Campus Software Image Management Using Cisco DNA Center Deployment Guide

Prescriptive Deployment Guide

November, 2019
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Introduction

Audience
The audience for this document is network administrators who wish to automate the upgrade of a Catalyst 9000 series switch at a branch or campus using Cisco DNA Center software image management (SWIM) solution.

About The Solution
Cisco DNA Center stores all the unique software images according to image type and version for the devices in your network. It allows to view, import, and delete software images and also push software images to the devices in your network. Software upgrade can also be scheduled for later date and time.

About This Guide
This guide demonstrates the value of the Cisco DNA Center software image management (SWIM) solution using a specific combination of equipment, OS version, and configuration. You may apply this procedure to any Catalyst 9000 series switch but in this guide, we will only focus on Catalyst 9300 switch.

Reader tip
For more information on Cisco DNA Center supported devices please refer to the compatibility matrix information https://www.cisco.com/c/en/us/support/cloud-systems-management/dna-center/products-device-support-tables-list.html

Use Cases
Standardize software images for your network devices with software image management (SWIM).
This document contains four major sections:

- The **Define** section presents a high-level overview of how software image management (SWIM) within Cisco DNA Center can help reduce device installation and upgrade times from hours to minutes.
- The **Design** section discusses the pre-requisites for setting up software image management (SWIM) in a network with Cisco DNA Center.
- The **Deploy** section of the guide shows how to standardize an image by marking as a golden image and go through the update image workflow to distribute and activate the golden image on a network device.
- The **Operate** section briefly discusses the known caveats of software image management (SWIM) in Cisco DNA Center.
Define

Solution overview
Cisco DNA Center can help with the non-fabric wired deployments in various different ways such as – network discovery, network inventory, return merchandise authorization, software image management (SWIM) etc.

Reader tip
This guide only covers software image management (SWIM). For day-zero onboarding of a switch with Plug and Play (PnP) and return merchandise authorization (RMA) refer to the following guide, Network Device Onboarding for Cisco DNA Center Deployment Guide.

Figure 2.
Campus Topology highlighting Standardize software images for your network devices with SWIM.

Cisco DNA Center is designed for intent-based networking (IBN). The solution breaks the process in to Day 0 and Day N. The solution provides a unified approach to provision enterprise networks comprised of Cisco routers, switches, and wireless devices with a near zero touch deployment experience.
Zero-touch device connectivity and Software Image Management (SWIM) features reduce device installation and upgrade times from hours to minutes and bring new remote offices online with plug-and-play ease from an off-the-shelf Cisco device. Software Image Management (SWIM) manages software upgrades and controls the consistency of image versions across your network.
Design

Before you proceed you must make sure you already have Cisco DNA Center installed on your network.

Reader tip

For more information on how to install Cisco DNA Center, refer to Cisco DNA Center Installation resources page.

Before performing an image upgrade, the following pre-requisites should be reviewed.

1. **Check the Minimum Software Releases Requirements on Devices**
   

2. **Devices have CLI /SNMP or HTTPS/SCP credentials.**
   
   Network devices should be in managed state or the administrators have CLI/SNMP or HTTPS/SCP credentials for Cisco DNA Center to discover them and bring them in managed state before performing a Software Image upgrade. This requirement is only for Day N scenario.

3. **CCO Credentials**
   
   Though this is not a mandatory requirement for SWIM but its strongly recommended to add CCO credentials. Otherwise, certain features like ROMMON upgrade or suggested and latest image display list of images will not function.

**Process: Use a Recommended Software Image**

Cisco DNA Center can display and allow you to select Cisco-recommended software images for the devices that it manages.

**Procedure 1. Add Cisco Credentials**

**Step 1.** Login to the Cisco DNA Center.

**Step 2.** Click the gear icon, then select System Settings.

**Step 3.** Select Settings and then Cisco Credentials from left.
Step 4. Under Cisco Credentials, select CCO

Step 5. Enter the Cisco Connection Online (CCO) username and password.
Step 6. Select **Use Cisco.com user ID** and click **Apply**.

Tech tip

The credentials (user and password) entered must have SUPER-ADMIN-ROLE OR NETWORK-ADMIN-ROLE privileges.

Cisco Credentials

Use credentials to connect to Cisco and verify access to software and services.

