Using PowerOn Auto Provisioning

This chapter describes how to deploy and use PowerOn Auto Provisioning (POAP)

This chapter contains the following sections:

Information About PowerOn Auto Provisioning

PowerOn Auto Provisioning (POAP) automates the process of upgrading software images and installing configuration files on Cisco Nexus switches that are being deployed in the network for the first time.

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

Note   The DHCP information is used only during the POAP.

POAP requires the following network infrastructure:

- A DHCP server to bootstrap the interface IP address, gateway address, and DNS server
- A TFTP or HTTP server containing the configuration script used to automate the software image installation and configuration process

• One or more servers containing the desired software images and configuration files

Figure 1: POAP Network Infrastructure
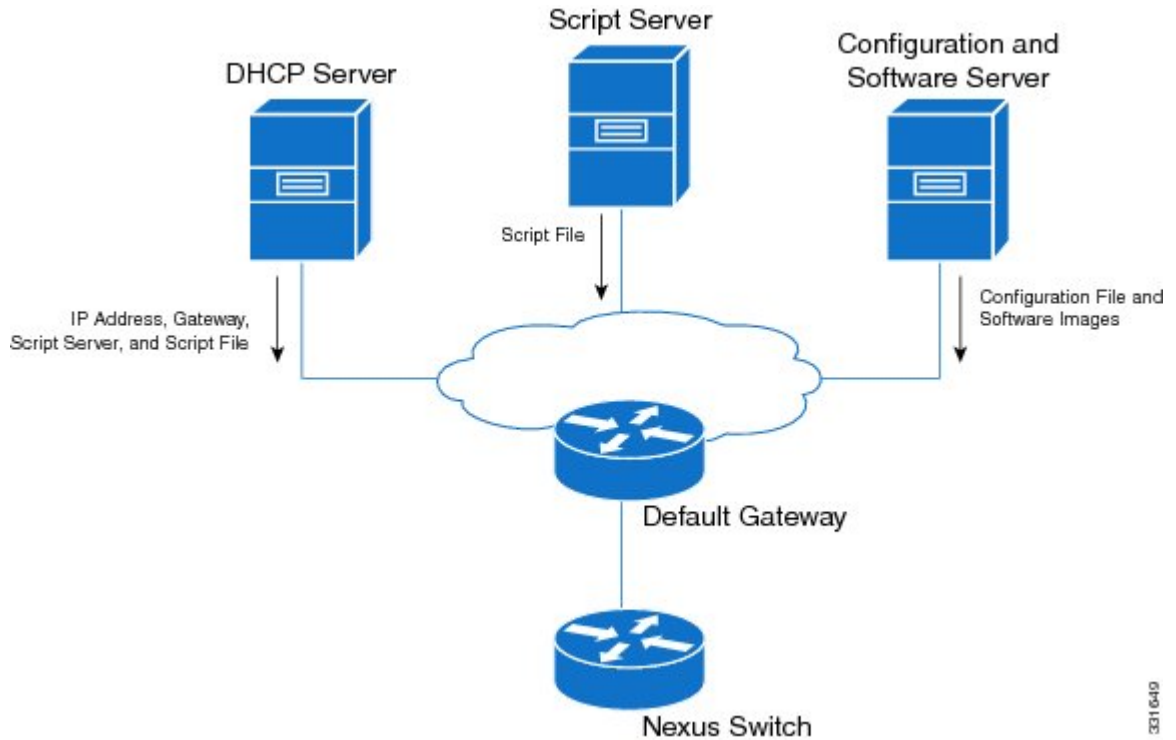
POAP Configuration Script

The reference script supplied by Cisco supports the following functionality:

• Retrieves the switch-specific identifier, for example, the serial number.

• Downloads the software image (system and kickstart images) if the files do not already exist on the switch. The software image is installed on the switch and is used at the next reboot.

• Schedules the downloaded configuration to be applied at the next switch reboot.

• Stores the configuration as the startup-configuration.

