

Smart Install Feature Guide

Cisco Services



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## INTRODUCTION



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### Introduction

Smart Install is a plug-and-play configuration and image-management feature that provides zero-touch deployment for new switches. You can ship a switch to a location, place it in the network and power it on with no configuration required on the device.

#### Key Benefits

A network using Smart Install includes a group of networking devices, known as clients, which are served by a common Layer 3 switch or router that acts as a director. In a Smart Install network, you can use the Zero-Touch Installation process to install new access layer switches into the network without any assistance from the network administrator. The director provides a single management point for images and configuration of client switches. When a client switch is first installed into the network, the director automatically detects the new switch, and identifies the correct Cisco IOS image and the configuration file for downloading. It can allocate an IP address and host name to a client. If a standalone switch in the network is replaced by another switch of the same SKU (a switch with the same product ID), it automatically gets the same configuration and image as the previous one. The director can also perform on-demand configuration and software image updates of a switch or a group of switches in the network.

Zero-touch updates also take place on preconfigured switches after you have entered the write erase and reload privileged EXEC

commands to clear the configuration.

#### Caution

If you touch the console keyboard during a zero-touch update and attempt to enter a command or a return on the switch, the auto install and Smart Install processes stop. To recover and restart the process, at the system prompt, enter the write erase and reload commands on the client and restart the process.

The director can act as a DHCP and TFTP server and can store the configuration and image files. These files can also be stored on a third-party TFTP server for the director to use. The client can download the image and configuration files from the director TFTP server or from a remote server.

#### Note

Switches running releases earlier than 12.2(52)SE are not Smart Install capable, but they can be Smart Install clients if they support the archive download-sw privileged EXEC command. Smart Install clients can be Layer 2 or Layer 3 switches. Switches running Cisco IOS Releases 3.2(0)SE and later, and 15.0 (2)SE and later, 3.6.(0)E, and 15.2.(2)E support Smart Install.

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See Supported Devices for Smart Install section for a list of supported switches, the roles they can play (client or director), and the required software releases.

In a typical Smart Install network, a client switch uses DHCP to get an IP address and the director snoops DHCP messages. For a client to participate in Smart Install zero-touch update, it must use DHCP, and all DHCP communication must pass through the director so that it can snoop all DHCP packets from clients. The most automatic operation is when all switches in the Smart Install network use DHCP and are Smart Install capable. However, any client switch that supports the archive download-sw privileged EXEC command to download a software image can be used in a zero-touch Smart Install network. Cisco IOS Release 3.2(0)SE and later, support software install.

### **Note**

A Smart Install network can have only one director.

A client switch can participate in Smart Install even if it is not directly connected to the director. The Smart Install network supports up to seven hops. Intermediate switches or clients connected to the director through an intermediate switch in a multihop environment can be, but are not necessarily Smart Install capable, provided the management VLAN is set to default VLAN 1.

If you use a VLAN other than vlan 1 for management, then the

intermediate switch must be Smart Install capable switch.

### **Scope**

A Smart Install network can be:

- A network where all client switches are of the same product ID (PID), for example, WS-2960S-48FPS-L. In this case, you can identify a default image and a seed or basic configuration to use on all client switches.
- A network that includes switches with different PIDs. In these networks, you can configure switch groups and specify that the same images and seed configuration files are applied to all switches in the group. A group can be based on a predefined PID, or you can create groups based on product ID, MAC address, switch stack number, MAC address, or client switch connectivity to a specific upstream neighbor. When switches in a group are replaced by another switch with the same product ID, the replacement switch receives the same configuration and image.

After a switch has an image and basic configuration, you can configure specific features on individual switches and save the configuration to the startup configuration file.

Figure 1-1 shows a Smart Install network with external DHCP and TFTP servers. There can be only one director amongst TFTP servers in any Smart Install network. The director can also serve as the DHCP and TFTP server.

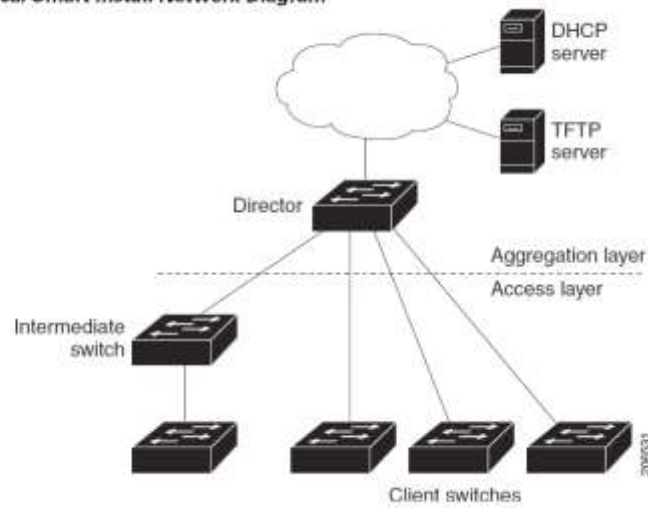
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Figure 1-1 Typical Smart Install Network Diagram



When a director is configured and a client joins the Smart Install network, Smart Install is automatically enabled on these devices. Beginning with Cisco IOS Release 12.2(58)SE, XE 3.4SG, 15.1(2)SG, 15.1(1)SY, 15.0(2)SE, 3.2(0)SE and later, 3.6.(0)E, or 15.2.(2)E, you can disable Smart Install on a device and also shut down its Smart Install TCP ports by entering the `no vstack` global configuration command on the client or director. When Smart Install is disabled on a device, any Smart Install configuration on it remains in the running configuration but does not take effect while Smart Install is disabled. To re-enable Smart Install on the device, enter the `vstack` global configuration command.

Switches participating in Smart Install zero-touch updates must use DHCP to obtain their IP addresses.

DHCP options are used to send:

- Image filename and location
- TFTP server IP address
- Hostname
- Configuration filename
- Director IP address to the other switches

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## Planning for Deployment

### Existing and Supported Topology

#### Smart Install Director

The director in a Smart Install network must be a Layer 3 switch running Cisco IOS Release 12.2(52)SE or later, XE 3.4SG, 15.1(2)SG, 15.0(2)SE or later, 15.1(1)SY or later, 3.2(0)SE or later, or a router running Cisco IOS Release 15.1(3)T or later. See Supported Devices for Smart Install for a list of switches that can perform the role of Smart Install director.

#### Note

IE2000 IE3000, and IE3010 support Director with Cisco IOS Release 15.2(2)E. To configure a device as director, enter the IP address of one of its Layer 3 interfaces in the `vstack director ip_address` global configuration command and enable it as director by entering the `vstack basic` command.

If you have entered the `no vstack global configuration` command to disable Smart Install on a device, the `vstack director ip_address` and `vstack basic` global configuration commands are not allowed on the device. To re-enable Smart Install on a device, enter the `vstack global configuration` command.

When a device is configured as director, The VLAN on which the DHCP snooping is automatically enabled becomes VLAN 1 by

default. The director begins building the director database in VLAN1. To specify another VLAN for Smart Install management, you can use the `vstack startup-vlan` global configuration command. Depending on the VLAN that is specified in the command, DHCP snooping is enabled on that VLAN so that the director can identify new switches that are connected to the network, known as non-VLAN 1 switches.

The database lists the client devices in the Smart Install network and includes this information:

- Type of switch (PID) for all switches, including switches in a stack
- MAC addresses for all switches, including switches in a stack
- IP address of the switch or stack
- Hostname
- Network topology including neighbors interfacing with the switch
- Serial number (only Smart Install capable switches)

#### Note

When the director is a switch, DHCP snooping is enabled on VLAN 1 by default. It is also enabled on other Smart Install management VLANs that are configured by entering the `vstack vlan vlan-range` global configuration command. You can use the `vstack startup-vlan` global configuration command to specify another VLAN that should be used for Smart Install management. Cisco IOS Releases 15.1(1)SY, 15.0(2)SE or later, 15.1(2)SG, 3.6.(0)E, 15.2.(2)E, and Cisco IOS XE 3.4SG support non-VLAN1 management and provide the ability to discover the client switches

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available on non-VLAN1.

In a Smart Install network that uses DHCP to assign IP addresses, you only need to configure the director. Client switches do not require any configuration. Although you can enter command-line interface commands on clients, configuration commands do not take effect unless the switch assumes the role of director.

### **Note**

You can configure the vstack commands in client mode, but this is effective only when the switch is converted to a director.

There can be only one director for a set of clients and you cannot configure a backup director. If the director fails:

- Director database must be rebuilt.
- Any update being performed for a non-Smart Install-capable switch might fail.
- The accumulated download status is lost.
- A configuration backup might not occur before the director restarts.

The director can change status and become a client switch if:

- The director interface that has the director IP address shuts down.
- The director interface that has the director IP address is deleted.
- The director IP address is changed.

If the director becomes a client, DHCP snooping is disabled, and the director database is no longer used. If the director IP address is provided by DHCP and you configure a different director IP address on a client switch, the client is longer part of the director's Smart Install network.

Smart Install relies on a TFTP server to store image and configuration files. The TFTP server can be an external device, or the director can act as a TFTP server. If the director is the TFTP server, the available flash file space on the director must be adequate to accommodate the client Cisco IOS image and configuration files. See the Configuring the TFTP Server section.

In a Smart Install network using DHCP, the DHCP server can be an external device or the director can act as the DHCP server. See the Configuring the DHCP Server section. The director snoops all DHCP packets that pass through it on VLANs that are configured as Smart Install management VLANs. All network DHCP packets from intermediate or client switches or from an external DHCP server must pass through the director. The director must be able to snoop all DHCP packets from clients.

### **Note**

Smart Install options in the DCHP offer are option 125, sub-option 5 (the image list file), option 125 sub-option 16 (the director IP address), and option 67 (the configuration file).

The director builds a topology director database for the network by collecting information from the network Smart Install switches. The director uses the database:



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- To assign a configuration file and image to a client.
- As a reference to obtain the PID, the image name, and the configuration file for an on-demand update of network switches.

The director periodically updates the director database based on CDP updates that it receives from neighbor switches and from Smart Install messages sent to the director by Smart Install capable clients. The updates contain information about the client neighbors.

### *Image List File*

An image list identifies the images to be loaded on the client. The image list file is the file that contains the correct image name for the client. When the director is the TFTP server, this file is stored in flash memory. Otherwise, it is stored in a remote, third-party TFTP server.

- When the file is stored in the director, the prefix for the image list is flash://, usbflash0://, bootflash://, bootdisk://, or disk0:// based on the appropriate file systems available on the switch.
- When the file is stored in a remote TFTP server, the prefix is tftp://ip\_address/image.tar.

### **Note**

In Catalyst Switches 3850 and 3650, the image is a bundled with .bin extension. Images must be stored either on the director or on the third-party TFTP server.

For a standalone switch, the image list file contains a single image. For a stack, the image list contains images for all members of the

stack, which could be the same image or different images. For a switch stack, the director creates the image list file after the user specifies the tar file for each switch in the stack.

Starting with Cisco IOS Release 12.2(55)SE or later, 15.1(1)SY, 15.0(2)SE and later, 3.2(0)SE and later, XE 3.4SG, 15.1(2)SG, 3.6.(0)E, and 15.2.(2)E, when the user specifies the tar file for each switch, the director automatically creates the image list file.

When an external TFTP server is used, the director writes the image list file to the TFTP server. It is recommended that the TFTP server permit the director to write the image list files to the TFTP Server. If the director does not have permission to write to the file system of the TFTP server, the director logs the failure in the system log. You can create the image list files and put them on the TFTP server manually if the director fails to do so automatically; you cannot fix the issue that prevents the director from writing to the TFTP server.

### **Note**

The upgrade process is initialized even when the imagelist file is copied manually, but the director tries to copy the image list file to the TFTP server and the failure system log is displayed periodically.

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### Configuration Files

The director manages these configuration files:

- Startup configuration—The configuration that a client uses when it boots.
- Seed configuration—A configuration on the director that is the basis for the client startup
- Backup configuration—An exact copy of a client startup configuration stored in the director.

### Smart Install Clients

Client switches have a direct or indirect connection to the director so that they can receive image and configuration downloads from it. A switch becomes a Smart Install client when either director or when the director IP address is configured on the switch manually. Client switches use the director database for image and configuration downloads and receive the image and configuration files from the Smart Install TFTP server.

A client switch can be an intermediate switch connected to another client switch. A client can be a standalone switch or a switch stack.

- Director can download images and configuration of clients that are not Smart Install. However, such clients are entered into the director database only if they are connected to a Smart Install capable switch. The director can telnet to the client switch and use the archive download-sw privileged EXEC command to

download software to the switch. The director must know the client switch password to perform the download.

- Smart Install capable switches can communicate directly with the director to update switch information, can have images and configuration downloaded, and can be managed by the director. A Smart Install capable client with the director IP address and connectivity to the director sends switch and neighbor information to the director by using the Smart Install protocol.

### Note

Switches running Cisco IOS XE Releases 3.2(0)SE and later, 3.6.(0)E, and 15.2.(2)E support software install.

All switches in the network with “network” connectivity to the director can be clients, whether or not they are Smart Install capable. A client switch needs an IP address for management communication and the director must be able to communicate with that IP address. Client switch IP addresses are assigned by DHCP or statically configured.

Smart Install capable clients send switch and neighbor information to the connected director for the director database. Client switches that are not Smart Install capable or that are not connected to a Smart Install capable switch are not entered into the director database. In a multihop topology, for the director to get the complete topology overview, any client switch upstream of a group of clients must be Smart Install capable. Clients not in the director database can get an on-demand update, but they cannot get a

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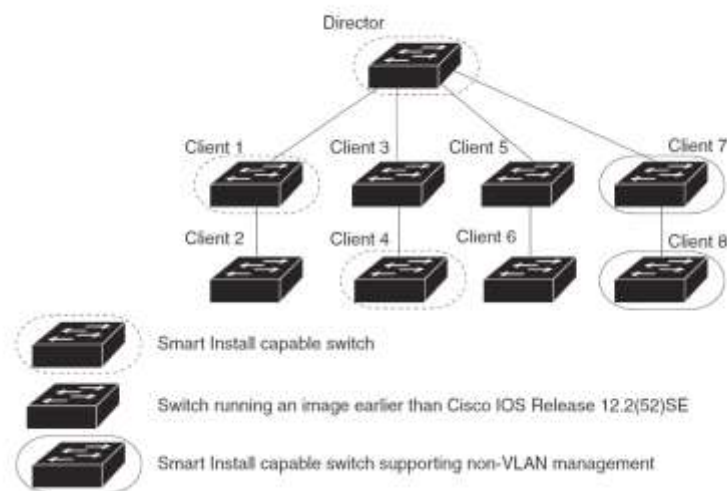


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zero-touch or group update.

Figure 1-2 shows some possible ways that clients can be interconnected in a network. Table 1-1 and Table 1-2 show the director database knowledge of each client and the type of update that is supported.

Figure 1-2 Possible Interconnections of Smart Install Clients



### Note

The topology shown in Figure 1-2 does not represent a typical Smart Install topology but is used to demonstrate possible types of client interconnections.

The Cisco IOS releases 12.2(52)SE or later, XE 3.4SG, 15.1(2)SG, 15.1(1)SY and later, 15.0(2)SE and later, and 3.2(0)SE and later, support the director role. The Cisco IOS releases 15.0(2)SE, 15.1(1)SY, 15.1(2)SG, XE 3.4SG, 15.0(2)EX, 15.0(2)EX1, 3.6.(0)E, and 15.2.(2)E are Smart Install capable switches, supporting non-VLAN management and providing the ability to discover the client switches available on non-VLAN 1.

Table 1-1 shows the switches that are in the director database and how the director obtained the information. When a client is a single hop from the director, the client uses CDP to send the director information about itself. When a client is a Smart Install capable switch, it sends information to the director about itself and its neighbors.