<table>
<thead>
<tr>
<th>CCO</th>
<th>License</th>
<th>PnP Connect</th>
</tr>
</thead>
</table>

**Cisco.com Credentials**

**Username**

---

**Password**

---

**Link your Smart Account**

Your current Smart Account is **BU Production Test**

- [ ] Use Cisco.com user ID
- [ ] Use different credentials
Deploy

This section of the guide shows how to standardize an image by marking as a golden image and go through the update image workflow to distribute and activate the golden image on a network device (example: Catalyst 9300 Series Switch).

Process: Upgrade Workflow

This process is used to import and upload the latest software images for a network device (example: Catalyst 9300 Series Switch) to the Cisco DNA Center software image repository.

<table>
<thead>
<tr>
<th>Tech tip</th>
</tr>
</thead>
<tbody>
<tr>
<td>When doing a major code update (example: 16.9.1 to 16.11.1) there is additional delay due to ROMMON code upgrade</td>
</tr>
</tbody>
</table>

Table 1. Software Images for the Catalyst 9300 Series Switches

<table>
<thead>
<tr>
<th>Platform</th>
<th>Software Version</th>
<th>Software Image Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco Catalyst 9300 Switch</td>
<td>IOS XE Release 16.9.1 (Current)</td>
<td>Install Mode (16.9.1)</td>
</tr>
<tr>
<td>Cisco Catalyst 9300 Switch</td>
<td>IOS XE Release 16.9.3 (Upgrade image)</td>
<td>Install Mode (16.9.3)</td>
</tr>
</tbody>
</table>

The following procedures are required for this process:

- Standardize the image by marking a Golden Image.
- Distribute and activate the software image for the switch.

Procedure 1. Standardize the image by marking a Golden Image

Images can be imported manually or automatically through Cisco Connection Online (CCO). For the purpose of this guide, we will use the latter.

Cisco DNA Center displays the suggested and latest image list for each of the device families.

<table>
<thead>
<tr>
<th>Tech tip</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCO credentials are required for Cisco DNA Center to fetch and display the suggested list of images automatically. To learn how, refer above to Process 1.</td>
</tr>
</tbody>
</table>

Use the following steps to apply software updates of images and software maintenance updates (SMUs) to the devices, by importing the required images, marking images as golden, and applying images to devices.

Step 1. Login to DNA Center.

Step 2. Go to Design > Image Repository

Step 3. Check the current image version that is marked as golden.
Tech tip

In the Network Device Onboarding with Cisco DNA Center Guide, the 16.9.1 was uploaded and marked as golden as part of the device onboarding with PnP process.

Step 4. Check the software image (example: 16.9.3) that is going to be marked as golden, already available in the image repository.

Step 5. If the image is not already available to mark as golden, click **Import**

Step 6. From the Import Image/Add-On dialog, choose a file location, and then click **Import**.

Step 7. Under **Image Repository**, click **Show Tasks** to verify if the import was successful.

Step 8. Under **Image Repository**, click **Imported Images** to expand the list of all the imported images that are pending to be assigned to a device family.
Step 9. Click on Assign next to the image name need to be assigned.

Step 10. The slide out panel will show the list of device series from CCO based on the selected image. Check the box next to the Device Series and click Assign.

Step 11. Go to the assigned Device Family and click the expand icon and verify the image imported is available to mark as golden.
Step 12. Click the pencil icon and select the appropriate role, to mark a Golden Image for specific device role.


Step 14. Verify image is marked as golden and ACCESS tag is selected.

Procedure 2. Activate the software image from the Cisco DNA Center image repository to the switch

Now that the image is in repository, it can be distributed and activated on the network devices. It’s recommended to run the activation at a specified date and time to comply with existing network change windows.
Before pushing a software image to a device, Cisco DNA Center runs a compliance check of devices in inventory compared to the images marked golden. Devices out of compliance with the golden image are marked as Need Update in inventory. If you have not designated a golden image for the device type, then the device's image cannot be updated.

Cisco DNA Center also performs pre-checks on the device, such as checking the health of the CPU, disk space, and the route summary etc. After it pushes a software image to a device, Cisco DNA Center repeats these checks to ensure that the state of the network remains unchanged.

The following are the steps for distributing software images to the Catalyst 9300 switch or any network device in the inventory.

**Step 1.** From the main Cisco DNA Center dashboard navigate to Provision > Devices

**Step 2.** Click the devices focus which is set to Inventory by default and select Software Images.

**Step 3.** From the list of devices, locate the switch (example: AD1-9300.cisco.local)

**Step 4.** Click Needs Update
Tech tip

If incorrect Golden Image is shown even after refreshing the page or running recheck the devices table, the image that is not set as Golden Image anymore will need to be deleted from the image repository and then only the Need Update option will be available.