We provide sample configuration scripts that were developed using the Python programming language and Tool Command Language (Tcl). You can customize one of these scripts to meet the requirements of your network environment. For information about customizing this script using Python, see the *Python Scripting and API Configuration Guide* at this URL: http://www.cisco.com/en/US/products/ps11541/products_ programming_reference_guides_list.html.
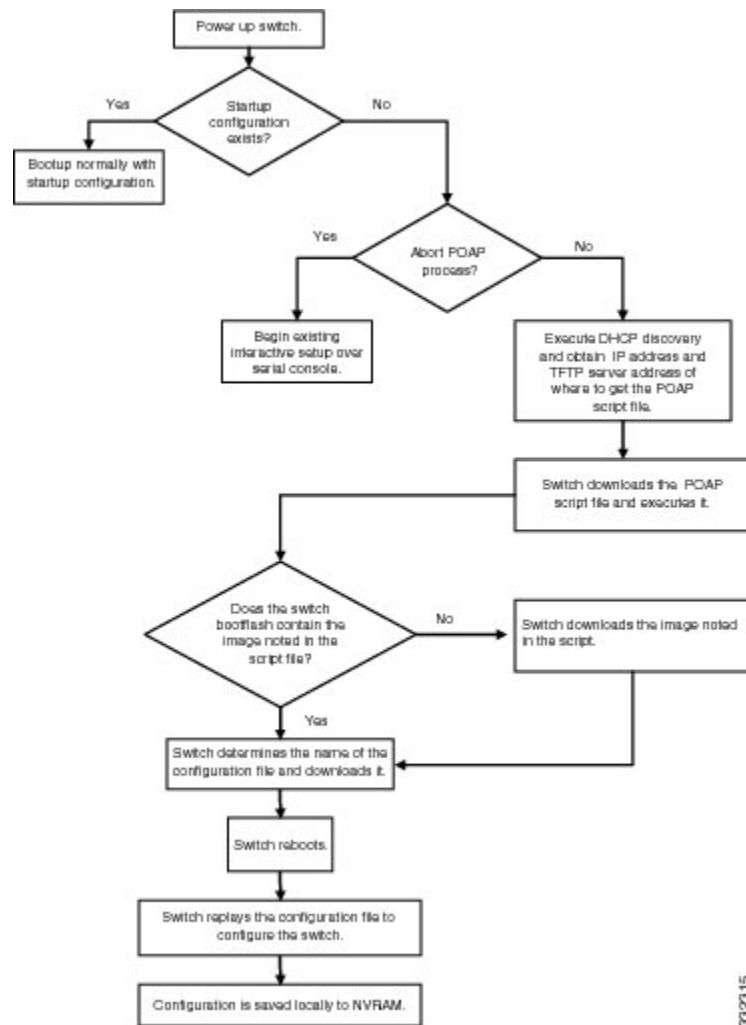
POAP Process

The POAP process has four phases:

1 Power up

2 DHCP discovery

3 Script execution

4 Post-installation reload

Within these phases, other process and decision points occur. The following illustration shows a flow diagram of the POAP process.

Figure 2: POAP Process

Power-Up Phase

When you power-up a switch for the first time, it loads the software image installed at manufacturing and tries to find a configuration file from which to boot. When no configuration file is found, POAP mode starts.

During startup, a prompt appears asking if you want to abort POAP and continue with normal setup. You can choose to exit or continue with POAP.

> **Note** No user intervention is required for POAP to continue. The prompt that asks if you want to abort POAP remains available until the POAP process is complete.

If you exit POAP mode, you enter the normal interactive setup script. If you continue in POAP mode, all the front-panel interfaces are set up in Layer 3 mode, which ensures that the device does not participate in any Layer 2 forwarding.

DHCP Discovery Phase

The switch sends out DHCP discover messages on all of the active interfaces (including the mgmt interface) soliciting DHCP offers from the DHCP server or servers. The DCHP client on the Cisco Nexus switch uses the switch serial number in the client-identifier option to identify itself to the DHCP server. The DHCP server can use this identifier to send information, such as the IP address and script file name, back to the DHCP client.