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**Table 1-1** Director Database Contents of Client Switches

| Client Switch | In Director Database? | Source of Database Information   |
|---------------|-----------------------|--|
| Client 1      | Yes                   | Learned from CDP and from Smart Install. The client also sends information about its neighbor (Client 2).                                |
| Client 2      | Yes                   | Information received from Client 1.  |
| Client 3      | Yes                   | Learned from CDP.  |
| Client 4      | No                    | No information available. The client is not an immediate neighbor of the director or another Smart Install switch.                       |
| Client 5      | Yes                   | Learned from CDP.  |
| Client 6      | No                    | No information available. The client is not an immediate neighbor of the director or another Smart Install switch.                       |
| Client 7      | Yes                   | Learned from CDP and from Smart Install. The client also sends information about its neighbor Client 8. Client 7 is a non-VLAN 1 switch. |
| Client 8      | Yes                   | The information to Client 8 will be sent by Client 7 via non-VLAN1. Client 8 is a non-VLAN 1 switch.                                     |

Table 1-2 shows the director database knowledge of each client and the type of update that is supported in various software versions. For information about Smart Install supported switches, routers, and minimum software releases for directors and clients, see Supported Devices for Smart Install.

**Table 1-2** Types of Updates Supported by Each Client

| Device   | Software Version  | Zero-Touch Update | On-Demand Update of Client | On-Demand Update of Group            |
|----------|---|-------------------|----------------------------|--------------------------------------|
| Client 1 | 12.2(52)SE or later   | Yes               | Yes                        | Yes                                  |
| Client 2 | Earlier than 12.2(52)SE   | Yes               | Yes                        | Yes                                  |
| Client 3 | Earlier than 12.2(52)SE   | Yes               | Yes                        | Yes                                  |
| Client 4 | 12.2(52)SE or later   | Yes               | Yes                        | Yes                                  |
| Client 5 | Earlier than 12.2(52)SE   | Yes               | Yes                        | Yes                                  |
| Client 6 | Earlier than 12.2(52)SE   | Yes               | Yes                        | No. Switch not in director database. |
| Client 7 | 15.0(2)SE, 15.1(1)SY, 15.1(2)SG, XE 3.4SG, 15.0(2)EX, 15.0(2)EX1, 3.6.(0)E, and 15.2.(2)E | Yes               | Yes                        | Yes                                  |
| Client 8 | 15.0(2)SE, 15.1(1)SY, 15.1(2)SG, XE 3.4SG, 15.0(2)EX, 15.0(2)EX1, 3.6.(0)E, and 15.2.(2)E | Yes               | Yes                        | Yes                                  |

To see the types of Smart Install clients in a network, enter the show vstack status privileged EXEC command.

```
Director# show vstack status
SmartInstall: ENABLED
Status: Device_type Health_status Join-window_status Upgrade_status
Device_type: S - Smart install N - Non smart install P - Pending
Health_status: A - Active I - Inactive
Join-window_Status: a - Allowed h - On-hold d - Denied
Image Upgrade: i - in progress I - done X - failed
Config Upgrade: c - in progress C - done x - failed
Director Database:
DevNo MAC Address Product-ID IP_addr Hostname Status
=====
0 0018.7363.4200 WS-C3750-24TS 172.20.249.54 IBD-MXD-ST Director
```

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|    |                |                 |                |            |           |
|----|----------------|-----------------|----------------|------------|-----------|
| 1  | 0016.4779.b780 | WS-C3750G-24TS  | 172.20.249.54  | IBD-MXD-ST | Director  |
| 2  | d0d0.fd37.5a80 | WS-C3750X-48P   | 172.20.249.54  | IBD-MXD-ST | Director  |
| 3  | 0026.5285.7380 | WS-C3750E-24TD  | 172.20.249.54  | IBD-MXD-ST | Director  |
| 4  | 0024.13c6.b580 | WS-C3750E-24TD  | 172.20.249.115 | DEV-c6.b5c | S A a     |
| 5  | 0021.a1ab.9b80 | WS-C2960-48TC-S | 172.20.249.249 | DEV-ab.9bc | S A a I C |
| 6  | 0024.5111.0900 | WS-C3750E-24TD  | 172.20.249.222 | DEV-11.094 | S A a I C |
| 7  | 001d.45f3.f600 | WS-C3750G-24TS  | 172.20.249.87  | DEV-90.f64 | S A a     |
| 8  | 0016.c890.f600 | WS-C3750G-24TS  | 172.20.249.87  | DEV-90.f64 | S A a     |
| 9  | 001f.2604.8980 | WS-C2960-48TC-S | 172.20.249.89  | DEV-04.89c | S A a I C |
| 10 | 001b.d576.2500 | WS-C3750E-24PD  | 172.20.249.91  | DEV-a6.1cc | S A a I C |

These fields were added in Cisco IOS Release 12.2(58)SE or 15.1(1)SY to provide more information about each client:

- Device type: S (Smart Install capable, running Cisco IOS Release 12.2(52)SE or later, 15.1(1)SY, 15.0(2)SE and later, 3.2(0)SE and later), 3.6.(0)E, or 15.2.(2)E, N (not a Smart Install device), or P (pending, unable to determine).
- Device health status: Active (the director is receiving periodic updates from the device) or Inactive (the device is disconnected or has not provided updates for three consecutive keepalive periods)
- Join window status: a (allowed), h (on hold), or d (denied). See the Using a Join Window section for more information.

- Upgrade status: An image update is i (in progress), I (complete), or X (failed). A configuration upgrade is c (in progress), C (complete), or x (failed).

### Smart Install Groups

When all switches in a Smart Install network have the same PID, they can run the same image and the same seed (basic) configuration file. In this case, you can assign a default image and configuration file for all clients. However, if there is more than one PID in the network or if you want a different configuration file to run on some switches, depending on their function in the network, you should configure Smart Install groups and assign an image and configuration file for each group.

Custom groups take precedence over built-in groups and are based on:

- Stack group—For switches in a stack, you can configure groups based on their number in the stack. Stack groups are used only for switch stack upgrades, and clients do not need to be in the director database. Starting with Cisco IOS Release 12.2(58)SE, 15.1(1)SY, 15.0(2)SE and later, 3.2(0)SE and later, 3.6.(0)E, and 15.2.(2)E if a stack is homogeneous (all one switch type), you do not need to identify each switch type.
- MAC address—You can create a custom group of specific switches by using the MAC addresses of the switches to configure the group. You can include switches with the same or different product IDs, as long as they use the same image and configuration file. Enter the show vstack neighbors all privileged EXEC

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- Command to see the MAC addresses of switches in the Smart Install network.
- **Connectivity**—You can configure a custom group based on network topology; that is, all switches that have the same upstream neighbor. Connectivity groups take precedence over groups with matching product IDs or stack numbers. Connectivity groups include only standalone switches (not switch stacks), and clients must be in the director database.

**Product IDs (PIDs)**—These product IDs are all supported models, including newer PIDs that were not shipping when the software was released and therefore are not in the CLI. PID groups include only standalone switches (not switch stacks), and clients do not need to be in the director database.

The priority of custom groups from high to low is stack group, MAC address, connectivity, and product ID.

- Built-in groups are based on PIDs that you can select from the CLI. These represent the fixed Ethernet switching products that were shipping when the software was released, for example, 3750, 3560, 2975, 2960, 3850, and 3650.

- Switches that belong to a group use the image and configuration file assigned to that group. If a client switch does not belong to a group in the director database, it is assigned the default image and configuration file.

### **Note**

If there is more than one switch PID in the network, we recommend configuring built-in or custom groups. The default image and configuration is used in networks with only one product ID.

An example of the use of custom groups is a network where all client switches are the same PID, but one requires a different configuration. For example, a retail store might have checkout counters and a pharmacy, and the pharmacy switch requires a different configuration. The checkout counters would use the default configuration, but you would create a custom group for the pharmacy.

### **Sizing Guidelines**

#### **DHCP and Smart Install**

DHCP is recommended in Smart Install networks and is required for zero-touch updates. On-demand updates do not require DHCP. In a DHCP network, DHCP snooping is automatically enabled on the director. The director snoops DHCP offers and requests to and from the client switches and uses DHCP snooping to insert the DHCP options used in the Smart Install operation.

However, because DHCP snooping is not supported on routed ports, you should not connect routed ports directly to the client or the director.

A DHCP server in a Smart Install network can be positioned in one of these ways:

- The Smart Install director can act as the DHCP server in the network. When the DHCP offer goes to the client switches, the director allocates the IP addresses and assigns configurations and images and the

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hostname as DHCP options in the DHCP offer and DHCP acknowledgment. DHCP snooping is automatically turned on for the director.

- The DHCP server can be another device (third-party server) in the Smart Install network. In this case, DHCP packets between the clients and DHCP server must pass through the director.

### Note

You can configure a join-window time period so that the director can only modify the DHCP offer and send the image and configuration files to the client during the configured window. The join window restricts Smart Install for a specified period of time and acts as a security precaution to control when a client can receive these files. See the Using a Join Window section.

- A third-party server and the director DHCP server can coexist in a network. In this case, the director is responsible only for the DHCP requests of the switches in the Smart Install network. The director maintains the Smart Install database and pool; other DHCP database functions are maintained by the third-party server. See the Configuring the DHCP Server section for configuration instructions.

If the Smart Install DHCP server is the director or another device running Cisco IOS and the network reloads, the server might assign new IP addresses to participating switches. If a switch IP address changes, it might no longer be reachable. If the director IP address changes, it is no longer the Smart Install director, which could break

the director and client switch relationships. This is an unlikely but possible corner-case occurrence. To prevent this occurrence, you should enable *DHCP remembering* by entering the `ip dhcp remember global` configuration command or the `remember DHCP-pool` configuration command on the DHCP server.

Non-Cisco IOS third-party DHCP servers require an IP-address-to-MAC-address binding to ensure that the same IP address is given to a switch on a reload.

### Note

In Smart Install networks that do not use DHCP, you must manually configure the director IP address on each client switch by entering the `vstack director ip-address` global configuration command. Client switches require only the director IP address. Smart Install networks that do not use DHCP cannot support zero-touch updates but can support on-demand update.

## Supported Devices for Smart Install

Table 1: Supported Switches

| Switch        | Can be Director? | Can be Client? |
|---------------|------------------|----------------|
| Catalyst 3850 | Yes              | Yes            |
| Catalyst 3650 | Yes              | Yes            |

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Table 2: Minimum Software Releases for Directors and Clients

| Directors     | Minimum Software Release   |
|---------------|----------------------------|
| Catalyst 3850 | Cisco IOS Release 3.2(0)SE |
| Catalyst 3650 | Cisco IOS Release 3.3(0)SE |

### Supported SKUs for Smart Install

Compatibility between Catalyst 3k Chassis, SKU ID, and SKI

| 3850 | SKU ID        | SKI                               |
|------|---------------|-----------------------------------|
|      | WS-C3850-24T  | 24 ports                          |
|      | WS-C3850-48T  | 48 ports                          |
|      | WS-C3850-24P  | 24 PoE+                           |
|      | WS-C3850-48P  | 48 PoE+                           |
|      | WS-C3850-48F  | 48 PoE+                           |
|      | WS-C3850-24U  | 24 UPOE                           |
|      | WS-C3850-48U  | 48 UPOE                           |
|      | WS-C3850-12S  | 12 SFP                            |
|      | WS-C3850-24S  | 24 SFP                            |
|      | WS-C3850-12XS | 12 1/10G SFP+                     |
|      | WS-C3850-24XS | 24 1/10G SFP+                     |
|      | WS-C3850-24XU | 24 UPOE (100Mbps/1/2.5/5/10 Gbps) |

|      |                 |   |
|------|-----------------|---|
|      | WS-C3850-12X48U | 48 UPOE (with 12 100Mbps/1/2.5/5/10 Gbps Ports) |
| 3650 | WS-C3650-24TS   | 24 ports  |
|      | WS-C3650-48TS   | 48 ports  |
|      | WS-C3650-24PS   | 24 ports, PoE+                                  |
|      | WS-C3650-48PS   | 48 ports, PoE+                                  |
|      | WS-C3650-48FS   | 48 ports, PoE+                                  |
|      | WS-C3650-24TD   | 24 ports  |
|      | WS-C3650-48TS   | 48 ports  |
|      | WS-C3650-24PD   | 24 ports, PoE+                                  |
|      | WS-C3650-48PD   | 48 ports, PoE+                                  |
|      | WS-C3650-48FD   | 48 ports, PoE+                                  |
|      | WS-C3650-48TQ   | 48 ports  |
|      | WS-C3650-48PQ   | 48 ports PoE+                                   |
|      | WS-C3650-48FQ   | 48 ports PoE+                                   |



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### Unsupported Services

More than 20 services are supported by the PnP Solution, out of which only seven are supported by SMI Proxy:

- "capabilities"
- "config-upgrade"
- "device-info"
- "image-install"
- "topology"
- "backoff"
- "bye"
- 

### Guidelines and Limitations

#### Configuration Guidelines and Recommendations for Smart Install Devices

If the startup configuration fails to download, the client can go into an infinite loop because there is no startup configuration to update. The only way to recover from the loop is to press Enter when the client is coming up after a reload so that the update process stops.

- When performing a zero-touch update, you should always update both the image and the startup configuration files. To update only the image or only the configuration file, use the `vstack download-image` or `vstack download-config` privileged EXEC commands for an on-demand download instead.
- To update only the image or only the configuration file, use the `vstack download-image` or `vstack download-config` privileged EXEC commands for an on-demand download instead.
- On the Catalyst 3750 and Catalyst 4500 series switches, beginning

with Cisco Release IOS XE 3.6.(0)E, and Cisco Release IOS 15.2(1)SG, 15.0(2)SE, and 15.2.(2)E, the following combinations of zero-touch upgrade are supported.

- Image and configuration zero-touch upgrade—User specifies both image and configuration on the director.
- Configuration-only zero-touch upgrade—User specifies configuration alone on the director.
- Image-only zero-touch upgrade—User specifies image alone on the director.

On the Catalyst 4500 series switch director and client functionality is supported; beginning with Cisco IOS Release IOS XE 3.6.(0)E the above mentioned combinations of zero-touch upgrade can be configured on the director or client.

- For the above features to work on the client side, the clients must be running the image with Cisco Release IOS 15.2(1)SG or higher.

#### Note

For an on-demand download, update the image and configuration on the client with the `vstack download-image` or `vstack download-config` commands.

If you trigger a zero-touch upgrade with backup enabled and Rev2 (such as, backed-up configuration) accessible on the SMI director, the Rev2 is sent for an upgrade. If you accidentally delete the Rev2 file, the zero-touch upgrade fails because the backup configuration is missing.

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However, the client attempts another reload and boots with the seed (default) configuration, ensuring a smoothly functioning zero-touch upgrade irrespective of the missing backup configuration.

If backup is enabled and an image-only upgrade is specified on the director, the client boots up with the backed-up configuration and the image specified when the upgrade launches on the client.

However, if backup is disabled, the client boots with the image [alone] specified on the director for that client.

- Switches are updated one hop at a time. The director cannot update switches in hop 2 while it is upgrading switches in hop 1.
- Because DHCP snooping is not supported on routed ports, you should not connect routed ports directly to the client or the director. Without DHCP snooping, the director will not detect a DHCP request from the client, which prevents Smart Install from working on that client. Routed ports cannot participate in Smart Install.
- For client switches with only 16 Mb of flash memory, before upgrading the Cisco IOS image, ensure that there is enough free flash space available to download a new image and delete unnecessary files. The configuration file might not be necessary because Smart Install can provide the configuration file when the client boots up.
- In Catalyst 6500 Supervisor Engine 2T switches, flash size supports onboard and external disks to download the image and the configuration file.
- The director can act as the TFTP server, eliminating the need for an

external TFTP serving device.

