndb-server-xnc.p12
/isan/vdc_1/virtual-instance/guestshell+/rootfs/home/admin/xnc/configuration/
```

Step 12 Exit the bash shell mode using the **exit** command.

Example:

```
bash-4.2$ exit
exit
N9396TX-116#
```

Step 13 Connect to virtual service console using the **virtual-service connect** command.

Example:

```
N9396TX-116# virtual-service connect name ova console
Connecting to virtual-service.  Exit using ^c^c^c
Entering character mode
Escape character is '^]'.
root@ N9396TX-116:~#
root@ N9396TX-116:~#
```

Step 14 Change current directory to `/xnclite/xnc/configuration`.

Example:

```
root@ N9396TX-116:~# cd /xnclite/xnc/configuration
root@ N9396TX-116:/xnclite/xnc/configuration#
```

Step 15 Set Java home path using the **export** command.

Example:

```
[admin@guestshell ~]$ export JAVA_HOME='/usr/lib/jvm/i586-wrs-jre'
```

Step 16 Convert the ndb-server-xnc.p12 to a password protected Java KeyStore (ndb-server-keystore) file using the **keytool** command. This command converts the sw1-xnc.p12 file to a password-protected ndb-server-keystore file. Create a new password for the destination JKS store and enter the source keystore password when prompted.

Example:

```
root@ N9396TX-116:/xnclite/xnc/configuration# /usr/lib/jvm/i586-wrs-jre/bin/keytool
 -importkeystore -srckeystore ndb-server-xnc.p12 -srcstoretype pkcs12 -destkeystore
ndb-server-keystore -deststoretype jks
Enter destination keystore password: cisco123
Re-enter new password: cisco123
Enter source keystore password: cisco123
Entry for alias 1 successfully imported.
Import command completed:  1 entries successfully imported, 0 entries failed or cancelled
```

Step 17 List and verify content in the java tlsKeyStore using the **keytool** command.

Example:

```
root@ N9396TX-116:/xnclite/xnc/configuration# /usr/lib/jvm/i586-wrs-jre/bin/keytool -list -v -keystore
 ndb-server-keystore
```

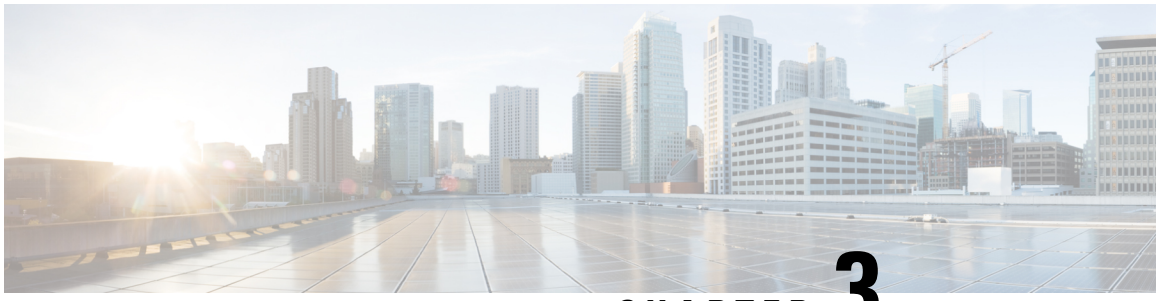
Step 18 Configure the tomcat-server.xml (stored in configuration folder) with key store password that was provided while generating the certificate. You can use VI editor and edit the following lines with keystore and keystorepass.

Example:

```
keystoreFile="configuration/ndb-server-keystore"
keystorePass="cisco123" server="Cisco XNC"
```

Step 19 Upload the CA certificate into Trusted Root certificate store of Web browser. See help for respective Web browsers about how to add the certificate to the Trusted Root certificate store. Use the password that you created while creating the certificate when prompted while uploading the certificate to the Web browser.

Step 20 Deactivate and activate the virtual service to restart the NDB.



CHAPTER 3

Logging in and Managing Cisco Nexus Data Broker

This chapter contains the following sections:

Configuring Cisco Nexus Data Broker

Configuring High Availability Clusters

Cisco Nexus Data Broker supports high availability clustering in active/active mode with up to five controllers. To use high availability clustering with Cisco Nexus Data Broker, you must edit the `config.ini` file for each instance of Cisco Nexus Data Broker.

Note IPv6 is supported in centralized NDB mode only, it is not supported in Embedded mode.

Note Cisco NDB supports only 2 node configuration or odd number node configuration. If you configure even number of nodes, the last node is not included in the cluster formation, ensuring odd number of nodes in a setup.

Table 2: Cluster Operation Status

Cluster Indicator	Cluster Status	Recommendation
Green	Operational	

Cluster Indicator	Cluster Status	Recommendation
Yellow	Some of the cluster nodes are not available	Do not make any changes or add to the existing NDB configuration.
Red	The node is isolated from the cluster.	Do not make any changes or add to the existing NDB configuration. Note: For two node cluster, you need to override in any one of the cluster node only, to ensure regular operation.

Before you begin

- All IP addresses must be reachable and capable of communicating with each other.
- All switches in the cluster must connect to all of the controllers.
- All controllers must have the same HA clustering configuration information in the `config.ini` files.
- All controllers must have the same information in the `xnc/configuration/startup` directory.
- If using cluster passwords, all controllers must have the same password configured in the `xncjgroups.xml` file. See Password Protecting the High Availability Clusters, on page 67.

Step 1 Open a command window on one of the instances in the cluster.

Step 2 Navigate to the `xnc/configuration` directory that was created when you installed the software.

Step 3 Use any text editor to open the `config.ini` file.

Step 4 Locate the following text:

```
# HA Clustering configuration (semi-colon-separated IP addresses of all controllers that are part of
 the cluster.)
# supernodes=<ip1>;<ip2>;<ip3>;<ipn>
```

Step 5 **Example:**

IPv4 example.

```
# HA Clustering configuration (semi-colon-separated IP addresses of all controllers that are part of
 the cluster.)
supernodes=10.1.1.1;10.2.1.1;10.3.1.1;10.4.1.1;10.5.1.1
```

Example:

IPv6 example.

```
# HA Clustering configuration (semi-colon-separated IP addresses of all controllers that are part of
 the cluster.)
supernodes=2001:22:11::1;2001:33::44::1;2001:55:66::1
```

Step 6 Save the file and exit the editor.

What to do next

(Optional) Use this procedure to configure the delay time for a node and the number of retries.

1. Ensure that Cisco Nexus Data Broker is not running on any of the instances in the cluster.
2. Open a command window on one of the instances in the cluster.
3. Navigate to the xnc/configuration directory that was created when you installed the software.
4. Use any text editor to open the xncjgroups.xmlfile.
5. Locate the following text:

   ```
   FD timeout="3000" max_tries="3"/
   ```

6. Modify the Latency Time value and maximum_tries value.
7. Save the file and exit the editor.
8. Repeat the above steps for all the instances of the cluster and restart NDB.

Password Protecting the High Availability Clusters

Step 1 Open a command window on one of the instances in the cluster.

Step 2 Navigate to the `xnc/configuration` directory.

Step 3 Use any text editor to open the `xncjgroups.xml` file.

Step 4 Locate the following text:

```
<!-- <AUTH auth_class="org.jgroups.auth.MD5Token" auth_value="ciscoXNC" token_hash="MD5"></AUTH> -->
```

Step 5 Remove the comments from the AUTH line.

Example:

```
<AUTH auth_class="org.jgroups.auth.MD5Token" auth_value="ciscoXNC" token_hash="MD5"></AUTH>
```

Step 6 (Optional) Change the password in the auth_value attribute.

By default, the cluster is protected with the password "ciscoXNC". You can change this password to whatever value you want, you need make the similar changes on all machines in the cluster.

Step 7 Save the file and exit the editor.

Editing Cisco Nexus Switch Configuration

Cisco Nexus Data Broker periodically verifies the Cisco Nexus Switch inventory and the topology so that the topology and inventory is in sync. Cisco Nexus data broker periodically rediscovers the switch inventory and the topology interconnection and status. This information is updated in the GUI depending on the status. You can configure the rediscovery interval and the default value is 60 seconds.

Step 1 Navigate to the `xnc/configuration` directory that was created when you installed the software.

Step 2 Use any text editor to open the `config.ini` file.

Step 3 Update the following parameters:

Name	Predefined Value in Seconds	Minimum Value in Seconds	Recommended Value in Seconds
of.messageResponseTimer	60	2	60
of.switchLivenessTimeout	120.5	60.5	120.5
of.flowStatsPollInterval	240	10	240
of.portStatsPollInterval	240	5	240
of.descStatsPollInterval	240	60	240
of.barrierMessagePriorCount	50	100	50
of.discoveryInterval	300	30	300
of.discoveryTimeoutMultiple	2	2	2
NX-API related system parameters			
nx.connectionDelayTimer	300	—	300
nx.flowStatsPollInterval	120	—	120
nx.tableStatsPollInterval	120	—	120
nx.portStatsPollInterval	120	—	120
nx.descStatsPollInterval	120	—	120
nx.lldpPollingTimer	10	—	10
nx.portPollingTimer	20	—	20

Note Predefined values are the values that Cisco includes in the `config.ini` file that is shipped with Cisco Nexus Data Broker. An em dash ("—") in this column of the table means that unless you explicitly update the value, the minimum value will be used.

Step 4 Save the file and exit the editor.

Step 5 Restart Cisco Nexus Data Broker.

Configuring Inactivity Timeout

By default, a user is logged out if the session is inactive for more than 10 minutes. You need to re-log in to the NDB to apply the new interval.

Step 1 Log into NDB UI.

Step 2 Navigate to **Administration** > **System** > **Session Timeout**.

Step 3 Enter inactivity timeout value in the **Session Timeout** text field and click **Submit**.

Step 4 Log out and log into NDB to apply the changes.

Configuring User Roles for Edge Ports

To enable RBAC for the App-User role, follow these steps:

Step 1 Open the `config.ini` file for editing.

Step 2 Locate the line `# Enforce restriction on edge/tap ports user can capture (default false).`

Step 3 Remove the comment character from the following line:

```
monitor.strictAuthorization=true
```

Step 4 Save your work and close the file.

Logging in to the Cisco Nexus Data Broker GUI

You can log into the Cisco Nexus Data Broker using HTTPS. The default HTTPS web link for the Cisco Nexus Data Broker GUI is `https://Nexus_Data_Broker_IP:8443/monitor`.

Note You must manually specify the https:// protocol in your web browser. The controller must also be configured for HTTPS.

Step 1 In your web browser, enter the Cisco Nexus Data Broker web link.

Step 2 On the launch page, do the following:

a) Enter your username and password.

The default username and password is admin/admin.

b) Click **Log In**.

Changing the Controller Access to HTTP

Starting with Cisco Nexus Data Broker Release 2.1, an unencrypted (HTTP) access to the GUI and the API to the controller access is disabled by default. You cannot access the controller with the URL http://<host>:8080.

If you want to change the controller access to HTTP, complete the following steps:

Step 1 Remove the comment character from the connector for port 8080 in the tomcat-server.xml file in the configuration directory as displayed in the following example:

Example:

```
<Service name="Catalina">
 <!--
   <Connector port="8080" protocol="HTTP/1.1"
              connectionTimeout="20000"
              redirectPort="8443" server="Cisco XNC" enableLookups="false" />
 -->
   <Connector port="8443" protocol="HTTP/1.1" SSLEnabled="true"
              scheme="https" secure="true"
              clientAuth="false" sslProtocol="TLS"
              keystoreFile="configuration/keystore"
              keystorePass="ciscoxnc" server="Cisco XNC"
              connectionTimeout="60000" enableLookups="false" />
```

Example:

Remove the comment character as displayed in the following example:

```
<Service name="Catalina">
    <Connector port="8080" protocol="HTTP/1.1"
               connectionTimeout="20000"
               redirectPort="8443" server="Cisco XNC" enableLookups="false" />

    <Connector port="8443" protocol="HTTP/1.1" SSLEnabled="true"
               scheme="https" secure="true"
               clientAuth="false" sslProtocol="TLS"
               keystoreFile="configuration/keystore"
               keystorePass="ciscoxnc" server="Cisco XNC"
               connectionTimeout="60000" enableLookups="false" />
```

Step 2 Restart the controller.

Cisco Nexus Data Broker GUI Overview

The Cisco Nexus Data Broker Release GUI contains the following tabs:

- Cisco Nexus Data Broker, Release Version
- **Configuration** tab at the top of the screen
- **Administration** tab at the top of the screen
- **Default** tab displaying the switches in use
- **Save** button—Enables you to save any additions or changes you make in Cisco Nexus Data Broker.
- The **Online help** button—Provides access to the online help for the current page.
- Bookmarks
- Administrator Details

The **Configuration** tab contains the following items:

- Topology
- Port Definitions
- Port Groups
- Monitoring Devices
- Service Nodes
- Filters
- Connections
- Redirections
- Statistics
- SPAN Sessions

The **Administration** tab contains the following items:

- Device Management
- Devices
- Flows
- Troubleshoot
- Consistency Check
- System Management
- User Management
- System

Topology Tools

The left side of the topology pane contains a zoom slider that allows you increase or decrease the size of the topology diagram. You can also increase or decrease the size of the topology diagram by scrolling up or down, respectively, with your mouse wheel.

You can move the entire topology diagram, a single topology element, or a node group. To move the diagram, an element, or a node group, click it and drag it.

To view information about a node or an edge port, hover over the node or edge port icon with your mouse. The information displayed depends on the device you choose.

To view information about a path, hover over the path in the topology diagram.

To view information about a filter, hover over the **Name** of the filter in the **Filters** tab.

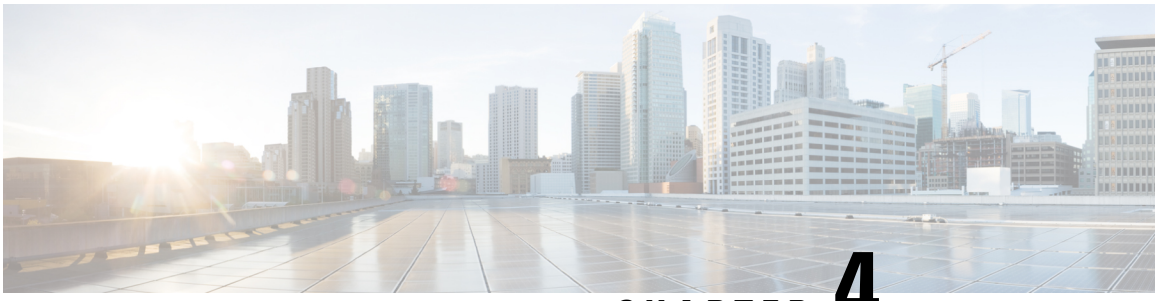
What's New Utility Tool

Starting with Cisco NDB Release 3.7, a new utility tools is added to the NDB user interface. This utility appears when you log into NDB and lists all the new features introduced for the release. You can also open this utility using the What's New icon on the NDB GUI.

Saving Configuration Changes

In Cisco Nexus Data Broker, Release 3.2.0 the auto-save configuration option is added. You can save the configuration changes, but it is not required. For example, if you configure Edge-SPAN, monitor the device, or configure any other functionality in Cisco Nexus Data Broker, it is saved automatically.

On the menu bar, click **Save**.



CHAPTER 4

Viewing and Adding Devices

This chapter contains the following sections:

Viewing and Adding Devices

On the **Devices** screen, the following tabs are displayed:

- Nodes Learned
- Device Connections
- Device Groups
- SPAN Management
- Subnet Gateway Configuration

On the **Nodes Learned** tab, the following details are displayed for each node:

- The name of the node
- The ID of the node
- IP Address of the node
- The number of ports on the node

When you click the node name under the tab **Node Name**, the **Update Node Information** window is displayed. Update the following fields in the window:

- **Node ID**: Enter the node ID.
- **Node Name**: The name of the node.
- **Tier**: Select the tier of the node from the following options in the drop-down list: Unknown, Access, Distribution, and Core.
- **Operation Mode**: Choose how the traffic is handled based on the flows. This can be one of the following:

Allow reactive forwarding—No default flows are programmed. How traffic that does not match a flow is treated depends upon the switch implementation.

Proactive forwarding only—The following default flows are programmed on the switch:

- Punt Link Layer Discovery Protocol (LLDP) packets.
- Drop all other traffic.

On the **Device Connections** tab, click **Add Device** to add a device, click **Remove Devices** to remove a device, or click **Rediscover Devices** to rediscover a device. When you click **Rediscover Devices** tab, the **Rediscover Device** window is displayed. Click **Rediscover Device** so that the device gets deleted and rediscovered again.

In each device window, click **View**, **Edit**, or **Delete** to add a device, edit an existing device, or delete a device. The following details are displayed for each device in each device window:

- The name of the device and its IP address
- The username on the device
- The type of the mode, for example, NX-API
- The uptime on the device, for example, date and time
- The hardware on the node

On the **Device Groups** tab, click **+ Group** to add a group of devices. In each group window, click **View**, **Edit**, or **Delete** to add a group of devices, edit an existing group of devices, or delete a group of devices respectively. The following details are displayed in each group window:

- The name of the node group, for example, Node Group Name One
- The names of the nodes in the group, for example, nx-tap-agg-sw1 and nx-tap-agg-sw2

On the **SPAN Management** tab, click **+ Add Device** to add an APIC device or the production switch to the network. Click **Remove Devices** to delete the devices or click **Rediscover Devices** to rediscover the devices. The production switch should be a Cisco Nexus 9000 Series switch or Cisco Nexus 3000 Series switch in NXOS mode. The feature NXAPI has to be enabled on these production switches.

Note If a device is unreachable and disconnects from NDB, NDB tries to locate and connect to the device after every 30 seconds.

The following columns are displayed on the **SPAN Management** tab to display the information about the devices:

- IP Address
- Username
- Type: The APIC device is listed as AC and the production switch will belated here is listed as PS.
- Active IP
- Secondary IP Address
- Tertiary IP Address

- Action

You must add an APIC controller before you can set up SPAN session and SPAN destination.

Starting with Cisco NDB release 3.6, Global deny ACLs are automatically added to all non-configured (Edge SPAN/TAP & Monitor) interfaces on a device. The Global deny ACL feature is equivalent to Block Rx feature. By default, Global Deny ACL feature is enabled for a device. To disable the Global Deny ACL feature, you need to add the configure.global.acls parameter and set it to *false* in the `config.ini` file. After setting the configure.global.acls parameter, you need to restart the system to disable Global Deny ACLs on the newly added devices.

Note To disable Global Deny ACL during CLI upgrade, run the CLI upgrade command and then configure the configure.global.acls parameter to *false* in the `config.ini` file before restarting the NDB. For example:

```
/xnc upgrade --perform --target-home {xnc_directory_to_be_upgraded} [--verbose] [--backupfile
 {xnc_backup_location_and_zip_filename}]
// In the config.ini file//
configure.global.acls=false
```

To disable Global Deny ACL features during configuration upload, set the configure.global.acls parameter to *false* in the `config.ini` file before restarting the NDB.

Starting with Cisco NDB release 3.6, when a new switch is discovered on NDB, the following connections are installed on the ISL interfaces:

- Default-Deny-ISL connection with Default-Deny-All, Default-Deny-MPLS, and Default-Deny-ARP filters. This connection is supported on all the types of switches in NXAPI mode.
- Default-Deny-ISL-ICMP connection with Default-Deny-ICMP and Default-Deny-ICMP-All filters. This connection is supported on 9200, 9300EX, 9300FX, 9500EX, and 9500FX switches in NXAPI mode.

All the ACLs related to the default filters are installed on the ISL interfaces of the new switch. By default, this feature is enabled for all the new ISL interfaces.

Note You can manage this feature using the mm.addDefaultISLDenyRules parameter in config.ini file. By default, themm.addDefaultISLDenyRules parameter is not be present in config.in file. To disable this feature, you need to add the mm.addDefaultISLDenyRules parameter to config.ini file ans set it to false and restart the device. For example:

```
mm.addDefaultISLDenyRules = false
```

Note To disable Default-Deny-ISL Default-Deny-ISL-ICMP features during CLI upgrade, run the CLI upgrade command and then configure the mm.addDefaultISLDenyRules parameter to *false* in the `config.ini` file before restarting the NDB. For example:

```
./xnc upgrade --perform --target-home {xnc_directory_to_be_upgraded} [--verbose] [--backupfile
 {xnc_backup_location_and_zip_filename}]
// In the config.ini file//
mm.addDefaultISLDenyRules=false
```

To disable Default-Deny-ISL Default-Deny-ISL-ICMP features during configuration upload, set the mm.addDefaultISLDenyRules parameter to *false* in the `config.ini` file before restarting the NDB.

Managing a Device in NDB

You can add, remove, or edit a device using NDB.

- Adding a Device
- Removing a Device
- Rediscovering a Device
- Managing Profile for a Device

Adding a Device

Complete these steps to add a device.

Note This procedure is applicable for releases prior to Cisco NDB Release 3.9.2. For the latest procedure (Release 3.9.2 and after), see the subsequent *Adding a Device* procedure.

Step 1 Navigate to **ADMINISTRATION** > **Device Connections** tab.

Step 2 Click **Add Device**, the **Add Device** dialog box opens.

Step 3 In the **Add Device** dialog box, enter the following details:

Table 3: New Device Details

Field	Description
IP address/Hostname	The name or IP address of the device. To add multiple devices in non-hybrid mode, add the hostnames or IP Addresses separated with the comma. For example, ndb1.cisco.com, ndb2.cisco.com, ndb3.cisco.com.
Username/Password	Select this option to add a device using username and password credentials.

Field	Description
Profile	Select this option to add a device using a profile. For more information about adding a device using profiles, see Profile Management, on page 82
Username	Username for authenitcating the device.
Password	Password for authenticating the device.
Connection Type	Type of connection supported. Currently, **NXAPI** is supported.
Port	The device communication port. For example, use port 80 for NX-API over HTTP and 443 for HTTPS.
Set Auxiliary Node	Indicates whether this NX-API connection is Auxillary for the OpenFlow device.
Device Prerequisites	To set the device to default configuration required for NX-API type of connection. This option is available for NXAPI connection type only without Auxiliary mode. To know more about the Device Prerequisites, see Device Prerequisites section.

Step 4 Click **Add Device** to create and add the new device to NDB. The new device is listed on the **DEVICE CONNECTION** tab.

Global deny ACLs are automatically added to all non-configured interfaces (Edge SPAN/TAP, Packet Truncation, Remote Source, and Local and Remote Monitor) on a device. By default, Global Deny ACL feature is enabled on all the devices. You can disable the Global Deny ACL feature by setting the *configure.global.acls* parameter to **false** in the config.ini file. Ensure that you restart NDB after making changes in the configuration file.

By default, deny ACL is enabled on all the Inter Switch Links (ISL) interfaces causig all the traffic in the ISL interfaces to be droped if there is no connection installed. The following connections are installed on the ISL interfaces:

- Default-Deny-ISL connection with Default-Deny-All, Default-Deny-MPLS, and Default-Deny-ARP filters. This connection is supported on all the types of switches in NXAPI mode.
- Default-Deny-ISL-ICMP connection with Default-Deny-ICMP and Default-Deny-ICMP-All filters. This connection is supported on Nexus 9200, 9300EX, 9300FX, 9500EX, and 9500FX switches in NXAPI mode.

You can disable deny ACL on all the ISL interfaces by setting the *configure.global.acls* parameter to **false** in the config.ini file. Ensure that you restart NDB after making changes in the configuration file.

You can disable Global deny ACL or ISL deny ACL during the CLI upgrade or configuration upload by using the CLI upgrade command and setting the *configure.global.acls* parameter to **false** in the config.ini file. For example:

```
xnc upgrade --perform --target-home {xnc_directory_to_be_upgraded} [--verbose] [--backupfile
{xnc_backup_location_and_zip_filename}]

