Overview

This chapter contains the following topics:

Programmability Overview

The Cisco NX-OS software running on the Cisco Nexus 3400-S platform switches is as follows:

- **Resilient**

  Provides critical business-class availability.

- **Modular**

  Has extensions that accommodate business needs.

- **Highly Programmatic**

  Allows for rapid automation and orchestration through Application Programming Interfaces (APIs).

- **Secure**

  Protects and preserves data and operations.

- **Flexible**

  Integrates and enables new technologies.

- **Scalable**

  Accommodates and grows with the business and its requirements.

- **Easy to use**

  Reduces the amount of learning required, simplifies deployment, and provides ease of manageability.

With the Cisco NX-OS operating system, the device functions in the unified fabric mode to provide network connectivity with programmatic automation functions.

Cisco NX-OS contains Open Source Software (OSS) and commercial technologies that provide automation, orchestration, programmability, monitoring, and compliance support.

For more information on Open NX-OS, see https://developer.cisco.com/site/nx-os/.

Standard Network Manageability Features

- SNMP (V1, V2, V3)
- Syslog
- RMON
- NETCONF
- CLI and CLI scripting

Advanced Automation Feature

The enhanced Cisco NX-OS on the device supports automation. The platform includes support for Power On Auto Provisioning (POAP).

The enhanced Cisco NX-OS on the device supports automation. The platform includes the following feature that supports automation:

- Power On Auto Provisioning (POAP) support

Power on Auto Provisioning Support

Power On Auto Provisioning (POAP) automates the process of installing and upgrading software images and installing configuration files on switches that are being deployed in the network for the first time. It reduces the manual tasks that are required to scale the network capacity.

When a switch with the POAP feature boots and does not find the startup configuration, the device enters POAP mode. It locates a DHCP server and bootstraps itself with its interface IP address, gateway, and DNS server IP addresses. The device obtains the IP address of a TFTP server or the URL of an HTTP server and downloads a configuration script that enables the device to download and install the appropriate software image and configuration file.

Programmability Support

Cisco NX-OS software on Cisco Nexus 3400-S platform switches support several capabilities to aid programmability.

NX-API Support

Cisco NX-API allows for HTTP-based programmatic access to the switch. This support is delivered by NX-API, an open source webserver. NX-API provides the configuration and management capabilities of the

Cisco NX-OS CLI with web-based APIs. The switch can be set to publish the output of the API calls in XML or JSON format. This API enables rapid development on the switch.

Python Scripting

Cisco Nexus 3400-S platform switches support Python v2.7.5 and later in both interactive and noninteractive (script) modes.

Beginning in Cisco NX-OS Release 9.3(5), support for Python 3 was added.

The Python scripting capability on the devices provides programmatic access to the switch CLI to perform various tasks, and to Power-On Auto Provisioning (POAP) and Embedded Event Manager (EEM) actions. Responses to Python calls that invoke the Cisco NX-OS CLI return text or JSON output.

The Python interpreter is included in the Cisco NX-OS software.

Tcl Scripting

Cisco Nexus 3400-S platform switches support Tcl (Tool Command Language). Tcl is a scripting language that enables greater flexibility with CLI commands on the switch. 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.

Bash

Cisco Nexus 3400-S platform switches support direct Bourne-Again Shell (Bash) access. With Bash, you can access the underlying Linux system on the device and manage the system.

Bash Shell Access and Linux Container Support

The Cisco Nexus 3400-S platform switches support direct Linux shell access and Linux containers. With Linux shell access, you can access the underlying Linux system on the switch and manage the underlying system. You can also use Linux containers to securely install your own software and to enhance the capabilities of the switch. For example, you can install bare-metal provisioning tools like Cobbler on a switch to enable automatic provisioning of bare-metal servers from the top-of-rack switch.

Guest Shell

The Cisco Nexus 3400-S platform switches support a guest shell that provides Bash access into a Linux execution space on the host system that is decoupled from the host Cisco NX-OS software. With the guest shell, you can add software packages and update libraries as needed without impacting the host system software.

Container Tracker Support

Cisco NX-OS can communicate with the Kubernetes API Server to understand the capabilities of the containers behind a given switch port.

The following commands communicate with the Kubernetes API Server:

- The **show containers kubernetes** command obtains data from *kube-apiserver* using API calls over HTTP.
- The **kubernetes watch** *resource* command uses a daemon to subscribe to requested resources and process streaming data from *kube-apiserver*.
- The **action** assigned in the **watch** command is performed on pre-defined triggers. (For example, Add or Delete of a Pod.)

Perl Modules

The Cisco Nexus 3400-S platform switches support the following selected PERL modules.:

- bytes.pm
- feature.pm
- hostname.pl
- lib.pm
- overload.pm
- Carp.pm
- Class/Struct.pm
- Data/Dumper.pm
- DynaLoader.pm
- Exporter/Heavy.pm
- FileHandle.pm
- File/Basename.pm
- File/Glob.pm
- File/Spec.pm
- File/Spec/Unix.pm
- File/stat.pm
- Getopt/Std.pm
- IO.pm
- IO/File.pm
- IO/Handle.pm
- IO/Seekable.pm
- IO/Select.pm
- List/Util.pm
- MIME/Base64.pm

- SelectSaver.pm
- Socket.pm
- Symbol.pm
- Sys/Hostname.pm
- Time/HiRes.pm
- auto/Data/Dumper/Dumper.so
- auto/File/Glob/Glob.so
- auto/IO/IO.so
- auto/List/Util/Util.so
- auto/MIME/Base64/Base64.so
- auto/Socket/Socket.so
- auto/Sys/Hostname/Hostname.so
- auto/Time/HiRes/HiRes.so