Follow these guidelines when configuring the director as TFTP server:

- The total flash space (used and free) on the director must be large enough to contain the director image and configuration file and the image and configuration files required for client switches.
- There must be enough available flash on the director to hold the client Cisco IOS images and configuration files. The Cisco IOS image files vary in size, depending on the client switch product IDs and whether or not crypto images are being installed.
- When the director is the TFTP server, a copy of the configuration file for each client switch is stored in the root directory of the flash file system on the director. There must be enough space for each planned client group.
- Most director switches have enough flash memory to hold one client Cisco IOS image and a small number of client configuration files. For example, the Catalyst 3750 switch can have a maximum flash size of 64 MB, which accommodates only 4 or 5 images, based on the image size.
- If the Smart Install network includes client switches with more than one product ID, you should use an external TFTP server.
- When the director is the TFTP server, downloading a TFTP file will be slower than the external TFTP server. If downloading the TFTP file is a priority, use an external TFTP

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server, especially if there are multiple clients performing TFTP downloads simultaneously.

- If the TFTP server is a third-party (non-Cisco) device, you should disable the server option to change the name of a file if another file is created with the same name. Otherwise, duplicate image list files might be created.
- Client switches can be on any VLANs other than the default if the director is configured to snoop on that VLAN (enter the `vstack vlan vlan-id global` configuration command) and if traffic from the VLAN flows through the director.
  - The director can snoop on multiple VLANs extending to clients on different Layer 2 subnets.
  - Client switches can be on different routed subnets as long as there are routes between the director and the subnet. In these cases, a relay agent between a client and director is required for Smart Install downloads.
  - Smart Install does not function if the client is connected directly to a routed port on the director.
- Stacking considerations
  - If the director is in a switch stack and a master switchover occurs when a non-Smart Install client switch is being updated, the client switch update is not completed.
  - If the client switch is a stack and not all members are up and operational, downloading of new images to the stack members fails.
- Upgrading a stack requires configuring a custom group matching the stack group.
- When a stack is upgraded, you should restart all stack members at the same time.
- When a stack is deliberately partitioned, the new stack should have the required configuration for upgrades, that is, the stack group members must be configured correctly.
- For Catalyst 3750-X, 3750-E, 3650-X, and 3650-E client switches, install the appropriate license files before updating the image. Smart Install does not apply to image licensing.
- To disable Smart Install on a director or client, enter the `no vstack global` configuration command on the device. Enter the `show vstack status` privileged EXEC command to see if Smart Install is enabled or disabled on a device.
- Client switches with static IP addresses cannot get zero-touch downloads but can receive on-demand downloads.
- If the director temporarily loses communication with the client switches, there is no impact to the Smart Install feature unless the client is in the middle of installing Cisco IOS images or downloading the configuration. If this happens, manual intervention might be required to restart the process.
- We recommend that configuration files do not include `boot host dhcp`. If a configuration file does include this configuration, do not apply the configuration file to switches with interfaces that do not have a configured IP address.

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- When a director is configured and a client joins the Smart Install network, Smart Install is automatically enabled on these devices. Beginning with Cisco IOS Release 12.2(58)SE, 15.1(1)SY, 15.0(2)SE and later, and 3.2(0)SE and later, you can disable Smart Install on a device and also shut down its Smart Install TCP ports by entering the `no vstack` global configuration command on the client or director.
  - When Smart Install is disabled on a device, any Smart Install configuration on the device remains in the running configuration but does not take effect while Smart Install is disabled.
  - When Smart Install is disabled on a device, the `vstack director ip_ address` and `vstack basic` global configuration commands are not allowed.
  - If you disable Smart Install on the director and there were Smart Install DHCP IP addresses configured, you need to manually unconfigure them.
  - To re-enable Smart Install on the device, enter the `vstack global` configuration command.
- Image-only or configuration-only upgrades cannot be performed on IBCs running an image prior to Cisco IOS Release XE 3.6.0E. If an IBC is configured for an image-only or configuration-only upgrade but the IBC does not support an upgrade, the following cases apply:
  - The Director is configured to perform an image-only upgrade for the client.
  - Prior to Cisco IOS Release XE 3.6.0E, IBC did not receive the configuration path and the configuration-only upgrade

failed, but the image upgrade proceeded and IBC reloaded. Although the image upgrades, Cisco does not claim this process to be “Image-only” because IBC tries to download the configuration file and fails, displaying error messages.

- The Director is configured to perform a configuration-only upgrade for the client.

Prior to Cisco IOS Release XE 3.6.0E, the configuration upgrade proceeded but IBC did not receive the image path, hence the image upgrade failed, and IBC did not reload. Most configuration commands are visible and can be entered on the director or on a client, but only the ones configured on the director take effect. If you enter commands on a client switch, they do not take effect now, but if the client later becomes the director, the commands are then valid.

### DHCP Configuration Guidelines

- Although we recommend that the director be configured to act as DHCP server for the clients, Smart Install can also use an external DHCP server. If you use an external device as DHCP server, you could configure the DHCP server to send option 125/sub-option 16 for the director IP address to avoid the possibility of fake DHCP servers.
- We recommend configuring a Cisco IOS DHCP server to remember IP bindings to ensure that devices in the Smart Install network retain the same IP address in the event of a network or device reload.
- In networks that do not use DHCP to assign IP addresses to the clients, you must configure the IP address of the director on each

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client switch.

- In a Smart Install network, we recommend not to configure DHCP snooping and DHCP relay on the same interface of the switch.

- 

### **Guidelines and Restrictions for SMI Proxy**

- The SMI Proxy requires SMI Director and PnP Agent on a device.
- When SMI Proxy is enabled, features like join-window and scenarios such as switch replacement are not supported. The latter is handled as a new client addition.
- Central PnP Server supports only homogeneous stack upgrades.
- After SMI Proxy is enabled, SMI Director is disabled.
- SMI Director and SMI Proxy are mutually exclusive.
- In SMI Proxy mode, once a device has completed a configuration or image upgrade successfully, you should not clear the entry of that device in the vstack download-status list. If an SMI client requires a write erase and reload, ensure that the entry is not present in the vstack download-status list.

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## Installing /Deploying

### Configuring the DHCP Server

To perform zero-touch updates, the Smart Install network must be running DHCP. The DHCP server might be the director, another Cisco device running Cisco IOS, or a non-Cisco third-party server. You can also have the director act as the Smart Install DHCP server and have another device perform all other DHCP server functions.

Use one of the following procedures to set up a Cisco device as DHCP server, or if you choose to configure a non-Cisco third-party device as DHCP server, follow the instructions in the product documentation for configuring a network address and a TFTP server.

#### **Note**

You should not configure any client switches participating in Smart Install as the DHCP server.

#### **Note**

If the DHCP server is the director or another Cisco IOS device and the network reloads, it is possible that DHCP could assign new IP addresses to the devices. This is an unlikely occurrence, but if it does happen, you might need to reassociate the director and client switches by manually entering the director IP address on the director or the client switches. To prevent this occurrence, configure the DHCP server to remember the IP bindings by entering the `ip dhcp remember global configuration` command or the `remember DHCP pool configuration` command.

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## Configuring the Director as the DHCP Server

You can configure the director as DHCP server and create DHCP server pools directly from the Smart Install director.

Beginning in privileged EXEC mode, follow these steps on the director to configure it as the DHCP server:

|               | Command   | Purpose  |
|---------------|---|--|
| <b>Step 1</b> | config <b>terminal</b>  | Enters global configuration mode.  |
| <b>Step 2</b> | vstack director <i>ip_address</i>                               | Configures the device as the Smart Install director by entering the IP address of an interface on the device.  |
| <b>Step 3</b> | vstack <b>basic</b>   | Enables the device as the Smart Install director.  |
| <b>Step 4</b> | vstack startup-vlan <i>vlan_value</i>                           | Specifies the default VLAN that the director should use for Smart Install management.  |
| <b>Step 5</b> | vstack dhcp-localserver <i>poolname</i>                         | Creates a name for the Smart Install DHCP server address pool, and enter vstack DHCP pool configuration mode.  |
| <b>Step 6</b> | address-pool <i>network-number</i><br><i>mask prefix-length</i> | Specifies the subnet network number and mask of the DHCP address pool.<br><b>Note</b> The prefix length specifies the number of bits that comprise the address prefix. The prefix is an alternative way of specifying the network mask of the client. The prefix length must be preceded by a forward slash (/). |
| <b>Step 7</b> | default-router <i>ip_address</i>                                | Specifies the IP address of the DHCP default router for the pool.<br><b>Note</b> You can use the vstack startup-vlan global configuration command to specify another VLAN that should be used for Smart Install management.  |

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|                |   |  |
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| <b>Step 8</b>  | <code>file-server address</code>                | Specifies the IP address of the TFTP server.<br><b>Note</b> If the director is also the TFTP server, you must enable it. See the Configuring the TFTP Server section.  |
| <b>Step 9</b>  | <code>exit</code>                               | Returns to global configuration mode.  |
| <b>Step 10</b> | <code>ip dhcp remember</code>                   | (Optional) Configures the DHCP server to remember the IP bindings of a device. If the network or device reloads, the DHCP server issues the same IP address to a client that it had before the reload. This command is supported in Cisco IOS Release 12.2(53) or later on switches and in Cisco IOS Release 15.1(3)T or later on routers. |
| <b>Step 11</b> | <code>end</code>                                | Returns to privileged EXEC mode.   |
| <b>Step 12</b> | <code>copy running-config startup config</code> | (Optional) Saves your entries in the configuration file.   |
| <b>Step 13</b> | <code>show dhcp server</code>                   | Verifies the configuration by displaying the DHCP servers recognized by the device.  |

This example shows how to configure the Smart Install director as the DHCP server:

```
Director# configure terminal
Director(config)# vstack director 1.1.1.20
Director(config)# vstack basic
Director(config)# vstack dhcp-localserver pool1
Director(config-vstack-dhcp)# address-pool 1.1.1.0 255.255.255.0
Director(config-vstack-dhcp)# default-router 1.1.1.30
Director(config-vstack-dhcp)# file-server 1.1.1.40
Director(config-vstack-dhcp)# exit
Director(config)# ip dhcp remember
Director(config)# end
```

DHCP snooping is automatically enabled on the director. Therefore, you do not need to enable it when the director is the DHCP server.



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## Configuring Another Device as DHCP Server

If the Smart Install director is not the DHCP server, you can use the traditional Cisco IOS DHCP commands to configure a server pool outside the Smart Install network. The director must have connectivity to the DHCP server. For procedures to configure other DHCP server options, see the “*Configuring DHCP*” section of the “*IP Addressing Services*” section of the *Cisco IOS IP Configuration Guide, Release 12.2* or the “*IP Addressing Services*” section of the *Cisco IOS IP Configuration Guide, Release 15.1* from Cisco.com. This procedure shows the minimum steps that you need to perform to configure a DHCP server.

### Note

Do not configure a client switch as DHCP server. If you configure DHCP server commands on a client switch, the switch will assign IP addresses, and will not be able to use Smart Install.

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Beginning in privileged EXEC mode, follow these steps:

|               | Command   | Purpose  |
|---------------|---|--|
| <b>Step 1</b> | <code>config terminal</code>                                  | Enters global configuration mode.  |
| <b>Step 2</b> | <code>ip dhcp pool <i>poolname</i></code>                     | Creates a name for the DHCP server address pool, and enters DHCP pool configuration mode.  |
| <b>Step 3</b> | <code>bootfile <i>filename</i></code>                         | Specifies the name of the configuration file to be used.   |
| <b>Step 4</b> | <code>network <i>network-number mask prefix-length</i></code> | Specifies the subnet network number and mask of the DHCP address pool.<br><b>Note</b> The prefix length specifies the number of bits that comprise the address prefix. The prefix is an alternative way of specifying the network mask of the client. The prefix length must be preceded by a forward slash (/). |
| <b>Step 5</b> | <code>option 150 <i>address</i></code>                        | Specifies the IP address of the TFTP server.   |
| <b>Step 6</b> | <code>remember</code>   | (Optional) Configures the DHCP pool to remember the IP bindings of a device. If the network or device reloads, the DHCP server issues the same IP address to a client that it had before the reload.   |
| <b>Step 7</b> | <code>end</code>  | Returns to privileged EXEC mode.   |

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This example shows how to configure another device as a DHCP server:

```
Switch # configure terminal
Switch(config)# ip dhcp pool pool1
Switch(dhcp-config)# network 10.10.10.0 255.255.255.0
Switch(dhcp-config)# option 150 10.10.10.1
Switch(dhcp-config)# remember
Switch(config-if)# end
```

When the director is a Layer 3 switch, DHCP snooping is automatically enabled on it. When there is a relay agent between the DHCP server and the director, you must enable DHCP snooping on the relay agent.

## Note

DHCP relay is not supported on interfaces connected to vStack VLAN on which DHCP snooping is enabled.

To enable DHCP snooping on a Cisco DHCP relay device, enter these global configuration commands:

- ip dhcp snooping
- ip dhcp snooping vlan *vlan-id* for other configured Smart Install VLANs
- no ip dhcp snooping information option (if the DHCP server is running Cisco IOS)

You must also enter the ip dhcp snooping trust interface configuration command on the director interface that is connected to the server. If the director and the DHCP server are on different VLANs, you must enable IP routing on the VLAN interface connected to the client switches, and enter this command:

- ip helper *address* (IP address of the DHCP server)

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## Configuring the TFTP Server

Smart Install stores image, configuration files, and post install files on a TFTP server. The director can function as the TFTP server, eliminating the need for an external TFTP-serving device. If the director is the TFTP server, image, configuration files and post install files are stored in the director flash memory. If the director does not have available memory storage space, you can store the files on a third-party server and point to that location.

If the TFTP server is a third-party (non-Cisco) device, you should disable the server option to change the name of a file if another file is created with the same name. Otherwise, duplicate image list files might be created.

In Catalyst 6500 Supervisor Engine 2T switches, flash size supports onboard and external disks to download the image, the configuration file and post install file.

When selecting the director to be the TFTP server, follow these:

- The total flash memory space (used and free) on the director must be large enough to contain the director image, and configuration file and the image, configuration files and the post install files required for client switches.
- There must be sufficient available flash memory on the director to hold the client Cisco IOS images and configuration files and post install files. The Cisco IOS image files vary in size, depending on the client product IDs and size of the images being installed.
- When the director is the TFTP server, a copy of the configuration file

for each client is stored in the root directory of the flash file system on the director. There must be sufficient space for each planned

- client.
- Most director devices have sufficient flash memory to hold one client Cisco IOS image, a small number of client configuration files and post install files. For example, the Catalyst 3750 switch can have a maximum flash size of 64 MB, which accommodates only 4 or 5 images, based on the image size.
- If the director is a switch and the Smart Install network includes client switches with more than one product ID, you should use an external TFTP server.

In more recent IOS releases, you do not need to configure the director as TFTP server. The director automatically gets the required image, configuration files and post install files and acts as the TFTP server when you specify flash: as the location from which to retrieve the files.

For example, for zero-touch updates of a default image and a configuration file, entering these commands on the director automatically configures the director as the TFTP server and enables the director DHCP server to provide these files to the clients.

```
vstack config flash:new_configuration_file
vstack image flash:image_name.tar
vstack script flash:post_install.txt
```

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## Establishing a Remote Client Session

You can perform configuration tasks on the client through a remote connection from the director. From the director, enter the vstack

`attach {client - index} | {client IP address}` command in EXEC mode to attach to a client interface and temporarily enable it as director. Select

a client by either choosing from a list that shows the active clients that are available within the Smart Install network or by entering the client IP address.

## Smart Install Configuration Examples

These are examples of how to configure a client default configuration on the director. The director should have Layer 3 enabled with multiple Layer 3 interfaces. The director has an IP address on the VLAN that is used for Smart Install management, and configures an IP address on the client VLAN interface. All clients are the same model type and use the default configuration. Clients added to the network are out-of-the box switches with no configuration, or switches that have had a write erase and reload.

### Note

VLANs are not required when the director is a router.

These examples show how to configure a default configuration with the director as TFTP server and with a third-party server.

## Director as the TFTP Server

In this example, the director is the TFTP server and the image and configuration file are stored in the director flash memory.

### Before Configuring the Director:

Define the Configuration File and Cisco IOS Image

**Step 1** You must transfer files to the director. TFTP is the preferred method of transferring files to and from the director. Locate a TFTP server that is IP-reachable by the director and put all files to be transferred on that server.

**Step 2** Using a text editor, create a file with the configuration commands for your default switch. In this example, the file name is *default\_configuration.txt*.