Step 5. Under Image Update Readiness Check, verify the correct Golden Image is shown.

Tech tip

Ensure that the Status column of all the checks shows either a green icon indicating success, or a yellow icon indicating a warning. If any of the checks shows a red icon indicating failure, the image on the platform cannot be upgraded. If necessary, correct any issues on the switch which resulted in a red icon indicating failure. Click the Recheck button in the upper right corner to re-run the readiness assessment.

Step 6. Under the Actions drop-down menu, select Software Image > Update Image.
Step 7. Go through the 3-steps Update Image workflow.

1. Distribute: Select Now or Later (recommended for production devices) and click Next.

2. Activate: Check Schedule Activation after Distribution is completed and click Next.

3. Confirm: Review the summary and click Confirm.
A notification is displayed stating the image update initiated.

Tech tip

If you have scheduled the distribution and activation for a future date and/or time you can view the upcoming scheduled task.

**Step 8.** Verify the under the **Software Image** column, **Need Update** changed to **In Progress**.

<table>
<thead>
<tr>
<th></th>
<th>Device Name</th>
<th>IP Address</th>
<th>Device Family</th>
<th>Site</th>
<th>Reachability</th>
<th>Software Image</th>
<th>Image Version</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AD1-9300.cisco.local</td>
<td>10.4.79.10</td>
<td>Switches and Hubs</td>
<td>.../Building 23/Floor 1</td>
<td>Reachable</td>
<td>CAT9K [16.9.1.0.70]</td>
<td>In Progress</td>
</tr>
</tbody>
</table>

**Step 9.** Monitor the **Update Status** of the device.

Tech tip

During this process the device will reboot and become **Unreachable** for a while (15-30mins).

a. **Update Status** changes to **Distribution in Progress**

<table>
<thead>
<tr>
<th>Software Image</th>
<th>Image Version</th>
<th>Update Status</th>
<th>Provision Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAT9K [16.9.1]</td>
<td>16.9.1</td>
<td>Distribution in Progress</td>
<td>Not Provisioned</td>
</tr>
</tbody>
</table>

b. **Update Status** changes to **Activation in Progress**

<table>
<thead>
<tr>
<th>Software Image</th>
<th>Image Version</th>
<th>Update Status</th>
<th>Provision Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAT9K [16.9.1.0.70]</td>
<td>16.9.1</td>
<td>Activation in Progress</td>
<td>Not Provisioned</td>
</tr>
</tbody>
</table>

c. **Update Status** changes to **Activation Success**

<table>
<thead>
<tr>
<th>Software Image</th>
<th>Image Version</th>
<th>Update Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>cat9k_iossxe.16.09.03.SPA</td>
<td>16.9.3</td>
<td>Activation Success</td>
</tr>
</tbody>
</table>

Verify the software image of the switch (example: AD1-9300.cisco.local) is now updated to the golden image (example: 16.9.3).
Operate

Known Caveats

- In Cisco DNA Center, it is mandatory to mark image as Golden for device family for upgrade at global or site levels. Golden image is essentially equivalent to the certified software image by Enterprise IT, which will be used to standardize the image for all relevant devices of this device family in customer network environment.

- Golden image can be defined not only on a per device family, but also on device role. In general, you may only have one golden image per device family and for that, use ALL tag to apply in the device role.

- Configuring a time zone within IOS XE devices via the `clock timezone` IOS CLI command may cause a warning to appear within the Image Upgrade Readiness Check panel, indicating the time is significantly different between your device and Cisco DNA Center. You may be able to clear this warning by removing the `clock timezone` command from the device, resyncing the device within inventory, and clicking on the Recheck button to run the readiness assessment again. This will cause the time format of the device be displayed in UTC time, rather than the local time zone.
## Appendix A— Hardware and software used for validation

<table>
<thead>
<tr>
<th>Functional area</th>
<th>Product</th>
<th>Software version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller (PnP Server)</td>
<td>Cisco DNA Center</td>
<td>1.3.1.2</td>
</tr>
<tr>
<td>Device to Onboard (PnP Agent)</td>
<td>Catalyst 9300 Switch Series</td>
<td>16.09.03</td>
</tr>
</tbody>
</table>
Appendix B—Glossary

Cisco DNA  Cisco Digital Network Architecture
Cisco PnP  Cisco Plug and Play
SWIM  Software Image Management
SSL  Secure Sockets Layer
VLAN  Virtual Local Area Network
Feedback

For comments and suggestions about this guide and related guides, join the discussion on [Cisco Community](https://www.cisco.com/community).