Path:<NDBhome>/configuration/configure.global.acls=false
```

Note You can also disable Global deny ACL or ISL deny ACL by uploading the configuration in a Web browser.

Adding a Device

Use this procedure to add a device (NDB switch). This procedure is applicable for Cisco NDB Release 3.9.2, and after.

Beginning with Release 3.9.2, the **Device Prerequisites** check-box is not optional. The system and interface configurations are by default configured by the NDB controller. The ACLs for the switch are part of the device onboarding.

Step 1 Navigate to **Administration** > **Device Connections** tab.

Step 2 Click the **Add Device** button.

The **Add Device** window is displayed on the right.

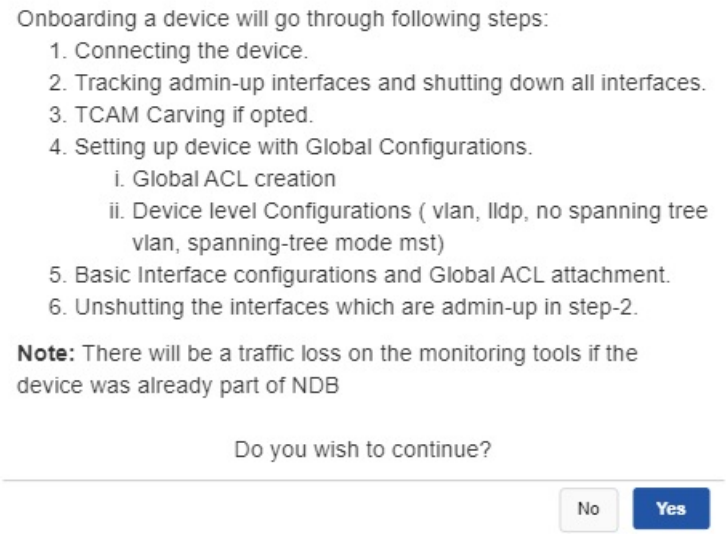
Step 3 Enter the following details in the **Add Device** window.

Table 4: Add Device (NXAPI)

Field	Description
IP address/Hostname	The name or IP address of the device. To add multiple devices in non-hybrid mode, add the hostnames or IP Addresses separated with the comma. For example, ndb1.cisco.com, ndb2.cisco.com, ndb3.cisco.com.
Username/Password	Select this option to add a device using username and password credentials. If you select this option, the following fields are displayed: • **Username**—Enter a username for logging in to the device. • **Password**—Enter the password for authenticating the device.
Profile	Select this option to add a device using a profile. For more information about adding a device using profiles, see Profile Management, on page 82
Port	The device communication port. For example, use port 80 for NX-API over HTTP and 443 for HTTPS.
Set Auxiliary Node	Check the check-box to indicate whether this NX-API connection is Auxillary for the OpenFlow device.
TCAM Carving	Check the **TCAM Carving**check-box. Select **Scale** or **Default** option. If the TCAM option is selected, NDB will carve the selected TCAM region and *Reload* the switch by default. If TCAM option is not selected, NDB checks for the TCAM region in the switch. If the TCAM region is already carved, NDB continues with the device onboarding process. If no TCAM region is carved, NDB aborts the device onboarding process. An error message indicating that the TCAM regions are not carved is displayed.

Step 4 Click **Add Device**.

A pop-window is displayed which gives details of the internal tasks involved before the device is onboarded on to the NDB network. Click **Yes** to continue with the device addition. The list of actions performed by the NDB controller for onboarding a device is displayed in the pop-up window (as displayed below):



The new device is listed under the **Device Connections** tab and the device name is indicated in green (*Ready*). If you have selected the **TCAM Carving** option earlier (see Step 3), the device is indicated in yellow (*Not Ready*). The device goes in for a reboot and turns green after a few minutes.

Note Do not connect the freshly added NDB device to the ACI fabric or the NX-OS fabric, until it is indicated as*Ready*.

Global deny ACLs are automatically added to all non-configured interfaces (Edge SPAN/TAP, Packet Truncation, Remote Source, and Local and Remote Monitor) on a device. By default, Global Deny ACL feature is enabled on all the devices. You can disable the Global Deny ACL feature by setting the *configure.global.acls* parameter to **false** in the config.ini file. Ensure that you restart NDB after making changes in the configuration file.

By default, deny ACL is enabled on all the Inter Switch Links (ISL) interfaces causig all the traffic in the ISL interfaces to be droped if there is no connection installed. The following connections are installed on the ISL interfaces:

- Default-Deny-ISL connection with Default-Deny-All, Default-Deny-MPLS, and Default-Deny-ARP filters. This connection is supported on all the types of switches in NXAPI mode.
- Default-Deny-ISL-ICMP connection with Default-Deny-ICMP and Default-Deny-ICMP-All filters. This connection is supported on Nexus 9200, 9300EX, 9300FX, 9500EX, and 9500FX switches in NXAPI mode.

You can disable deny ACL on all the ISL interfaces by setting the *configure.global.acls* parameter to **false** in the config.ini file. Ensure that you restart NDB after making changes in the configuration file.

You can disable Global deny ACL or ISL deny ACL during the CLI upgrade or configuration upload by using the CLI upgrade command and setting the *configure.global.acls* parameter to **false** in the config.ini file. For example:

```
xnc upgrade --perform --target-home {xnc_directory_to_be_upgraded} [--verbose] [--backupfile
{xnc_backup_location_and_zip_filename}]

Path:<NDBhome>/configuration/configure.global.acls=false
```

Note You can also disable Global deny ACL or ISL deny ACL by uploading the configuration in a Web browser.

Removing a Device

To remove a device from NDB, complete these steps

Step 1 Navigate to **Device Connections** tab.

Step 2 Select the device to remove from the table.

Step 3 Click **Remove Devices**. The **Remove Devices** dialog box opens.

Step 4 Verify the selected device(s) in the **Remove Devices** dialog box and click either of the two options:

- Remove Device: Use this option to remove the device connection from NDB while retaining the device configuration.
- Purge & Remove Device: Uset this option to remove the device connection from NDB along with the device configuration.

Rediscovering a Device

To rediscover a device from NDB, complete these steps:

Step 1 Navigate to **Device Connections** tab.

Step 2 Select the device(s) to rediscover from the table under the **Device Connections** tab.

Step 3 Click **Rediscover Devices**, the **Redicover Devices** window appears.

Step 4 Verify the selected devices in the **Redicover Devices** window.

Step 5 Click **Rediscover Devices** to rediscover the device(s).

A pop-window is displayed indicating an impact on the traffic. Click **Yes** to continue.

Managing Profile for a Device

You can attach a profile to an exisitng device or change the profile attached to a device using NDB. Complete these steps to add or change a profile to a device:

Note This feature is currently supported in NXAPI mode only.

Step 1 Navigate to **Device Connections** tab.

Step 2 Click **Add/Change Profile to Device**, the **Add/Change Profile to Device** window appears.

Step 3 Verify the selected devices in the **Add/Change Profile to Device** window. You can edit the following details in the **Add/Change Profile to Device** window:

- **Profile**: Select a profile to attach. For more information about the profiles, see Profile Management section.
- **Connection Type**: Specify the supported connection type. Currently, **NXAPI** is supported.
- **Port**: The device communication port. For example, use port 80 for NX-API over HTTP and 443 for HTTPS.

Device in Maintenance Mode

Beginning with Release 3.9.2, when the NDB controller is not able to connect to a device, the controller tries to refresh the device connection and on failure, moves the device to maintenance mode. NDB controller continues to make periodic attempts to connect to the device. On successful connection, the device is moved out of the maintenance mode.

You can move an NDB device to maintenance mode while performing device maintenance activities, such as, NX-OS upgrade of the device, switch reload, etc. The NDB controller cannot modify any of the device configurations while the device is in maintenance mode. When the device is moved out of this mode, the NDB controller can make changes to the the device configurations, as required.

Note An NDB device is automatically moved to maintenance mode if it is disconnected from the NDB controller.

To put a device in/out of maintenance mode, navigate to **Administration** > **Device Connections**. Select the required device. The available options for maintenance mode are:

- Maintenance on—adds an NDB device manually to maintenance mode.
- Maintenance off—removes an NDB device manually from maintenance mode.
- Remove maintenance—disconnects the device that is currently in maintenance mode. The NDB controller can not make further attempts to connect to the device.

When a device is in maintenance mode, the same is indicated in the **Device Connections** tab. The Device Status column indicates *Maintenance.* When the device moves out of maintenance mode, the Device Status column indicates *Ready*. You can also check the status of the device in the **Topology** tab. An *M* in red indicates that the device is in maintenance mode.

Device Prerequisites

Starting with Cisco NDB release 3.8, NDB pushes basic configuration to a newly added switch into NDB. Manual configuration of the NX-API devices to make it ready for NDB is not required. As a part of the adding a new device, the prerequisites are configured by NDB on the devices.

You need to ensure that NX-API is enabled on the new device for NDB to push prerequisite configuration successfully.

Following configurations are pushed into the new switch by NDB.

- TCAM configurations based on the device platform
- MST mode is enabled on the Spanning Tree
- Basic VLAN Configuration
- LLDP feature is enabled (only for the centralized mode of NDB)

Note Device is rebooted after all the configurations are successfully pushed by NDB. The device reboot is required because of the TCAM configurations. The reboot is supported from NX-OS is 9.2(3) and above

The Device Prerequisites can be configured when you add or edit a device, or when you add or change profile to device.

Profile Management

Starting with Cisco NDB release 3.8, you can add, edit, or delete a profile through NDB. A profile allow you to manage multiple switches attached to a NDB. You can attach multiple switches to a profile. The profile configuration is applied to all the member switches.

Adding a Profile

Complete these steps to add a profile:

Step 1 Navigate to **ADMINSTRATION** > **User Management**.
Step 2 On the **User Management** page, click **Profile** tab.
Step 3 Click **Add Profile** to open the **Add Profile** dialog-box.
Step 4 Enter name of the profile in the **Profile Name** text-field.
Step 5 Enter the user name to be configured for the member switches in the **User Name** text-field.
Step 6 Enter the password to be configured for the member switches in the **Password** text-field.
Step 7 Click **Create** to create a new profile.

Editing a Profile

To edit a profile using NDB, complete these steps:

Step 1 Navigate to **ADMINSTRATION** > **User Management** > **Profile** tab.
Step 2 Click **Edit** to edit a profile. The **Edit Profile** dialog box opens.
Step 3 Enter new name of the profile in the **Profile Name** text-field.
Step 4 Enter the new user name to be configured for the member switches in the **User Name** text-field.
Step 5 Enter the new password to be configured for the member switches in the **Password** text-field.

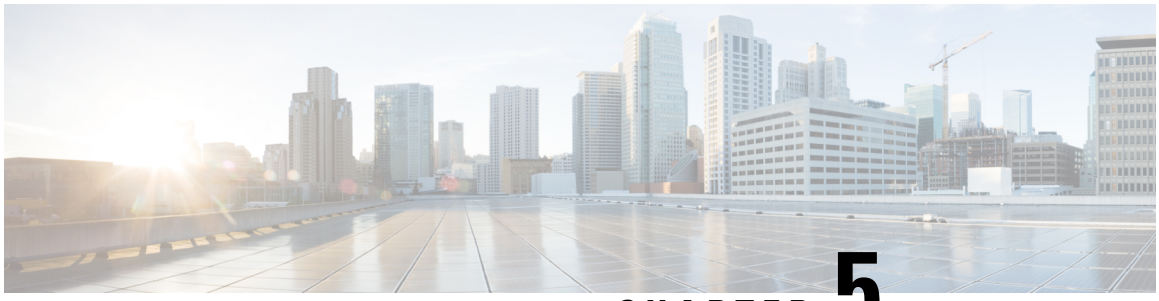
Step 6 Click **Submit**. All the devices that are part of the profile are rediscovered with the updated credentials.

Deleting a Profile

Complete these steps to delete a profile:

Step 1 Navigate to **ADMINSTRATION** > **User Management** > **PROFILE**.

Step 2 On the **Profile** page, click **Delete** for the profile to delete it.The deleted profile is removed from the **Profile** page.



CHAPTER 5

Configuring Cisco Nexus 9000 Series Switches

This chapter contains the following sections:

Guidelines and Limitations for Cisco Nexus 9000 Series Switches

See the following guidelines and limitations for configuring Cisco Nexus 9000 Series switches through Cisco Nexus Dashboard Data Broker.

- Beginning with Cisco NX-OS Release 7.0(3)I7(2), you can enable TAP aggregation for Cisco Nexus 9500 platform switches with N9K-X9700-EX and N9K-X9700-FX line card.
- To enable TAP AGG feature on N9K-X9700-EX and N9K-X9700-FX line card, you need to configure hardware acl tap-agg globally on the Cisco Nexus 9500 switches.
- Cisco Nexus Dashboard Data Broker supports NX-API protocol for Cisco Nexus 9000 series family of devices starting with Release 7.x.
- The devices that are going to provisioned by Cisco Nexus Dashboard Data Broker are assumed to have LLDP enabled and the LLDP feature should not be disabled during the device association with Cisco Nexus Dashboard Data Broker. If the LLDP feature is disabled, there might be an inconsistency in Cisco Nexus Dashboard Data Broker that cannot be fixed without device deletion and re-addition.
- Cisco Nexus Dashboard Data Broker assumes that the device interfaces configured by the port definitions are L2 switch ports and these interfaces have device configurations as switchport trunk by default.
- Cisco Nexus 9200 Series switches do not support Q-in-Q VLAN tagging for the Edge SPAN and Edge TAP port.
- For Cisco Nexus 9000 Series switches, upgrade the Cisco NX-OS software to Cisco NX-OS Release 7.x or above.

- You can now add a Cisco Nexus 9000 Series switch to the Cisco Nexus Dashboard Data Broker that can be discovered through NX-API protocol. Once the connection is successful, all the line card information for chassis model 9500 is discovered.
- Prior to deploying the Cisco Nexus 9000 Series switches for Tap/SPAN aggregation through Cisco Nexus Dashboard Data Broker with NX-API mode, the following configurations should be completed:
  - Configure the ACL TCAM region size for IPV4 port ACLs or MAC port ACLs.
  - Enable NX-API feature in the switch using the **feature nxapi** command.
  - Configure **switchport mode trunk** on all the inter-switch ports and the port-channels.
- Cisco Nexus Dashboard Data Broker periodically rediscovers the switch inventory, the topology interconnection, and the status. This information is updated in the GUI depending on the status. The rediscovery interval can be configured and the default value for the rediscovery interval is every 10 seconds.

Configuring TCAM Hardware Sizing on Cisco Nexus 9000 Series Switches

The TCAM configuration is based on the filtering requirement. You may need to configure multiple TCAM entries based on your filtering requirement. Complete these steps to configure a TCAM:

SUMMARY STEPS

1. Use the **hardware access-list tcam region <region> <tcam-size>** command to configure the following TCAM regions:

DETAILED STEPS

	Command or Action	Purpose

Step 1	Use the **hardware access-list tcam region <region> <tcam-size>** command to configure the following TCAM regions:	`NAT ACL[nat] size = 0`
		`Ingress PACL [ing-ifacl] size = 1024`
		`VACL [vacl] size = 0`
		`Ingress RACL [ing-racl] size = 0`
		`Ingress L2 QOS [ing-l2-qos] size = 256`
		`Ingress L3/VLAN QOS [ing-l3-vlan-qos] size = 0`
		`Ingress SUP [ing-sup] size = 512`
		`Ingress L2 SPAN filter [ing-l2-span-filter] size = 256`
		`Ingress L3 SPAN filter [ing-l3-span-filter] size = 0`
		`Ingress FSTAT [ing-fstat] size = 0`
		`span [span] size = 512`
		`Egress RACL [egr-racl] size = 1792`
		`Egress SUP [egr-sup] size = 256`
		`Ingress Redirect [ing-redirect] size = 512`
		`Egress L2 QOS [egr-l2-qos] size = 0`
		`Egress L3/VLAN QOS [egr-l3-vlan-qos] size = 0`
		`Ingress Netflow/Analytics [ing-netflow] size = 512`
		`Ingress NBM [ing-nbm] size = 0`

	Command or Action	Purpose
		TCP NAT ACL[tcp-nat] size = 0 Egress sup control plane[egr-copp] size = 0 Ingress Flow Redirect [ing-flow-redirect] size = 0 Ingress PACL IPv4 Lite [ing-ifacl-ipv4-lite] size = 0 Ingress PACL IPv6 Lite [ing-ifacl-ipv6-lite] size = 0 MCAST NAT ACL[mcast-nat] size = 0 Ingress PACL Super Bridge [ing-pacl-sb] size = 1024 Ingress Storm Control [ing-storm-control] size = 0 Ingress VACL redirect [ing-vacl-nh] size = 0 Egress PACL [egr-ifacl] size = 0 See the *Cisco Nexus 9000 Series NX-OS Security Configuration Guide* for the step-by-step TCAM hardware sizing configuration on Cisco Nexus 9000 Series Switches. **Note** Cisco Nexus Dashboard Data Broker in OpenFlow mode supports Ethernet MAC source and destination addresses as match capabilities only when the OpenFlow TCAM region is configured as double wide (for example, **hardware access-list tcam region openflow 512 double-wide**). If the OpenFlow TCAM region is configured as non double wide, only ether type match is supported as match capabilities.

Enabling Cisco NX-API on Cisco Nexus 9000 Series Switches Using CLI

You can now manage multiple Cisco Nexus 9000 Series switches that are connected in a topology. Cisco Nexus Dashboard Data Broker plugin can discover the switch interconnections using LLDP and update the topology services within Cisco Nexus Dashboard Data Broker. The switch interconnections can be a physical link or a port-channel interface. The topology displays only the interconnections between Cisco Nexus 9000 Series switches that are added to the NDB device list. The topology interconnection is displayed in the GUI.

Complete the following steps for enabling Cisco NX-API on Cisco Nexus 9000 Series switches:

Procedure

	Command or Action	Purpose
Step 1	Enable the management interface.	Enable the management interface on the switch.
Step 2	switch# **conf t**	Enter the configuration mode.
Step 3	switch (config) # **feature nxapi**	Enable the NX-API feature.

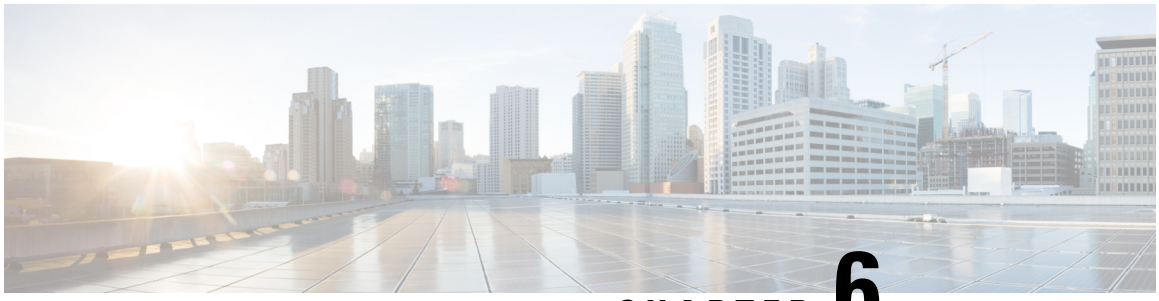
	Command or Action	Purpose
Step 4	switch (config) # **nxapi http port** *80*	Configure the HTTP port.
Step 5	switch (config) # **nxapi https port** *443*	Configure the HTTPS port. For the step-by-step configuration information for enabling the NX-API feature on Cisco Nexus 9000 Series switches, see the *Cisco Nexus 9000 Series NX-OS Programmability Guide*.

Enabling Switch Port Mode as Trunk on the Inter-switch Ports and Port Channels

Complete the following steps to enable the switch port mode on the inter-switch ports and port-channels:

Procedure

	Command or Action	Purpose
Step 1	switch(config)# **config t**	Enables the configuration mode.
Step 2	switch(config)# interface {{**type** *slot*/*port*} | {*port-channel number*}}	Specifies an interface to configure.
Step 3	switch(config-if)# **switchport mode** {*access* | *trunk*}	Configures the switchport mode as access or trunk on the inter-switch ports and the port-channels.
Step 4	switch(config)# **exit**	Exits the configuration mode.



CHAPTER 6

Configuring the Nexus Data Broker

This chapter contains the following sections:

Viewing Topology

Click the **Topology** tab in the left frame to view the topology in the network.

Note Starting with Cisco NDB Release 3.7, additional information such as hardware detail and software detail is displayed for each device along with the port count in the topology diagram.

Configuring Port Definition

When you click **Port Definition** tab in the GUI, the **Port Definition** screen is displayed. Select the switch from the drop-down list to configure the ports.

On the **Port Definition** screen, the following two tabs are displayed:

- Port Configuration
- SPAN Destination

Click the **Port Configuration** tab, the following tabs are displayed:

- Configure Multiple Ports
- Remove port Configuration
- Add Service Node
- Add Monitoring Device

When you click **Configure Multiple Ports** tab, the **Configure Multiple Ports** window is displayed. The following details are displayed on the screen: Number, Status, Port Name, Type, In Use, Port ID, and Action.

Note Beginning with Cisco Nexus Data Broker, Release 3.1, the interface description is updated from the Cisco Nexus Data Broker GUI to the switch and the interface description is also available from the switch into the Cisco Nexus Data Broker GUI. When using in Openflow mode, the NX-API auxiliary connection is required for this functionality to work.

Note On the Port Configuration tab, the port name and the interface are displayed as hyperlinks. When you click the port name, you can view the running configuration for that interface on the tab.

If you want to remove any ports, select the port and click **Remove port Configuration** tab.

Click **Add Service Node** to add a service node.

Click **Add Monitoring Device** to add a monitoring device.

On the **Port Configuration** screen, the following port details are displayed for the selected node:

- Serial Number
- Status
- Port name
- Type
- In Use
- Port ID
- Action—When you click **Configure**, the **Configure Ports** window is displayed.

On the **SPAN Destination** tab, the following details are displayed:

- SPAN Destination Name
- SPAN Destinations
- Node Connector
- Monitor Port Type
- Description

Configuring Ports

Complete the following steps to configure a port.

Step 1 Select the switch for which you want to configure the port details on the **Port Configuration** screen.

Step 2 Click **Configure** under **Action**.

The **Configure Ports** window is displayed.

Step 3 In the **Configure Ports** window, configure the port type from the **Select a port type** drop-down list by selecting one of the following options:

- **Add Monitoring Device**
- **Edge Port-SPAN**
- **Edge Port-TAP**
- **Production Port**
- **Packet Truncation Port**
- **Remote Source Edge Span Port**

Monitoring Device—Creates a monitoring device for capturing traffic and configures the corresponding delivery port.

Edge Port-SPAN—Creates an edge port for incoming traffic connected to an upstream switch that is configured as a SPAN destination.

Edge Port-TAP—Creates an edge port for incoming traffic connected to a physical TAP port.

Production Port—Creates a production port for the ingress and egress traffic.

Packet Truncation Port—Creates packet truncation on egress ports.

Remote Source Edge Span Port—Configures remote source monitoring.

Note Starting with Cisco NDB Release 3.6, you can configure Maximum Transmission Unit (MTU) for all the Cisco Nexus 9xxx devices in NX-API mode using NDB GUI. MTU can be configured at the system level (node level or global level) and the Interface Level (supported only on SPAN and TAP ports). The default value for MTU is 1500 and you can configure MTU between 1500 and 9216.

Jumbo MTU is the maximum MTU that can be configured for a node. When you configure Jumbo MTU at the system level, the same MTU value is applied to all the node ISLs.

Note Starting with Cisco NDB Release 3.4, a description can have a leading numerical for Edge-SPAN, Edge-TAP, Monitoring devices, Production ports, Filter names, Connections, and Redirections (NX-API, OpenFlow and NX-AUX mode).

Note To receive the traffic from the production network, the production ingress port is configured. After entering the service nodes (multiple security tools), the traffic exits the data center through the production egress port.

Note Starting with Cisco Nexus Data Broker, Release 3.2, when Edge-SPAN, Edge-TAP, monitoring device, or production port is defined in NX-API mode of configuration, the CLI command, **spanning-tree bpdufilter enable** is automatically configured in the interface mode on the ports to filter the BPDU packets. This configuration is applicable for all Cisco Nexus 3000 and 9000 Series switches. The sample configuration is displayed in the example:

```
switch#
show run interface eth1/1
interface ethernet1/1
switchport mode trunk
mode tap-aggregation
spanning-tree bpdufilter enable
```

Note Production port has be enabled for Q-in-Q in Cisco Nexus Data Broker and a unique VLAN should be assigned for each production port. This VLAN should not overlap with any production VLAN numbers.

Note The **spanning-tree bpdufilter enable** CLI command should be configured by the user on all the inter-switch ports for all Cisco Nexus series switches and Cisco Nexus Data Broker does not configure this command.

Note Once an interface is configured with Q-in-Q, do not configure multiple VLAN filters for the Q-in-Q configured interface.

When you select the port type, the title of the window changes to **Manage Configure Ports**.

Step 4 (Optional) In the **Port Description** field, enter the port description.

Beginning with Cisco Nexus Data Broker, Release 3.1, the interface description is updated from the Cisco Nexus Data Broker GUI to the switch and the interface description is also available from the switch into the Cisco Nexus Data Broker GUI. When using in Openflow mode, the NX-API auxiliary connection is required for this functionality to work.

Step 5 Required: Enter VLAN ID for the port.

The port is configured as dot1q to preserve any production VLAN information. The VLAN ID is used to identify the port that the traffic is coming from.

Step 6 (Optional) If APIC is available, you can select the ACI side port and designate it as the SPAN destination port.

Step 7 In the **Enable Packet Truncation** field, enter the packet length.

Step 8 A check box is added for **Block Tx** and it is applicable for both Edge-SPAN and Edge-TAP where you can block the traffic that is being transmitted out of Edge-SPAN AND Edge-TAP interface.

Step 9 A check box is added for **Drop ICMPv6 Neighbour Solicitation** and by default all the ICMP traffic is blocked for all the Edge-SPAN and Edge-TAP port types for Nexus 9300-EX and 9200 Series switches. For the rest of Nexus 9000 Series switches, user has to manually enable this feature to deny or block all the ICMP traffic. This feature is currently available on NX-API based switches for NX-OS versions I5 and later.

Step 10 A check box is added for **Enable Timestamp Tagging** to append timestamp tag on the packets using the Timestamp Tagging feature. You can configure this feature on a single device or multiple devices.

For Nexus 9300-EX and 9200 series switches, this feature is applicable for Edge-SPAN and Edge-TAP ports and on the Monitoring devices. To configure Timestamp Tagging feature, ensure that PTP feature is enabled on the device. You need to enable Timestamp tagging on monitoring device and edge ports. If Timestamp Tagging feature is not configured on either side of the connection, Edge-SPAN/Edge-TAP and Monitor Devices, the packets are not tagged with timestamp. For Nexus 3500 Series switches, the Timestamp Tagging feature is applicable only for the Monitoring devices.

Step 11 Click **Submit** to save the settings or click **Clear** to clear the details.

Once you configure a port, you can click **Edit** under **Action** on the **Port Configuration** screen to edit the port details. You can click **Remove** under **Action** on the **Port Configuration** screen to clear the port details.

Editing In Use Ports

Starting with NDB Release 3.4, you can edit the select fields under Port configuration(Edge-Span, Edge-Tap or Production) while in use. Ports can be edited in all the modes of connection. The following table lists the fields that you can edit for port in use.:

Section	Field	Editable
Port Configuration	Port Description	Yes
	Block Tx	Yes
	Port Type	No
	VLAN Packet Truncation	No
	Drop ICMPv6 Neighbour Solicitation	Yes
	Enable Timestamp Taggin	Yes

Enabling or Disabling Ports

Starting with Cisco NDB Release 3.4, you can now enable or disable an interface using the NDB GUI. This feature is currently available for NX-API and NX-AUX based switches. A switch based on OpenFlow mode does not support this feature.

Step 1 Select the switch for which you want to configure the port details on the **Port Configuration** screen.

Step 2 Click **Enable/Disable** to enable or disable the selected port.

Note You can enable or disable only one interface at a time.

Configuring Multiple Ports

You can configure multiple ports for a node.

Step 1 Click **Configure Multiple Ports** on the **Port Configuration** screen. The **Configure Multiple Ports** window is displayed.

Step 2 Use **CTRL/SHIFT** to select multiple ports in the **Select Ports** field.

Step 3 Select port type from the drop-down list in the **Select Port Type** field.

Step 4 Click **Submit** to save the settings.

Port Channels

A port channel is an aggregation of multiple physical interfaces that creates a logical interface. You can bundle up to 8 individual active links into a port channel to provide increased bandwidth and redundancy. If a member port within a port channel fails, the traffic previously carried over the failed link switches to the remaining member ports within the port channel. Port channeling also load balances traffic across these physical interfaces. The port channel stays operational as long as at least one physical interface within the port channel is operational.

You create a port channel by bundling compatible interfaces. You can configure and run either static port channels or ports channels running the Link Aggregation Control Protocol (LACP).

Any configuration changes that you apply to the port channel are applied to each member interface of that port channel. For example, if you configure Spanning Tree Protocol (STP) parameters on the port channel, the Cisco NX-OS applies those parameters to each interface in the port channel.

You can use static port channels, with no associated protocol, for a simplified configuration. For more efficient use of the port channel, you can use the Link Aggregation Control Protocol (LACP), which is defined in IEEE 802.3ad. When you use LACP, the link passes protocol packets.

Configuring Port Groups

You can create a port group and add the ports to the connection. Starting with Cisco Nexus Data Broker, Release 3.2, you can create port groups for different source ports. The port groups can be a combination of the edge-span and the edge-tap ports across different switches. You can select ports, define port groups, provide a name to the port group, select the port group in a connection screen (only one port group per connection), and use the ports defined in the port group as source ports for creating a connection. Selecting individual ports is disabled when using a port group.

Complete the following steps to configure port groups:

Step 1 Select the switch for which you want to configure the port details on the Port Configuration screen.

Step 2 Click **Port Groups** tab in the left frame.

Step 3 Click **+ Add Group** to create a port group.

Step 4 In the **Create Port Group** window, enter the group name in the **Group Name** field.

Step 5 In the **Select Node** field, select a node, for example, N9K-116.

Step 6 In the **Select Port** field, select a port, for example, Ethernet1/1 (Ethernet1/1).

You can add only edge-span and edge-tap ports and you cannot add production ports to the port groups.

Step 7 Click **+ Add To Group** to add the port to the group.

You can add multiple ports to the group.

Step 8 Click **Apply**.

The port group is displayed on the **Port Groups** screen with the following information for the group, for example, **Name**, **Connection Name**, **Ports** and **Action**.

Starting with NDB 3.4 release, you can now configure selected fields under Port Group. This feature is supported on the switches running in NX-API, OpenFlow, or NX-AUX mode.

Starting with Cisco NDB Release 3.7, **Created By** and **Modified By** information is displayed for Port Groups in the NDB UI.

The following table lists the fields that you can configure for a Port Group:

Section	Field	Editable
Port Group	Port Description	Yes
	Port	Yes
	Port Name	Yes (If the port is not part of an active connection)
	Port Group	Yes (If the port group is not part of an active connection)

Editing In Use Port Groups

You can edit an in-use port group using NDB GUI. To edit an in-use port group, complete the following steps:

Note Starting with Cisco NDB release 3.8, you can now rename an in-use port group.

Note Starting with NDB 3.4 release, you can edit the port groups that are currently in use in a connection. This feature is supported on the switches running in NX-API, OpenFlow, or NX-AUX mode.

Step 1 Select the switch for which you want to configure the port details on the **Port Group** pane.

Step 2 Click **Edit** on the listed table row.

Editable Attributes for In Use Port Groups

The following table lists the fields that you can edit for a Port Group that is currently in use:

Section	Field	Editable
Port Group	Port Description	Yes
	Port	Yes
	Port Name	Yes.
	Port Group	Yes (If the port group is not part of an active connection)

Adding a Monitoring Device

To add a new monitoring device, complete these steps:

Step 1 Navigate to the **Monitoring Device** tab under **Configuration**.

Step 2 Click **Add Monitoring Device**.

Step 3 In the **Monitoring Device** window, complete the following fields:

Name	Description
Monitoring Device Name	Add the service node name. **Note** The valid characters for the monitoring devices are the alphanumeric characters and the special characters: period ("."), underscore ("_"), and hyphen ("-").
Select Switch Node	Select the switch node.
Select Port	Select the port.
Port Description	Description for the port.

Name	Description
Icons	Select a Monitoring Device Icon.
Local Monitor Device	Indicates that the monitoring device is available in the local network.
Block Rx	Block any traffic from being received from the monitoring tools. This option is selected by default. You can turn this option off by unchecking the box. **Note** Rx traffic is blocked using Unidirectional Ethernet for Cisco N9K-95xx switches with N9K-X97160YC-EX line card (NX-OS 9.3(3) or later).
Enable Timestamp Tagging	Time stamp tagging is supported on Cisco Nexus 3500, 9200 and 93XXX-EX Series switches. Cisco Nexus 3500 Series switches require NX-OS Release 6.0(2)A8(1) or later version.
Enable Timestamp Strip	Select this option to remove timestamp tag from the source packets.
MTU	You can configure MTU at the system level (node level or global level) and the Interface Level. The default value for MTU is 1500 and you can configure MTU between 1500 and 9216. Jumbo MTU is the maximum MTU that can be configured for a node. When you configure Jumbo MTU at the system level, the same MTU value is applied to all the node ISLs.

Step 4 Click **Submit** to create the monitoring device.

Adding a Remote Monitoring Device

Starting with Cisco NDB Release 3.7, you can now use a device outside the network as a monitoring device using the Encapsulated Remote Switch Port Analyzer (ERSPAN) Source Session feature for Cisco Nexus 9300 FX and EX series switches. This feature enables you to direct the traffic for monitoring outside the local network

Note You can associate a remote delivery port to only one destination port group.

To add a new remote monitoring device, complete these steps:

Step 1 Navigate to the **Monitoring Device** tab under **Configuration**.

Step 2 Click **Add Monitoring Device**.

Step 3 In the **Monitoring Device** window, complete the following fields:

Name	Description
Monitoring Device Name	Add the service node name. **Note** The valid characters for the monitoring devices are the alphanumeric characters and the special characters: period ("."), underscore ("_"), and hyphen ("-").
Select Switch Node	Select the switch node.
Select Port	Select the port.
Port Description	Description for the port.
Block Rx	Not applicable
Remote Monitor Device	Select this option to indicate that the monitoring device is available in the local network.
Enable Timestamp Tagging	Enable Timestamp Tagging for remote monitoring.
Enable Timestamp Strip	Enable Timestamp Strip for remote monitoring.
MTU	Enable MTU for remote monitoring.
Icons	Select a Monitoring Device Icon.
Interface IP	IP address to be assigned to the selected interface.
Destination IP	IP Address where ER-SPAN terminates and should be reachable from the selected port.

Step 4 Click **Submit** to create the monitoring device.

Note You cannot use more than one remote delivery port per switch per connection.

Note You cannot share the same source interface across with multiple connections.

Note Remote monitor tool involving inter switched links is restricted to only one connection per ISL.

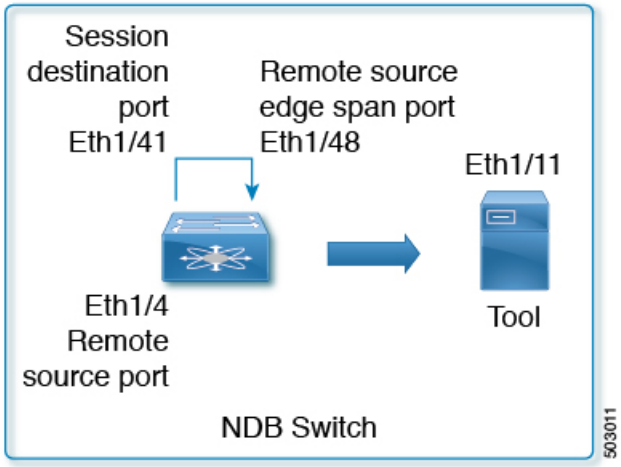
Adding a Remote Source Edge SPAN

Starting with Cisco Nexus Data Broker Release 3.8, you can now configure remote source monitoring on devices (Nexus 9300-EX, 9300-FX, 9300-FX2, 9500-EX, and 9500-FX) running NX-OS version 9.3(1) or later.

From Release 3.9, traffic from APIC can be captured on NDB via remote source (ERSPAN).

After you add a remote source edge-span, you can edit all fields except the remote source and the IP address fields. To edit these fields, you must remove this configuration and redo the configuration.

For better understanding, consider the topology as shown below. The image represents the configuration of a remote source edge span, on a device where the interface ethernet1/4 of the device is a L3 port which receives traffic from the ERSPAN source. Interface ethernet1/41 of the device is configured as session destination, interface ethernet1/48 of the device is configured as remote source edge span and interface ethernet1/11 of the device is configured as a monitoring tool.



Step 1 Configure remote source termination. Navigate to the **CONFIGURATION** > **Port Definitions** .

Step 2 In the **Port Definition** page, click **Configure** for an interface to configure remote source monitoring. The **Configure Ports** dialog box opens.

Step 3 From the **Select a port type** drop-down list, select **Remote Source Egde-SPAN**.

Step 4 In the **Port Description** field, enter the port configuration.

Step 5 (Optional) In the **VLAN ID** field, enter the VLAN ID for the port that you want to set for this configuration.

Step 6 (Optional) In the **Enable Packet Truncation** field, enter the packet length.

Step 7 In the **ERSPAN ID** field, enter ERSPAN Id for the Remote Source Termination session. The range of ERSPAN ID is from 1 to 1023.

This value should be the same as that of ERSPAN source session.

Step 8 (Optional) Check the **Use Loopback interface** dialog box to create a loopback. From the **Select Loopback** drop-down list, select a loopback. You can also create a new loopback, if not available. To create a new loopback, click **Configure Loopback**. In the **Configure Loopback Interface** dialog box that appears, do the following:

a) Enter loopback ID in the **Loopback ID** field.
b) Enter IP address in the **IP Address** field.
c) Click **Submit** to create a new loopback and close the **Configure Loopback Interface** dialog box. The Loopback IP address will be used for the session creation.

Step 9 From the **Session Destination** drop-down list select session destination port for the monitoring session.

The interface configured as session destination (Eth1/41) redirects decapsulated traffic to remote source edge span. For this redirection to work, the session destination interface should have physical loopback cable with remote source edge span (Eth1/48).

Step 10 From the **Remote Source** drop-down list, select the interface to be configured as a remote source port, where ERSPAN encapsulated packets are received.

Remote source configured on Ethernet1/4 interface is an L3 port which receives traffic either through IP address (when loopback interface is not selected) or loopback interface (when loopback interface is configured). The IP address must be similar to the destination IP address configured in the ERSPAN source session.

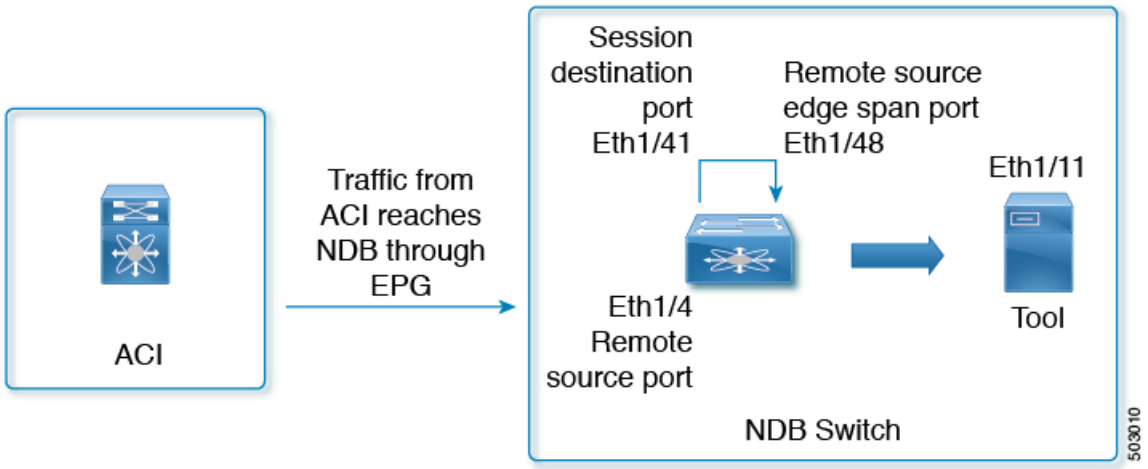
Step 11 In the **IP Address** field, enter IP address of the packet source. This IP address is used to create the monitor session if the **use loopback** option is not enabled.

Step 12 If you have APIC configured, the Destination pane is displayed and the Node Type is automatically populated with APIC (which cannot be changed). For details about SPAN Destination creation, see Adding SPAN Destination, on page 144.

Step 13 Click **Submit** to complete the process.

The remote source edge span configured on interface ethernet 1/48, receives the decapsulated traffic and redirects it to the monitoring tool.

Note For adding Remote source edge span for ACI, traffic from the ACI reaches the NDB through EPG (as shown below). The behavior of the remote source, session destination and the created remote source edge span is similar to what is defined in the this task. The value of the ERSPAN ID is the Flow ID for the span destination.



Editing In Use Monitoring Device

Starting with Cisco NDB, Release 3.4, you can edit a monitoring device configuration using the NDB GUI. Support to edit description of a Monitoring device is available for NX-API, OpenFlow, and NX-AUX based switches. For the OpenFlow devices, the updated descriptions are synchronized to NDB User Interface (UI) only. For NX-API and NX-AUX devices, the updates are synchronized to NDB UI and the switch interface.

The following table lists the fields that you can configure for Monitoring Devices:

Section	Field	Editable
Monitor Devices	Monitor Devices Name	Yes (If the monitoring device is not in use)
	Port Description	Yes
	Block Rx	Yes
	Icons	Yes
	Enable Timestamp Tagging	Yes
	Enable Timestamp Strip	Yes
	MTU	Yes

Adding a Service Node

Starting with Cisco NDB Release 3.7, **Created By** and **Modified By** information is displayed for Service Nodes in the NDB UI.

Complete the following steps to add a service node:

Step 1 Navigate to the **Service Nodes** tab under **Configuration** and click **+ Service Node**.

Step 2 In the **Add Service Node** window, enter the name of the service node.

Step 3 Select the ingress port for the service node from the **Service Node Ingress Port** drop-down list.

Step 4 Select the egress port for the service node from the **Service Node Egress Port** drop-down list.

Step 5 Enable health check on a service node by selecting the **Service Node Health Check** option.

Beginning with Cisco Nexus Data Broker, Release 3.2, you can configure the wait interval in the **config.ini** file before the health check is up. The **ServiceNodeHealthCheckWaitInterval** is the variable in the **config.ini** file to set the wait interval. If you do not specify a value or if the value is 0 for the wait interval in the **config.ini** file, the default value of 5 Seconds is used. The wait interval is not applicable if the port is in shutdown state.

This option works only in the OpenFlow mode. The controller or the NDB injects a packet in the service node ingress port and the packet is received at the egress port. The packets are checked at the interval of every 5 seconds. If five packets are not received in 5 seconds, the health of the service node is considered as down.

For the service node, a new field is displayed in the details: Service Node Status. This field displays the status of the service node.

Step 6 Select a service node icon from the available options.

Step 7 Click **Save**.

Editable Fields for an Active Service Node

Starting with Cisco NDB, Release 3.4, you can now edit and configure Service Node fields using the NDB GUI. For the OpenFlow devices, the updated descriptions are synchronized to NDB User Interface (UI) only. For NX-API and NX-AUX devices, the updates are synchronized to NDB UI and the switch interface.

The following table lists the fields that you can configure for an active Service Node:

Section	Field	Editable
Service Node	Description	Yes
	Icon	Yes
	Service Node Health Check	Yes
	Service Node Name	Yes (If the service node is not in use)
	Service Node Ingress Port	No
	Service Node Egress Port	No
	Ingress port Description	Yes
	Egress port Description	Yes

User Defined Field

You can define a User Defined Field (UDF) and use it while creating a filter for traffic management.

Starting with Cisco NDB Release 3.7, **Created By** and **Modified By** information is displayed for User Defined Fields in the NDB UI.

Note Starting with Cisco NDB Release 3.6, you can add multiple UDFs while defining a filter. You can add upto four UDFs for each filter.

Table 5: UDF Support Matrix

UDF Ethertype	NDB Version	NXOS Version	Platform
IPv4	3.3	7.0(3)I5(2)	9200 & 9300
IPv6	3.6	7.0(3)I6(1)	93xx EX/FX , 95xx EX/FX , 92xx

Note Please refer the NXOS documentation for number of UDF support per platform.

To use UDF to manage traffic, you need to:

- Define a UDF, see Defining a UDF.
- Create a filter using the UDF, see Adding Filters.
- Apply the filter (configured with UDF) to a connection to manage traffic, see Adding Connections.

Table 6: Qualifying Region for UDF for Different Platforms

Platform	UDF Qualifying TCAM region
Cisco Nexus 9200, 9300-EX/9300-FX and 9500-EX/9500-FX	ing-ifacl
Other platforms	ifacl

Defining a UDF

Complete the following steps to define a UDF:

Step 1 Log into NDB application.

Step 2 Navigate to **Configuration** tab, click **UDF Definition** to define a user defined filter. The **UDF Definition** window is displayed.

Step 3 In the **UDF Definition** window, complete the following fields:

Name	Description
Name field	The name of the user defined field.
Keyword	If **Header** option is selected, the Inner (Offset base from inner/outer header) and L3/L4 (Offset base from L3/L4 header) is enabled.
Offset field	Number of characters to offset while using matching criteria.
Devices	Cisco Nexus 9000 Series switch name.
Type	Specifiy UDFv4 or UDFv6 support.

Step 4 Click **Add UDF**. The newly added UDF appears in the **UDF Definition** window.

Note Any change in a UDF definition requires device reboot.

Note By default, NDB generates a UDF named *udfInnerVlan* and *udfInnerVlanv6*, used to match the inner VLAN in the ISL ports.

Note The icon for UDF is yellow in color immediately after it is created. After you reboot the device, if the UDF is successfully installed, the UDF icon color changes to green, else it changes to red color.

Adding Filters

Beginning with Cisco Nexus Data Broker, Release 3.3, the Default-Match-All filter includes the following protocols packet filtering:

- IPv4
- IPv6
- ARP
- MPLS Unicast
- MPLS Multicast
- MAC

Before you begin

Note The hardware command that is a pre-requisite for the IPv6 feature is **hardware access-list tcam region ipv6-ifacl 512 double-wide** .

Note Beginning with NDB 3.4 release, you can now edit Filter Name using the NDB GUI. This feature is supported on the switches running in NX-API, OpenFlow, or NX-AUX mode.

Step 1 On the **Filters** tab, click **Add Filter** to add a filter. The **Add Filter** window is displayed.

Step 2 In the **Filter Description** section of the **Add Filter** window, complete the following fields:

Name	Description
Name field	The name of the filter. **Note** The name cannot be changed once you have saved it.
Bidirectional check box	Check this box if you want the filter to capture traffic information from a source IP, source port, or source MAC address to a destination IP, destination port, or destination MAC address, and from a destination IP, destination port, or destination MAC to a source IP, source port, or source MAC address.

Step 3 In the **Layer 2** section of the **Add Filter** window, complete the following fields:

Ethernet Type field	Required. The Ethernet type of the Layer 2 traffic. The default value displayed is IPv4, or you can choose one of the following: • IPv6 • ARP • LLDP • Predefined EtherTypes • All EtherTypes • Enter Ethernet Type—If you choose Enter Ethernet Type as the type, enter the Ethernet type in hexadecimal format. If you choose Predefined EtherTypes, all predefined Ethernet types contained in the config.in file are associated with the rule, and you should not configure any other parameters.
VLAN Identification Number field	The VLAN ID for the Layer 2 traffic. You can enter a single VLAN ID, a range of VLAN ID values, or comma-separated VLAN ID values and VLAN ID ranges, for example, 1-4,6,8,9-12.
VLAN Priority field	The VLAN priority for the Layer 2 traffic.
Source MAC Address field	The source MAC address of the Layer 2 traffic.
Destination MAC Address field	The destination MAC address of the Layer 2 traffic.

Step 4 In the **Layer 3** section of the **Add Filter** window, update the following fields:

Name	Description
Source IP Address field	The source IP address of the Layer 3 traffic. This can be one of the following: • The host IP address, for example, 10.10.10.10 • Discontiguous source IP address, for example, 10.10.10.10, 10.10.10.11, 10.10.10.12 • An IPv4 address range, for example, 10.10.10.10-10.10.10.15 • An IPv4 subnet, for example, 10.1.1.0/24 • The host IP address in IPv6 format, for example, 2001::0 • Combination of range and simple IP addresses, for example, 4.4.4.1,4.4.4.2-4.4.4.4,4.4.4.5. **Note** • When a switch is used in NX-API mode, you can now select an IPv6 filter and setup a connection. You can enter a single IPv6 address, comma separated multiple IPv6 addresses, an IPv6 address range, and/or IPv6 subnet in the **Source IP Address** field. • If you configure a range of Layer 3 source IP addresses, you cannot configure ranges of Layer 4 source or destination ports. • If you configure a range of Layer 3 source IP addresses, you cannot configure ranges of Layer 2 VLAN identifiers. **Note** When using IPv6 address in the filter, the **Ethernet Type** should be set to IPv6.

Name	Description
Destination IP Address field	The destination IP address of the Layer 3 traffic. This can be one of the following: • The host IP address, for example, 10.10.10.11 • An IPv4 address range, for example, 10.10.10.11-10.10.10.18 • An IPv4 subnet, for example, 10.1.1.0/24 • The host IP address in IPv6 format, for example, 2001::4 • The subnet, for example, 10.0.0.0/25 **Note** • When a switch is used in NX-API mode, you can now select a IPv6 filter and setup a connection. You can enter a single IPv6 address only in the **Destination IP Address** field. The comma separated multiple IPv6 addresses, an IPv6 address range, and/or IPv6 subnets are not supported. The hardware command that is a pre-requisite is for using the IPv6 feature is **hardware access-list tcam region ipv6-ifacl 512** . • If you configure a range of Layer 3 source IP addresses, you cannot configure ranges of Layer 4 source or destination ports. • If you configure a range of Layer 3 source IP addresses, you cannot configure ranges of Layer 2 VLAN identifiers.
Protocol drop-down list	Choose the Internet protocol of the Layer 3 traffic. This can be one of the following: If you choose Enter Protocol as the type, enter the protocol number in decimal format. • ICMP • TCP • UDP • Enter Protocol

Name	Description
UDF drop-down list	User Defined Field. • UDF: UDF name. • UDF value: Value to be matched in decimal notation (0-65535). Example: if you want to match 0x0806, enter 2054 which is 0x0806 in decimal notation. • UDF Mask: Mask value in packet to be matched. Mask is applied to the value for matching purposes. Example: to exactly match 2054 (0x0806) enter 65535 (0xffff), to match 2048-2063 (0x0800-0x080f) use 65520 (0xfff0). **Note** If Add default udf for inner vlan option is selected, you can add only one UDF (UDF that matches outervlan offset). The udfInnerVlan is applied to the ISL links along with QinQ vlan specified on the SPAN port. **Note** UDF option is enabled for IPv4 and IPv6 ethertypes.
ToS Bits field	The Type of Service (ToS) bits in the IP header of the Layer 3 traffic. Only the Differentiated Services Code Point (DSCP) values are used.
Advanced Filter field	Advanced filter, combination of Ethernet type and attributes to manage traffic.

Step 5 In the **Layer 4** section of the **Add Filter** dialog box, complete the following fields:

Name	Description
Source Port drop-down list	Choose the source port of the Layer 4 traffic. This can be one of the following: • FTP (Data) • FTP (Control) • SSH • TELNET • HTTP • HTTPS • Enter Source Port **Note** Beginning with Cisco Nexus Data Broker Release 3.2 , you can enter comma separated single port numbers and a range of the source port numbers in the **Enter Source Port** field. **Note** • If you configure a range of Layer 4 source ports, you cannot configure ranges of Layer 3 IP source or destination addresses. • If you configure a range of Layer 4 source ports, you cannot configure ranges of Layer 2 VLAN identifiers

Name	Description
Destination Port drop-down list	Choose the destination port of the Layer 4 traffic. This can be one of the following: • FTP (Data) • FTP (Control) • SSH • TELNET • HTTP • HTTPS • Enter Destination Port **Note** Beginning with Cisco Nexus Data Broker Release 3.2 , you can enter comma separated single port numbers and a range of the source port numbers in the **Enter Destination Port** field. **Note** • If you configure a range of Layer 4 destination ports, you cannot configure ranges of Layer 3 IP source or destination addresses. • If you configure a range of Layer 4 destination ports, you cannot configure ranges of Layer 2 VLAN identifiers

Step 6 In the **Layer 7** section of the **Add Filter** dialog box, complete the following fields:

Name	Description
HTTP Method field	You can configure matching on the HTTP methods and redirect the traffic based on that method. Select one or more methods to match within a single filter. This option is available only when the destination port is HTTP or HTTPS. • Connect • Delete • Get • Head • Post • Put • Trace **Note** Layer 7 match is supported only with the NX-API mode only and it is not supported in OpenFlow. **Note** The TCP option length is enabled when you select any one of the methods from Layer 7 traffic.
TCP Option Length field	You can extend the filter configuration to specify the TCP option length in the text box. The default value on the text box is 0. All methods within the filter have the same option length. Enter the TCP option length in a decimal format. **Note** The value on the text box should be in the multiples of 4 and it can range from 0-40.