**Step 3** Save the *default\_configuration.txt* to the TFTP server.

**Step 4** Identify the Cisco IOS image you want loaded as the default image on the switches, for example, *c2960-lanbase-tar.122-53.SE.tar*. Put that file in the TFTP server.

You should have two files on the TFTP server: the configuration file and the Cisco IOS image.

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## Note

After the director is enabled and configured with the default image name, it creates a tailored configuration file for boot up and an image list file with the default image and puts them in flash memory.

## Transfer These Files to the Director

**Step 1** Before you start, make sure that you have room in the flash memory for the Cisco IOS image. The output of the `dir` command shows the available space near the end of the output. If you do not have enough space for the image, do one of these:

- Remove files to free up some space.
- Consider using an external TFTP server for the Smart Install. (That is a different scenario that is not described here.)

**Step 2** To transfer files to the director, you must copy *from* the director, not *to* the director. The director must initiate the transfer. From the Cisco IOS console, enter these commands:

```
Director# copy tftp://tftp ip address/default_configuration.txt flash:
Director# copy tftp://tftp ip address/IOS_image_file.tar flash:
```

## Note

This normally takes several minutes.

## Configure a Director

By default, new Ethernet switches shipped from Cisco (for example, Catalyst 2960 switches) boot up without a configuration file. These switches issue a DHCP request on the default VLAN that is configured for the Smart Install director. The director recognizes the DHCP request on the VLAN and responds.

In this example, the director is both the TFTP server and the DHCP

server, and it serves IP addresses on VLAN 1.

## Note

If the director is a router, all clients connected to Layer 3 interfaces on the router will be recognized.

**Step 1** Assign an IP address to the director on the VLAN 1 interface. If the director is a router, assign an IP address on any Layer 3 interface. You can also use a loopback interface on the director. In this example, the *director\_ip\_address* is 192.168.1.1.

```
Director(config)# interface vlan 1
Director(config)# ip address 192.168.1.1 255.255.255.0
```

**Step 2** Configure the director for the default image and configuration file.

```
Director(config)# vstack config flash:default_configuration.txt
Director(config)# vstack image flash:IOS_image_file_name.tar
```

**Step 3** Configure the director to serve as the DHCP server for clients.

```
Director(config)# vstack dhcp-localserver smart_install_pool
```

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```
Director(config-vstack-dhcp)# address-pool network_ip_address
255.255.255.0
Director(config-vstack-dhcp)# file-server network_ip_address
Director(config-vstack-dhcp)# default-router network_ip_address
Director(config-vstack-dhcp)# exit
Director(config)# ip dhcp remember
```

## Step 4 Enable Smart Install on the director.

```
Director(config)# vstack director director_ip_address
Director(config)# vstack basic
```

Any switch that boots up without a configuration file on the default Smart Install VLAN or on an Layer 3 interface on the router becomes a Smart Install client of the director. As clients are powered up and discovered by the director, they are updated and given the configuration defined in *default\_configuration.txt*.

### Note

If the configuration file is not present when the Smart Install client boots up, the client attempts to retrieve the DHCP address from VLAN1. If VLAN 1 is not allowed in the network, then the Smart Install client attempts to identify the startup VLAN from the CDP packets that it receives from the upstream data (that is, data received either from a Smart Install client that is already part of the network, or from the director that the client is connected to).

Use these commands to see the Smart Install network:

- To see the update of new clients in progress: Director# show vstack download
- To see the clients and information about them: Director# show vstack status
- 

### Third-Party, Non-Cisco IOS Device as the TFTP Server

In this example, the customer stores all client image and configuration files on an external, third-party server reachable by the director and client switches.

#### Before Configuring the Director:

Define the Configuration File and Cisco IOS Image

Step 1 You must transfer files to the director and TFTP is the preferred method. Locate a TFTP server that is IP-reachable by the director, and put all files to be transferred on the TFTP server.

Step 2 Using a text editor, create a file with the configuration commands that you want for the default switch. In this example, the file name is *default\_configuration.txt*.

Step 3 Save the *default\_configuration.txt* to the TFTP server.

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Step 4 Identify the Cisco IOS image you want loaded as the default image on the switches, for example *c2960-lanbase-tar.122-53.SE.tar*. Put that file in the TFTP server.

You should have two files on the TFTP server: the configuration file and the Cisco IOS image.

## Note

After the director is enabled and configured with the default image name, it automatically creates a tailored configuration file and an image list file for boot up and stores the files in the TFTP server.

## Configure the Director

By default, new Ethernet switches shipped from Cisco (for example, Catalyst 2960 switches) boot up without a configuration file. These switches send a DHCP request on the default Smart Install VLAN. The director recognizes the DHCP request and responds.

## Note

If the director is a router, all clients connected to Layer 3 interfaces on the router are recognized.

In this example, the director is not acting as the TFTP server. It is acting as the DHCP server, and it serves IP addresses on VLAN 1.

Step 1 Assign an IP address to the director on the VLAN 1 interface on a

switch or any Layer 3 interface on a router. In this example, the *director\_ip\_address* is 192.168.1.1.

```
Director(config)# interface vlan 1
Director(config)# ip address 192.168.1.1 255.255.255.0
```

Step 2 Configure the director for the default configuration file and image.

```
Director(config)# vstack config tftp://server-ip-
address/default_configuration.txt
Director(config)# vstack image tftp://server-ip-
address/default_image_file.tar
```

Step 3 Configure the director as the DHCP server for clients.

```
Director(config)# vstack dhcp-localserver smart_install_pool
Director(config-vstack-dhcp)# address-pool network_ip_address
255.255.255.0
Director(config-vstack-dhcp)# file-server network_ip_address
Director(config-vstack-dhcp)# default-router network_ip_address
Director(config-vstack-dhcp)# exit
Director(config)# ip dhcp remember
```

Step 4 Enable Smart Install on the director.

```
Director(config)# vstack director director_ip_address
Director(config)# vstack basic
```

Any switch that boots up without a configuration file on the default Smart Install VLAN or on a Layer 3 interface on the router, becomes a Smart Install client of the director. As clients power up and are discovered by the director, they are updated and given the configuration defined in *default\_configuration.txt*.



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## Note

If the configuration file is not present when the Smart Install client boots up, the client attempts to retrieve the DHCP address from VLAN 1. If VLAN 1 is not allowed in the network, then the Smart Install client attempts to identify the startup VLAN from the CDP packets that it receives from the upstream data (that is, data received either from a Smart Install client that is already part of the network, or from the director that the client is connected to).

Use these commands to see the Smart Install network.

To see the update of new clients in progress: Director# show vstack download status

To see the clients and information about them: Director# show vstack status

## Deployment Scenarios

### Configuring a Network with Single or Mixed Switch Types

To configure a network with single or mixed switch types, perform the following procedures:

- Configuring a Network That Includes a Single Switch Type
- Using Built-In Groups to Configure a Mixed Network with Two Switch Types

### Configuring a Network That Includes a Single Switch Type

When all client switches in the Smart Install network are the same

switch product ID and are performing the same functions, they would use the same image, the same seed (base) configuration file and same post install file. In this case, you can configure a default image, a seed configuration file, and the same post install file for all clients in the network.

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Beginning in privileged EXEC mode, follow these steps on the director to set the default image and configuration file, and the post install file for all clients in the network:

|               | Command   | Purpose  |
|---------------|---|--|
| <b>Step 1</b> | config terminal   | Enters global configuration mode.  |
| <b>Step 2</b> | vstack director <i>ip_address</i>   | Configures the device as Smart Install director by entering the IP address of an interface on the device.  |
| <b>Step 3</b> | vstack basic  | Enables the device as the Smart Install director.  |
| <b>Step 4</b> | vstack startup-vlan <i>vlan_value</i>   | Specifies the default VLAN that the director should use for Smart Install management.  |
| <b>Step 5</b> | Vstack image<br>{flash: <i>image_name</i> .tar <br>tftp:// <i>location</i><br><i>image_name</i> .tar} | Enters the location and image.<br><b>Note</b> Although visible in the command-line help, these options are not supported: ftp:, http:, https:, null:, nvram:, rcp:, scp:, system:, <b>tmpsys:</b> .<br><ul style="list-style-type: none"><li>flash:<i>image_name</i>.tar—Enter if the director is the TFTP server and the image is in the director flash memory.</li></ul> <b>Note</b> The images for the Catalyst 3850 and 3650 platforms are bundled with a .bin extension; the .tar extension is not available.<br><b>Note</b> Instead of flash:, you can also enter flash0:, flash1:, or <b>usb:</b> |

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|               |   |   |
|---------------|---|---|
| <b>Step 6</b> | vstack config {flash:<br><i>config.txt</i>   tftp:// <i>location</i><br><i>config.txt</i> } | <p>Enters the location and the default configuration file name. The configuration file is a text file that contains the configuration file to be downloaded to the client.</p> <p><b>Note</b> Although visible in the command-line help, these options are not supported: ftp:, http:, https:, null:, nvram:, rcp:, scp:, system:, <b>tmpsys:</b>.</p> <ul style="list-style-type: none"><li>• For location, enter flash: if the TFTP server is the director and the configuration file is in the director flash memory.</li></ul> <p><b>Note</b> Instead of flash:, you can also enter flash0:, flash1:, or usb:.</p> <ul style="list-style-type: none"><li>• For location, enter tftp: if the TFTP server is not the director or if the file is not in the director flash memory. In this case, enter tftp://<i>director ip_address</i>.</li><li>• <i>config.txt</i>—Enter the filename of the default seed configuration file for clients in the</li></ul> |
|---------------|---|---|

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|                |   |   |
|----------------|---|---|
| <b>Step 7</b>  | <pre>vstack script {flash:<br/>post_install.txt  <br/>tftp://location<br/>post_install.txt}</pre> | <p>Enters the location of the post install script file for the default group. The post install file is a text file that contains the post install CLI commands to be downloaded to the client.</p> <p><b>Note</b> Although you must provide the image or the config, or the image and the config, the post install script is optional.</p> <p>this comment applies to all locations below where post-install configuration is described</p> <p><b>Note</b> Although visible in the command-line help, these options are not supported: ftp:, http:, https:, null:, nvram:, rcp:, scp:, system:, <b>tmpsyz:</b></p> <ul style="list-style-type: none"><li>• For location, enter flash: if the TFTP server is the director and the post install file is in the director flash memory.</li></ul> <p><b>Note</b> Instead of flash:, you can also enter flash0:, flash1:, or <b>usb:</b></p> <ul style="list-style-type: none"><li>• For location, enter tftp: if the TFTP server is not the director or if the file is not in the director flash memory. In this case enter tftp://director ip_address.</li><li>• <i>post_install.txt</i>—Enter the filename of the default post install file for clients in the network.</li></ul> |
| <b>Step 8</b>  | <b>end</b>  | Returns to privileged EXEC mode.  |
| <b>Step 9</b>  | copy running-config startup config  | (Optional) Saves your entries in the configuration file.  |
| <b>Step 10</b> | show vstack config  | Verifies the configuration.   |

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A client switch sends an error message if it is unable to download an image, a configuration file or post install file due to miscommunication, if either of the following apply:

- An image, configuration file, or post install file is unavailable.
- If a join window is configured and the DHCP acknowledgment occurs outside the configured time frame.

If a Cisco device is being used as the TFTP server, you should configure it as described in the Configuring the TFTP Server section.

This example shows how to configure a default image and configuration file for a Smart Install network if the director is the TFTP server and the default image, configuration file and post install file are in the director flash memory:

```
Director# configure terminal
Director(config)# vstack director 1.1.1.20
Director(config)# vstack basic
Director(config)# vstack image flash:c2960-lanbase-tar.122-52SE.tar
Director(config)# vstack config flash:2960lanbase_config.txt
Director(config)# vstack script flash:2960lanbase_post_install.txt
Director(config)# end
```

This example shows how to configure a default image, configuration file, and post install file when the TFTP server is not the director:

```
Director# configure terminal
Director(config)# vstack director 1.1.1.20
Director(config)# vstack basic
Director(config)# vstack image tftp://101.122.33.10/c2960-
```

```
lanbase-
```

```
tar.122-52SE.tar
```

```
Director(config)# vstack config
tftp://101.122.33.10/2960LANBase_config.txt
Director(config)# vstack script
tftp://101.122.33.10/2960LANBase_post_install.txt
Director(config)# end
```

## Using Built-In Groups to Configure a Mixed Network with Two Switch Types

You can use built-in groups in a Smart Install network to configure a group of switches that have one product ID with an image, configuration file, and post install file, and to configure a second group of switches that have another product ID with another image, configuration file, and post install file. You could also have other clients in the network that do not belong to either of these groups and could use the default image, configuration file, and post install file if they match the default product ID.

Beginning in privileged EXEC mode, follow these steps on the director to configure the image, configuration file, and post install file for two different product IDs in the Smart Install network:

### Note

If the device is already configured as an SMI director, Steps 1 thru 5 are optional. If the device is already configured as a director, skip to Step 6 for on-demand updates.

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|               | Command   | Purpose  |
|---------------|---|--|
| <b>Step 1</b> | <code>config terminal</code>                              | Enters global configuration mode.  |
| <b>Step 2</b> | <code>vstack director <i>ip_address</i></code>            | Configures the device as Smart Install director by entering the IP address of an interface on the                |
| <b>Step 3</b> | <code>vstack basic</code>                                 | Enables the device as the Smart Install director.  |
| <b>Step 4</b> | <code>vstack startup-vlan <i>vlan_value</i></code>        | Specifies the default VLAN that the director should use for Smart Install management.                            |
| <b>Step 5</b> | <code>vstack group built-in <i>product_family1</i></code> | Identifies the first built-in group product ID, and enters Smart Install group configuration mode for the group. |

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|               |                                      |   |
|---------------|--------------------------------------|---|
| <b>Step 6</b> | image <i>location image_name.tar</i> | <p>Enters the location and image name for group 1.</p> <ul style="list-style-type: none"><li>• For location, enter <b>flash:</b> (if the TFTP server is the director and the file is stored in the director flash memory).</li></ul> <p><b>Note</b> Instead of flash:, you can also enter flash0:, flash1:, or usb:.</p> <ul style="list-style-type: none"><li>• For location, enter <b>tftp:</b> and the location of the configuration file for group 1 if the file is not stored in the director flash memory.</li></ul> <p><b>Note</b> Although visible in the command-line help, these options are not supported: ftp:, http:, https:, null:, nvram:, rcp:, scp:, system:, tmpsys:.</p> <p><b>Note</b> The images for the Catalyst 3850 and 3650 platforms are bundled with a .bin extension; the .tar extension is not available.</p> <ul style="list-style-type: none"><li>• <i>image_name.tar</i>—Enter the name of the image tar file for clients in group 1.</li></ul> |
|---------------|--------------------------------------|---|

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|               |  |   |
|---------------|--|---|
| <b>Step 7</b> | <code>config location config_filename</code>           | <p>Enters the location and configuration file for group 1.</p> <ul style="list-style-type: none"><li>For location, enter <b>flash:</b> (if the TFTP server is the director and the file is stored in the director flash memory).</li></ul> <p><b>Note</b> Instead of flash:, you can also enter flash0:, flash1:, or usb:.</p> <ul style="list-style-type: none"><li>For location, enter <b>tftp:</b> and the location of the configuration file for group 1 if the file is not stored in the director flash memory.</li></ul> <p><b>Note</b> Although visible in the command-line help, these options are not supported: ftp:, http:, https:, null:, nvram:, rcp:, scp:, system:, tmpsys:.</p>   |
| <b>Step 8</b> | <code>script location<br/>post_install_filename</code> | <p>Enters the location and post install file for group 1.</p> <p><b>Note</b> Although you must provide the image or the config, or the image and the config, the post install script is optional.</p> <ul style="list-style-type: none"><li>For location, enter <b>flash:</b> (if the TFTP server is the director and the file is stored in the director flash memory).</li></ul> <p><b>Note</b> Instead of flash:, you can also enter flash0:, flash1:, or usb:.</p> <ul style="list-style-type: none"><li>For location, enter <b>tftp:</b> and the location of the post install file for group 1 if the file is not stored in the director flash memory.</li></ul> <p><b>Note</b> Although visible in the command-line help, these options are not supported: ftp:, http:, https:, null:, nvram:, rcp:, scp:, system:, tmpsys:.</p> |
| <b>Step 9</b> | Exit   | Returns to global configuration mode.   |



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| <b>Step 10</b> | vstack group built-in<br><i>product_family2</i> | Identifies the second built-in group product ID, and enters Smart Install group configuration mode for the group.  |
| <b>Step 11</b> | image <i>location image_name.tar</i>            | <p>Enters the location and image name for group 2.</p> <ul style="list-style-type: none"><li>For location, enter <b>flash:</b> (if the TFTP server is the director and the file is stored in the director flash memory).</li></ul> <p><b>Note</b> Instead of flash:, you can also enter flash0:, flash1:, or usb:.</p> <ul style="list-style-type: none"><li>For location, enter <b>tftp:</b> and the location of the configuration file for group 2 if the file is not stored in the director flash memory.</li></ul> <p><b>Note</b> Although visible in the command-line help, these options are not supported: ftp:, http:, https:, null:, nvram:, rcp:, scp:, system:, tmpsys:.</p> <p><b>Note</b> The images for the Catalyst 3850 and 3650 platforms are bundled with a .bin extension; the .tar extension is not available.</p> |
| <b>Step 12</b> | config <i>location config_filename</i>          | <p>Enters the location and configuration file for group 2.</p> <ul style="list-style-type: none"><li>For location, enter <b>flash:</b> (if the TFTP server is the director and the file is stored in the director flash memory).</li></ul> <p><b>Note</b> Instead of flash:, you can also enter flash0:, flash1:, or usb:.</p> <ul style="list-style-type: none"><li>For location, enter <b>tftp:</b> and the location of the configuration file for group 2 if the file is not stored in the director flash memory.</li></ul> <p><b>Note</b> Although visible in the command-line help, these options are not supported: ftp:, http:, https:, null:, nvram:, rcp:, scp:, system:, tmpsys:.</p>  |

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|----------------|--|---|
| <b>Step 13</b> | <code>script location</code><br><code>post_install_filename</code> | <p>Enters the location and post install file for group 2.</p> <p><b>Note</b> Although you must provide the image or the config, or the image and the config, the post install script is optional.</p> <ul style="list-style-type: none"><li>For location, enter <b>flash:</b> (if the TFTP server is the director and the file is stored in the director flash memory).</li></ul> <p><b>Note</b> Instead of flash:, you can also enter flash0:, flash1:, or usb:.</p> <ul style="list-style-type: none"><li>For location, enter <b>tftp:</b> and the location of the post install file for group 2 if the file is not stored in the director flash memory.</li></ul> <p><b>Note</b> Although visible in the command-line help, these options are not supported: ftp:, http:, https:, null:, nvram:, rcp:, scp:, system:, tmpsyz:.</p> |
| <b>Step 14</b> | End  | Returns to privileged EXEC mode.  |
| <b>Step 15</b> | copy running-config startup config                                 | (Optional) Saves your entries in the configuration file.  |
| <b>Step 16</b> | show vstack group built-in detail                                  | Verifies the configurations.  |

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A client switch sends an error message if it cannot download an image, configuration file, or post install file due to misconfiguration, provided either of the two apply:

- The image, configuration file, or post install file is unavailable.
- If a join window is configured and the DHCP acknowledgment occurs outside of the configured time frame.

This example uses built-in groups to configure all 3560 24-port switches in the network with one image, configuration file, and post install file, it configures all 2960 24-port switches in the network with another image, configuration file, and post install file.