The DHCP discover message also solicits the following options from the DHCP server.

- TFTP server name or TFTP server address—The DHCP server relays the TFTP server name or TFTP server address to the DHCP client. The DHCP client uses this information to contact the TFTP server to obtain the script file.

- Bootfile name—The DHCP server relays the bootfile name to the DHCP client. The bootfile name includes the complete path to the bootfile on the TFTP server. The DHCP client uses this information to download the script file.

When multiple DHCP offers that meet the requirement are received, an offer is randomly chosen. The device completes the DHCP negotiation (request and acknowledgment) with the selected DHCP server, and the DHCP server assigns an IP address to the switch. If there is a failure in any of the subsequent steps in the POAP process, the IP address is released back to the DHCP server.

If no DHCP offers meet the requirements, the switch does not complete the DHCP negotiation (request and acknowledgment) and an IP address is not assigned.

Figure 3: DHCP Discovery Phase
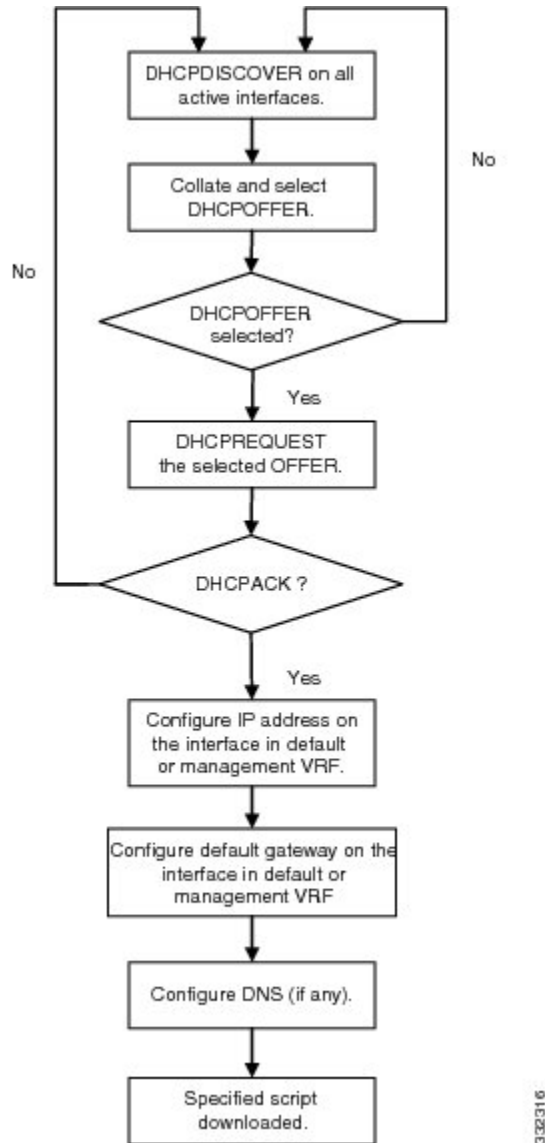
Script Execution Phase

Once the device has bootstrapped itself using the information in the DHCP acknowledgement, the script file is downloaded from the TFTP server or the HTTP server.

The switch runs the configuration script, which downloads and installs the software image and downloads a switch-specific configuration file.

However, the configuration file is not applied to the switch at this point, because the software image currently running on the switch might not support all of the commands in the configuration file. After the switch reboots,

it begins running the new software image, if one was installed. At that point, the configuration is applied to the switch.

Note If the switch loses connectivity, the script stops, and the switch reloads its original software images and bootup variables.

Post-Installation Reload Phase

The switch restarts and applies (replays) the configuration on the upgraded software image. Afterward, the switch copies the running configuration to the startup configuration.

Guidelines and Limitations for POAP

- The Cisco Nexus switch software image must support POAP for this feature to function.