Step 7 Click **Add Filter**.

Advanced Filter support

Starting with Cisco Nexus Data Broker, Release 3.3, advanced filtering option is available to manage the traffic. Advanced filtering provides multiple options to filter (permit or deny) the traffic based on Ethernet type and attributes such as Acknowledgment, FIN, Fragments , PSH, RST, SYN, DSCP, Precedence, TTL, packet-length, and NVE. Advanced filtering is available for the following Ethernet types and options:

Table 7: Advanced Filtering Support

Data Type	Supported Options
IPv4	DSCP, Fragment, Precendence, and TTL
IPv4 with TCP	Acknowledgment, DSCP, Fragment, FIN, Precedence, PSH, RST, SYN, and TTL
IPv4 with UDP	DSCP, Fragment, Precendence, and TTL
IPv6	DSCP and Fragment
IPv6 with TCP	Acknowledgment, DSCP, Fragment, FIN, PSH, RST, and SYN
IPv6 with UDP	DSCP and Fragment

Important Advanced Filtering is available only for NX-API on Cisco Nexus 9000 platform.

Important The value of Time to Live (TTL) attribute ranges from 0 to 255.

- For Nexus 9200 devices, the maximum value of TTL that can be set is 3.
- For rest of the Nexus 9000 series devices, the maximum TTL value can be 3 for NX-OS version 7.0(3)I6(1) and above. For NXOS versions 7.0(3)I4(1) and below, you can configure any value within the range.

While configuring advanced filtering support, you cannot:

- Configure DSCP and Precedence together in advance filtering.
- Configure fragments and ACK or SYN or FIN or PSH or RST together in advance filtering.
- Configure fragments and port numbers with UDP and IPv4 or IPv6 Combination
- Configure Precedence and HTTP Methods with IPv4 and TCP Combination.

Adding Connections

Starting with Cisco Nexus Data Broker Release 3.7, you can lock a connection while creating it using the **Lock Connection** option on the **Add Connection** page. Locking a connection prevents unauthorized changes to a connection.

Before you begin

- Add a filter to be assigned to the connection.
- Configure a monitoring device (optional).

- Configure an edge port or multiple edge ports (optional).

Beginning with Release 3.9.2, Q-in-Q VLAN is mandatory on all source ports in an ISL connection. After an upgrade to Release 3.9.2, the connections created in the previous releases are available, but if you need to modify/clone any of the connections created earlier, adding Q-in-Q VLAN is mandatory, else you will not be able to save your changes to the updated connection.

Step 1 On the **Connections** tab, click **+ Connection**. The **Add Connections** window is displayed.

Step 2 In the **Add Connections** window, you can add the **Connection Name** and the **Priority** of the connection in the **Connection Details** area:

Field	Description
Connection Name	The name of the connection.
Description	Enter the description when creating a new connection.
Priority	The priority that you want to set for the connection. Connection by default has priority of 100. It can be changed in the range of <2-10000>. Priority is applicable to the ACL rules on the span port. Connection with a higher priority takes precedence. Traffic will pass through a connection with a higher priority based on the match criteria (filters). For example, connection with priority 101 is given preference when compared to a connection with priority 100.
Lock Connection	Select this option to lock the connection you are creating to prevent any unauthorized modification.

Step 3 In the **Allow Matching Traffic** area, modify the following fields:

Field	Description
Allow Filters drop-down list	Choose a filter to use to allow matching traffic. **Note** You cannot choose the same filter for Allow Filters that you choose for Drop Filters.
Set VLAN field	The VLAN ID that you want to set for the connection. **Note** This functionality is available only in Openflow mode.
Select Destination Port Group(s) field	Select **Port Group** option and then selet the destination port group from th drop-down list for the new connection.

Field	Description
Strip VLAN at delivery port check box	Check this box to strip the VLAN tag from the packet before it reaches the delivery port. **Note** The Strip VLAN at delivery port action is only valid for connections with a single edge port and one or more delivery devices for a single, separate node. This functionality is available only in Openflow mode.
Destination Devices list	The monitoring devices that you want to associate with the filter. You can choose one or more devices by checking the boxes next to their names.

Step 4 In the **Drop Matching Traffic** area, complete the following fields:

Field	Description
Drop Filters	Choose the default filter **Default-Match-all** or use other filters to drop the matching traffic. **Note** You cannot choose the same filter for Drop Filters that you choose for Allow Filters.

Step 5 In the **Source Ports (Optional)** area, complete the following fields:

Field	Description
Select Source Node drop-down list	Choose the source node that you want to assign. **Note** If you do not choose a source node, the any-to-multipoint loop-free forwarding path option is used, and traffic from all nondelivery ports is evaluated against the filter. **Note** When setting up a new redirection, you can see the number of flows that are part of each input port. When you click the port number, the flow details are displayed.

Field	Description
Select Source Port drop-down list	Choose the port on the source node that you want to assign. **Note** Only edge ports can be used as source ports. **Note** If you do not select a source port while adding a new connection, the following warning message is displayed: No source port is selected. Connection will be setup from all configured Edge-SPAN and Edge-TAP ports. Click OK to continue with the connection installation/creation. It ensures that you do not install any to multi point connection and disrupt any existing traffic. Click Cancel to take you to the connection setup page.
In the **Source Ports (Optional)** area, select **Port Group** instead of **Source Ports**.	Select a port group from **Select Port Group** drop-down list. If you do not have any port groups configured, click **+ Port Group** to add a port group.

Note Similar to the number of Edge-TAP or Edge-SPAN ports are displayed on top of each switch in the topology, the number of forwarding rules that a particular monitoring tool is part of are displayed when you hover the mouse over a switch. A popup table displays the rule (connection) names within which the monitoring tool is being used.

Note In Cisco Nexus Data Broker, Release 3.2.0, you can also select a port group in which case the individual ports cannot be selected.

Step 6 Do one of the following:

- Click **Save Connection** to save the connection, but not to install it until later.
- Click **Install Connection** to save the connection and install it at the same time.
- Click **Dry Run** to estimate the amount of traffic that will be generated on the new connection.
- Click **Close** to exit the connection without saving it.

If Cisco NDB detects two connections having the same Q-in-Q VLAN (while adding a new connection or modifying an existing one), merging the connections is possible. After clicking **Save Connection** or **Install Connection**, a pop-up window is displayed. Click **Yes** to merge the two connections.

Note You can estimate the amount of traffic generated for a new connection using the Dry Run feature. This feature samples the traffic for 30 seconds for the new connection and estimates the approximate traffic generated for the connection. You can use the Dry Run feature before adding a new connection.

You can manage the Dry Run feature using the mm.dryrun.timer parameter in the `config.ini` file. To enable the Dry Run feature, set the mm.dryrun.timer paramter to a value greater than zero. If the mm.dryrun.timer paramter is set to zero, the Dry Run feature is disabled.

The Dry Run feature shows the topology for the new connection with information about the estimated traffic. The feature samples the traffic for few (mm.dryrun.timer value in config.ini file) seconds for the new connection and estimates the approximate traffic generated for the connection. You can use the Dry Run feature before adding a new connection.

The following fields are displayed on the **Connection Setup** screen:

- Name
- Allow Filters
- Drop Filters
- Source Ports/Port Groups
- Devices
- Priority
- Last Modified By
- Description
- Status
- Action

Note A color coded band highlighting all the above fields indicates the status of the connection. The factors affecting the status of a connection are - operational and administration state of the source ports, operational state and administration state of the monitoring tools and the sessions involved in the connection. A green band indicates that the connection is operational, else the band is indicated in yellow or pink. A yellow band indicates the connection is partially successful; one or more source port(s) and monitoring tools have errors. A pink band indicates that the connection has failed; check the state of all the source ports and monitoring tools.

Note Beginning with Cisco Nexus Data Broker, Release 3.2, if you have added two or more interfaces (source ports) using the Connections tab, two interfaces (source ports) are displayed by default. If you have more than two interfaces (source ports) in the **Connections** tab, you can expand or collapse the source ports by using **more...** or **less...** options that are provided in the GUI.

Click **i Search Connections** tab in the Connections screen to search for the connections using the keywords, **Success**, **Installing**, **Creating**, **Partial**, and **Failed**.

Note If a remote monitoring tool is selected, same sources or remote monitoring tool cannot be shared across connections. This condition applies to ISL links also.

Connection with AutoPriority

Starting with Cisco NDB Release 3.4, you can configure filters with overlapping IP address. The traffic from the interfaces with overlapping IP addresses is forwarded to all the monitors configured for the IP address. This feature is supported for the switches running NX-API, OpenFlow, and AUX mode.

You can also configure rules with common IP addresses.You can configure IP address and port overlapping in the same filter.

Beginning with Cisco Nexus Data Broker, Release 3.3, you can now add a new connection with AutoPriority. This functionality provides flexibility to map filters to mulitple destination devices in a connection.The priority of a connection with Auto-Priority is set to the value configured in **config.ini** file. You can configure the *connection.autopriority.priorityValue* attribute in the **config.ini** file with a priority value to be used for all the new connections with auto-priority. The connection information lists the allowed filters along with the destination devices.

Restrictions and Usage Guidelines

Follow these restrictions and usage guidelines for creating a connection with auto-priority:

- To add a new connection with AutoPriority across devices (with multiple hops), the QinQ VLAN configuration is required.
- You can configure only one connection with Auto-Priority mode for each source port/port group.

Adding a New Connection With Auto-Priority

To add a new connection with Auto-Priority, complete these steps:

Before you begin

Ensure that you have configured the monitoring device, destination device, and filters before adding a new connection.

Step 1 Log into the NDB application.

Step 2 Navigate to **Configuration** -> **Connection**, and click **New Connection with AutoPriority** to add a new connection. The **New Connection with AutoPriority** window is displayed.

Step 3 In the **New Connection with AutoPriority** window, complete the following fields:

Name	Description
Connection Name field	The name of the connection.
Description field	Short description of the connection.
Devices/Port Groups drop-down list	The name of the destination device or the destination port group. Select **Devices** and then select a destination device from the Destination Device drop-down list and select corresponding filter from the Allow Filter drop-down list. You can add multiple destination devices with filters for a connection with AutoPriority mode. Select **Port Group** and then select destination port group.
Allow Filters list	Filter to apply to the destination device.

Name	Description
Set VLAN field	VLAN ID range to override the incoming tagged VLAN traffic.
(Optional) **Source Ports** Section	Select Source Ports or Port Group button to create or modify a connection.
Select Source Node drop-down list	Source Node Id.
Select Source port drop-down list	Source Node port number.
Select Port Group	If Port Group Button is enabled, select a Port Group from the drop down for creating or modifying a connection.

Adding Redirections

Note The redirection setup feature is supported on Cisco Nexus 3000 Series and Cisco Nexus 9300 switches with Release 7.x.

Cisco Nexus Data Broker lets you configure redirection policies that match specific traffic, redirecting it through multiple security tools before it enters or exits your data center using redirection.

Before you begin

- Add a filter to be assigned to the redirection.
- Configure a monitoring device (optional).
- Configure an edge port or multiple edge ports (optional).
- The production ingress port, the production egress port, and the service node should be on the same redirection switch.

Step 1 On the **Redirections** tab, click **+ Redirection**. The **Add Redirection** window is displayed.

Step 2 In the **Add Redirection** window, you can add the **Redirection Name** and the **Priority** of the redirection in the **Redirection Details** area:

Field	Description
Redirection Name	The name of the redirection. **Note** The name of the redirection cannot be changed once you have saved it.
Description	Enter the description when creating a new redirection.

Field	Description
Set Auto Priority checkbox	Check this option to enable the auto-priority for redirection, The priority of the redirection is set based on the existing redirections that are installed on the selected ingress ports. If auto-priority is enabled, redirection has a default priority of 10000. Next redirection with auto-priority enabled will have the priority value as the last priority minus 1. Without the auto-priority feature, the default value is 100. It can be changed in the range of <2-10000>. Priority value 1 is reserved for the backup bypass flows. **Note** The priority of the redirection should not be configured as 1. Also, if the last priority is configured as 2, you cannot clone the redirection with auto-priority enabled. You have to manually clone the redirection.
Priority	The priority that you want to set for the redirection. The valid range of the values is 0–10000. The default is 100.
Automatic Fail-safe checkbox	Check this option to enable the fail-safe feature of redirection. When you enable this feature, the direct flow from the production ingress port and the egress port is created that matches all ethertype traffic of low priority.

Step 3 In the **Matching Traffic** area, modify the following fields:

Field	Description
Filters drop-down list	Choose a filter to use to allow matching traffic. **Note** You cannot choose the same redirection for the filter.

Step 4 In the **Redirection Switch** area, modify the following fields:

Field	Description
Select Redirection Switch drop-down list	Select the redirection switch that you want to assign.

Note You can have only one ingress port and one egress port per one redirection switch.

Step 5 In the **Service Nodes (OPTIONAL)** area, complete the following fields:

Field	Description
Select Service Node drop-down list	Select the redirection service node that you want to assign and click **Add Service Node**.

Note If you want to add multiple service nodes, you should add them in an order in which you want the packets to travel.

Starting with Cisco Nexus Data Broker, Release 3.2.0, the order of the service nodes is maintained. For example, if you have added the service nodes s1, s2, and s3 to redirection in an order. The service nodes become operationally down and therefore, they get removed from the redirection. Once the nodes become operationally up, they are added to the redirection in the same order.

Step 6 Select the **Reverse ServiceNode Direction** option to enable reverse direction on the service node.

When you enable this option and click **Submit**, the ingress and egress ports of the service node are swapped and reverse redirection is enabled on the service node. The option is also displayed as enabled in the **Redirections** tab.

Step 7 In the **Production Ports** area, complete the following fields:

Field	Description
Select Production Ingress Port drop-down list	Select the production ingress port that you want to assign. **Note** You can select only one ingress port. Multiple ingress ports are not allowed. You cannot use the same ports as the ingress and the egress ports. **Note** When setting up a new redirection, you can see the number of flows that are part of each input port. When you click the port number, the flow details are displayed.
Select Production Egress Port drop-down list	Select the production egress port that you want to assign.

Step 8 In the **Delievery Devices to copy traffic (OPTIONAL)** area, complete the following fields:

Field	Description
Select Device drop-down list	Select a device, for example, a switch from the drop-down list, that you want to assign and click **Add Device**. **Note** You can select multiple delivery devices for the redirection.

Field	Description
Select Monitor Traffic drop-down list	When creating inline redirection with copy, the monitoring port receives one flow from the production ingress port and another from the egress port of service node. Starting with Cisco Nexus Data broker Release 3.2, a filtering mechanism is added in the GUI to filter out the traffic. Use the drop down list to select the traffic to copy device in redirection. The following optios are displayed in the drop-down list: • Production Ingress-- Flow from the production ingress port • Production Egress-- Flow from the egress port of the service node • Both-- Flow from both the ports (the ingress and the egress ports)

Step 9 Do one of the following:

- Click **Save Redirection** to save the redirection, but not to install it until later.
- Click **Install Redirection** to save the redirection and install it at the same time.
- Click **Close** to exit the redirection without saving it.

Step 10 When you click **Install Redirection** to save the redirection and install it at the same time, the redirection path on the redirection switch is displayed on the production ingress ports, service nodes, and the production egress ports.

Step 11 Click **Flow Statistics** to view the flow statistics for the redirection switch.

The following fields provide information on the flow statistics:

- In Port field—The Input port(s) from which the traffic is matched. An asterisk ("*") indicates any input port.
- DL Drc field—The source MAC address to be matched for the incoming traffic. An asterisk ("*") indicates any source MAC address.
- DL Dst field—The destination MAC address to be matched for the incoming traffic. An asterisk ("*") indicates any destination MAC address.
- DL Type field—The Ethertype to be matched for the incoming traffic. For example, "IPv4" or "IPv6" is used for all IP traffic types.
- DL VLAN field—The VLAN ID to be matched for the incoming traffic. An asterisk ("*") indicates any VLAN ID.
- VLAN PCP field—The VLAN priority to be matched for the incoming traffic. An asterisk ("*") is almost always displayed in this field.
- NW Src field—The IPv4 or IPv6 source address for the incoming traffic. An asterisk ("*") indicates any source address based on IPv4 or IPv6 Ethertypes.
- NW Dst field—The IPv4 or IPv6 destination address for the incoming traffic. An asterisk ("*") indicates any destination address based on IPv4 or IPv6 Ethertypes.

- NW Proto field—The network protocol to be matched for the incoming traffic. For example, "6" indicates the TCP protocol.
- TP Src field—The source port associated with the network protocol to be matched for the incoming traffic. An asterisk ("*") indicates any port value.
- TP Dst field—The destination port associated with the network protocol to be matched for the incoming traffic. An asterisk ("*") indicates any port value.
- Actions field—The output action to be performed for the traffic matching the criteria specified, for example, "OUTPUT = OF|2".
- Byte Count field—The aggregate traffic volume shown in bytes that match the specified flow connection.
- Packet Count field—The aggregate traffic volume shown in packets that match the specified flow connection.
- Duration Seconds field—The amount of time, in milliseconds, that the specific flow connection has been installed in the switch.
- Idle Timeout field—The amount of time, in milliseconds, that the flow can be idle before it is removed from the flow table.
- Priority field—The priority assigned to the flow. The flows with higher priority numbers take precedence.

Step 12 Click **Close** to close the flow statistics display window.

Viewing Statistics

View the flow and port statistics for the switches on the Statistics tab.

Note When you select a switch on the statistics page, the **Auto Refresh** tab for the switch is ON by default. Click **Auto Refresh: Off** to disable auto refresh on the Statistics tab. The screen is refreshed every 30 seconds and the updated statistics for the switch are displayed on the screen.

Step 1 Navigate to the **Statistics** tab under **Configuration** and click a node from the drop-down list to check and view the flow and port statistics of that node.

You can also navigate to the statistics of another switch by selecting the switch in the drop down box.

You can view the flow statistics, for example:

- Flow Name
- In Port
- DL Source
- DL Destination
- DL Type

- DL VLAN
- VLAN PCP
- NW Source
- NW Destination
- NW Proto
- TP Source
- TP Destination
- AP HttpMd
- AP TcpOptLn
- Actions
- Byte Count
- Packet Count
- Duration Seconds
- Idle Timeout
- Priority

Step 2 Click the **Ports** tab to check the ports statistics.

You can view the ports statistics as displayed in the following fields.

Note If you are programming the switches with OpenFlow, when you navigate to the **Statistics** tab, select a switch, and select **Ports** tab, the statistics gathered from the switches for the **Rx Frame Errs** and **Collisions** are not supported. The value of -1 is displayed rather than N/A because the variable needs to be an integer.

- Port Name
- Rx Packets
- Tx Packets
- Rx Bytes
- Tx Bytes
- Rx Rate (kbps)
- Tx rate (kbps)
- Rx Drops
- Tx Drops
- Rx Errors
- Tx Errors
- Rx Frame Errors

- Rx Overrun Errors
- Rx CRC Errors
- Collisions

Viewing Connection Port Statistics

Starting with Cisco NDB Release 3.4, port statistics are shown along with the connection path information in the NDB GUI. This feature is supported for Nexus 9K and Nexus 3K Series switches based on NX-API, OpenFlow, and NX-AUX mode.

To view the port statistics for a connection, complete the following steps:

Step 1 Navigate to **CONFIGURATION** -> **Connections** .

Step 2 On the **Connection** page, click a connection name for which you want to view the port statistics.

Step 3 Click **Port Statistics** to open the **Flow Statistics** page.

Step 4 Click **Port** tab to view the port statistics for the selected connection.

Deleting Flow and Port Statistics

Starting with Cisco NDB release 3.4, you can now clear port and flow statistics using the NDB GUI. You can either clear all the port related statistics for a switch or clear statistics for a specific port on the switch. For This feature is currently available only for NXAPI based Nexus 9K and Nexus 3K switches.

To clear flow statistics, complete the following steps:

Step 1 Navigate to the **CONFIGURATION** → **Statistics** and click the **Flows** tab to clear flow statistic. Click **Delete ALL** to clear all the flow statistics such as byte count and packet count for the switch.

Step 2 Click the **Ports** tab to clear port statistics.

a) Select a port and click **Delete** to delete statistics for the selected port.

b) Click **Delete All** to clear statistics for all the ports (interfaces) on the switch.

Device Return Material Authorization

Starting with Cisco NDB release 3.8, you can initiate Return Material Authorization (RMA) for a NDB device. This feature maps the configuration from the RMA device to the new device. To RMA a device, complete these steps:

Step 1 Navigate to **ADMINISTRATION** > **Devices** > **DEVICE CONNECTIONS** tab.

Step 2 On the **DEVICE CONNECTIONS** tab, select the switch you want to RMA and click **Remove Devices**. The **Remove Devices** dialog box opens.

Step 3 In the **Remove Devices** dialog box, click **Remove Device**.

Note Do not use **Purge & Remove Device** option, this option removes the device and deletes all the configuration from the NDB.

Step 4 Click **RMA** tab, for the device to RMA, enter the serial number for NX-API device or DPID for OpenFlow devices. For Auxilary devices, you need to enter both OF and serial number.

Note To get the serial number for a NX-API device, use **show module** command for non-modular chassis (look for Serial-Num in the output) or use **show hardware** command for modular chassis switches (look for serial number under Switch hardware ID information in the output).

Note To get the DPID for OpenFlow device, use **show openflow switch 1** command and look for DPID value under the OF features.

Step 5 Click **Submit**.

Step 6 Add a new device. For information about adding a new device, see Adding a Device, on page 76.

Purging Device Configuration

Starting with Cisco NDB release 3.6, you can now remove and purge all the configuration information (such as connection and redirection) associated with a device that has been removed from the NDB.

To remove device configuration, complete the following steps:

Step 1 Navigate to the **ADMINISTRATION** > **Devices** > **Purge Devices**.

Step 2 Select the devices for which you want to remove all the configuration information and click **Purge Devices**. All the configurations associated with the removed device will be deleted from NDB database.

Exporting and Importing NDB Configuration

You can export and import the device configuration in JSON file format. The configuration file includes information about the connected as well as disconnected devices with all the configuration information (other than port-channel).

Exporting NDB Configuration

Complete the following steps to export a configuration from NDB:

Step 1 Navigate to **Administration** -> **System** -> **Backup/Restore** -> **Node**, and click **Export** tab.
Step 2 Click **Refresh** to list the latest list of NDB devices.
Step 3 Select a device for exporting the configuration from the **Configuration** Pane.
Step 4 (Optional) Select **Include Connections** check box to include connection information such as filters and connections.
Step 5 (Optional) Select **Include Redirections** check box to include connection information such as filters, service nodes, and redirections.
Step 6 Click **Generate new Configuration** to create and save the configuration in JSON format.

Importing NDB Configuration

Complete the following steps to import a configuration into NDB:

Step 1 Navigate to **Administration** -> **System** -> **Backup/Restore**-> **Node**, and click **Import** tab.
Step 2 Click **Select Configuration**, the **File Upload** dialog box appears.
Step 3 Select a JSON file and click **Open**. The selected configuration appears in the **Import** section.
Step 4 Click **Edit** to enter device password (applicable only for NXAPI and NX-AUX mode).
Step 5 (Optional) Select **Include Connections** check box to include connection information such as filters and connections.
Step 6 (Optional) Select **Include Redirections** check box to include connection information such as filters, service node, and redirections.
Step 7 Click **Apply** to apply the configuration to NDB. The **Compatibility Matrix** page appears.
Step 8 Select **Accept and continue** to import the configuration.

Managing Sampled Flow Configuration

Starting with Cisco NDB Release 3.4, you can now manage the Sampled Flow (sFlow) on NDB switches that are based on NX-API. This feature is currently not available for OpenFlow and NX-AUX based switches. sFlow allows you to monitor real-time traffic in data networks that contain switches and routers. It uses the sampling mechanism in the sFlow agent software on switches and routers to monitor traffic and to forward the sample data to the central data collector.

To enable sFlow on a port, complete the following steps:

Step 1 Log into the NDB GUI.
Step 2 Navigate to **CONFIGURATION** -> **Port Definition** tab.
Step 3 Click **Configure Node** to open the **Node Configuration** pane. The **Node Configuration** window is displayed.
Step 4 Click **Configure sFlow** to open the **Configure sFlow** pane.
Step 5 Select **Enable sFlow** from the **Enable/Disable sFlow** drop-down list to open the **Confiigure sFlow** pane.
Step 6 In the **Confiigure sFlow** pane, enter the following details and click Submit.

Field	Description
Agent IP address	sFlow agent IP address.
Select a VRF	VRF to use to reach the SFlow collector IP address.
Collector IP address	SFlow collector address.
Collector UDP	SFlow collector UDP.
Counter Poll Interval	SFlow counter poll interval.
Max Datagram Size	Maximum sampling data size.
Sampling rate	Data sampling rate.
Select Data Source(s)	SFlow datasource interface (Edge-ports)

Note Use **Add to Group** option to add the configured port to a Group of ports.

Note In Sflow pane, the **Select Data Source** field displays only those ports that are configured either as a Edge-SPAN or as a Edge-TAP .

To verify SFLow configuration on a switch, use the show sflow command:

```
RU-29-2003(config)# show sflow
sflow sampling-rate : 4096
sflow max-sampled-size : 128
sflow counter-poll-interval : 20
sflow max-datagram-size : 1400
sflow collector-ip : 0.0.0.0 , vrf : default
sflow collector-port : 6343
sflow agent-ip : 10.16.206.122
sflow data-source interface Ethernet1/1
```

Configuring MPLS Filtering

Starting with Cisco NDB release 3.8, you can filter MPLS traffic. To configure a MPLS filter, complete the following steps:

Step 1 Navigate to **CONFIGURATION** > **Port Definition**.

Step 2 Click **Configure Node** to open **Node Configuration** window.

Step 3 Select **Enable MPLS Filtering** from the **MPLS Filter Configuration** drop-down list.

Step 4 Click **Submit** to enable MPLS ACL configuration on the selected device globally.

Step 5 Create a MPLS filter, navigate to **CONFIGURATION** > **Filters**.

Step 6 In the **Filter** window, click **Add Filter**.

Step 7 Enter filter name in the **Name** text-field.

Step 8 Select **Enter Ethernet Types** from the **Ethernet Type** drop-down list. In the text-field below, enter the hexadecimal values for ethernet types. Ethernet types can be unicast or multicast. For MPLS ACL, enter 0x8847 and 0x8848.

Step 9 Select a MPLS label from the **MPLS Label** drop-down list.

Step 10 Enter MPLS value in the **MPLS Value** text-field.

Step 11 Click **Add** to add the MPLS label to the filter. You can add up to four MPLS labels to a filter.

Step 12 Click **Add Filter** to create a filter with MPLS ACLs.

Step 13 Create a connection, navigate to **CONFIGURATION** > **Connections** > **User Connections** tab.

Step 14 Click **Connections** > **Add a Connection**.

Step 15 In the **Add Connections** window, you can add the **Connection Name** and the **Priority** of the connection in the **Connection Details** area:

Field	Description
Connection Name	The name of the connection.
Description	Enter the description when creating a new connection.
Priority	The priority that you want to set for the connection. Connection by default has priority of 100. It can be changed in the range of <1-10000>.
Lock Connection	Select this option to lock the connection you are creating to prevent any unauthorized modification.

Step 16 In the **Allow Matching Traffic** area, modify the following fields:

Field	Description
Allow Filters drop-down list	Choose the MPLS filter you created to allow matching MPLS traffic
Set VLAN field	The VLAN ID that you want to set for the connection. **Note** This functionality is available only in Openflow mode.
Destination Detail	Specifiy the destination details.
Device radio-button	Select this option and from the list of devices select the monitoring device.
Source Ports radio-button	Select this option to specify the source port.
Select Source Node drop-down list	Choose the source node that you want to assign. **Note** If you do not choose a source node, the any-to-multipoint loop-free forwarding path option is used, and traffic from all nondelivery ports is evaluated against the filter.
Select Source Port drop-down list	Choose the port on the source node that you want to assign.

Step 17 Do one of the following:

- Click **Save Connection** to save the connection, but not to install it until later.
- Click **Install Connection** to save the connection and install it at the same time.

Step 18 Verify the configuration using the **show** command

Configuring Symmetric/Non-Symmetric Load Balancing and MPLS Tag Stripping

From the Cisco Nexus Data Broker GUI and the REST API interfaces, you can now configure symmetric load balancing and enable MPLS tag stripping on the Cisco Nexus 3000 Series and Cisco Nexus 9000 Series switches using NX-API as the configuration mode.

Before you begin

Add device to Cisco Nexus Data Broker using NX-API.

Step 1 In the topology diagram, click the node for which you wish to configure MPLS tag stripping.

Step 2 In the **Port Configuration** window, click **Configure Node**. The **Node Configuration** window is displayed.

Step 3 In the **Load Balancing Type Configuration** drop-down list, select the type and corresponsing **Hashing Option**.

Step 4 In the **MPLS Strip Configuration** drop-down list, choose one of the following:

- Enable MPLS Strip.
- Disable MPLS Strip.

Step 5 When you select **Enable MPLS Strip** option, the **Label Age** field is displayed. In the field, enter a value for the MPLS strip label age. The range for MPLS strip label age configuration is 61-31622400.

Note MPLS strip is only supported for L3 packets under the MPLS label stack. MPLS strip for pseudowires or VPLS is not supported.

Step 6 Click **Submit**.

Symmetric/Non-Symmetric Load Balancing Options

The following table lists the symmetric and non-symmetric load balancing options:

Table 8: Symmetric / Non-Symmetric Load Balancing Port Channel Support

Configuration type	Hashing Configuration	Platforms	Options
Symmetric	SOURCE_DESTINATION	N9K*, N3K-C3164XXX, N3K-C32XXX	IP, IP-GRE, IP-L4PORT, IP-L4PORT-VLAN, IP-VLAN, L4PORT, MAC
		Rest	IP, IP-GRE, PORT, MAC, IP-ONLY, PORT-ONLY
Non-symmetric	SOURCE DESTINATION	N9K*, N3K-C3164XXX, N3K-C32XXX	IP, IP-GRE, IP-L4PORT, IP-L4PORT-VLAN, IP-VLAN, L4PORT, MAC
		Rest	IP, IP-GRE, PORT, MAC

Configuring PTP Using NDB

A PTP system can consist of a combination of PTP and non-PTP devices. PTP devices include ordinary clocks, boundary clocks, and transparent clocks. Non-PTP devices include ordinary network switches, routers, and other infrastructure devices.

PTP is a distributed protocol that specifies how real-time PTP clocks in the system synchronize with each other. These clocks are organized into a master-member synchronization hierarchy with the grandmaster clock, the clock at the top of the hierarchy, determining the reference time for the entire system. Synchronization is achieved by exchanging PTP timing messages, with the members using the timing information to adjust their clocks to the time of their master in the hierarchy. PTP operates within a logical scope called a PTP domain.

Starting with Cisco NDB Release 3.4, you can configure PTP Timestamping feature using the NDB GUI. PTP is a time synchronization protocol for nodes distributed across a network. Its hardware timestamp feature provides greater accuracy than other time synchronization protocols such as Network Time Protocol (NTP).

Note Starting with Cisco NDB release, 3.8, you can configure PTP on Nexus 3548 switches.

Note For Cisco NDB 3.4 release and later, PTP Timestamp Tagging feature is supported on the Cisco Nexus 93XXX-EX and 92XX Series switches.

Note Starting with Cisco NDB release 3.8, Timestamp Tagging is supported on Cisco Nexus 9500 Series switches.

Note You need to enable PTP for all the devices in the network to ensure PTP clock time synchronization.

Note After PTP is configured. the default PTP configuration is synchronized with all the ISL ports of the corresponding device.

To configure PTP using NDB GUI, complete these steps:

Step 1 Log into Cisco NDB GUI.

Step 2 Navigate to **CONFIGURATION** -> **Port Definition** tab.

Step 3 Click **Configure Node** to open the **Node Configuration** pane.

Step 4 Click **Configure PTP** to open the **Configure PTP** pane.

Step 5 Select **Enable PTP** from the **Enable/Disable PTP** drop-down list.

Step 6 Enter the PTP source IP address in the **Source IP Address** text field.

Step 7 Select the interfaces on which you want to enable PTP from the **Select Port(s)** list.

Step 8 Click **Submit** to enable PTP on the selected interfaces.

NetFlow

NetFlow identifies packet flows for ingress IP packets and provides statistics based on these packet flows. NetFlow does not require any change to either the packets themselves or to any networking device.

Note In order to provide enough free space to monitor flows, the ing-netflow TCAM region is carved to 512 by default on Cisco Nexus 9300-FX platform switches. If more space is required, use the **hardware access-list tcam region ing-netflow size** command to modify the size of this TCAM region, using a multiple of 512. For more information, see the "Configuring ACL TCAM Region Sizes" section in the *Cisco Nexus 9000 Series NX-OS Security Configuration Guide*.

Netflow is supported on the following platforms:

- 9300-FX
- 9300-EX
- 9300-FX2
- 9500-EX
- 9500-FX

Note For more information about NetFlow, see *Cisco Nexus 9000 Series NX-OS System Management Configuration Guide*

Configuring NetFlow

Starting with Cisco Nexus Data Broker, release 3.8, you can configure NetFlow using NDB. Complete these steps to configure NetFlow using NDB:

- Creating a Flow Record, on page 132
- Creating a Flow Exporter, on page 133
- Creating a Flow Monitor, on page 134
- Applying a Flow Monitor to an Interface, on page 135

Creating a Flow Record

You can create a flow record and add keys to match on and nonkey fields to collect in the flow.

Step 1 Navigate to **CONFIGURATION** > **Port Definitions** > **PORT CONFIGURATION** tab.

Step 2 Click **Configure Node**.

Step 3 In the **Node Configuration** dialog box, click **Configure Netflow**. The **Configure Netflow** page appears.The **Configure Netflow** page contains three sections: **Records**, **Exporter**, and **Monitor**.

Step 4 Click **Add Record** to open **Add Record** dialog box.

Step 5 In the **Name** field, enter a name for the record. You can enter up to 63 alphanumeric characters for the flow record name.

Step 6 In the **Description** field, enter description for the record.

Step 7 From the **Match parameters** drop-down list, select a paramter for the flow record.

Table 9: Match Paramters

Parameter	Description
IP Protocol	Specifies that the IP protocol field is to be matched.
IP TOS	Specifies that the ToS field is to be matched.
IPv4 Source Address	Specifies that the IPv4 source address field is to be matched.
IPv4 Destination Address	Specifies that the IPv4 destination address field is to be matched.
IPv6 Source Address	Specifies that the IPv6 source address field is to be matched.
IPv6 Destination Address	Specifies that the IPv6 destination address field is to be matched.
IPv6 Flow-Label	Specifies that the IPv6 flow label field is to be matched.

Parameter	Description
IPv6 Options	Specifies that the IPv6 options field is to be matched
Transport Source Port	Specifies that the transport source port field is to be matched.
Transport Destination Port	Specifies that the transport destination port field is to be matched.
MAC Source Address	Specifies that the MAC source address field is to be matched.
MAC Destination Address	Specifies that the MAC destination address field is to be matched.
Ethertype	Specifies that the ethertype field is to be matched.
VLAN	Specifies that the VLAN field is to be matched.

Note Ensure that you select either Layer 2 parameters or Layer 3 parameters.

Ensure that you select at least one match parameter and one collect parameter.

Step 8 From the **Collect parameters**, select a paramter for the flow record.

Table 10: Collect Paramters

Parameter	Description
Counter Bytes	Collects bytes based counters.
Counter Packets	Collects packet based counters.
IP Version	Collects the IP version of the flow
Transport TCP Flags	Collects the TCP transport layer flags for the packets in the flow.
SYS Uptime First	Collects the system up time for the first packet in the flow.
SYS Uptime Last	Collects the system up time for the last packet in the flow.

Step 9 Click **Submit** to create a new record. The new record is listed under the **Records** section.

Creating a Flow Exporter

Creating a Flow Exporter

The flow exporter configuration defines the export parameters for a flow and specifies reachability information for the remote NetFlow Collector.

Step 1 Click **Add Exporter** in the **Configure Netflow** page.

Step 2 In the **Add Exporter** dialog box, enter the following details:

Table 11: Add Exporter Fields

Field	Description
Name	Name of the flow exporter being configured.
Description	Description for the flow exporter.
Destination	IP address of the exporter.
Source	Interface on the switch through which the flow cache reaches the destination port.
Transport UDF Port	Specifies the UDP port to use to reach the NetFlow Collector. The range is from 0 to 65535.
DSCP	Differentiated services codepoint value. The range is from 0 to 63.
Version	NetFlow export version.
Option Exporter	Flow exporter statistics resend timer. The range is from 1 to 86400 seconds.
Template Date Timeout	Template data resend timer. The range is from 1 to 86400 seconds.

Step 3 Click **Submit** to create a flow exporter.

Creating a Flow Monitor

You can create a flow monitor and associate it with a flow record and a flow exporter. All of the flows that belong to a monitor use the associated flow record to match on the different fields, and the data is exported to the specified flow exporter.

Step 1 On the **Configure Netflow** page, click **Add Monitor**. The **Add Monitor** dialog box appears.

Step 2 In the **Add Monitor** dialog box, enter the following details:

Table 12: Flow Monitor Details

Field	Description
Name	Name of the Flow Monitor.
Description	Description for the Flow Monitor.
Record	Record to attach to the Flow Monitor.

Field	Description
Exporter	Flow Exported to attach to the Flow Monitor. You can select a maximum of 2 Flow Exporters for each Flow Monitor.

Step 3 Click **Submit** to create the Flow Monitor. The new Flow Monitor is listed under the **Monitor** section on the **Configure Netflow** page.

Applying a Flow Monitor to an Interface

You need to apply a flow monitor to an Edge-SPAN port (interface or VLAN) to complete the Netflow configuration and select VLAN from the **Port Configuration** page. Complete these steps to apply a Flow Monotor to an interface:

Step 1 Navigate to **CONFIGURATION** > **Port Definitions** > **PORT CONFIGURATION**.

Step 2 Click **Configure** for the Ethernet interface on which you plan to attach the Flow Monitor.

Step 3 In the **Configure Ports** dialog box, select **Edge Port - SPAN** from the **Select a port type** drop-down list.

Step 4 Enter VLAN number in the **VLAN ID** field. VLAN field is mandatory if the flow monitor is mapped with a L3 record.

Step 5 Select a Netflow monitor from the **Netflow Monitor** drop-down list.

Step 6 Click **Submit** to apply the selected Netflow monitor to the interface. The flow monitor name appears for the configured interface in the **PORT CONFIGURATION** tab.

Configuring Packet Truncation

Starting with Cisco NDB Release 3.5, you can configure packet truncation on egress ports for Cisco Nexus 9300 FX and EX series switches. Packet truncation involves discarding bytes from a packet starting at a specified byte position. All the data after the specified byte position is discarded. Packet truncation is required when the main information of interest is in the header of a packet or in the initial part of the packet.

Packet truncation enables users to perform header analytics efficiently on the main information in the initial part of the packet . This helps in tools optimization like improving tools performance by eliminating transmission of the unnecessary part of the packet payload and increases storage capacity, by giving tools more room to store the important portions of each packet.

Table 13: Support for Packet Truncation

EX Chassis	FX Chassis	Nexus 9364C, Nexus 9332C	Nexus 9336C-FX2	EOR switches with -EX or -FX LCs
Support started from NX-OS Release 7.0(3)I7(1)	Support started from NX-OS Release 7.0(3)I7(1)	Support started from NX-OS Release 7.0(3)I7(2)	Support started from NX-OS Release 7.0(3)I7(3)	9.3(1)
MTU size range is 320 to 1518 bytes	MTU size range is 64 to 1518 bytes	MTU size range is 64 to 1518 bytes	MTU size range is 64 to 1518 bytes	Depends on LC

EX Chassis	FX Chassis	Nexus 9364C, Nexus 9332C	Nexus 9336C-FX2	EOR switches with -EX or -FX LCs
Four active localized SPAN sessions	Four active localized SPAN sessions	Four active localized SPAN sessions	Four active localized SPAN sessions	-

Note Starting with Cisco NDB release 3.8, you can now configure packet truncation on Cisco Nexus 9500 Series switches.

Note You can configure a maximum of four monitoring devices with packet truncation on a switch.

To configure packet truncation on a device, you need to:

1. Configuring a Packet Truncation Interface
2. Defining a Monitoring Device with Packet Truncation Interface

Configuring a Packet Truncation Interface

A packet truncation port (used to block the ingress traffic) is associated with a monitoring tool which is the egress port for a packet.

To configure a packet truncation interface, complete these steps:

Step 1 Log into NDB.

Step 2 Navigate to the **CONFIGURATION** > **Port Definition** and select the switch for which you plan to configure packet truncation.

Step 3 Click **PORT CONFIGURATION** tab.

Step 4 Click **Configure** for the interface selected for configuration.

Step 5 In the **Configure Ports** pane, click **Select a port type** and then click **Packet Truncation Port**.

Step 6 (Optional) Enter description for the port in the **Port Description** text field.

Step 7 Click **Submit** to create a packet truncation port.

By default a packet truncation port is blocked for ingress traffic.

Note Ensure that the status of the packet truncation port is Administratively Up (green icon) and that the other end of the link is not connected to the same NDB switch. To change the port Layer 2 status to Up, you need to connect to another switch or create a loopback using a third party loopback fiber optic.

What to do next

After the packet truncation port is created, you need to create a monitoring device with the packet truncation port. For more information, see Defining a Monitoring Device with Packet Truncation Interface section.

Defining a Monitoring Device with Packet Truncation Interface

Complete the following steps to define a monitoring device with a packet truncation interface:

Step 1 Navigate to the **CONFIGURATION** > **Port Definition** and select the switch for which you plan to configure packet truncation.

Step 2 Click **PORT CONFIGURATION** tab.

Step 3 Click **Configure** for the interface selected for configuration.

Step 4 In the **Configure Ports** pane, click **Add Monitoring Device**.

Step 5 In the **Monitoring Device** window, complete the following fields:

Name	Description
Monitoring Device Name	Name of the monitoring device.
Select Switch Name	Name of the switch to add the monitoring device to.
Select Port	Packet truncation port you configured.
Port Description	Description of the port.

Step 6 Select **Packet Truncation**.

Step 7 Enter maximum packet size in the **MTU Size** text field. The MTU size can be between 320 and 1518 bytes.

Packet truncation discards bytes from the header of an incoming packet based on the set MTU size.

Step 8 From the **Select Packet Truncation Port** drop-down list, select the packet truncation port you created on the same switch.

Step 9 (Optional) Select device icon for the monitoring device.

Step 10 Click **Submit** to create the monitoring device.

What to do next

Create a new connection using the monitoring device to implement the packet truncation feature. For more information, see Adding Connections.

Show Tech for NX-API Devices

The show tech for NX-API devices feature enables you to collect information from one or more switches in one attempt, instead of collecting data separately from each switch. This is useful during debugging as all the relevant logs are readily available and can be downloaded.

Limitations

- Supported only on Nexus switches in NX-API mode.

Prerequisites

- Ensure that one or more switches are connected to the NDB server and the AUX mode is disabled.

Show tech data collection from switches can be performed in two modes:

Basic mode– contains the below set of show commands:

- **show version**
- **show hostname**
- **show hardware**
- **show modules**
- **show cores**
- **show system uptime**
- **show system reset-reason**
- **show running-config**

Advanced mode– contains a broader set of show commands and they are:

- **show version**
- **show hostname**
- **show hardware**
- **show modules**
- **show cores**
- **show system uptime**
- **show system reset-reason**
- **show accounting-log**
- **show logging logfile**
- **show running-config**
- **show nxapi**
- **show nxapi retries**
- **show processes memory | grep nginx**
- **show processes memory | grep vsh**
- **show nxapi-server logs**
- **show interface**
- **show lldp neighbors detail**
- **show access-lists**
- **show access-lists summary**
- **show hardware access-list tcam region**

Configuring Show Tech

This task has details about how to configure a show tech job.

Step 1 Login to the NDB UI.

Step 2 Navigate to **Administration**> **System**> **Tech Support**.

Step 3 Click **Trigger** to trigger a tech support job.

The Trigger Show Tech pane is displayed.

Step 4 Select the devices for which you need to collect the data. Click each device for it to get selected.

You can click **Select All** to select all the displayed devices.

The devices you have selected are displayed in the Selected Switches area.

Step 5 Select the **Type of Operation** by choosing the required radio button – Basic or Advanced (the applicable commands for each have been discussed earlier). The commands applicable for Basic and Advanced are displayed in the area below.

Step 6 Click **Submit** to trigger the tech support job.

At any given time, only one job is executed.

Step 7 The job is created and the job details are displayed in a table format with the following details:

- Job ID – job identification which includes the date the job was created. The most recently created job appears at the beginning of the table. Click the job ID to view more details about the job, such as, node and host details , status and reason.
- Job Type – job type based on type of operation selected.
- Status – the current status of the job. The statuses are color-coded for easy identification. The available statuses are –
  - Success – job is successfully completed.
  - Partial – job is partially successful. For eg, if multiple devices were selected, then, may be the failure has occurred on one of the selected switches.
  - Failure – job is not successful.
  - In progress – job is currently in progress.
  - Created – job is ready for execution, but is in a queue.
  - Aborted – job was created but was not allowed to complete.
- Action – when a job is successfully completed, you can perform either of the actions- Delete or Download and Delete.
- Download – a zip file is downloaded onto your local machine.
- Download and Delete – a zip file is downloaded on to your local machine and the file is removed from the server.

Note The following folders are by default downloaded besides the show tech folder – configuration folder, configuration start up folder and general logs. This enables the tech support team to get all the information together and results in faster analysis.

What to do next

You can do any of the following operations after submitting a show tech job.

- Re-trigger – Select the check box next to the job ID and click re-trigger to re-trigger a job. In progress and Created jobs cannot be re-triggered. The show tech log files are replaced with the latest set of files, after retriggered job is successful.
- Abort – Select the check box next to the job ID and click Abort. Only In progress and Created jobs can be aborted.
- Remove – Select the check box next to the job ID and click Remove.

Multiple eligible jobs can be removed/aborted/re-triggered at a time.

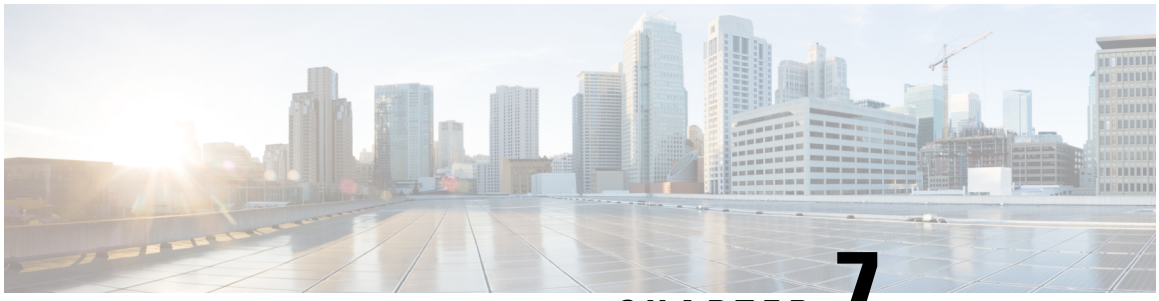
Syslog

In the NDB server backend, you can tune the `logback.xml` file to send logs to the Syslog server. You can customize the log format as per your requirement.

If NDB server(s) are running, restart the servers after the changes are made in the `logback.xml` file.