```
Director# configure terminal
Director(config)# vstack director 1.1.1.20
Director(config)# vstack basic
Director(config)# vstack group built-in 3560 24
Director(config-vstack-group)# image tftp://101.122.33.10/c3560-
ipbase1mk9-tar.122-52.SE.tar
Director(config-vstack-group)# config tftp://101.122.33.10/3560-
24-ipbase_config.txt
Director(config-vstack-group)# script tftp://101.122.33.10/3560-
24-ipbase_post_install.txt
Director(config)# exit
Director(config)# vstack group built-in 2960 24
Director(config-vstack-group)# image tftp://101.122.33.10/c2960-
lanbasek9-tar.122-52.SE.tar
Director(config-vstack-group)# config tftp://101.122.33.10/2960-
24-LANbase_config.txt
Director(config-vstack-group)# script tftp://101.122.33.10/3560-
24-ipbase_post_install.txt
Director(config)# end
```

## Best Practices

It is recommended to check and have a dedicated front-port connectivity between Director and Client.

## Uninstall

### Disabling Smart Install on a Device

When a director is configured and a client joins the Smart Install network, Smart Install is automatically enabled on these devices. Beginning with Cisco IOS Release 12.2(58)SE, 15.1(1)SY, 15.0(2)SE and later, or 3.2(0)SE and later, you can disable Smart Install on a device and also shut down its Smart Install TCP ports by entering the `no vstack` global configuration command on the client or director. When Smart Install is disabled on a device, any Smart Install configuration on it remains in the running configuration but does not take effect while Smart Install is disabled.

When Smart Install is disabled on a device, the `vstack director ip_ address` and `vstack basic` global configuration commands are not allowed on the device. To reenab Smart Install on a device, enter the `vstack` global configuration command.

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## Configuring Smart Install Devices

### Information about SMI Proxy

Prior to Cisco IOS XE 3.6.0E releases, Smart Install was the routine way to manage zero-touch deployments (ZTD) for Catalyst devices. Cisco's solution toward ZTD, Plug and Play (PnP) provides an agent that runs on each networking device and a server that manages your network devices with respect to configuration, image, and more.

Beginning with Cisco IOS XE 3.6.0E and IOS 15.2(2)E, PnP Agent is available on Catalyst 4500 series, Catalyst 3850, Catalyst 3650, IE 2000, IE 3000, IE 3010, Catalyst 2K and Catalyst 3K switches. Devices running older releases (prior to Cisco IOS-XE 3.6.0E, and IOS 15.2(2)E) rely on existing ZTD solutions such as Smart Install to enable IOS version updates. Devices running the older release cannot communicate with the central PnP Server. These devices require a migration path to reach the PnP Server.

Beginning with Cisco IOS XE 3.6.1E and IOS 15.2(2)E1, Catalyst 4500, Catalyst 3850, Catalyst 3750, Catalyst 3650, and Catalyst 3560 switches support SMI PnP Proxy, which leverages SMI functionality in existing network device and allows for image and configuration upgrade of devices running older versions. SMI Proxy is applicable only to platforms that support SMI Director. The SMI Proxy feature will run on a network device that is running version IOS-XE 3.6.1E or IOS 15.2(2)E1 and is configured for PnP Agent and SMI Proxy. This device will bridge the communication from older devices running Smart Install to the

PnP Server. It will "proxy" as the PnP Agent for devices running older versions, enabling these devices to behave as if the SMI Proxy device is the SMI Director. The SMI Proxy device will contact the central PnP Server on behalf of the device running older versions to retrieve image and configuration information.

This section contains:

- [How SMI Proxy Interacts with Smart Install Devices and the PnP Agent](#)
- [SMI Proxy and Tailored Configuration Files](#)
- [SMI Proxy Database](#)

### [How SMI Proxy Interacts with Smart Install Devices and the PnP Agent](#)

After accepting different requests from various smart install clients, SMI Proxy provides all the mandatory information to the PnP Agent for each request. PnP Agent then forwards these requests to the PnP Server on behalf of the smart install client. The PnP Agent forwards the corresponding response from the PnP server to the SMI Proxy for further processing. SMI Proxy allows a central PnP Server administrator to possess a single view of the network with respect to the image and configuration, even when some of the switches in the network are only SMI-capable.

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### *How SMI Clients and Directors Communicate*

Smart Install clients can communicate with a director only within the network. SMI Proxy leverages existing client communication with the director, extracting relevant data from a networking device. SMI Proxy mediates between Smart Install clients and the PnP Server, maintaining a database similar or equivalent to the data gleaned by the director.

### *How SMI Proxy and PnP Agent Communicate*

SMI Proxy can trigger the PnP server to send service requests in the following ways:

- When a new SMI client device boots, it sends the "device came up notification" request to SMI Proxy, which sends the information request to the PnP Server through the PnP Agent.
- If SMI Proxy receives a backoff request for any SMI client, it starts the backoff timer. After the timer expires, SMI Proxy sends the work information request to PnP Server through PnP Agent.
- When the SMI Proxy receives the work information "bye" request from PnP Server, it immediately sends the work request to the PnP Server.
- When SMI Proxy receives the client request, PnP Agent sends that request to PnP Server and awaits a response. PnP Agent then evaluates whether the response is intended for the local device or

- the proxied client. If the former, the PnP Agent consumes the message; else, it is communicated to SMI Proxy.
- 

### **SMI Proxy and Tailored Configuration Files**

The director (IBD) controls which image or configuration is forwarded to the client switches (for example, SMI IBC). It is essential to upgrade older switches that do not run an SMI-capable image. To enable IBD to communicate with such switches and suitably upgrade them, a tailored configuration file was introduced.

In SMI proxy mode, to acquire the PID, VID, and SN of each client, SMI Proxy follows the "reverse telnet" mechanism supported by SMI on older devices.

Starting with IOS XE 3.6.1E and 15.2(2)E1, a director device supports and treats all clients as older devices. The proxy device uses the tailored configuration file to telnet [to] clients and acquire the output data for the show version command. When the proxy device reloads, a new tailored configuration file, `client_cfg_pnp.txt`, is generated.

This is an example of a newly-created tailored configuration file:

```
!  
version 12.2  
!  
enable password cisco  
!
```

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```
username cisco
!
ip http authentication enable <ckadapa>:this config is required
!
do telnet 5.1.1.1 19140
!
vstack director 5.1.1.1
!
end
!
```

### SMI Proxy Database

SMI functionality works off the MAC address whereas the PnP solution, the UDI. SMI Proxy creates the UDI and adds the entry in SMI Proxy database for further communications (e.g., when SMI Proxy wants to send information from the SMI Client to the PnP Server). With the client's MAC address, SMI Proxy searches the database to acquire the SMI Client's UDI. When SMI Proxy wants to send the message received from PnP server to the SMI Client, it uses UDI to acquire the MAC address of the SMI Client. SMI Proxy uses this MAC address to send that message to respective SMI Clients. This file is created locally under "flash:/vstack" or "bootflash:/vstack" based on the platform with the name smi\_pnp\_proxy\_db.txt. Before creating the entry, SMI Proxy searches for the entry in the database.

If the entry is missing, SMI Proxy adds it to the database, which is stored in the file and contains the entries for stale devices that were in the network previously. If the entry exists, SMI Proxy takes no action. Whenever the device on which SMI Proxy is running reboots, while

that device is booting, the device retrieves the database from the file. Clearing this database is disallowed. The show command alone can display the entries.

### Configuration Steps

#### Adding a Client Switch to the Network

When a switch arrives from the factory, it contains the factory default image. When it is plugged in and connected to the network and boots up, it tries to get its IP address from DHCP. When a device is added to the network, a notification is sent to the director that a new client has joined. If the switch is connected (directly or indirectly) to the Smart Install director, the director recognizes the new switch through DHCP offers and acknowledgments. The director searches its database to determine if the switch belongs to a configured group. If not, the director determines if the switch matches the Smart Install network default PID. If the director has a configuration for the type of client that was added and if the join window is open, the new client receives the image and configuration files.

#### Note

When clients in a Smart Install network consist of more than one PID, you should configure built-in groups or custom groups based on MAC address, connectivity, stack group, or product-ID, and define the image and configuration files for each group.

If the DHCP Server is external or internal (running on the director), the director inserts options into the DHCP response, informing the client

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where to download its IOS image and configuration file provided the join window is open.

## Note

If a join window has been configured, the Smart Install configuration and image files are sent to the client only during the configured time period. A client switch sends an error message if it cannot download an image or configuration file due to misconfiguration, if the image or configuration file is not available, or if a join window is configured and the DHCP acknowledgments occurs beyond the configured time frame. See the Using a Join Window section for more information.

After a switch has been added to the Smart Install network, you can do an on-demand download of an image or configuration file to the client at any time if the switch meets these criteria:

- A switch that is not Smart Install capable must have an enable mode password and a valid IP interface.
- A switch running the Smart Install image must have a valid IP interface.

If a client switch in the Smart-Install network is running Cisco IOS Release 12.2(55)SE or later, or 3.2(0)SE and later, 15.0(2)EX, 15.0(2)EX1, 3.6.(0)E, and 15.2.(2)E is replaced with a switch with the same product ID, the new client receives the same image and configuration as the replaced client. See the Replacing a Client Switch section. See Configuring Smart Install Devices section for typical

configurations.

## Connecting to a Client Switch

To connect to the client switch command-line interface, enter the `vstack attach {client-index | client_ip_address}` privileged EXEC command. The client-index number represents active clients in the Smart Install network, displayed in the command-line help by entering a question mark (?) after the `vstack attach` command. The same client number is valid until the client reboots.

```
Director# vstack attach ?  
1 c3750-2042 @ IP 10.0.0.1 : MAC 0000.0040.4080  
2 c3750-2045 @ IP 10.0.0.2 : MAC 0000.000c.0d80
```

A.B.C.D IP address of remote node to attempt attaching to

To attach to a client, the client switch must be configured for telnet service and have a configured enable password.

## Enabling Proxy on the Device

Beginning in privileged EXEC mode, follow these steps to enable SMI Proxy:

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|               | Command  | Purpose   |
|---------------|--|---|
| <b>Step 1</b> | config terminal  | Enters global configuration mode.   |
| <b>Step 2</b> | [no] vstack proxy {ip-address <i>smi-ip</i>   interface <i>interface name</i> } [startup-vlan <i>vlan_value</i> ] [pnp-profile <i>profile-name</i> ] | <p>Enables SMI SMI Proxy mode.</p> <p>The [no] form of the vstack proxy command turns off support for SMI clients.</p> <ul style="list-style-type: none"><li>• Enter <b>ip-address</b> and the IP address. Launches SMI and enables director functionality on a device. This is a two-step "internal" process:</li><li>• SMI Proxy calls functions related to the <b>vstack director</b> <i>director_IP</i> command. where <i>director_IP</i> must match with at least one of the switch IP. In a scenario where an external DHCP server provides the addresses and the director IP to switches, the switch with matching director and switch IP addresses is eligible for only <b>vstack basic</b> configurations.</li><li>• Executes the <b>vstack</b>, <b>vstack director</b>, <b>vstack basic</b>, and <b>vstack startup-vlan</b> commands to enable 'Director' functionality on the switch.</li><li>• Enter <b>interface</b> and the interface name.<br/>Given the interface name, the SMI Proxy uses the associated IP address to enable director functionality.</li><li>• Enter <b>startup-vlan</b> and the VLAN value. Defined to support a non-Vlan1 scenario.<br/>Specifies the default VLAN that the director should use for Smart Install operations. Depending on the VLAN that is specified in the command, DHCP snooping is enabled on that VLAN so that the director can identify new switches that are connected to the network. If this command is not entered, however, VLAN 1 is used as default.</li></ul> |
| <b>Step 3</b> | end  | Returns to privileged EXEC mode.  |



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|               |   |  |
|---------------|---|--|
| <b>Step 4</b> | <code>copy running-config startup config</code> | (Optional) Saves your entries in the configuration file.             |
| <b>Step 5</b> | <code>show vstack config</code>                 | Verifies the configuration.  |
| <b>Step 6</b> | <code>show vstack proxy-db</code>               | Displays the SMI clients that are present in the SMI proxy database. |

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Once SMI Proxy is enabled, the following commands are not accessible:

- `vstack director ip`
- `vstack basic`
- `vstack join-window`
- `vstack backup`

When SMI Proxy is enabled the output of the configuration `vstack` command is as follows:

```
IBD(config)# vst ?
dhcp-localserver Configure vstack dhcp parameters
proxy Configure smi pnp proxy feature
startup-vlan Configure vstack startup management vlan
vlan Configure vstack management vlan
<cr>
```

This example shows how to configure SMI Proxy on interface vlan 1:

```
Switch# configure terminal
Switch(config)# vstack proxy interface vlan 1 startup-vlan 1
Switch(config)# end
```

This example shows how to configure SMI Proxy at ip-address 4.1.1.1:

```
Switch# configure terminal
Switch(config)# vstack proxy ip-address 4.1.1.1 startup-vlan 1
Switch(config)# end
Switch# configure terminal
Switch(config)#vstack proxy ip-address 4.1.1.1 startup-vlan 1
pnp-profile pnp-zero-touch
Switch(config)# end
```

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## Maintaining and Updating the Software Image

### Updating On-Demand to a New Image or Configuration

When a director is established and default or group images and configuration files are defined and there is connectivity between the director and a client switch, you can perform on-demand image and configuration updates. You can use this capability on a new client switch to make it Smart Install capable or on existing clients to update the image or configuration.