- POAP does not support provisioning of the switch after it has been configured and is operational. Only auto-provisioning of a switch with no startup configuration is supported.

- If a LACP Layer 3 port-channel is configured on an uplink device connected to the Cisco Nexus device that is being bootstrapped using POAP, the port-channel is not active because all the member links are in a suspended state. Therefore, the Cisco Nexus device that is being bootstrapped using POAP cannot reach the DHCP server or any other infrastructure device needed for POAP. To work around this issue, configure a static L3 port-channel on the uplink device connected to the Cisco Nexus device that is being bootstrapped using POAP.

- If you use POAP to bootstrap a Cisco Nexus device that is a part of a vPC pair using static port-channels on the VPC links, the Cisco Nexus device activates all of its links upon POAP startup. The dually connected device at the end of the VPC links might start sending some or all of its traffic to the port-channel member links connected to the Cisco Nexus device, and the traffic would be lost.

   To work around this issue, you can configure LACP on the vPC links so that the links do not incorrectly start forwarding traffic to the Cisco Nexus device that is being bootstrapped using POAP.

- If you use POAP to bootstrap a Cisco Nexus device that is connected downstream to a Cisco Nexus Series 7000 device through a LACP port-channel, the Cisco Nexus 7000 Series device defaults to suspend its member port if it cannot bundle it as a part of a port-channel. To work around this issue, configure the Cisco Nexus 7000 Series device to not suspend its member ports using the no lacp suspend-individual command from interface configuration mode.

- Important POAP updates are logged in the syslog and are available from the serial console.

- Critical POAP errors are logged to the bootflash. The filename format is *date-time*_poap_*PID*_[init,1,2].log, where *date-time* is in the YYYYMMDD_hhmmss format and *PID* is the process ID.

- Script logs are saved in the bootflash directory. The filename format is *date-time*_poap_*PID*_script.log, where *date-time* is in the YYYYMMDD_hhmmss format and *PID* is the process ID.

Setting Up the Network Environment To Use POAP

Procedure

Step 1   Modify the basic configuration script provided by Cisco or create your own script. For information, see the *Python Scripting and API Configuration Guide*.

Step 2   Every time you make a change to the configuration script, ensure that you recalculate the MD5 checksum by running **# f=poap_fabric.py ; cat $f | sed '/^#md5sum/d' > $f.md5 ; sed -i "s/^#md5sum=.*/#md5sum=\"$(md5sum $f.md5 | sed 's/ .*//')\"/" $f** using a bash shell. For more information, see the *Python API Reference Guide*

Step 3   (Optional) Put the POAP configuration script and any other desired software image and switch configuration files on a USB device accessible to the switch.

Step 4   Deploy a DHCP server and configure it with the interface, gateway, and TFTP server IP addresses and a bootfile with the path and name of the configuration script file. (This information is provided to the switch when it first boots.)
You do not need to deploy a DHCP server if all software image and switch configuration files are on the USB device.

Step 5   Deploy a TFTP or HTTP server to host the configuration script.

Step 6   Deploy one or more servers to host the software images and configuration files.

Configuring a Switch Using POAP

Before You Begin

Make sure the network environment is set up to use POAP. For information, see the section.

Procedure

Step 1   Install the switch in the network.

Step 2   Power on the switch.
If no configuration file is found, the switch boots in POAP mode and displays a prompt asking if you want to abort POAP and continue with normal setup.

Step 3   No entry is required to continue to boot in POAP mode. If you want to exit POAP mode and enter the normal interactive setup script, enter **y** (yes).
The switch boots, and the POAP process begins. For information, see the section.

What to Do Next

Verify the configuration.

Verifying the Device Configuration

Use one of the following commands to verify the configuration after bootstrapping the device using POAP:

Command	Purpose
show running-config	Displays the running configuration.
show startup-config	Displays the startup configuration.

For detailed information about the fields in the output from these commands, see the *Cisco Nexus 3000 Series NX-OS Command Reference*.