```
File Location: /xnc/configuration/logback.xml

Sample Syslog configuration:
Add below config with respective Syslog server IP address and port number in logback.xml
file.
  <appender name="SYSLOG" class="ch.qos.logback.classic.net.SyslogAppender">
    <syslogHost>10.16.206.171</syslogHost>
    <facility>LOCAL7</facility>
    <port>514</port>
    <suffixPattern>[%thread] %logger %msg</suffixPattern>
  </appender>

Append "<appender-ref ref="SYSLOG" />" in root as shown below,
  <root level="error">
    <appender-ref ref="STDOUT" />
    <appender-ref ref="SYSLOG" />
    <appender-ref ref="xnc.log" />
  </root>
```

After upgrade, these configuration changes in the `logback.xml` file will be lost. Thus, after upgrading the controller to newer a NDB version, check and restore this configuration manually.



CHAPTER 7

Integrating Cisco Nexus Data Broker With Cisco ACI

This chapter contains the following sections:

SPAN Management

Switch port Analyzer (SPAN) is an efficient and high performance traffic monitoring system. It duplicates the network traffic and routes the packets to an the analyzer for monitoring. SPAN is used for troubleshooting connectivity issues and calculating network utilization, and performance monitoring.You can add, edit, remove, and rediscover a device to SPAN using NDB.

Adding a Device to SPAN

Complete these steps to add a device to Switch Port Analyzer (SPAN).

Note Starting with Cisco NDB release 3.8, you can add multiple APIC in NDB.

Step 1 Navigate to **ADMINISTRATION** > **Devices** > **SPAN MANAGEMENT** tab.

Step 2 Click **Add Device**, the **Connect to Devices** dialog box appears.

Step 3 Select **ACI** option to add a new APIC device to SPAN. To add a new NX-OS based device, select the **NXOS** option.

Step 4 In the **Connect to Devices** dialog box, enter the following details:

Table 14: New Device Details

Field	Description
APIC IP Addresses (Applicable for adding APIC device)	
APIC IP Address / HostName (Primary)	Primary APIC IP address or hostname.
APIC IP Address (Secondary)	Secondary (backup) APIC IP address or hostname. This field is optional.
APIC IP Address (Tertiary)	Tertiary (backup) APIC IP address or hostname. This field is optional.
NXOS Device Details (Applicable for adding NX-OS based device)	
Address	IP address of the NX-OS device.
Port	The device communication port.
Username	Username for authenitcating the device.
Password	Password for authenticating the device.

Step 5 Click **Connect**to add the new device to SPAN. The new device is listed under the **SPAN MANAGEMENT** tab.

Editing a SPAN Device

Complete these steps to edit details of a SPAN device:

Step 1 Navigate to **ADMINSTRATION** > **Devices** > **SPAN MANAGEMENT** tab .

Step 2 Click **Edit** for a device to edit device details. The **Edit Device** dialog box appears. You can update the following details for a device:

Field	Description
Port	Specify new port number for communication. This field is available only for NX-API devices.
User Name	Specify new user name for the device authentication.
Password	Specify new password for the device authentication.

Step 3 Click **Edit Device** to apply the updated information and close the **Edit Device** dialog box.

Rediscovering a SPAN Device

You can rediscover a device after updating device details using the Rediscover Devices feature. To rediscover a device, complete these steps:

Step 1 Navigate to **ADMINSTRATION** > **Devices** > **SPAN MANAGEMENT** tab.

Step 2 Select a device to rediscover from the list of devices under the **SPAN MANAGEMENT** tab.

Step 3 Click **Rediscover Devices**, the **Rediscover Devices** dialog box appears.

Step 4 Verify the selected device for rediscorvering and click **Rediscover Device**.

Step 5 Click **Yes** in the dialog box to complete the rediscovery process.

Removing a Device from SPAN

You can remove a device from SPAN while retaining its configuration or you can remove a device from SPAN and delete all the corresponding device configuration from a SPAN. Complete these steps to remove a device from SPAN.

Step 1 Navigate to **ADMINSTRATION** > **Devices** > **SPAN MANAGEMENT** tab.

Step 2 From the list of devices under the **SPAN MANAGEMENT** tab, select the device(s) to remove.

Step 3 Click **Remove Devices**. The **Remove Devices** dialog box appears.

Step 4 Verify the selected device(s) in the **Remove Devices** dialog box and click either of the two options:

- **Remove Device**: Use this option to remove the device from SPAN while retaining the device configuration.
- **Purge & Remove Device**: Use this option to remove the device and device configuration from SPAN.

The device is removed from the **SPAN MANAGEMENT** tab.

Viewing the SPAN Management Tab

The **SPAN Management** tab is displayed on the **Devices** screen under the **Administration** tab in the GUI.

Note Starting with Cisco Nexus Data Broker, release 3.8, you can configure multiple APIC devices on NDB.

On the **SPAN Management** tab, click **+ Add Device**. The **Connect to Device** window is displayed. Complete the following steps to connect to the device:

Before you begin

For APIC and production switches, the centralized deployment of Cisco Nexus Data Broker is mandatory.

Step 1 Choose **ACI** device to add an APIC device.

Step 2 In the **APIC IP Addresses** panel, add the **APIC IP Address** (**Primary**), **APIC IP address** (**Secondary**), and **APIC IP address** (**Tertiary**).

Step 3 In the **User Details** panel, add **Username** and **Password**.

Step 4 After an ACI device has been added, the ACI radio button is disabled. Then you can add a NXOS production switch. Click **NXOS** in the first step to add a NXOS production switch.

The NX-API feature has to be enabled for the NXOS production switch to be added. To add a NXOS production switch in the **SPAN Management** tab, one NX-API device should already exist. This is a pre-requisite.

Step 5 Click **Connect**.

The NXOS production switch is displayed with the **Type** as **PS** in the **SPAN Management** tab. The **APIC IP Address** (**Primary**), **APIC IP address** (**Secondary**), and **APIC IP address** (**Tertiary**) do not apply to the NXOS production switch. Therefore, those fields are blank. You can also edit the credentials of the NXOS production switch. Once the production switch is added, it is displayed in the Configuration tab in green. In the Port Configuration window, you can configure SPAN Destination in the production Nexus switches that are NX-API enabled.

Viewing the SPAN Destination Tab

When you click **Port Definition** tab in the GUI, the **Port Definition** screen is displayed. Select the switch from the drop-down list to configure the ports.

On the **Port Definition** screen, the following two tabs are displayed:

- Port Configuration
- SPAN Destination

On the **SPAN Destination** tab, the following details are displayed:

- SPAN Destination Name
- SPAN Destinations
- Node Connector
- Monitor Port Type
- Description

Adding SPAN Destination

When you configure a port as an edge SPAN port and the port is connected to the API side, you can select the APIC device, pod, node, and port from the ACI side and set the port as SPAN destination. SPAN destination can now be configured on the Cisco Nexus 9000 or Cisco Nexus 3000 Series production switches.

Note For APIC SPAN destination, when you configure a port as an Edge SPAN port and the port is connected to the API side, you can select the pod, the node, and the port from the ACI side and set the port as SPAN destination. For production switch SPAN destination, when you configure a port as an Edge SPAN port and the port is connected to the production switch side, you can select the node and the port from the production switch side and set the port as SPAN destination.

You can add SPAN destination only after either an APIC or the production switch has been successfully added to the network.

Step 1 Select the switch for which you want to configure the port details on the **Port Configuration** screen.

Step 2 Click **Configure** under **Action**.

The **Configure Ports** window is displayed.

Step 3 In the **Configure Ports** window, configure the port type from the **Select a port type** drop-down list by selecting one of the following options:

- **Edge Port-SPAN**
- **Remote Source Edge-SPAN**

Edge Port-SPAN—Creates an edge port for incoming traffic connected to an upstream switch that is configured as a SPAN destination.

Remote Source Edge-SPAN — Creates a remote edge span port.

Note You can select either Edge Port-SPAN or Remote Source Edge-SPAN to create a SPAN Destination.

When you select the port type, the title of the window changes to **Manage Configure Ports**.

Step 4 (For Edge Port-SPAN) In **Manage Configure Ports** window, the details of the selected node are displayed.

Step 5 In the **Destination** panel, if the APIC device is added, it is listed in the drop-down list. Select the **Node Type** as **APIC** from the drop-down list.

The **SPAN Destination** and **Copy Device** tabs are displayed.

Step 6 When you click the **SPAN Destination** tab, the **Select SPAN Destination** window is displayed. From the Select APIC Node dropdown list, select an APIC node.

Select the appropriate span destination based on the connection,

Note Go directly to Step 10, when you select **Remote Source Edge-Span** for creating a SPAN Destination.

Step 7 From the **Select Node** drop-down list, select an APIC device.

Step 8 Select corresponding leaf switch, node and port from the **Select Pod** drop-down list, **Select Node** drop-down list, and **Select Port** drop-down list to configure the SPAN Destination.

Step 9 Click **Apply**.

The port is now configured as SPAN destination part and it is displayed on the Port Definition screen.

Step 10 (For Remote Source Edge-SPAN) Click the **Span Destination** button.

The **Select Span Destination** pane is displayed.

a) Select the Node, Tenant, Profile and EPG from the drop down list.
b) (Optional) Enter the **Span Destination Name**. You can assign a name for easy identification. This is used by the APIC.
c) Enter the Source IP Address. Source IP address is the base IP address of the IP subnet of the source packets.
d) The Destination IP Address is automatically populated. The Destination IP address is the IP address of the remote server that receives the replicated packets.
e) Enter the Flow ID. Flow ID is the flow identifier of the SPAN packet. Flow ID is automatically populated based on the ERSPAN ID that was specified with Remote Source Edge-SPAN.
f) Enter the Time to Live (TTL) value. The range for TTL is from 1 to 255 hops. If set to zero, then no TTL is specified. The default is 64 hops.
g) Click **Apply.**

The **Configure Ports** pane is dispalyed.

Step 11 (Optional) In the **Configure Ports** dialog box, under **Destination** section, specifiy MTU for the SPAN Destination in the **MTU** text-field. You can configure MTU range between 1 and 9216.

Step 12 Click **Submit**.

Creating Copy Devices Using Copy Sessions (BETA)

When you configure a port as an edge-SPAN port, you can create copy devices using Copy Sessions (BETA) functionality.

Note You can add SPAN destination and copy devices only after an APIC device has been successfully added to the network.

Step 1 Select the switch for which you want to configure the port details using the **Port Configuration** screen.

Step 2 Click **Configure** under **Action**.

The **Configure Ports** window is displayed.

Step 3 In the **Configure Ports** window, configure the port type from the **Select a port type** drop-down list by selecting one of the following options:

- **Add Monitoring Device**
- **Edge Port-SPAN**
- **Edge Port-TAP**
- **Production Port**

Monitoring Device—Creates a monitoring device for capturing traffic and configures the corresponding delivery port.

Edge Port-SPAN—Creates an edge port for incoming traffic connected to an upstream switch that is configured as a SPAN destination.

Edge Port-TAP—Creates an edge port for incoming traffic connected to a physical TAP port.

Production Port—Creates a production port for the ingress and egress traffic.

When you select the port type, the title of the window changes to **Manage Configure Ports**.

Step 4 In **Manage Configure Ports** window, the details of the selected node are displayed.

Step 5 In the **Destination** panel, if the APIC device is added, it is listed in the drop-down list. Select the **Node Type** as **APIC** from the drop-down list.

The **SPAN Destination** and **Copy Device** tabs are displayed. See *Adding SPAN Destination* section for adding SPAN destination.

Step 6 When you click the **Copy Device** tab in the same window, the **Create Copy Device (BETA)** window is displayed.

Step 7 In the General panel, enter the name of the device in the **Name** field. The values for the fields, **Device Type** and **Physical Domain** are hard-coded.

Step 8 In the Device Interface panel, enter the details in the following fields: **Name**, **Pod**, **Node**, and **Port**. The value for the field, **Path Type** is hard-coded.

Step 9 In the Cluster panel, enter the details in the following fields, **Name** and **VLAN Encap**. The value for the field, **Interface** is hard-coded.

Step 10 Click **Submit** to save the settings.

The name and the path of the copy device is displayed in the destination panel.

Step 11 When you click **Submit** in **Manage Configure Ports** window, the device is displayed in the **Destination** column in the **Port Configuration** screen. When you hover over the device name in the GUI, the name of the **Copy Device** is displayed.

Step 12 Once the **Copy Device** is added, it is displayed in the **APIC Copy Session (BETA)** screen under the **Copy Device** tab.

The following fields are displayed under the **Copy Device** tab: **Cluster Name**, **Managed**, **Device Type**, and **Service Type**.

Step 13 In the **APIC Copy Session (BETA)** screen, the **Service Graph** tab is displayed. When you click **+Add Service Graph**, the **Add Service Graph (BETA)** window is displayed.

Step 14 Add name for the service graph in the **Name** field.

Step 15 Select the copy device for the service graph in the **Copy Device** field.

The copy devices that are created by Cisco Nexus Data Broker are listed in the **Copy Device** field.

Step 16 Click **Submit** to save the settings.

Once the service graph is added, it is displayed in the **APIC Copy Session (BETA)** screen under the **Service Graph** tab. The fields that are displayed on the tab are **Name**, **Copy Device**, **Function Nodes**, and **Action**. The parameters that can be edited for the service graph are **Name** and **Copy Device** only. You can click **Remove** under **Action** column in the **APIC Copy Session (BETA)** screen to remove the service graph.

Note By default, the copy device and the service graph get created under the common tenant.

Adding SPAN Sessions

On the SPAN Sessions tab, the following fields are displayed:

- SPAN Session

- Filter
- Devices
- SPAN Source
- SPAN Destination

You can add a SPAN session in ACI. Complete the following steps to add a SPAN session.

Note Starting with Cisco NDB release 3.8, a new column named, **Status**, is added on the SPAN Session tab that displays the status of each session. The status of a SPAN session depends on Operational status of the session in APIC and status of the connection attached to it (if a connection is attached to the session).

Note You can create a maximum of 4 SPAN sessions on a switch.

Step 1 Navigate to **ADMINISTRATION** > **Devices** > **SPAN MANAGEMENT** tab.

Step 2 Click **Add SPAN Session** to add a SPAN session. The **Add SPAN Session** window is displayed.

Step 3 In the **Add SPAN Session** window, add a session name in the **SPAN Session Name** field.

Step 4 Under **SPAN Sources**, select **ACI** as device type from the **Select Device Type** option list.

Step 5 Select an APIC node from the drop-down list on which the SPAN session is to be configured.

Step 6 Click **Apply SPAN Source**.

Step 7 In the **SPAN SOURCES** pane, click **+ Apply SPAN Source**. In the pane, click **+ Apply Leaf Ports** to add a leaf port to capture the traffic from multiple leaf ports. Or optionally, you can click **+Apply EPG/AAEP** to add an EPG source. Enter the values in the following fields:

a) If **+ Apply Leaf Ports** is clicked.
b) In the **Apply Leaf Ports** window, select a pod using the drop-down list in the **POD** field.
c) Select a node using the drop-down list in the **Node** field.
d) Select a port using the drop-down list in the **Port** field.
e) Click **Apply Leaf Ports**.
f) In the **SPAN SOURCES** pane, select a direction from the **Incoming**, **Outgoing**, or **Both** options.

The selected Span source is displayed in the **Span Source** field.

g) If **+Apply EPG / AAEP** is clicked.

Note Starting with Cisco NDB Release 3.7, you can now add multiple EPGs in the same SPAN session.

h) To add EPG source, select a tenant from the **Tenant** drop-down list in the **Add EPG** window.

Note
- All EPG interfaces work only when all the ports are within the same leaf switch.
- If an EPG is spread across multiple switches, select the corresponding SPAN destination on all the leaf switches.

i) Select a profile using the drop-down list in the **Profile** field.

j) Select EPG associated with the tenant using the **EPG** drop-down list.

The selected **SPAN Source** is displayed.

k) Select EPG or AAEP member from the **EPG Members** drop-down list.
l) Click **+Add**.
m) Click **Apply EPG/AAEP**.

Note If the EPG is selected, by default, Cisco Nexus Data Broker listens for the changes in the statically or dynamically configured interfaces of the selected EPG. If there is any change, it is applied to the SPAN session. The web socket connection is not secured with the certificates. To disable the event listening, add **enableWebSocketHandle=false** in the **config.ini** file under **xnc/configuration** folder.

Note When new EPG members are added in APIC, if there is no SPAN destination on the leaf switch that matches the newly added EPG member as part of the configured SPAN session, NDB ignores this event and the new EPG member are not shown in NDB.

Step 8 In the **SPAN Destination** field, select SPAN destination.

Select appropriate SPAN Destination. If directly connected, select local span destination, else select remote span destination.

If you install ACI SPAN session, it lists the SPAN destination that is created in ACI.

If you install NXOS SPAN session, it lists the SPAN destination that is created in NXOS.

Note Ensure that each leaf switch in the SPAN source has at least one corresponsing SPAN destination.

Note Starting with Cisco NDB Release 3.7, addition of multiple SPAN Destinations in the same SPAN session is supported.

Step 9 (Optional) Select a connection in the **Select Connections** field.

Note Starting with Cisco NDB Release 3.7, attaching a connection to the SPAN session is optional.

Step 10 (Optional) In the **Action** pane, select a priority for the SPAN session.

Step 11 (Optional) Select a rule using the drop-down list in the **Rule Filter** field.

Step 12 (Optional) Select a destination device to which the traffic is sent.

Step 13 Do one of the following:

- Click **Save SPAN Session** to save the session without installing it on ACI.
- Click **Install SPAN Session** to save and install the session on ACI.

Note Starting with Cisco NDB release 3.8, you can install a saved SPAN session on ACI using the **Toggle Install** button. Select the saved SPAN session that you want to install and click **Toggle Install** button to install the session on ACI. You can also uninstall a SPAN session without removing it from NDB using the **Toggle Install** button. The SPAN session in uninstalled from ACI but remains saved on the NDB for future use.

Step 14 Click **OK**.

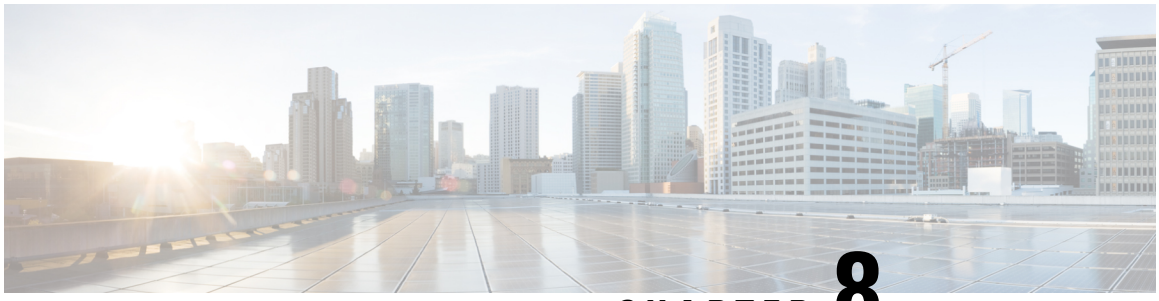
As a result, a SPAN session is set up in ACI. It also sets up a connection automatically on the Cisco Nexus Data Broker with the same SPAN session name and this connection redirects the traffic from that source port to the monitoring device.

Note Each leaf can have a maximum of 4 SPAN sessions.

You can set up additional SPAN sessions. You can append a new SPAN session to the existing connection. In that case, you can select the new SPAN session in the Add SPAN Session window, use the same connection that is previously created, select new SPAN sources from different leaf ports, select the SPAN destination, and add the SPAN session.

It creates a new session in ACI, but it appends an existing connection to include the new traffic on the Cisco Nexus Data Broker side.

You can edit or clone the existing SPAN sessions. If you want to remove a SPAN session, click the session and click **Remove SPAN Session(s)** A message box is displayed asking you to confirm, **Remove the following sessions?**, if you want to remove the displayed SPAN session. Click **Remove SPAN Sessions** to confirm. If the SPAN session is using an existing connection, the connection is updated automatically with the changes. If it is the last connection associated with the SPAN session, the connection is deleted.



CHAPTER 8

Viewing and Adding Flows

This chapter contains the following sections:

Viewing Flows

Note This functionality is applicable only for OpenFlow mode of deployment.

On the **Flows** tab, the following fields are displayed:

- Serial Number
- Status
- Flow Name
- Node

What to do next

Click **+ Flow** to add a flow.

Adding a Flow

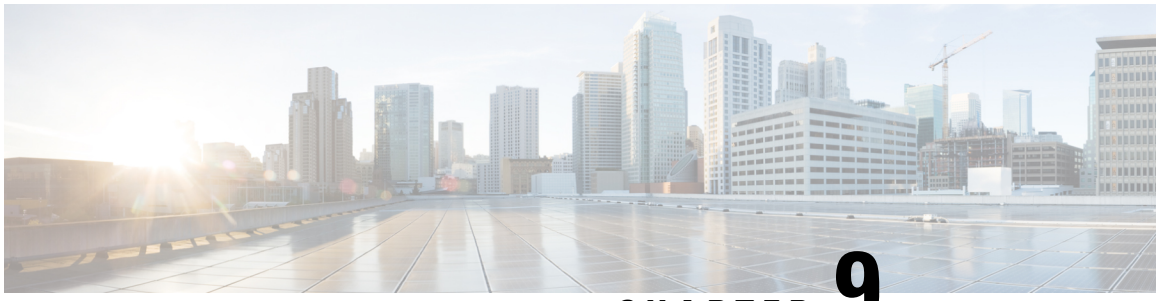
Step 1 Navigate to the **Flows** tab under **Administration**, click **+ Flow** to add a flow.

Step 2 On the **Add Flow Description** window, update the following fields:

Name	Description
Name field	The name that you want to assign to the flow. **Note** You cannot change the name of the flow entry after it is saved.
Select a Node drop-down list	Select a node name for the device. **Note** The node you choose cannot be changed one you save the flow entry.
Input Port drop-down list	Choose the port on the node where traffic enters the flow.
Priority field	The priority that you want to apply to the flow. The default priority is 500. Flows with a higher priority are given precedence over flows with a lower priority. **Note** The priority is considered only when all of the Layer 2, Layer 3, and Layer 4 match fields are equal.
Hard Timeout field	The amount of time in milliseconds for the flow to be installed before it is removed from the flow table.
Idle Timeout field	The amount of time in milliseconds that the flow can be idle before it is removed from the flow table.
Layer 2	
Ethernet Type field	The Ethernet type for the Layer 2 traffic. The Ethernet type for IPv4, in hexadecimal format, is displayed by default. Either accept the default value, or enter one of the following, in hexadecimal format: • IPv6 • ARP • LLDP
VLAN Identification Number field	The VLAN ID for the Layer 2 traffic.
VLAN Priority field	The VLAN priority for the Layer 2 traffic.
Source MAC Address field	The source MAC address for the Layer 2 traffic.
Destination MAC Address field	The destination MAC address for the Layer 2 traffic.
Layer 4	
Source Port field	The source port of the Layer 4 traffic.
Destination Port field	The destination port of the Layer 4 traffic.

Name	Description
Protocol field	The Internet protocol number of the Layer 4 traffic. Enter the IP protocol number in decimal, hexadecimal, or octal format.
Actions drop-down list	Select an action from the drop-down list.

Step 3 Click **Install Flow** to install the flow into the device OR click **Save Flow** to save the flow to the **Flow Entries** table, but the system does not install the flow in the flow table of the device.



CHAPTER 9

Viewing Consistency Check

This chapter contains the following sections:

Consistency Check

Consistency check shows the number of controller or node inconsistencies for each device and provides option to resolve the inconsistency issues. The consistency check feature shows three types of inconsistencies:

- Controller flows inconsistency: Flows are present in Cisco NDB, but missing from the device.
- Node flows inconsistency: Flows are present in the switch, but missing from Cisco NDB.
- ACL attachment on port inconsistency (applicable only for NX-API): Incorrect ACLs are attached to the interface(s) of an NDB device. To fix this type of inconsistency, see Fixing Inconsistent ACL Attachment on a Port, on page 156 procedure.

Viewing Consistency Check

To check for inconsistency for an OpenFlow or NX-API based device, complete the following steps:

On the **Consistency Check** tab, the following details are displayed:

Step 1 Navigate to **ADMINISTRATION** > **Consistency Check**.

Step 2 Click **FLOW CHECK NX-API/OpenFlow** tab to view the summary of inconsistencies for the NX-API/OpenFlow based devices. On the **Consistency Check** tab, the following details are displayed:

- Node Name
- Inconsistent Controller Flow
- Inconsistent Node Flow
- Non NDB Flows

- Inconsistent ACL Attachment on Port

Note To fix an inconsistent flow, select the devices from the list and click **Fix Inconsistent Flow**.

Step 3 To view detailed inconsistency information:

- Click **Inconsistent Controller Flows** to view the controller inconsistencies.
- Click **Inconsistent Node Flows** to view the node inconsistencies.
- Click **Non NDB Flows** (available only for NX-API) to view the ACLs present in the device by default or added manually.

Step 4 To resolve the inconsistency issues:

- Click **Fix Inconsistent Flows** on the **Controller Inconsistent** page, to add the missing controller flows to the device.
- Click **Fix Inconsistent Flows** on the **Node Inconsistent** page, to remove the stale flows from the device.

Fixing Inconsistent ACL Attachment on a Port

Use this procedure to fix the incorrect acls attached to a port of an NDB switch.

A few example scenarios that indicates inconsistent port ACL attachment:

- A configured port should have a port acl attached, and not a global acl.
- Default acls, such as MAC, ipv4, ipv6 are not attached to the port.
- When ISLs are discovered, *globalacl* is indicated on the port, instead of *portacl*.

Step 1 Log in to Cisco Nexus Data Broker.

Step 2 Navigate to **Administration** > **Consistency Check** > **Flow Check NX-API**.

Step 3 Select the device by checking the check-box and click the **Inconsistent ACL Attachment on Port** button.

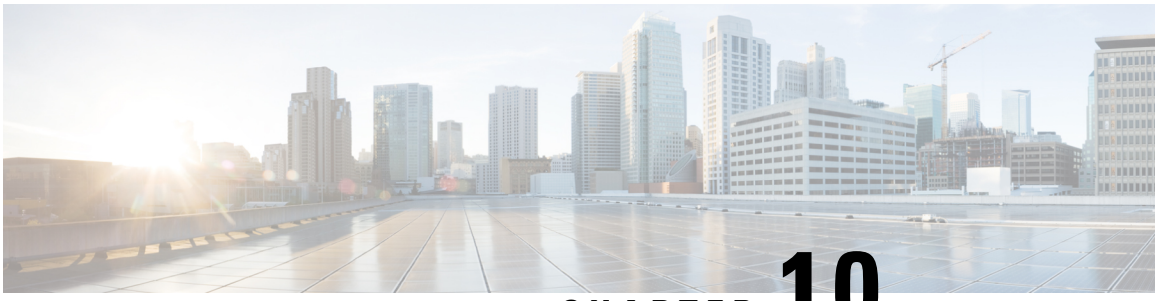
A new window is displayed with the interface details of the inconsistent ACL attachment on ports for the selected device. The inconsistencies are categorized as:

- Inconsistent attachment—incorrect ACL(s) attached to a port.
- Not attached—ACLs are not attached to a port.
- Attachement to be removed—a port channel member should not have any ACL(s) attached to it, but in case it has, then it will be displayed under this heading.

Step 4 Select the inconsistency to be fixed by checking the corresponding check-box.

Step 5 Click the **Fix Inconsistencies** button. This action sets the correct ACL(s) on the interface(s) of the NDB switch.

Click the **Export All** button to get a `.csv` file of all the inconsistencies for the selected device.



CHAPTER 10

Managing Users

This chapter contains the following sections:

Adding a User

After creating a user, you can change the password, but you cannot change the roles assigned to the user.

Step 1 Navigate to the **User Management** tab under **Administration** and click **+ User** to add a user.

Step 2 In the **Add User** window, complete the following fields:

Name	Description
Username field	The name that you want to assign to the user.
Password field	The password for the user. Passwords must be between 8 and 256 characters long, contain uppercase and lowercase characters, have at least one numeric character, and have at least one nonalphanumeric character.
Verify Password field	Verify the password by re-entering it.

Name	Description
Choose Role(s) drop-down list	Choose the role that you want to assign to the user. You can assign more than one role. It can be one of the following: • **Application User**—Provides privileges that are defined in the specified application. • **Security**—Provides privileges that are defined in the security application. • **Network Administrator**—Provides full administrative privileges to all applications. • **Network Operator**—Provides read-only privileges to all applications. • **Slice User**—Provides access to a specified slice.
Enter a Role Name field	If you choose **Application User**, enter the name that you want to assign to the role.

Step 3 Click **Save** in the **User Management** window or click **Cancel** to cancel the action.

Adding a Role

Step 1 Navigate to the **User Management** tab under **Administration** and click **+ Role**.

Step 2 In the **Add Role** window, complete the following fields:

Field	Description
Name field	The name of the role.

Field	Description
Level drop-down list	Choose the level that you want to assign to the role. This can be one of the following: • App-Administrator—Has full access to all Cisco Nexus Data Broker resources but the App-Administrator cannot add NXAPI or production devices into NDB because Administration tab is not available in NDB for App-Administrator role . • App-User—Has full access to create, edit, clone, or delete connections and redirections that are assigned to his resource group and resources that are created by another user with similar permissions. An App-User can only view Edge-SPAN, Tap, Monitoring device, and Production ports. An App-User can view resources that are created by another user with similar permissions in Toplogy page of NDB. But, you can not configure Edge-SPAN or Connections created by another App-User.
Assign Group(s)	Assign groups to the selected role.

Step 3 Click **save**.

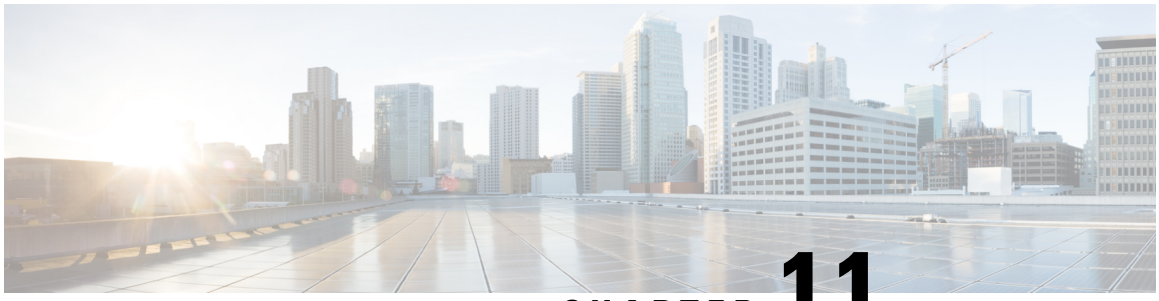
Adding a Group

Step 1 Navigate to the **User Management** tab under **Administration** and click **+ Groups**.

Step 2 In the **Add Group** window, complete the following field:

Field	Description
Resource Group Name	The name of the resource group.
Select Switch Node	Select a switch node from the drop-down list.
+ Assign Switch and Ports	Click + to add a new switch to the group.
Select Ports	Select the ports associated with the switch.
Assign Group to Roles	Assign a role to the group.

Step 3 Click **Save**.



CHAPTER 11

Configuring the Setup for a Use Case in the Centralized Mode

This chapter contains the following sections:

Configuring Cisco Nexus Data Broker For Centralized Mode Using The CLI

Complete the following steps to configure

Step 1 Create two connections.

a) Connection 1 aggregates TAP and SPAN port. Apply filters and deliver to two monitor devices in switch-2, that is connected to ½ and 1/1.

b) Connection 2 receives the TAP port traffic. After applying HTTP filter, the traffic is directed to only one monitor device.

Step 2 Run Cisco Nexus Data Broker in Linux server.

Step 3 Verify that the ofa package is there.

Step 4 Install ofa.

a) virtual-service install name ofa package ofa_mmemb-1.1.5-r3-n3000-SPA-k9.ova

b) sh virtual-service list

c) configure

d) virtual-service ofa

e) activate

f) show virtual-service list

Step 5 Configure OpenFlow switch.

a) switch-1(config-virt-serv)# openflow

b) switch-1(config-ofa)# switch 1

c) switch-1(config-ofa-switch)# pipeline 203

d) switch-1(config-ofa-switch)# controller ipv4 10.16.206.161 port 6653 vrf management security none
e) switch-1(config-ofa-switch)# sh int br
f) switch-1(config-ofa-switch)# of-port interface ethernet1/1-4
g) switch-1(config-ofa-switch)# of-port interface ethernet1/47
h) switch-2(config-ofa-switch)# show virtual-service list

Example

Run Cisco Nexus Data Broker in Linux server.