The process of triggering an on-demand upgrade for Catalyst 4500 switch IBC differs from other platforms. The difference resides with the ISSU upgrade option. In a typical upgrade of a Catalyst 3500 platform, let's say, the IBC reloads after the upgrade. In contrast, to prevent the downtime for a Catalyst 4500 IBC, you can complete an On-demand upgrade by selecting the ISSU option of the vstack download-image CLI.

You can initiate an on-demand download if the switch has a valid IP interface. For on-demand download on a switch that is not Smart Install capable, the switch must also have an enable password configured.

### **Note**

In Catalyst 3850 and 3650 switches, the client should be in installed mode to update the image.

Beginning with Cisco IOS Release 12.2(58)SE, 15.1(1)SY, 15.0(2)SE and later, and 3.2(0)SE and later, 3.6.(0)E, and 15.2.(2)E, you can perform on-demand updates to multiple clients simultaneously.

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Beginning in privileged EXEC mode, follow these steps on the director to perform an on-demand update on a client switch.

|               | Command   | Purpose   |
|---------------|---|---|
| <b>Step 1</b> | <code>config terminal</code>                    | Enters global configuration mode.   |
| <b>Step 2</b> | <code>vstack director ip_ address</code>        | Configures the device as the Smart Install director by entering the IP address of an interface on the device. |
| <b>Step 3</b> | <code>vstack basic</code>                       | Enables the device as the Smart Install director.   |
| <b>Step 4</b> | <code>vstack startup-vlan<br/>vlan_value</code> | Specifies the default VLAN that the director should use for Smart Install management.                         |
| <b>Step 5</b> | <code>end</code>                                | Returns to privileged EXEC mode.  |

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|               |   |  |
|---------------|---|--|
| <b>Step 6</b> | <pre>vstack download-image tar <i>image_URL</i> {<i>ip_address</i>   index <i>name</i>} <i>remote_switch_passwo</i> <i>rd</i> [override] reload [in <i>time</i>] or vstack download-image built-in <i>product_family</i> <i>port_config</i> <i>remote_switch_passwor</i> <i>d</i> [override] reload [in <i>time</i>] or vstack download-image {<i>imagelist_file_URL</i> {<i>ip_address</i>   index <i>name</i>} / built-in <i>product_family</i></pre> | <p>Starts an on-demand tar image download on a Smart Install client switch:</p> <ul style="list-style-type: none"><li>• Enter the <i>image_URL</i> and location and the IP address of the client. or Enter the <i>imagelist_file</i> and location and the IP address of the client (for releases earlier than 12.2(55)SE).</li><li>• <i>ip_address</i>—Enter the IP address of the client switch.</li><li>• <b>index name</b>—Enter the index name from the director database for multiple clients or a range of clients (for example, 1-3, 4). This feature was added in Cisco IOS Release 12.2(58)SE, 15.1(1)SY, 15.0(2)SE and later, or 3.2(0)SE and later.</li><li>• Enter <b>built-in</b>, and select the product family and port configuration from the command-line help.</li></ul> <p><b>Note</b> Use this option if you have identified the image for the specified built-in group by entering the image <i>location image_name.tar</i> Smart Install group configuration command.</p> <ul style="list-style-type: none"><li>• <i>remote_switch_password</i> —Enter the password for the client switch.</li></ul> <p><b>Note</b> A password is needed only if the switch is running a Cisco IOS image earlier than 12.2(52)SE. It is not required for switches already in the Smart Install network. If you are upgrading the image for multiple clients, all clients must have the same password or must have no password (None).</p> <ul style="list-style-type: none"><li>• (Optional) <b>override</b>—Overrides the existing image on the client switch.</li><li>• (Optional) <b>issu</b> attempts to upgrade using ISSU.</li></ul> |
|---------------|---|--|

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|---------------|--|---|
| <b>Step 7</b> | vstack download-config<br>{ <i>config_URL ip_address</i> /<br>built-in <i>product_family</i><br><i>port_config</i> }<br><i>remote_switch_password</i><br>startup [reload] [in<br><i>time</i> ] | <p>Starts an on-demand configuration download on a Smart Install client switch:</p> <ul style="list-style-type: none"><li>• Enter the configuration filename and location and the IP address of the client</li><li>• Enter <b>built-in</b> and select the product family and port configuration from the command-line help.</li></ul> <p><b>Note</b> Use this option if you have identified the configuration for the specified built-in group by entering the <i>config location config_filename</i> Smart Install group configuration command.</p> <p>The remaining keywords and arguments have these meanings:</p> <ul style="list-style-type: none"><li>• <i>remote_switch_password</i> —Enters the password for the client switch.</li></ul> <p><b>Note</b> A <i>password</i> is required only for switches that are not Smart Install capable. It is not required for switches already in the Smart Install network.</p> <ul style="list-style-type: none"><li>• <b>startup</b>—Applies the configuration to the switch startup configuration.</li><li>• (Optional) <b>reload</b>—Reloads the switch.</li></ul> |
| <b>Step 8</b> | show vstack download-  | Checks status of the download.  |

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This example shows how to configure a Smart Install director to schedule an on-demand download of an image and configuration file to the client switch with the IP address 1.1.1.30 and password of *mypassword*. The download takes place in 6 hours and 30 minutes.

```
Director# configure terminal
Director(config)# vstack director 1.1.1.20
Director(config)# vstack basic
Director(config)# end
Director# vstack download-image tar tftp://101.122.33.10/c2960-
lanbase9-tar.122-52.SE.tar 1.1.1.30 mypassword reload in 06:30
Director#                vstack                download-config
tftp://101.122.33.10/2960LANBase_config.txt 1.1.1.30 mypassword
reload in 06:30
```

This example shows the same configuration for a built-in group.

```
Director# configure terminal
Director(config)# vstack director 1.1.1.20
Director(config)# vstack basic
Director(config)# end
Director# vstack download-image built-in 3750 24 mypassword
override reload in 6:30
Director# vstack download-config built-in 3750 24 mypassword
reload in 06:30
```

Using Custom Groups to Configure Groups Based on Connectivity, MAC Address, Stack Number, or Product ID, you can configure a custom group to set up the image and configuration file for all client switches that match connectivity, MAC address, stack number, or product IDs for switches in a stack. A client switch sends an error message if it cannot download an image or configuration file due to misconfiguration, if the image or configuration file is not available, or if

a join window is configured and the DHCP acknowledgment occurs outside of the configured time frame.

## Configuring Custom Group Based on Connectivity

You can configure a custom group based on the connectivity or topology of switches in a Smart Install network. For example, you would use a connectivity match to configure a group of switches that are connected to the director through a single interface or switches that are connected to the director through a specific intermediate switch. A connectivity match takes priority over product ID or stack number custom groups and over built-in groups, but not over groups based on MAC addresses. Switches that do not match the connectivity configuration would acquire the configuration file, post install file, and image in either a built-in group or through the default configuration.

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Beginning in privileged EXEC mode, follow these steps on the director to configure a custom group based on connectivity:

|               | Command   | Purpose  |
|---------------|---|--|
| <b>Step 1</b> | config terminal   | Enters global configuration mode.  |
| <b>Step 2</b> | vstack director <i>ip_address</i>                             | Configures the device as the Smart Install director by entering the IP address of an interface on the device.  |
| <b>Step 3</b> | vstack basic  | Enables the device as the Smart Install director.  |
| <b>Step 4</b> | vstack startup-vlan<br><i>vlan_value</i>                      | Specifies the default VLAN that the director should use for Smart Install management.  |
| <b>Step 5</b> | vstack group custom<br><i>group_name</i><br>connectivity      | Identifies a custom group based on a connectivity match, and enters Smart Install group configuration mode for the group.  |
| <b>Step 6</b> | match host <i>ip_address</i><br>interface <i>interface-id</i> | Identifies the client switches for the custom group: <ul style="list-style-type: none"><li>• <b>host</b> <i>ip_address</i>—The IP address of the upstream neighbor of the client (this could be the director or an intermediate device).</li><li>• <b>interface</b> <i>interface-id</i>—The interface on the upstream neighbor to which the clients is connected. The interface ID must be the full identifier for the interface, such as GigabitEthernet 2/0/1.</li></ul> |



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|---------------|---|--|
| <b>Step 7</b> | image <i>location</i><br><i>image_name.tar</i>    | <p>Enters the location and image file for the custom group.</p> <ul style="list-style-type: none"><li>• <i>location</i>—Enter <b>flash:</b> if the TFTP server is the director and the file is stored in the director flash memory, or enter <b>tftp:</b> and the location of the imagefile: Instead of <b>flash:</b>, you can also enter <b>flash0:</b>, <b>flash1:</b>, or <b>usb:</b>.</li></ul> <p><b>Note</b> Although visible in the command-line help, these options are not supported: flash1:, ftp:, http:, https:, null:, nvram:, rcp:, scp:, system:, tmpsys:.</p> <p><b>Note</b> The images for the Catalyst 3850 and 3650 platforms are bundled with a .bin extension; the .tar extension is not available.</p> |
| <b>Step 8</b> | config <i>location</i><br><i>config_filename.</i> | <p>Enters the location and configuration file for the custom group.</p> <ul style="list-style-type: none"><li>• <i>location</i>—Enter <b>flash:</b> if the TFTP server is the director and the file is stored in the director flash memory, or enter <b>tftp:</b> and the location of the configuration file. Instead of <b>flash:</b>, you can also enter <b>flash0:</b>, <b>flash1:</b>, or <b>usb:</b>.</li></ul> <p><b>Note</b> Although visible in the command-line help, these options are not supported: flash1:, ftp:, http:, https:, null:, nvram:, rcp:, scp:, system:, tmpsys:.</p>   |

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|----------------|--|--|
| <b>Step 9</b>  | <code>config location</code><br><code>post_install_filename</code> | Enters the location and post install file for the custom group.<br><b>Note</b> Although you must provide the image or the config, or the image and the config, the post install script is optional. <ul style="list-style-type: none"><li><i>location</i>—Enter <b>flash:</b> if the TFTP server is the director and the file is stored in the director flash memory, or enter <b>tftp:</b> and the location of the post install file. Rather than <b>flash:</b>, you can also enter <b>flash0:</b>, <b>flash1:</b>, or <b>usb:</b></li></ul> <b>Note</b> Although visible in the command-line help, these options are unsupported: flash1:, ftp:, http:, https:, null:, nvram:, rcp:, scp:, system:, tmpsys:. |
| <b>Step 10</b> | <code>end</code>   | Returns to privileged EXEC mode.   |
| <b>Step 11</b> | <code>copy running-config startup</code>                           | (Optional) Saves your entries in the configuration file.   |
| <b>Step 12</b> | <code>show vstack group custom</code>                              | Verifies the configuration.  |

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This example creates a custom group named *testgroup2* for all switches that are connected to the specified host and interface and configures the group to use the specified image file and configuration.

```
Director# configure terminal
Director(config)# vstack director 1.1.1.20
Director(config)# vstack basic
Director(config)# vstack group custom textgroup2 connectivity
Director(config-vstack-group)# match host 1.1.1.10 interface
GigabitEthernet 1/0/3
Director(config-vstack-group)# image tftp://101.122.33.10/c3750-
ipbase-tar.122-52.SE.tar
Director(config-vstack-group)# config tftp://101.122.33.10/3750-
24-ipbase_config.txt
Director(config-vstack-group)# script tftp://101.122.33.10/3750-
24-ipbase_post_install.txt
Director(config-vstack-group)# exit
Director(config)# end
```

## Configuring a Custom Group Based on MAC Address

You can configure a custom group based on the MAC addresses of switches in a Smart Install network. A MAC address match takes priority over any other matches. The switches that do not match the MAC addresses in the group would get the configuration, post install file, and image for another group or the default configuration.

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Beginning in privileged EXEC mode, follow these steps on the director to configure a custom group based on connectivity:

|               | Command                                      | Purpose  |
|---------------|--|--|
| <b>Step 1</b> | config terminal                              | Enters global configuration mode.  |
| <b>Step 2</b> | vstack director <i>ip_address</i>            | Configures the device as the Smart Install director by entering the IP address of an interface on the device.  |
| <b>Step 3</b> | vstack basic                                 | Enables the device as the Smart Install director.  |
| <b>Step 4</b> | vstack startup-vlan <i>vlan_value</i>        | Specifies the default VLAN that the director should use for Smart Install management.  |
| <b>Step 5</b> | vstack group custom<br><i>group_name mac</i> | Identifies a custom group based on a MAC address match, and enters Smart Install group configuration mode for the group.   |
| <b>Step 6</b> | match <i>mac_address</i>                     | Enters the MAC address of the client switch to be added to the custom group. Repeat the command for each MAC address to be added.<br><br><b>Note</b> To see MAC addresses of switches in the Smart Install network, enter the show vstack neighbors all privileged EXEC command.<br>Switches added to the group must be able to use the same image and configuration file. |

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|               |  |  |
|---------------|--|--|
| <b>Step 7</b> | image <i>location</i><br><i>image_name.tar</i> | Enters the location and image file for the custom group. <ul style="list-style-type: none"><li>• <i>location</i>—Enter <b>flash:</b> if the TFTP server is the director and the file is stored in the director flash memory, or enter <b>tftp:</b> and the location of the image. Instead of <b>flash:</b>, you can also enter <b>flash0:</b>, <b>flash1:</b>, or <b>usb:</b>.</li></ul> <b>Note</b> Although visible in the command-line help, these options are not supported: flash1:, ftp:, http:, https:, null:, nvram:, rcp:, scp:, system:, tmpsys:.<br><b>Note</b> The images for the Catalyst 3850 and 3650 platforms are bundled with a .bin extension; the .tar extension is not available. |
| <b>Step 8</b> | config <i>location config_filename</i>         | Enters the location and configuration file for the custom group. <ul style="list-style-type: none"><li>• <i>location</i>—Enter <b>flash:</b> if the TFTP server is the director and the file is stored in the director flash memory, or enter <b>tftp:</b> and the location of the configuration file. Instead of <b>flash:</b>, you can also enter <b>flash0:</b>, <b>flash1:</b>, or <b>usb:</b>.</li></ul> <b>Note</b> Although visible in the command-line help, these options are not supported: flash1:, ftp:, http:, https:, null:, nvram:, rcp:, scp:, system:, tmpsys:.   |

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|                |  |   |
|----------------|--|---|
| <b>Step 9</b>  | <code>script location</code><br><code>post_install_filename</code> | Enters the location and post install file for the custom group.<br><b>Note</b> Although you must provide the image or the config, or the image and the config, the post install script is optional. <ul style="list-style-type: none"><li><code>location</code>—Enter <code>flash:</code> if the TFTP server is the director and the file is stored in the director flash memory, or enter <code>tftp:</code> and the location of the post install file. Instead of <code>flash:</code>, you can also enter <code>flash0:</code>, <code>flash1:</code>, or <code>usb:</code></li></ul> <b>Note</b> Although visible in the command-line help, these options are unsupported: <code>flash1:</code> , <code>ftp:</code> , <code>http:</code> , <code>https:</code> , <code>null:</code> , <code>nvrn:</code> , <code>rcp:</code> , <code>scp:</code> , <code>system:</code> , <b><code>tmpsys:</code></b> |
| <b>Step 10</b> | <code>end</code>   | Returns to privileged EXEC mode.  |
| <b>Step 11</b> | <code>copy running-config startup</code>                           | (Optional) Saves your entries in the configuration file.  |
| <b>Step 12</b> | <code>show vstack group custom</code>                              | Verifies the configuration.   |

This example creates a custom group named *testgroup3* that includes the three switches identified by MAC address, and configures the group to use the specified image file and configuration.

```
Director# configure terminal
Director(config)# vstack director 1.1.1.20
Director(config)# vstack basic
Director(config)# vstack group custom textgroup3 mac
Director(config-vstack-group)# match mac 0023.34ca.c180
Director(config-vstack-group)# match mac 001a.a1b4.ee00
Director(config-vstack-group)# match mac 00:1B:54:44:C6:00
Director(config-vstack-group)# image tftp://101.122.33.10/c3750-
ipbase-tar.122-52.SE.tar
Director(config-vstack-group)# config tftp://101.122.33.10/3750-
24-ipbase_config.txt
Director(config-vstack-group)# script tftp://101.122.33.10/3750-
24-ipbase_post_install.txt
```

```
Director(config-vstack-group)# exit
Director(config)# end
```

## Configuring a Custom Group Based on a Stack Number

You can configure a custom group based on the number of the switch in the stack. Any switch in a stack that matches the stack number and product ID gets the same configuration.

