



## Overview

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## Licensing Requirements

For a complete explanation of Cisco NX-OS licensing recommendations and how to obtain and apply licenses, see the [Cisco NX-OS Licensing Guide](#).

## Software Image

The Cisco NX-OS software consists of the NXOS software image (nxos.9.2.2t.bin). This image runs on all Cisco Nexus 3400-S Series switches.

## Software Compatibility

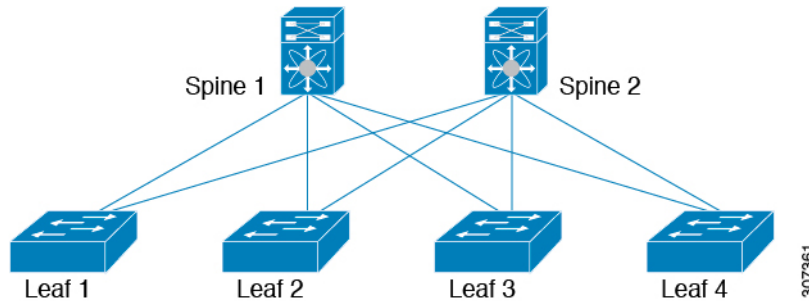
The Cisco NX-OS software interoperates with Cisco products that run any variant of the Cisco IOS software. The Cisco NX-OS software also interoperates with any networking operating system that conforms to the IEEE and RFC compliance standards.

## Spine/Leaf Topology

The Cisco Nexus 3400-S Series switches support a two-tier spine/leaf topology.

The following figure shows an example of a spine/leaf topology with four leaf switches connecting into two spine switches and two Ethernet uplinks from each leaf to each spine.

**Figure 1: Spine/Leaf Topology**



## Modular Software Design

The Cisco NX-OS software supports distributed multithreaded processing on symmetric multiprocessors (SMPs) and multi-core CPUs. The modular processes are created on demand, each in a separate protected memory space. Processes are started and system resources are allocated only when you enable a feature. A real-time preemptive scheduler helps to ensure the timely processing of critical functions.

## Serviceability

The Cisco NX-OS software has serviceability functions that allow the device to respond to network trends and events. These features help you with network planning and improving response times.

## Switched Port Analyzer

The Switched Port Analyzer (SPAN) feature allows you to analyze all traffic between ports (called the SPAN source ports) by nonintrusively directing the SPAN session traffic to a SPAN destination port that has an external analyzer attached to it. For more information about SPAN, see the *Cisco Nexus 3400-S Series NX-OS System Management Configuration Guide*.

## Ethalyzer

Ethalyzer is a Cisco NX-OS protocol analyzer tool based on the Wireshark (formerly Ethereal) open source code. Ethalyzer is a command-line version of Wireshark for capturing and decoding packets. You can use Ethalyzer to troubleshoot your network and analyze the control-plane traffic. .

## Smart Call Home

The Call Home feature continuously monitors hardware and software components to provide e-mail-based notification of critical system events. A versatile range of message formats is available for optimal compatibility with pager services, standard e-mail, and XML-based automated parsing applications. It offers alert grouping capabilities and customizable destination profiles. You can use this feature, for example, to directly page a network support engineer, send an e-mail message to a network operations center (NOC), and employ Cisco

AutoNotify services to directly generate a case with the Cisco Technical Assistance Center (TAC). For more information about Smart Call Home, see the *Cisco Nexus 3400-S Series NX-OS System Management Configuration Guide*.

## Online Diagnostics

Cisco generic online diagnostics (GOLD) verify that hardware and internal data paths are operating as designed. Boot-time diagnostics, continuous monitoring, and on-demand and scheduled tests are part of the Cisco GOLD feature set. GOLD allows rapid fault isolation and continuous system monitoring. For information about configuring GOLD, see the *Cisco Nexus 3400-S Series NX-OS System Management Configuration Guide*.

## Embedded Event Manager

Cisco Embedded Event Manager (EEM) is a device and system management feature that helps you to customize behavior based on network events as they happen. For information about configuring EEM, see the *Cisco Nexus 3400-S Series NX-OS System Management Configuration Guide*.

## Manageability

This section describes the manageability features for the Cisco Nexus 3400-S Series switches.

## Simple Network Management Protocol

The Cisco NX-OS software is compliant with Simple Network Management Protocol (SNMP) version 1, version 2, and version 3. A large number of MIBs is supported. For more information about SNMP, see the *Cisco Nexus 3400-S Series NX-OS System Management Configuration Guide*.

## Configuration Verification and Rollback

The Cisco NX-OS software allows you to verify the consistency of a configuration and the availability of necessary hardware resources prior to committing the configuration. You can preconfigure a device and apply the verified configuration at a later time. Configurations also include checkpoints that allow you to roll back to a known good configuration as needed. For more information about rollbacks, see the *Cisco Nexus 3400-S Series NX-OS System Management Configuration Guide*.