```
[root@rhel64-ndb-nxapi NDB3.0.0]#
[root@rhel64-ndb-nxapi NDB3.0.0]# ls
ndb1000-sw-app-k9-3.0.0.zip  xnc
[root@rhel64-ndb-nxapi NDB3.0.0]#
 [root@rhel64-ndb-nxapi NDB3.0.0]# cd xnc/
[root@rhel64-ndb-nxapi xnc]# ls
bin  configuration  etc  lib  logs  plugins  runxnc.cmd  runxnc.sh  version.properties
work
[root@rhel64-ndb-nxapi xnc]# ./runxnc.sh -start
Running controller in background with PID: 11987, to connect to it please SSH to this host
 on port 2400
[root@rhel64-ndb-nxapi xnc]#
```

Configure NDB to run as a service in the Linux server.

1. Download the script file named, `ndb`, based on the operating system (Ubuntu, CentOs, or Redhat). The service script is available at: https://github.com/datacenter/nexus-data-broker/tree/master/serviceScripts.
2. Update the Java Home location in the script file for NDB version is 3.2 and earlier. For the NDB version 3.3 and later, comment the line that configures Java Home.

   ```
   export JAVA_HOME=/usr/lib/jvm/java-8-openjdk-amd64/jre
   ```

3. Change the permissions for the script file to 755. Use the **chmod 755 ndb** command. For example:

   ```
   ndb-inst# chmod 755 ndb
   ```

4. Update the NDB location in the downloaded script file.

   ```
   NDB_PATH - /home/user/xnc
   ```

5. Copy the script file to the `/etc/init.d/` folder in the Linux server.
6. Start, stop, and restart the NDB using the following commands

   ```
   ndb-inst # ndb stop
   ndb-inst # ndb start
   ndb-inst # ndb restart
   ```

Verify that the ofa package is installed.

```
switch-1 - Switch
==========

switch-1#
switch-1# dir
       4096    Jun 01 23:55:07 2016  .patch/
       1044    Aug 13 00:15:17 2014  20140813_001215_poap_3799_init.log
```

```
         16    Aug 13 00:30:15 2014  cert.err
       9255    Jun 01 23:38:11 2016  clean_config
    2885642    May 12 22:11:57 2014  lltormtc-dplug-mzg.6.0.2.A3.0.23.bin
    4194304    Sep 08 19:24:42 2014  messages
       3752    Mar 18 00:48:03 2014  mts.log
   36825088    Apr 19 18:47:44 2016  n3500-uk9-kickstart.6.0.2.A6.5a.bin
   37472256    Jun 01 23:43:34 2016  n3500-uk9-kickstart.6.0.2.A8.0.15.bin
  180349300    Apr 19 18:49:37 2016  n3500-uk9.6.0.2.A6.5a.bin
  190244286    Jun 01 23:42:07 2016  n3500-uk9.6.0.2.A8.0.15.bin
   54343680    Apr 24 05:27:43 2016  ofa_mmemb-1.1.5-r3-n3000-SPA-k9.ova
       4096    Mar 18 06:08:07 2014  onep/
       3314    Apr 25 18:14:18 2014  sercert.p12
       1024    Apr 19 18:58:37 2016  sprom_cstruct_2_0_0
       1024    Apr 19 18:59:22 2016  sprom_cstruct_3_0_0
       4096    Jan 01 03:25:17 2011  vdc_2/
       4096    Jan 01 03:25:17 2011  vdc_3/
       4096    Jan 01 03:25:17 2011  vdc_4/
       4096    Jun 01 23:31:49 2016  virt_strg_pool_bf_vdc_1/
       4096    Jun 01 23:31:49 2016  virtual-instance/
       4096    Aug 09 02:20:14 2014  virtual-instance-stby-sync/
  243671040    May 09 20:55:18 2016  xnclite_ofa_jdk1877.ova
  243732480    May 10 21:51:52 2016  xnclite_ofa_jdk1892.ova

Usage for bootflash://
 1124974592 bytes used
 770195456 bytes free
 1895170048 bytes total
switch-1#
```

Install ofa.

```
switch-1#
switch-1# virtual-service install name ofa package ofa_mmemb-1.1.5-r3-n3000-SPA-k9.ova
Note: Installing package 'bootflash:/ofa_mmemb-1.1.5-r3-n3000-SPA-k9.ova' for virtual service
 'ofa'. Once the install has finished, the VM may be activated. Use 'show virtual-service
list' for progress.

switch-1# sh virtual-service list

Virtual Service List:

Name                     Status              Package Name
--------------------------------------------------------------------------------
ofa                      Installed           ofa_mmemb-1.1.5-r3-n3000-SPA-k9.ova

switch-1# configure
Enter configuration commands, one per line.  End with CNTL/Z.
switch-1(config)# virtual-service ofa
switch-1(config-virt-serv)# activate
Note: Activating virtual-service 'ofa', this might take a few minutes. Use 'show
virtual-service list' for progress.
switch-1(config-virt-serv)# show virtual-service list

Virtual Service List:

Name                     Status              Package Name
--------------------------------------------------------------------------------
ofa                      Activated           ofa_mmemb-1.1.5-r3-n3000-SPA-k9.ova

switch-1(config-virt-serv)#
```

Configure OpenFlow switch.

```
switch-1(config-virt-serv)# openflow
switch-1(config-ofa)# switch 1
switch-1(config-ofa-switch)# pipeline 203
switch-1(config-ofa-switch)# controller ipv4 10.16.206.161 port 6653 vrf management security
 none
switch-1(config-ofa-switch)# sh int br

--------------------------------------------------------------------------------
Ethernet      VLAN   Type Mode   Status  Reason                   Speed     Port
Interface                                                                   Ch #
--------------------------------------------------------------------------------
Eth1/1        1       eth  access up      none                       10G(D) --
Eth1/2        1       eth  access down    SFP not inserted           10G(D) --
Eth1/3        1       eth  access up      none                       10G(D) --
Eth1/4        1       eth  access up      none                       10G(D) --
Eth1/5        1       eth  access down    SFP not inserted           10G(D) --
Eth1/6        1       eth  access down    SFP not inserted           10G(D) --
Eth1/7        1       eth  access down    SFP not inserted           10G(D) --
Eth1/8        1       eth  access down    SFP not inserted           10G(D) --
Eth1/9        1       eth  access down    SFP not inserted           10G(D) --
Eth1/10       1       eth  access down    SFP not inserted           10G(D) --
Eth1/11       1       eth  access down    SFP not inserted           10G(D) --
Eth1/12       1       eth  access down    SFP not inserted           10G(D) --
Eth1/13       1       eth  access down    SFP not inserted           10G(D) --
Eth1/14       1       eth  access down    SFP not inserted           10G(D) --
Eth1/15       1       eth  access down    SFP not inserted           10G(D) --
Eth1/16       1       eth  access down    SFP not inserted           10G(D) --
Eth1/17       1       eth  access down    SFP not inserted           10G(D) --
Eth1/18       1       eth  access down    SFP not inserted           10G(D) --
Eth1/19       1       eth  access down    SFP not inserted           10G(D) --
Eth1/20       1       eth  access down    SFP not inserted           10G(D) --
Eth1/21       1       eth  access down    SFP not inserted           10G(D) --
Eth1/22       1       eth  access down    SFP not inserted           10G(D) --
Eth1/23       1       eth  access down    SFP not inserted           10G(D) --
Eth1/24       1       eth  access down    SFP not inserted           10G(D) --
Eth1/25       1       eth  access down    SFP not inserted           10G(D) --
Eth1/26       1       eth  access down    SFP not inserted           10G(D) --
Eth1/27       1       eth  access down    SFP not inserted           10G(D) --
Eth1/28       1       eth  access down    SFP not inserted           10G(D) --
Eth1/29       1       eth  access down    SFP not inserted           10G(D) --
Eth1/30       1       eth  access down    SFP not inserted           10G(D) --
Eth1/31       1       eth  access down    SFP not inserted           10G(D) --
Eth1/32       1       eth  access down    SFP not inserted           10G(D) --
Eth1/33       1       eth  access down    SFP not inserted           10G(D) --
Eth1/34       1       eth  access down    SFP not inserted           10G(D) --
Eth1/35       1       eth  access down    SFP not inserted           10G(D) --
Eth1/36       1       eth  access down    SFP not inserted           10G(D) --
Eth1/37       1       eth  access down    SFP not inserted           10G(D) --
Eth1/38       1       eth  access down    SFP not inserted           10G(D) --
Eth1/39       1       eth  access down    SFP not inserted           10G(D) --
Eth1/40       1       eth  access down    SFP not inserted           10G(D) --
Eth1/41       1       eth  access down    SFP not inserted           10G(D) --
Eth1/42       1       eth  access down    SFP not inserted           10G(D) --
Eth1/43       1       eth  access down    SFP not inserted           10G(D) --
Eth1/44       1       eth  access down    SFP not inserted           10G(D) --
Eth1/45       1       eth  access down    SFP not inserted           10G(D) --
Eth1/46       1       eth  access down    SFP not inserted           10G(D) --
Eth1/47       1       eth  access up      none                       10G(D) --
Eth1/48       1       eth  access down    SFP not inserted           10G(D) --

--------------------------------------------------------------------------------
Port   VRF          Status IP Address                              Speed    MTU
--------------------------------------------------------------------------------
mgmt0  --           up     10.16.206.129                           1000     1500
```

```
switch-1(config-ofa-switch)#
switch-1(config-ofa-switch)#
switch-1(config-ofa-switch)#
switch-1(config-ofa-switch)# of-port interface ethernet1/1-4
switch-1(config-ofa-switch)# of-port interface ethernet1/47
switch-1(config-ofa-switch)#

Switch-2
======

switch-2(config-ofa-switch)# show virtual-service list

Virtual Service List:

Name                      Status             Package Name
------------------------------------------------------------------------
ofa                       Activated          ofa_mmemb-1.1.5-r3-n3000-SPA-k9.ova

switch-2(config-ofa-switch)#
```

What to do next

For centralized mode, complete the steps for configuring Cisco Nexus Data Broker using the GUI as outlined in the next section.

Configuring Cisco Nexus Data Broker in Centralized Mode Using The GUI

After configuring the Cisco Nexus Data Broker using the CLI, complete the following steps:

Step 1 Open a new browser window and type *https://<NDB-IP>:8443*.

Step 2 Configure the TAP and SPAN ports using the GUI.

Step 3 Select switch 2 and configure the delivery ports.

Step 4 Add switch 1 and switch 2 in NX-API as in auxiliary mode by enabling the **Set Auxiliary Node** option in the **Add Device** window.

Step 5 Click **Nodes Learned** to configure the mode.

Step 6 For switch 1, click on the OpenFlow device ID and change the **Operation Mode** in the **Update Node Information** window to **Proactive forwarding only** option.

Step 7 For switch 2, click on the OpenFlow device ID and change the **Operation Mode** in the **Update Node Information** window to **Proactive forwarding only** option.

Step 8 In the **Port Definition** window, click **Edit** for delivery port 1/1.

Step 9 Check the **Enable Timestamp Tagging** option in the **Configure Ports** window and click **Submit**.

Step 10 In the **Port Definition** window, click **Edit** for delivery port 1/2.

Step 11 Check the **Enable Timestamp Tagging** option in the **Configure Ports** window and click **Submit**.

After you configure the timestamp, the **TS-Tag** field is displayed next to the port under the **Port Configuration** tab. You can view the monitoring devices in the **Monitoring Devices** tab.

Step 12 Add different traffic filters under the **Filters** tab.

Step 13 Click **Topology** to understand how the devices are learned.

Step 14 Click **Connections** to create a connection.

Step 15 Click **Add Connection** and add filters and the monitoring devices for connection 1.

Step 16 Add connection 2 in a similar way.

After the connections are created, view the connections in the **Connections** tab.

Step 17 View the final topology.

Example of the configuration on switch 1 and switch 2:

```
Switch 1 Configuration: switch-1

hardware profile tcam region racl 512
hardware profile tcam region ifacl 1024 double-wide
hardware profile forwarding-mode openflow-only
hardware internal mtc-usd ttag-eth-type 0x88b5
snmp-server user admin network-admin auth md5 0x188749ba5e1c6af881227235b1b14d04 priv
0x188749ba5e1c6af881227235b1b14d04 localizedkey

vlan 1
vrf context management
  ip route 0.0.0.0/0 10.16.206.1

interface Ethernet1/1
  no lldp transmit
  spanning-tree bpdufilter enable
  mode openflow
  no shutdown

interface Ethernet1/2
  no lldp transmit
  spanning-tree bpdufilter enable
  mode openflow
  no shutdown

interface Ethernet1/3
  no lldp transmit
  switchport mode trunk
  spanning-tree bpdufilter enable
  mode openflow
  no shutdown

interface Ethernet1/4
  no lldp transmit
  switchport mode trunk
  spanning-tree bpdufilter enable
  mode openflow
  no shutdown

interface Ethernet1/5
  no shutdown

interface Ethernet1/6
  no shutdown

interface Ethernet1/7
  no shutdown
```

```
interface Ethernet1/8
  no shutdown

interface Ethernet1/9
  no shutdown

interface Ethernet1/10
  no shutdown

interface Ethernet1/11
  no shutdown

interface Ethernet1/12
  no shutdown

interface Ethernet1/13
  no shutdown

interface Ethernet1/14
  no shutdown

interface Ethernet1/15
  no shutdown

interface Ethernet1/16
  no shutdown

interface Ethernet1/17
  no shutdown

interface Ethernet1/18
  no shutdown

interface Ethernet1/19
  no shutdown

interface Ethernet1/20
  no shutdown

interface Ethernet1/21
  no shutdown

interface Ethernet1/22
  no shutdown

interface Ethernet1/23
  no shutdown

interface Ethernet1/24
  no shutdown

interface Ethernet1/25
  no shutdown

interface Ethernet1/26
  no shutdown

interface Ethernet1/27
  no shutdown

interface Ethernet1/28
  no shutdown
```

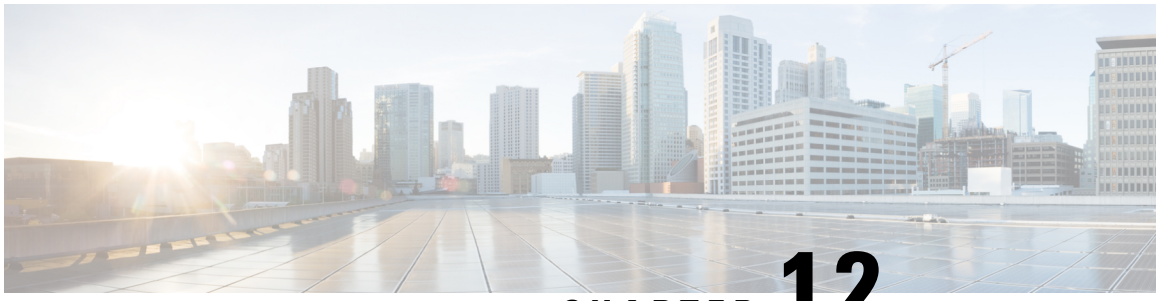
```
interface Ethernet1/29
  no shutdown

interface Ethernet1/30
  no shutdown

interface Ethernet1/31
  no shutdown

interface Ethernet1/32
  no shutdown

interface Ethernet1/33
  no shutdown

interface Ethernet1/34
  no shutdown

interface Ethernet1/35
  no shutdown

interface Ethernet1/36
  no shutdown

interface Ethernet1/37
  no shutdown

interface Ethernet1/38
  no shutdown

interface Ethernet1/39
  no shutdown

interface Ethernet1/40
  no shutdown

interface Ethernet1/41
  no shutdown

interface Ethernet1/42
  no shutdown

interface Ethernet1/43
  no shutdown

interface Ethernet1/44
  no shutdown

interface Ethernet1/45
  no shutdown

interface Ethernet1/46
  no shutdown

interface Ethernet1/47
  no lldp transmit
  spanning-tree bpdufilter enable
  mode openflow
  no shutdown

interface Ethernet1/48
  no shutdown

interface mgmt0
```

```
  vrf member management
  ip address 10.16.206.129/24
line console
line vty
boot kickstart bootflash:/n3500-uk9-kickstart.6.0.2.A8.0.15.bin
boot system bootflash:/n3500-uk9.6.0.2.A8.0.15.bin
openflow
  switch 1
    pipeline 203
    controller ipv4 10.16.206.161 port 6653 vrf management security none
    of-port interface ethernet1/1-4
    of-port interface ethernet1/47
virtual-service ofa
  activate
====================================

Switch 2 Configuration  : switch-2


hardware profile tcam region racl 512
hardware profile tcam region ifacl 1024 double-wide
hardware profile forwarding-mode openflow-only
hardware internal mtc-usd ttag-eth-type 0x88b5
snmp-server user admin network-admin auth md5 0xb7289bc7f348c5044b495f93bac10137 priv
0xb7289bc7f348c5044b495f93bac10137 localizedkey

vlan 1
vrf context management
  ip route 0.0.0.0/0 10.16.206.1

interface Ethernet1/1
  no lldp transmit
  ttag
  switchport mode trunk
  spanning-tree bpdufilter enable
  mode openflow
  no shutdown

interface Ethernet1/2
  no lldp transmit
  ttag
  switchport mode trunk
  spanning-tree bpdufilter enable
  mode openflow
  no shutdown

interface Ethernet1/3
  no shutdown

interface Ethernet1/4
  no shutdown

interface Ethernet1/5
  no shutdown

interface Ethernet1/6
  no shutdown

interface Ethernet1/7
  no shutdown

interface Ethernet1/8
  no shutdown
```

```
interface Ethernet1/9
  no shutdown

interface Ethernet1/10
  no shutdown

interface Ethernet1/11
  no shutdown

interface Ethernet1/12
  no shutdown

interface Ethernet1/13
  no shutdown

interface Ethernet1/14
  no shutdown

interface Ethernet1/15
  no shutdown

interface Ethernet1/16
  no shutdown

interface Ethernet1/17
  no shutdown

interface Ethernet1/18
  no shutdown

interface Ethernet1/19
  no shutdown

interface Ethernet1/20
  no shutdown

interface Ethernet1/21
  no shutdown

interface Ethernet1/22
  no shutdown

interface Ethernet1/23
  no shutdown

interface Ethernet1/24
  no shutdown

interface Ethernet1/25
  no shutdown

interface Ethernet1/26
  no shutdown

interface Ethernet1/27
  no shutdown

interface Ethernet1/28
  no shutdown

interface Ethernet1/29
  no shutdown

interface Ethernet1/30
```

```
  no shutdown

interface Ethernet1/31
  no shutdown

interface Ethernet1/32
  no shutdown

interface Ethernet1/33
  no shutdown

interface Ethernet1/34
  no shutdown

interface Ethernet1/35
  no shutdown

interface Ethernet1/36
  no shutdown

interface Ethernet1/37
  no shutdown

interface Ethernet1/38
  no shutdown

interface Ethernet1/39
  no shutdown

interface Ethernet1/40
  no shutdown

interface Ethernet1/41
  no shutdown

interface Ethernet1/42
  no shutdown

interface Ethernet1/43
  no shutdown

interface Ethernet1/44
  no shutdown

interface Ethernet1/45
  no shutdown

interface Ethernet1/46
  no shutdown

interface Ethernet1/47
  no lldp transmit
  spanning-tree bpdufilter enable
  mode openflow
  no shutdown

interface Ethernet1/48
  no shutdown

interface mgmt0
  vrf member management
  ip address 10.16.206.130/24
line console
line vty
```

```
boot kickstart bootflash:/n3500-uk9-kickstart.6.0.2.A8.0.15.bin
boot system bootflash:/n3500-uk9.6.0.2.A8.0.15.bin
openflow
  switch 1
    pipeline 203
    controller ipv4 10.16.206.154 port 6653 vrf management security none
    controller ipv4 10.16.206.161 port 6653 vrf management security none
    of-port interface ethernet1/1-2
    of-port interface ethernet1/47
virtual-service ofa
  activate
```



CHAPTER 12

Managing System

This chapter contains the following sections:

About Slices

The slices screen provides a way for you, as a network administrator, to partition networks into many logical networks. This feature allows you to create multiple disjoint networks and assign different roles and access levels to each one. Each logical network can be assigned to departments, groups of individuals, or applications. Multiple disjoint networks can be managed using the Cisco Nexus Data Broker application.

The slices are created based on the following criteria:

- Network devices—The devices that can be used in the slice.

  Network devices can be shared between slices.

- Network device interfaces—The device interfaces that can be used in the slice.

  Network device interfaces can be shared between slices.

- Flow Specification—A combination of source and destination IP, protocol, and source and destination transport ports used to identify the traffic that belongs to the slice.

Flow specifications can be assigned to different slices if the associated network devices and interfaces are disjointed.

Note You can also use VLAN IDs to segregate the slice traffic.

Slices must be created by a Cisco Nexus Data Broker user with the Network Administrator role. After creation, the slices can be managed by a user with the Slice Administrator role.

As part of the initial NDB build, one slice is available and is called the Default slice. The following configurations can be performed only on the default slice of the NDB controller:

- Adding a new device
- Editing global configurations for devices
- Changing profiles for users
- Changing the parameters for users and associated roles
- Fixing inconsistent device and connection flows

Adding a Slice

Step 1 Log in to the Cisco Nexus Data Broker GUI using your administrator credentials.

Step 2 Navigate to **Administration** > **System** > **Slices**.

Step 3 To add a slice, click the **Add Slice** button.

The **Add Slice** slide-in pane is displayed.

Step 4 Enter the required details for the slice that you want to create in the **Add Slice** pane.

Step 5 Click **Add Slice**.

You can view the new slice in the **Slices** tab.

Note After a new slice is added, the default slice is in *read-only* mode. If an active port configuration and/or connection is present on the default slice, then, it is rendered unavailable.

The devices added to a slice are displayed in the slice. For example, if device D1 is added to slice S1, and if the device goes into maintenance mode (or failed state or not ready state), the device is no longer displayed on S1, but is displayed on the default slice.

Adding Nodes and Ports to a Slice

Note While a switch can be a part of multiple slices, a port can be a part of only one slice at any given time.

Before you begin

- Ensure that the ports are not configured before you add them to a slice.

Step 1 Navigate to **Administration** > **System** > **Slices**.

Step 2 From the list of slices in the **Slices** tab, click to choose the slice for which you want to add the nodes and ports.

The **Slice Details** slide-in pane is displayed with the slice name that you chose.

Step 3 To add a node to a slice, choose a node from the **Select Node** drop-down list and then select the list of ports from the **Add Ports To Slice** menu.

Step 4 Click **Add Port(s)**.

Ensure to have all the ports of a device on the same slice.

Removing a Node from the Slice

Before you begin

- Ensure that you remove the connections, UDFs, filters, and port configurations,in a slice before you remove it.

Step 1 Log in to the Cisco Nexus Data Broker GUI using your administrator credentials.

Step 2 Navigate to **Administration** > **System** > **Slices**.

The list of slices is displayed.

Step 3 From the list of slices, choose the slice that you want to remove.

The **Slice Details** slide-in pane is displayed with the details of the slice.

Step 4 Make a note of the ports and nodes added to the slice.

Step 5 You must remove the connections, port configurations and ports in a slice before you remove it.

To remove the connections:

a) Navigate to **Configurations** > **Connections** .

b) Select the required connection and click **Remove Connections** .

To remove the port configurations:

a) Navigate to **Configurations** > **Port Definition** > **Port Configurations** .
b) Select the required port and click **Remove Port Configuration** .

The port configurations and connections have been removed from the slice.

Step 6 Navigate to **Administration** > **System** > **Slices**.

Step 7 Select the **default** slice from the drop-down list on top of the window.

Step 8 Choose the slice from which a node is to be removed.

The **Slice Details** slide-in pane is displayed with the appropriate slice details.

Step 9 Select all the ports associated with the nodes to be removed from the slice and click **Remove Ports**.

The ports are removed from the slice.

Removing a Slice

Before you begin

- Ensure that you remove the connections, UDFs, filters, and port configurations,in a slice before you remove it.

Step 1 Log in to the Cisco Nexus Data Broker GUI using your administrator credentials.

Step 2 Navigate to **Administration** > **System** > **Slices**.

The list of slices is displayed.

Step 3 From the list of slices, choose the slice that you want to remove.

The **Slice Details** slide-in pane is displayed with the details of the slice.

Step 4 Make a note of the ports and nodes added to the slice.

Step 5 You must remove the connections, port configurations and ports in a slice before you remove it.

To remove the connections:

a) Navigate to **Configurations** > **Connections** .
b) Select the required connection and click **Remove Connections** .

To remove the port configurations:

a) Navigate to **Configurations** > **Port Definition** > **Port Configurations** .
b) Select the required port and click **Remove Port Configuration** .

The port configurations and connections have been removed from the slice.

Step 6 Navigate to **Administration** > **System** > **Slices**.

Step 7 Select the **default** slice from the drop-down list on top of the window.

Step 8 From the list of slices, choose the slice(s) that you want to remove and click **Remove Slice** button.

The **Remove Slice** slide-in pane is displayed.

Step 9 Click **Remove Slice** in the pane.

Adding a Flow Specification

Before you begin

Create a slice before you add a flow specification.

Note Be default, a flow specification is bidirectional.

Step 1 Navigate to the **System** tab under **Administration** and click **+ Flow Spec** to add a flow specification for the selected slice.

Step 2 In the **Add Flow Spec** dialog box, complete the following fields:

Name	Description
Name field	The name that you want to use for the flow specification.
VLAN field	The VLAN ID or the range of VLAN IDs that you want to use for the flow specification.
Source IP field	The source IP address that you want to use for the flow specification.
Destination IP field	The destination IP address that you want to use for the flow specification.
Protocol field	The IP protocol number in decimal format that you want to use for the flow specification.
Source Port field	The source port that you want to use for the flow specification.
Destination Port field	The destination port that you want to use for the flow specification.

Step 3 Click **Save**.

OR you can click **Cancel** to cancel the action.

About AAA Servers

AAA enables the security appliance to determine who the user is (authentication), what the user can do (authorization), and what the user did (accounting). Cisco Nexus Data Broker uses Remote Authentication Dial-In User Service (RADIUS) or Terminal Access Controller Access-Control System Plus (TACACS+) to communicate with an AAA server.

Remote authentication and authorization is supported using the AAA server. To authenticate each user, Cisco Nexus Data Broker uses both the login credentials and an attribute-value (AV) pair that assigns the authorized role for the user as part of the user administration. After successful authentication, the Cisco AV pair is returned to Cisco Nexus Data Broker for resource access authorization.

Adding a AAA Server

Note You can verify the status of AAA TACACS server before adding it using the **Check Server** option on the **Add AAA Server** dialog box. The **Check Server** option verifies whether the AAA server that you are configuring is reachable or not and whether the credentials are valid or not.

Note When the configured AAA server(s) are not reachable, the user request is authenticated locally. If the AAA server is reachable and the user authentication fails, the user request is not authenticated locally.

Step 1 Navigate to the **AAA** tab under **System** and click **Add Server**.

The **Add AAA Server** window is displayed.

Step 2 In the **Add AAA Server** window, complete the following fields:

Name	Description
Protocol field	Choose the protocol for the AAA server. This can be one of the following: • **Radius+** • **TACACS+** • **LDAP** **Note** For detailed information about how to configure LDAP for AAA server, see Configuring User Authentication for LDAP.
Server Address field	Server IP address or Domain Name.
Secret field	The shared secret configured on the AAA server.

Name	Description
User Name field	User name for authentication..
Password field	Password for authenticating the user.

Step 3 (Optional) Click **Check Server** to verify whether the server is reachable and authentication credentials are valid or not.

Note The **Check Server** option is available only for TACACS AAA server.

Step 4 Click **Save**.

What to do next

If you chose RADIUS as the protocol for the AAA server, you need to configure user authentication for RADIUS.

Configuring User Authentication for RADIUS Server

User authorization on a RADIUS server must conform to the Cisco Attribute-Value (av-pair) format. In the RADIUS server, configure the Cisco av-pair attribute for a user as follows:

```
shell:roles="Network-Admin Slice-Admin"
```

Viewing Cluster Information

Navigate to the **Cluster** tab under **System** to view information about the clusters.

The cluster management dialog boxes are read-only. The dialog box lists the IP addresses of all of the Cisco Nexus Data Broker instances in the cluster.

Note For the backup and upload features to work properly, all the servers in the cluster should be stopped and then they should be restarted. You should not configure any functionality during this time. Once the upload configuration is done, you should not configure anything from any other nodes in the cluster as it might to lead to few inconsistencies in the data.

Viewing the OSGi Console

You can view all of Cisco Nexus Data Broker bundles that comprise the application by viewing the OSGi Web Console.

Note This procedure does not provide a step-by-step guide to everything you can do in the OSGi Web Console for **Cisco XNC Bundles** list. It guides you in opening the OSGi Web Console and viewing bundle information.

Step 1 Navigate to the **System** tab under **Administration**.
A new browser tab opens.

Step 2 Click **OSGI**.

Step 3 Enter your username and password, and then press **Enter**.

The **Cisco – XNC Bundles** list is displayed. In this page you can view all of the active packages, filter on the package name to specify bundle names, and complete other tasks.

Step 4 When you are finished viewing the list, close the **Cisco – XNC Bundles** browser tab.

Viewing the Northbound API Content

You can view all of Cisco Nexus Data Broker northbound API content for the application by opening a browser tab using the **Northbound API** tool (book icon) in the menu bar.

Step 1 From the menu bar, click the **Northbound API** button.

A new browser tab (Swagger UI) is opened and the complete list of northbound API content used in Cisco Nexus Data Broker is displayed.

From this tab, you can do the following:

- Show or hide the operations for an API.
- List the operations for an API.
- Expand the operations for an API.

Step 2 When you are finished viewing northbound API content, close the browser tab.

Downloading the System Log Files

You can download log files for Cisco Nexus Data Broker to use for analysis. Log files are saved as a .zip archive.

Note Starting with Cisco Nexus Data Broker Release 3.7, naming convention for the System log files has changed. The System log file name now reflects the time stamp when the file is generated. For example, `NDBLogs-21Aug2018_11_15_08.zip`.

Note Starting with Cisco Nexus Data Broker Release 3.7, the System log file now provides additional details such as the device connection information, number of redirections, and details about all the devices managed by NDB.

Step 1 Navigate to the **System** tab under **Administration**.

Step 2 Click **Download Logs**.

A dialog box opens in the browser prompting you to either open or save the .zip file.

Step 3 Do one of the following:

- Save the archive to a location of your choosing, for example, `home/ndbconfig`.
- Open the archive to view the contents, and then save it.

Backing Up or Restoring the Configuration Using NDB GUI

Starting with Cisco NDB, Release 3.4, you can create and restore a NDB configuration backup instantly during the pre-deployment phase. Support for instant backup is currently available in NX-OS, OpenFlow, and AUX switches.

Using this feature, a backup point is created with current NDB configuration that can be restored to the system. Cisco NDB provides three backup options:

- Schedule backup to NDB Server—Backup is created at the specified time in the NDB server in the backup directory of xnc.
- Backup now to NDB server—Backup is created in the NDB server in the backup directory of xnc.
- Backup now locally—Backup is created and available for download using Web browser.

Cisco NDB provides two restore options:

- Restore from Server—Configuration is restored from a server.
- Restore Locally—Configuration is restored from a local directory.

Backing Up or Restoring the Configuration Using the CLI

Step 1 Navigate to the `xnc/bin` directory that was created when you installed the software.

Step 2 Back up the configuration by entering the **./xnc config --backup** command.

The **--backup** option creates a backup archive (in .zip format) of the startup configuration in the current `xnc` distribution. The backup archive is stored in `{xncHome}/backup/`. A new archive is created each time that the backup command is entered using a filename with the current timestamp.

Step 3 Restore the configuration by entering the **./xnc config --restore --backupfile** {*zip_filename*} command.

The **--restore** option restores the startup configuration of the current `xnc` distribution from an existing backup archive. The restore action requires the absolute path of the backup archive.

Scheduling Configuration Backup to NDB Server

Beginning with Cisco Nexus Data Broker, Release 3.2, you can schedule automatic configuration backup to a server with a start date and an end date. Backup is created at the specified time in the NDB server in the backup directory of XNC. When any configuration is performed in Cisco Nexus Data Broker, it is saved automatically.

Note Beginning with Cisco Nexus Data Broker, Release 3.2, you do not need to use the **Save** option to save the Cisco Nexus Data Broker configurations. Even after you restart the server, the configuration is autosaved.

Step 1 Navigate to **Administration** -> **System** -> **Backup/Restore** tab.

Step 2 From the **Backup** drop-down list, select **Schedule backup to NDB Server** to open the **Schedule** page.

Step 3 In the **Schedule** page, enter the following details:

Field	Description
Start Date	Date to start the configuration backup.
Start Time	Time to start the configuration backup.
Choose Pattern	Select the pattern of the backup. Valid options are: • Daily • Weekly • Monthly
Choose	Select when to stop the backup process. Valid options are: • No End Date: Continue taking backup as per the specified frequency. • End Date: Continue taking backup till the specified date. • Occurences: Indicates the number of times to take the backup.
Enable	Enables the scheduled backup.

Restoring Configuration Locally

You can upload the saved system configuration files for Cisco Nexus Data Broker to restore the Cisco Nexus Data Broker application in the case of a failure or other event. After restoring you configuration, you will need to restart Cisco Nexus Data Broker.

Direct upload path to Cisco Nexus Data Broker is available from Cisco Nexus Data Broker, Release 3.0 or above. If you are running a previous release, upload it to Release 3.0 first before uploading to Release 3.2.

Step 1 Navigate to **Administration** > **System** > **Backup/ Restore**.

Step 2 Click the **Restore Locally** button.

The **Upload Configuration** pane is dislayed.

Step 3 Browse in your local machine and navigate to the file.

Step 4 Check the Restore checkbox.

When you check the Restore check box, the configuration is restored in the NDB switch too. This is applicable for release 3.8 and after.

The backup earlier performed by clicking the **Backup** button is used for restore.

Step 5 Click **Upload Configuration**.

Step 6 Restart the server, and then log back in to the Cisco Nexus Data Broker GUI.

Backing Up Configuration Locally

Configuration backup is created in the local machine in the specified directory. You can backup the system configuration locally in case you need to restore the system after an upgrade or other change. System configuration files are saved in a zipped archive.

Step 1 Navigate to **Administration** -> **System** -> **Backup/Restore** tab.

Step 2 From the **Backup** drop-down list, select **backup now locally**.
The configuration backup is created and dowloaded to the local directory.

Restoring Configuration from a Server

You can restore NDB configuration from a server using the NDB GUI. Complete the following steps to restore a confguration from a server:

SUMMARY STEPS

1. Navigate to **Administration** -> **System** -> **Backup/Restore** tab.
2. Select a backup from the list and click **Restore** to restore the selected configuration.

DETAILED STEPS

Step 1 Navigate to **Administration** -> **System** -> **Backup/Restore** tab.

Step 2 Select a backup from the list and click **Restore** to restore the selected configuration.

Recovering the Administrative Password

The Cisco Nexus Data Broker network administrator user can return the administrative password to the factory default.

Note The software may or may not be running when this command is used. If the software is not running, the password reset takes effect the next time that it is run.

Step 1 Open a command window where you installed Cisco Nexus Data Broker.

Step 2 Navigate to the `xnc/bin` directory that was created when you installed the software.

Step 3 Reset the administrative password by entering the **./xnc reset-admin-password** [**--wait-seconds** {*wait_time*} **--password** {*password*}] command.

Resets the admin password to the default or specified password by restarting the user manager.

- The **wait-seconds** is the length of time, in seconds, to wait for the user manager to restart. The minimum is 5 seconds and the maximum is 60 seconds.
- The **password** is the administrative password.

Note
- The password must be from 8 to 256 characters, contain both uppercase and lowercase characters, and have at least one number and one non-alphanumeric character.
- If you leave the password blank, it is reset to the factory default of "admin".
- Each time that you reset the administrative password, make sure that the new password meets these requirements or you will not be able to log in to Cisco Nexus Data Broker.

Uninstalling the Application Software

Before you begin

Ensure that your Cisco Nexus Data Broker application is stopped before proceeding.

Step 1 Navigate to the directory where you created the Cisco Nexus Data Broker installation.

For example, if you installed the software in `Home/CiscoNDB`, navigate to the `Home` directory.

Step 2 Delete the `CiscoNDB` directory.

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