### Note

A client switch in a stack can be updated only when it belongs to a custom stack group. It cannot belong to the default group.

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Beginning in privileged EXEC mode, follow these steps on the director to configure a custom group based on the stack number:

|               | Command   | Purpose   |
|---------------|---|---|
| <b>Step 1</b> | config terminal   | Enters global configuration mode.   |
| <b>Step 2</b> | vstack director <i>ip_address</i>   | Configures the device as Smart Install director by entering the IP address of an interface on the device.   |
| <b>Step 3</b> | vstack basic  | Enables the device as the Smart -Install director.  |
| <b>Step 4</b> | vstack startup-vlan <i>vlan_value</i>   | Specifies the default VLAN that the director should use for Smart Install management.   |
| <b>Step 5</b> | vstack group custom <i>group_name</i><br>stack                                  | Identifies a custom group based on matching the stack number and enters Smart Install group configuration mode for the group.   |
| <b>Step 6</b> | match <i>switch_number</i><br><i>stack product_family</i><br><i>port_config</i> | Identifies the client switches for the custom group: <ul style="list-style-type: none"><li>• <i>switch_number</i>—Number of the switch in the stack. The range is from 1 to 9.</li><li>• <i>product_family</i>—Select the stack product family from the command-line help.</li><li>• <i>port_config</i>—Switch port configuration. To see the available port configurations, enter a? after the product family.</li></ul> |

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|               |   |  |
|---------------|---|--|
| <b>Step 7</b> | image <i>location image_name.tar</i>    | <p>Enters the location and image file for the custom group.</p> <ul style="list-style-type: none"><li>• <i>location</i>—Enter <b>flash:</b> if the TFTP server is the director and the file is stored in the director flash memory or enter <b>tftp:</b> and the location of the imagefile. Instead of <b>flash:</b>, you can also enter <b>flash0:</b>, <b>flash1:</b>, or <b>usb:</b>.</li></ul> <p><b>Note</b> Although visible in the command-line help, these options are not supported: flash1:, ftp:, http:, https:, null:, nvram:, rcp:, scp:, system:, tmpsys:.</p> <p><b>Note</b> The images for the Catalyst 3850 and 3650 platforms are bundled with a .bin extension; the .tar extension is not available.</p>                |
| <b>Step 8</b> | config <i>location config_filename.</i> | <p>Enters the location and configuration file for the custom group.</p> <ul style="list-style-type: none"><li>• <i>location</i>—Enter <b>flash:</b> if the TFTP server is the director and the file is stored in the director flash memory or enter <b>tftp:</b> and the location of the configuration file for the group. Instead of <b>flash:</b>, you can also enter <b>flash0:</b>, <b>flash1:</b>, or <b>usb:</b>.</li></ul> <p><b>Note</b> Although visible in the command-line help, these options are not supported: flash1:, ftp:, http:, https:, null:, nvram:, rcp:, scp:, system:, tmpsys:.</p> <ul style="list-style-type: none"><li>• <i>config_filename</i>—The filename of the configuration file for the group.</li></ul> |



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|                |  |  |
|----------------|--|--|
| <b>Step 9</b>  | <code>script location post_install_filename</code> | <p>Enters the location and post install file for the custom group.</p> <p><b>Note</b> Although you must provide the image or the config, or the image and the config, the post install script is optional.</p> <ul style="list-style-type: none"><li><i>location</i>—Enter <b>flash:</b> if the TFTP server is the director and the file is stored in the director flash memory or enter <b>tftp:</b> and the location of the post install file. Instead of <b>flash:</b>, you can also enter <b>flash0:</b>, <b>flash1:</b>, or <b>usb:</b>.</li></ul> <p><b>Note</b> Although visible in the command-line help, these options are not supported: flash1:, ftp:, http:, https:, null:, nvram:, rcp:, scp:, system:, tmpsys:.</p> <p><i>post_install_filename</i>—The filename of the post install file for the group.</p> |
| <b>Step 10</b> | <code>end</code>                                   | Returns to privileged EXEC mode.   |
| <b>Step 11</b> | <code>copy running-config startup config</code>    | (Optional) Saves your entries in the configuration file.   |
| <b>Step 12</b> | <code>show vstack group custom detail</code>       | Verifies the configuration.  |

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This example creates a custom group named *testgroup* for all switches that are identified as switch member 2 in a Catalyst 3750 24-port stack to use the specified image, configuration file, and post install file.

```
Director# configure terminal
Director(config)# vstack director 1.1.1.20
Director(config)# vstack basic
Director(config)# vstack group custom testgroup stack
Director(config-vstack-group)# image tftp://101.122.33.10/c3750-ipbase-tar.122-52.SE.tar
Director(config-vstack-group)# config tftp://101.122.33.10/3750stack_config.txt
Director(config-vstack-group)# script tftp://101.122.33.10/3750stack_post_install.txt
Director(config-vstack-group)# match 1 3750 24poe
Director(config-vstack-group)# match 2 3750 24poe
Director(config-vstack-group)# match 3 3750 24poe
Director(config-vstack-group)# exit
Director(config)# end
```

## Custom Group Based on Product ID

You can configure a custom group based on the product ID of switches in a Smart Install network. Switches that do not match the product ID in the group can be provided the configuration file, post install file and image for another group, or the default configuration.

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Beginning in privileged EXEC mode, follow these steps on the director to configure a custom group based on connectivity:

|               | Command  | Purpose  |
|---------------|--|--|
| <b>Step 1</b> | config terminal                                  | Enters global configuration mode.  |
| <b>Step 2</b> | vstack director <i>ip_address</i>                | Configures the device as the Smart Install director by entering the IP address of an interface on the device.  |
| <b>Step 3</b> | vstack basic                                     | Enables the device as the Smart Install director.  |
| <b>Step 4</b> | vstack startup-vlan <i>vlan_value</i>            | Specifies the default VLAN that the director should use for Smart Install management.  |
| <b>Step 5</b> | vstack group custom <i>group_name</i> product-id | Identifies a custom group based on a product-ID match, and enters Smart Install group configuration mode for the group.  |
| <b>Step 6</b> | match <i>product-id</i>                          | Enters the product ID of the client switches in the custom group.<br><b>Note</b> The product ID can be the same as that of a built-in group. If a client matches a built-in group and a custom group, the custom group takes   |
| <b>Step 7</b> | image <i>location image_name.tar</i>             | Enters the location and image file for the custom group.<br><ul style="list-style-type: none"><li><i>location</i>—Enter <b>flash:</b> if the TFTP server is the director and the file is stored in the director flash memory, or enter <b>tftp:</b> and the location of the image. Instead of <b>flash:</b>, you can also enter <b>flash0:</b>, <b>flash1:</b>, or <b>usb:</b>.</li></ul> <b>Note</b> Although visible in the command-line help, these options are not supported: flash1:, ftp:, http:, https:, null:, nvram:, rcp:, scp:, system:, tmpsys:. |

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|                |  |   |
|----------------|--|---|
| <b>Step 8</b>  | <code>config location config_filename.</code>      | <p>Enters the location and configuration file for the custom group.</p> <ul style="list-style-type: none"><li><i>location</i>—Enter flash: if the TFTP server is the director and the file is stored in the director flash memory, or enter tftp: and the location of the configuration file. Instead of flash:, you can also enter flash0:, flash1:, or usb:.</li></ul> <p><b>Note</b> Although visible in the command-line help, these options are not supported: flash1:, ftp:, http:, https:, null:, nvram:, rcp:, scp:, system:, <b>tmpsys:</b>.</p>   |
| <b>Step 9</b>  | <code>script location post_install_filename</code> | <p>Enters the location and post install file for the custom group.</p> <p><b>Note</b> Although you must provide the image or the config, or the image and the config, the post install script is optional.</p> <ul style="list-style-type: none"><li><i>location</i>—Enter flash: if the TFTP server is the director and the file is stored in the director flash memory, or enter tftp: and the location of the post install file. Instead of flash:, you can also enter flash0:, flash1:, or usb:.</li></ul> <p><b>Note</b> Although visible in the command-line help, these options are not supported: flash1:, ftp:, http:, https:, null:, nvram:, rcp:, scp:, system:, <b>tmpsys:</b>.</p> |
| <b>Step 10</b> | <code>end</code>                                   | Returns to privileged EXEC mode.  |
| <b>Step 11</b> | <code>copy running-config startup config</code>    | (Optional) Saves your entries in the configuration file.  |
| <b>Step 12</b> | <code>show vstack group custom detail</code>       | Verifies the configuration.   |

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This example creates a custom group named *testgroup4* that includes switches that match the product ID WS-C2960-48TC-L, and configures the group to use the specified image file, configuration file, and the post install file.

```
Director# configure terminal
Director(config)# vstack director 1.1.1.20
Director(config)# vstack basic
Director(config)# vstack group custom textgroup4 product-id
Director(config-vstack-group)# match WS-C2960-48TC-L
Director(config-vstack-group)# image tftp://101.122.33.10/c2960-
lanbase-tar.122-52.SE.tar
Director(config-vstack-group)#                               config
tftp://101.122.33.10/c2960-lanbase_config.txt
Director(config-vstack-group)#                               script
tftp://101.122.33.10/c2960-lanbase_post_install.txt
Director(config-vstack-group)# exit
Director(config)# end
```

## Obtaining Latest Software Files

### Managing File Downloads on Clients

You can use download management to download image and configuration files to a client. For non-Smart Install clients, an HTTP emulation process manages file downloads. For Smart Install capable clients, file downloads are performed when a request is received from the director.

### Download Management for Non-Smart Install Clients

For non-Smart Install capable clients, you can initiate downloads from

the director through HTTP emulation. The client initiates a new connection to the director, and the director initiates a new HTTP connection to the non-Smart Install client on port 80. The image file name and configuration file name from the group database is gathered, and a download is issued on the non-Smart Install client through HTTP emulation. After the download is complete, a reload is issued on the client.

### Note

Stackable switches must have the correct configuration present because they do not have a default image and configuration.

### Download Management for Smart Install Clients

For Smart Install-capable clients to receive image and configuration files, the client performs a write erase and reload. The client establishes connectivity with the director and gathers information about the image and the configuration files. When this information is gathered, the client begins the update. When the update is complete, the Smart Install-capable client reboots.

### Configuring a Client Hostname Prefix

When configuring switches out of the box, to help identify the switches and their locations in the network, you can enter this global configuration command on the director:

```
vstack hostname-prefix prefix
```

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You can then enter a prefix to the hostname for clients in the Smart Install network. The last part of the switch hostname for a switch that had a DHCP request snooped through the director contains the last 3 bytes of the switch MAC address.

This example shows how to configure the hostname *Cisco* for a client that has been DHCP-snooped. The second display shows the resulting switch hostname assignment:

```
Director(config)# vstack hostname-prefix Cisco
Director(config)# exit
```

If you then telnet to that switch from the director, the hostname is shown:

```
Director#
*Mar 1 17:21:43.281: %SYS-5-CONFIG_I: Configured from console by console
*Mar 1 17:21:52.399: %DHCP-6-ADDRESS_ASSIGN: Interface Vlan1 assigned DHCP address 172.16.0.17, mask 255.255.0.0, hostname CISCO-bf.97c0#
```

## Configuring Additional Smart Install Management VLANs

Client switches can be on any VLANs if you configure the director to snoop on the VLAN by entering the `vstack vlan vlan-id` global configuration command and if traffic from the VLAN flows through the director. The director can snoop on multiple VLANs extending to clients on different Layer 2 subnets. By default, when the director is an Ethernet switch, VLAN 1 is the Smart Install management VLAN and the

only VLAN that DHCP snoops on. You can, however, use the `vstack startup-vlan` global configuration command to specify another default VLAN.

You can add additional Smart Install management VLANs or a range of VLANs to participate in DHCP snooping. You can configure any number of Smart Install management VLANs.

### **vstack vlan *vlan-id***

This command is not supported when the director is a router. On a router, after you enable Smart Install with the `vstack basic` command, clients connected to any Layer 3 interface on the router will continue to communicate with Smart Install. Clients must have a default route to reach the director as specified in its DHCP pool.

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Beginning in privileged EXEC mode, follow these steps on the director to configure a startup VLAN:

|                | Command                               | Purpose   |
|----------------|---------------------------------------|---|
| <b>Step 1</b>  | config terminal                       | Enters global configuration mode.   |
| <b>Step 2</b>  | vstack director <i>ip_address</i>     | Configures the device as the Smart Install director by entering the IP address of an interface on the device.   |
| <b>Step 3</b>  | vstack basic                          | Enables the device as the Smart Install director.   |
| <b>Step 4</b>  | vstack vlan <i>vlan-id</i>            | Specifies the VLAN for Smart Install management.  |
| <b>Step 5</b>  | vstack startup-vlan <i>vlan_value</i> | Specifies the startup VLAN that the director should use for Smart Install management.<br><b>Note</b> Ensure that this VLAN is already present in the system as a VLAN for Smart Install |
| <b>Step 6</b>  | no vstack startup-vlan                | Removes the VLAN as the startup VLAN so that VLAN 1 now becomes the startup VLAN for Smart Install management.  |
| <b>Step 7</b>  | <b>end</b>                            | Returns to privileged EXEC mode.  |
| <b>Step 8</b>  | no vstack vlan                        | (Optional) Removes the earlier <i>vlan-id</i> VLAN from the Smart Install management VLAN list.   |
| <b>Step 9</b>  | copy running-config startup           | (Optional) Saves your entries in the configuration file.  |
| <b>Step 10</b> | show vstack group custom              | Verifies the configuration.   |

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## Updating Client Switches

Supported types of image and configuration updates:

- Zero-touch update—For a client with no configuration. This could be for the initial installation of an image and configuration on a new client, for image and configuration installation on a client after a write erase and reload, or, in case of a replacement switch, if vstack backup is enabled. The Smart Install network must run DHCP to perform zero-touch updates.
- On all clients, prior to Cisco IOS Release XE 3.5.0E and Cisco IOS 15.2(1)SG, only image+config zero-touch upgrades were supported. With Cisco IOS Release XE 3.6.0E and Cisco IOS Release 15.2(1)SG, image+config zero-touch upgrade are no longer mandatory; zero-touch config alone and zero-touch image alone upgrades are now supported on all clients.
- On-demand update—For clients that are already in the network and connected to the director. On-demand updates can be performed on single client or on all clients that belong to a built-in group. DHCP is not required for on-demand updates. The director needs the IP address of a client for a single-client update if the client is not in a built-in group. For an on-demand update of a client running an image earlier than 12.2(52)SE, the client must have an enable password and an IP interface configured.