## Role-Based Access Control

With role-based access control (RBAC), you can limit access to device operations by assigning roles to users. You can customize access and restrict it to the users who require it. For more information about RBAC, see the *Cisco Nexus 3400-S Series NX-OS Security Configuration Guide*.

## Cisco NX-OS Device Configuration Methods

You can use these methods to configure Cisco NX-OS devices:

- The CLI from a Secure Shell (SSH) session, a Telnet session, or the console port. SSH provides a secure connection to the device. The CLI configuration guides are organized by feature. For more information,

see the Cisco NX-OS configuration guides. For more information about SSH and Telnet, see the *Cisco Nexus 3400-S Series NX-OS Security Configuration Guide*.

- The XML management interface, which is a programmatic method based on the NETCONF protocol that complements the CLI. For more information, see the *Cisco NX-OS XML Interface User Guide*.
- The Cisco Data Center Network Management (DCNM) client, which runs on your local PC and uses web services on the Cisco DCNM server. The Cisco DCNM server configures the device over the XML management interface. For more information about the Cisco DCNM client, see the *Cisco DCNM Fundamentals Guide*.

## Programmability

This section describes the programmability features for the Cisco Nexus 3400-S Series switches.

### Python API

Python is an easy-to-learn, powerful programming language. It has efficient high-level data structures and a simple but effective approach to object-oriented programming. Python's elegant syntax and dynamic typing, together with its interpreted nature, make it an ideal language for scripting and rapid application development in many areas on most platforms. The Python interpreter and the extensive standard library are freely available in source or binary form for all major platforms from the Python website: <http://www.python.org/>. The Python scripting capability gives programmatic access to the CLI to perform various tasks and Power-On Auto Provisioning (POAP) or Embedded Event Manager (EEM) actions. For more information about the Python API and Python scripting, see the *Cisco Nexus 3400-S Series NX-OS Programmability Guide*.

### Tcl

Tool Command Language (Tcl) is a scripting language. With Tcl, you gain more flexibility in your use of the CLI commands on the device. You can use Tcl to extract certain values in the output of a **show** command, perform switch configurations, run Cisco NX-OS commands in a loop, or define EEM policies in a script.

### Cisco NX-API

The Cisco NX-API provides web-based programmatic access to the Cisco Nexus 3400-S Series switches. This support is delivered through the NX-API open-source web server. The Cisco NX-API exposes the complete configuration and management capabilities of the command-line interface (CLI) through web-based APIs. You can configure the switch to publish the output of the API calls in either XML or JSON format. For more information about the Cisco NX-API, see the *Cisco Nexus 3400-S Series NX-OS Programmability Guide*.



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**Note**

NX-API performs authentication through a programmable authentication module (PAM) on the switch. Use cookies to reduce the number of PAM authentications and thus reduce the load on PAM.

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### Bash Shell

The Cisco Nexus 3400-S Series switches support direct Linux shell access. With Linux shell support, you can access the Linux system on the switch in order to use Linux commands and manage the underlying system.

For more information about Bash shell support, see the *Cisco Nexus 3400-S Series NX-OS Programmability Guide*.

## About the Innovium Shell

The Cisco Nexus 3400-S platform switches consist of the following:

- Cisco Nexus 3408-S, which is a 4-RU switch with 8 module slots. The module slots can accept a mix of line-card expansion modules (LEMs) for extra high-speed connectivity.
- Cisco Nexus 3432D-S, which is a 1-RU chassis switch with a fixed port configuration. This switch has no module slots or LEMs.

Cisco Nexus 3400-S platform switches use Innovium Teralynx ASICs, which exist on the switch motherboard. A specific shell enables access directly to the ASICs, or passing ASIC commands to the shell from Cisco NX-OS. This shell is the Innovium shell (innoshell).

## Traffic Routing, Forwarding, and Management

This section describes the traffic routing, forwarding, and management features supported by the Cisco NX-OS software.

### Ethernet Switching

The Cisco NX-OS software supports high-density, high-performance Ethernet systems and provides the following Ethernet switching features:

- IEEE 802.1D-2004 Rapid and Multiple Spanning Tree Protocols (802.1w and 802.1s)
- IEEE 802.1Q VLANs and trunks
- IEEE 802.3ad link aggregation
- Unidirectional Link Detection (UDLD) in aggressive and standard modes

For more information, see the *Cisco Nexus 3400-S Series NX-OS Interfaces Configuration Guide* and the *Cisco Nexus 3400-S Series NX-OS Layer 2 Switching Configuration Guide*.

### IP Routing

The Cisco NX-OS software supports IP version 4 (IPv4) and IP version 6 (IPv6) and the following routing protocols:

- Open Shortest Path First (OSPF) Protocol Versions 2 (IPv4) and 3 (IPv6)
- Intermediate System-to-Intermediate System (IS-IS) Protocol (IPv4 and IPv6)
- Border Gateway Protocol (BGP) (IPv4 and IPv6)
- Enhanced Interior Gateway Routing Protocol (EIGRP) (IPv4 only)
- Routing Information Protocol Version 2 (RIPv2) (IPv4 only)

The Cisco NX-OS software implementations of these protocols are fully compliant with the latest standards and include 4-byte autonomous system numbers (ASNs) and incremental shortest path first (SPF). All unicast protocols support Non-Stop Forwarding Graceful Restart (NSF-GR). All protocols support all interface types, including Ethernet interfaces, VLAN interfaces, subinterfaces, port channels, and loopback interfaces.

For more information, see the *Cisco Nexus 3400-S Series NX-OS Unicast Routing Configuration Guide*.

## IP Services

The following IP services are available in the Cisco NX-OS software:

- Virtual routing and forwarding (VRF)
- Dynamic Host Configuration Protocol (DHCP) helper
- Hot Standby Router Protocol (HSRP)
- Enhanced object tracking
- Unicast graceful restart for all protocols in IPv4 unicast graceful restart for OPSFv3 in IPv6

For more information, see the *Cisco Nexus 3400-S Series NX-OS Unicast Routing Configuration Guide*.

## Quality of Service

The Cisco NX-OS software supports quality of service (QoS) functions for classification, marking, queuing, policing, and scheduling. Modular QoS CLI (MQC) supports all QoS features. You can use MQC to provide uniform configurations across various Cisco platforms. For more information, see the *Cisco Nexus 3400-S Series NX-OS Quality of Service Configuration Guide*.

## Network Security Features

The Cisco NX-OS software includes the following security features:

- Control Plane Policing (CoPP)
- Message-digest algorithm 5 (MD5) routing protocol authentication
- Authentication, authorization, and accounting (AAA)
- RADIUS and TACACS+
- SSH Protocol Version 2
- SNMPv3
- Policies based on MAC and IPv4 addresses supported by named ACLs (port-based ACLs [PACLs], VLAN-based ACLs [VACLs], and router-based ACLs [RACLs])
- Traffic storm control (unicast, multicast, and broadcast)

For more information, see the *Cisco Nexus 3400-S Series NX-OS Security Configuration Guide*.

## Supported Standards

This table lists the IEEE compliance standards.

**Table 1: IEEE Compliance Standards**

Standard	Description
802.1D	MAC Bridges
802.1p	Class of Service Tagging for Ethernet frames
802.1Q	VLAN Tagging
802.1s	Multiple Spanning Tree Protocol
802.1w	Rapid Spanning Tree Protocol
802.3ab	1000Base-T (10/100/1000 Ethernet over copper)
802.3ad	Link aggregation with LACP
802.3ae	10-Gigabit Ethernet

This table lists the RFC compliance standards. For information on each RFC, see [www.ietf.org](http://www.ietf.org).

**Table 2: RFC Compliance Standards**

Standard	Description
<b>BGP</b>	
<a href="#">RFC 1997</a>	<i>BGP Communities Attribute</i>
<a href="#">RFC 2385</a>	<i>Protection of BGP Sessions via the TCP MD5 Signature Option</i>
<a href="#">RFC 2439</a>	<i>BGP Route flap damping</i>
<a href="#">RFC 2519</a>	<i>A Framework for Inter-Domain Route Aggregation</i>
<a href="#">RFC 2545</a>	<i>Use of BGP-4 Multiprotocol Extensions for IPv6 Inter-Domain Routing</i>
<a href="#">RFC 2858</a>	<i>Multiprotocol Extensions for BGP-4</i>
<a href="#">RFC 2918</a>	<i>Route Refresh Capability for BGP-4</i>
<a href="#">RFC 3065</a>	<i>Autonomous System Confederations for BGP</i>

Standard	Description
<a href="#">RFC 3392</a>	<i>Capabilities Advertisement with BGP-4</i>
<a href="#">RFC 4271</a>	<i>BGP version 4</i>
<a href="#">RFC 4273</a>	<i>BGP4 MIB - Definitions of Managed Objects for BGP-4</i>
<a href="#">RFC 4456</a>	<i>BGP Route Reflection: An Alternative to Full Mesh Internal BGP (IBGP)</i>
<a href="#">RFC 4486</a>	<i>Subcodes for BGP cease notification message</i>
<a href="#">RFC 4724</a>	<i>Graceful Restart Mechanism for BGP</i>
<a href="#">RFC 4893</a>	<i>BGP Support for Four-octet AS Number Space</i>
<a href="#">RFC 5004</a>	<i>Avoid BGP Best Path Transitions from One External to Another</i>
<a href="#">RFC 5396</a>	<p><i>Textual Representation of Autonomous System (AS) Numbers</i></p> <p><b>Note</b> RFC 5396 is partially supported. The asplain and asdot notations are supported, but the asdot+ notation is not.</p>
<a href="#">RFC 5549</a>	<i>Advertising IPv4 Network Layer Reachability Information with an IPv6 Next Hop</i>
<a href="#">RFC 5668</a>	<i>4-Octet AS Specific BGP Extended Community</i>
ietf-draft	Bestpath transition avoidance (draft-ietf-idr-avoid-transition-05.txt)
ietf-draft	Peer table objects (draft-ietf-idr-bgp4-mib-15.txt)
ietf-draft	Dynamic Capability (draft-ietf-idr-dynamic-cap-03.txt)
<b>IP Services</b>	
<a href="#">RFC 768</a>	<i>UDP</i>



<b>Standard</b>	<b>Description</b>
RFC 783	<i>TFTP</i>
RFC 791	<i>IP</i>
RFC 792	<i>ICMP</i>
RFC 793	<i>TCP</i>
RFC 826	<i>ARP</i>
RFC 854	<i>Telnet</i>
RFC 959	<i>FTP</i>
RFC 1027	<i>Proxy ARP</i>
RFC 1305	<i>NTP v3</i>
RFC 1519	<i>CIDR</i>
RFC 1542	<i>BootP relay</i>
RFC 1591	<i>DNS client</i>
RFC 1812	<i>IPv4 routers</i>
RFC 2131	<i>DHCP Helper</i>
RFC 2338	<i>VRRP</i>
<b>IS-IS</b>	
RFC 1142 (OSI 10589)	<i>OSI 10589 Intermediate system to intermediate system intra-domain routing exchange protocol</i>
RFC 1195	<i>Use of OSI IS-IS for routing in TCP/IP and dual environment</i>
RFC 2763	<i>Dynamic Hostname Exchange Mechanism for IS-IS</i>
RFC 2966	<i>Domain-wide Prefix Distribution with Two-Level IS-IS</i>
RFC 2973	<i>IS-IS Mesh Groups</i>
RFC 3277	<i>IS-IS Transient Blackhole Avoidance</i>
RFC 3373	<i>Three-Way Handshake for IS-IS Point-to-Point Adjacencies</i>
RFC 3567	<i>IS-IS Cryptographic Authentication</i>

<b>Standard</b>	<b>Description</b>
<a href="#">RFC 3847</a>	<i>Restart Signaling for IS-IS</i>
ietf-draft	Internet Draft Point-to-point operation over LAN in link-state routing protocols (draft-ietf-isis-igp-p2p-over-lan-06.txt)
<b>OSPF</b>	
<a href="#">RFC 2328</a>	<i>OSPF Version 2</i>
<a href="#">RFC 2370</a>	<i>OSPF Opaque LSA Option</i>
<a href="#">RFC 2740</a>	<i>OSPF for IPv6 (OSPF version 3)</i>
<a href="#">RFC 3101</a>	<i>OSPF Not-So-Stubby-Area (NSSA) Option</i>
<a href="#">RFC 3137</a>	<i>OSPF Stub Router Advertisement</i>
<a href="#">RFC 3509</a>	<i>Alternative Implementations of OSPF Area Border Routers</i>
<a href="#">RFC 3623</a>	<i>Graceful OSPF Restart</i>
<a href="#">RFC 4750</a>	<i>OSPF Version 2 MIB</i>
<b>RIP</b>	
<a href="#">RFC 1724</a>	<i>RIPv2 MIB extension</i>
<a href="#">RFC 2082</a>	<i>RIPv2 MD5 Authentication</i>
<a href="#">RFC 2453</a>	<i>RIP Version 2</i>
<b>SNMP</b>	
<a href="#">RFC 2579</a>	<i>Textual Conventions for SMIV2</i>
<a href="#">RFC 2819</a>	<i>Remote Network Monitoring Management Information Base</i>
<a href="#">RFC 2863</a>	<i>The Interfaces Group MIB</i>
<a href="#">RFC 3164</a>	<i>The BSD syslog Protocol</i>
<a href="#">RFC 3176</a>	<i>InMon Corporation's sFlow: A Method for Monitoring Traffic in Switched and Routed Networks</i>

Standard	Description
<a href="#">RFC 3411</a> and <a href="#">RFC 3418</a>	<i>An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks</i>
<a href="#">RFC 3413</a>	<i>Simple Network Management Protocol (SNMP) Applications</i>
<a href="#">RFC 3417</a>	<i>Transport Mappings for the Simple Network Management Protocol (SNMP)</i>