You can do zero-touch or on-demand updates to any Smart Install client switches. You can also use the vstack download-image and vstack download-config privileged EXEC commands from the director

to update the image or configuration of any switch as long as the director has a connection (directly or through another switch) to the switch. You can also telnet to a client switch and use the archive download-sw privileged EXEC command to update switch software. When you telnet to a client switch, you must know the switch enable passwords to do any configuration.

Beginning with Cisco IOS Release 12.2(58)SE, 15.1(1)SY, 15.0(2)SE, 3.2(0)SE and later, 3.6.(0)E, you can perform a simultaneous update of multiple clients that have the same product ID and password by entering the index numbers from the director database in the vstack download-image privileged EXEC command.

### Zero-Touch Installation

A zero-touch installation is an update initiated by the director on a client switch that has no configuration. You can perform a zero-touch installation on Smart Install capable switches and non-Smart Install switches. The zero-touch installation occurs automatically with little or no intervention. A switch with no configuration can be a new, out-of-box switch or one on which you have entered the write erase and reload privileged EXEC commands.

During a zero-touch installation, do not touch the console keyboard or attempt to enter a command or auto return on the switch. Else, the auto install and Smart Install processes stop. To recover and restart the process, you need to return to the system prompt, enter write erase and reload commands, and restart the process.



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If the TFTP server is the director, the file is saved in the director root directory. If the server is another device, it is saved in the *tftproot directory*. This is the default directory in the TFTP server where the files to be sent using TFTP are stored. The imagelist file, the new configuration file, and the image are also stored in this directory. See the Configuring the TFTP Server section.

## Migration

### Backing Up the Client Configuration

After a client boots up, it sends a copy of its startup configuration to the director. This file is the backup configuration for that client. Any time the user, directly or through the director, saves a client configuration, a backup configuration is created. The configuration is stored on the local repository on the director or on a remote repository on a server. The backup file is used to reconfigure a client during a zero-touch replacement.

### Note

Client backup is supported only when the director and client are running Cisco IOS Release 12.2(55)SE or later.

Client configuration backup is enabled by default. You can disable it by entering the `no vstack backup global configuration` command. You enable the file backup feature on the director by entering the `vstack backup` and you can configure a repository for the backup files. If you

do not specify a repository, the files are stored in the director flash:/vstack directory.

A client configuration backup is triggered:

- When the write memory privileged EXEC command is entered on the client.
- When the director boots up, it requests configuration information from clients and backs up these configurations.

### Replacing a Client Switch

You can use zero-touch replacement to exchange and install a like-type client in the Smart Install network. When a new switch is added to the network, a CDP database update is sent to the director, which determines if this is a new MAC address and therefore a new client. When a client needs to be replaced and is removed from the network, the CDP database lists the removed client as *inactive*. If another client MAC address with the same product-ID is detected on the same port, this client is considered a *replacement* client. The director gives it the same image and configuration that the previous client had.

The director removes the entry for the replaced client from the director database. If the replaced client is put elsewhere in the network, the director creates a new entry for it that includes the client's new information.

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During a zero-touch replacement, the replacement client receives the last backed-up configuration file, which is stored in the director or a remote repository. Client configuration files are backed up by default, unless you disable this functionality on the director.

Only one Smart Install client can be replaced at a time on the same branch and only if there is one path to the director.

## Note

Zero-touch replacement is supported only when the director and the replaced client are running Cisco IOS Release 12.2(55)SE or later, 15.1(1)SY, 15.0(2)SE and later, 3.2(0)SE and later, 15.0(2)EX, 15.0(2)EX1, 3.6.(0)E, or 15.2.(2)E. When a client switch running an earlier release is replaced, the new switch receives a seed replacement.

When the replacement client and existing client do not have the same product ID, port connections, or interfaces, the replacement client is considered new to the Smart Install network. For example, a replacement client must be connected to the same ports on the director and on other client switches as was the original client. When a new device is added to the network, a notification is sent to the director that a new client has joined. If the director has a configuration for the type of client that was added and if the join window is open, the new client receives the image and configuration files.

## Using a Join Window

A join window is a time window during which the client can update image or configuration files. The director can provide information about the image and configuration to the client only during this window. A client attempting to join the Smart Install network outside the join window is not allowed to do so and cannot update the image and configuration files.

Use the `vstack join-window mode auto global configuration` command to automatically update clients with the latest image and configuration files when they are added during a join window. Use the `no vstack join-window mode global configuration` command to put the client in a hold state.

Use the following commands to open or close a join window:

- Enter the `vstack join-window start [date] hh:mm [interval] [end date] [recurring]` global configuration command to configure a time window to control downloads of configuration and image files to client switches.
- Enter the `vstack join-window close global configuration` command to manually close a join window, enter the `no vstack join-window close global configuration` command to manually open a join window.

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## Note

You cannot combine the `vstack join-window start` and `[no] vstack join-window` commands to close and open the join window.

If a join window *is* configured, a zero touch update is possible only during the configured window. If a switch connects to the director at any time other than during the join window, the Smart Install configuration and image files are not automatically downloaded. Instead, the new switch receives the default files from the DHCP server. This feature provides control of the files and prevents unauthorized switches from receiving the Smart Install configuration.

If a join window *is not* configured, a zero touch update can happen at any time because that is the default state.

When a join window is configured, and the DHCP acknowledgement occurs outside of the configured window, a client switch sends an error message that it cannot download an image or configuration file.

## Configuring Join Window Mode

The join window mode includes a *hold* state that adds an extra level of security for the client. The hold state lets you control whether or not the client can receive a software upgrade, and how the upgrade is performed. The hold-state is either *on* or *off* when the join window is active.

You configure automatic join window mode with the `vstack join-`

`window mode auto` global configuration command. In this mode, when a client joins the network, the director automatically upgrades it when the join window is open.

When you set the mode to manual by entering the `no vstack join-window mode global` configuration command, when a client joins the network during an open join window, the client is put on the hold list.

You can review clients on the hold list by entering the `show vstack status user EXEC` command. You can remove a client from the hold list by entering the `vstack on-hold-clients remove global` configuration command.

## Note

When a client has been removed from the hold state to allow that client to join the network, you must restart the client to again put it in the hold state (if the mode is manual) or to automatically upgrade if the mode is auto and the join window is open.

When a new client joins the network and the mode is set to auto, the join window state is active, whether or not the join window is open or closed. When the mode is set to manual and the join window is open, the client is put on the hold list. If the join window is closed, the client cannot join the network (denied). [Table 1-3](#) lists the join window states and the actions that are allowed or not allowed for each state.

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Table 1-3 Join Window States and Functionality

| Join Window State | Zero-Touch Updates             | On-Demand Updates | Configuration Backup |
|-------------------|--------------------------------|-------------------|----------------------|
| Active            | Allowed                        | Allowed           | Allowed              |
| Deny              | Not allowed                    | Allowed           | Allowed              |
| Hold              | Allowed with user intervention | Allowed           | Not allowed          |

Starting with Cisco IOS Release 12.2(58)SE,15.1(1)SY, 15.0(2)SE and later, 3.2(0)SE and later, 3.6.(0)E, and 15.2.(2)E, you can manually change the join window state for a client or multiple clients from the denied state to the active or held state by using the `vstack join-window-status index client-id {allowed | held}` privileged EXEC command.

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## Maintaining the Database

### Managing Client Configuration Files

You can manage the client configuration files through the director that is set up as TFTP server, or through a third-party TFTP server. Only supported devices that are Smart Install capable can perform the role of director and save client configuration files to a repository. See Supported Devices for Smart Install to see a list of devices that can be a Smart Install network director.

The backup feature does not need to be enabled; it is on by default. However, if you have disabled it and want to save the configuration files to a repository, use the `vstack backup global configuration` command to enable the feature. After enabling the backup feature, use the `vstack backup file-server` global configuration command to specify a repository on the TFTP server to save the configurations files. The repository will define where the files are saved.

Every time the write memory privileged EXEC command is issued on the client, its configuration files are saved to the director-TFTP server or third-party TFTP server.

These names are assigned to the client backup files:

- `HostnameMAC address.rev1`
- `HostnameMAC address.rev2` (most recent version)

When the client undergoes a hostname change, the configuration files are not backed up until you enter the write memory command. When

a new mapping is created between the client with a new hostname and the two configuration files, the existing mapping is removed. On a third-party TFTP server, after a new mapping is created between the client with a new hostname and the two configuration files, the files are not removed.

### Note

Do not remove the backed-up client files from the third-party TFTP server repository. Otherwise, the backup feature does not work properly.

### Backing Up Files after Loss of Connection

If the client-to-director connection is lost after issuing the write memory command, the back-up process fails. You must reestablish the connection so that the client file is backed up on the director. If you entered the write memory command more than once, the files associated with the last write memory command event are backed up on the director. If the client reloads or fails before receiving feedback that the backup was successful, any changes made to the client startup do not take effect until you reload the client.

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## Extracting and Displaying Tar Files

When the client sends a tar file to the director, you can use the `vstack untar source-url [destination-url]` command in EXEC mode to extract and display the files in a specified location. However, when the client sends a tar file to a third-party TFTP server, you cannot use the director to extract and display the files. The tar files are placed into the preconfigured directory within the repository. If the directory is not configured, the files are extracted and displayed in the director root directory flash memory.

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## Monitoring

### System Messages

#### How to Read System Messages

System log messages can contain up to 80 characters and a percent sign (%), which follows the optional sequence number or time-stamp information, if configured. Messages appear in this format:

```
seq no:timestamp: %facility-severity-MNEMONIC:description  
(hostname-n)
```

```
seq no:timestamp: %facility-severity-MNEMONIC:description
```

By default, a switch sends the output from system messages to a logging process. In a switch stack, stack members append their hostnames to the output from system messages and redirect the output to the logging process on the stack master.

Each system message begins with a percent sign (%) and is structured as follows:

```
%FACILITY-SEVERITY-MNEMONIC: Message-text
```

- FACILITY is two or more uppercase letters that show the facility to which the message refers. A facility can be a hardware device, a protocol, or a module of the system software. The facility for Smart Install messages is *SMI*.
- SEVERITY is a single-digit code from 0 to 7 that reflects the severity of the condition. The lower the number, the more serious the situation.

Table 5-1 Message Severity Levels

| Severity Level    | Description                                 |
|-------------------|---|
| 0 - emergency     | System is unusable.                         |
| 1 - alert         | Immediate action required.                  |
| 2 - critical      | Critical condition.                         |
| 3 - error         | Error condition.                            |
| 4 - warning       | Warning condition.                          |
| 5 - notification  | Normal but significant condition.           |
| 6 - informational | Informational message only.                 |
| 7 - debugging     | Message that appears during debugging only. |

- MNEMONIC is a code that uniquely identifies the message.
- Message-text is a text string describing the condition. This portion of the message sometimes contains detailed information about the event, including terminal port numbers, network addresses, or addresses that correspond to locations in the system memory address space. Because the information in these variable fields changes from message to message, it is represented here by short

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strings enclosed in square brackets ([ ]). A decimal number, for example, is represented as [dec].

Table 5-2 Variable Fields

| Representation | Type of Information                            |
|----------------|--|
| [dec]          | Decimal integer                                |
| [char]         | Single character                               |
| [chars]        | Character string                               |
| [enet]         | Ethernet address (for example, 0000.FEED.00C0) |
| [hex]          | Hexadecimal integer                            |
| [inet]         | Internet address                               |

## Error Message Traceback Reports

Some messages describe internal errors and contain traceback information. Include this information when you report a problem to your technical support representative.

This message example includes traceback information:

-Process= "Exec", level= 0, pid= 17

-Traceback= 1A82 1AB4 6378 A072 1054 1860

Some system messages ask you to copy the error messages and take further action.

## Output Interpreter

The Output Interpreter provides additional information and suggested resolutions based on the output of many CLI commands, such as the show tech-support privileged EXEC command.

<https://www.cisco.com/cgi-bin/Support/OutputInterpreter/home.pl>

## Bug Toolkit

The Bug Toolkit provides information on open and closed caveats. You can search for all known bugs in a specific Cisco IOS Release.

<http://tools.cisco.com/Support/BugToolkit/>



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## Troubleshooting

### Error messages

#### Smart Install System Messages

**Error Message** SMI-3-IMAGELIST\_FAILED: Default image list creation failed.

**Explanation** The creation of the default image list file failed in flash memory. Possible reasons for this failure are that there is insufficient space in the flash memory of the Smart Install director, an error occurred while the default image list file was created, or there is no default image configured.

**Recommended Action** Verify that the director flash memory has sufficient space. If necessary, free some flash memory space (a default image list file would need about 100 bytes of space). If necessary, reconfigure the director.

**Error Message** SMI-3-IMG\_CFG\_NOT\_CONFIGURED: [chars] (IP Address :[inet]) : The Director does not have a image list file or a configuration file configured for this Product-ID

**Explanation** The Smart Install director does not have an image list file or configuration file for the device, preventing a successful upgrade. [chars] is the Smart Install device on which the message is displayed, which can be either the client or director, and [inet] it the IP address of that device.

### Note

When the message appears on the director, [chars] provides redundant information.

**Recommended Action** Make sure that the device is added to a built-in group or user-defined group. Configure an image list file or configuration file for the group by using the vstack group built-in global configuration command for the built-in group or vstack group custom global configuration command for the user-defined group.

**Error Message** SMI-3-INTERNAL\_ERROR: [chars] - [dec]

**Explanation** An internal software error occurred on the Smart Install director switch. [chars] describes the error, and [dec] is the error return code.

**Recommended Action** Copy the message exactly as it appears on the console or in the system log. Research and attempt to resolve the error by using the Output Interpreter. Use the Bug Toolkit to look for similar reported problems. If you still require assistance, open a case with the TAC, or contact your Cisco technical support representative, and provide the representative with the gathered information.

**Error Message** SMI-3-SMI\_CLIENT\_BACKUP\_FAILURE: Client Device startup configuration backup fail on repository

**Explanation** The Smart Install client switch has failed to back up its startup configuration to the repository. (This message appears only on

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the client switch.)

**Recommended Action** Verify that you can ping the director switch from the client switch. Verify that the client switch can reach the repository. On the director, look at the output of the show vstack config privileged EXEC command to verify that the configuration parameters are correct and that the backup mode is on. Verify that the directory setting on the repository is correct, especially if the repository is an external TFTP server.

**Error Message** SMI-3-SMI\_DIRECTOR\_BACKUP\_FAILURE: Client Device ([inet]) startup configuration backup fail on repository: [chars] - reason: [chars]

**Explanation** The Smart Install client switch has failed to back up its startup configuration to the repository. [inet] is the IP address of the client switch. The first [chars] is the repository path, and the seconds [chars] is the reason for the failure. (This message appears only on the director switch.)

**Recommended Action** Verify that you can ping the director switch from the client switch. Verify that the client switch can reach the repository. On the director, look at the output of the show vstack config privileged EXEC command to verify that the configuration parameters are correct and that the backup mode is on. Verify that the directory setting on the repository is correct, especially if the repository is an external TFTP server.

**Error Message** SMI-3-TAILOR\_FAILED: Legacy switches will not be

upgraded

**Explanation** The creation of a tailored Smart Install configuration file failed. Possible reasons for this failure are that there is insufficient space in the director flash memory or an error occurred while the new configuration file was created.

**Recommended Action** Verify that the director flash memory has sufficient space. If necessary, free some flash memory space (a tailored configuration would need about 100 bytes of space). If necessary, reconfigure the director.

**Error Message** SMI-3-UPGRD\_FAILED: Device (IP address: [inet]) [chars] upgrade failed

**Explanation** The Smart Install client switch could not upgrade. [inet] is the IP address of the client switch. [chars] is the image or the configuration.

**Recommended Action** Verify that the configuration on the director switch is correct. Verify that the client switch can reach the TFTP server. Verify that the image or configuration file exists on the TFTP server and is specified correctly.

**Error Message** SMI-5-DIRECTOR: Director is [chars]

**Explanation** The status of the Smart Install director changed. [chars] is the status (*Enabled* or *Disabled*).

**Recommended Action** No action is required.

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**Error Message** SMI-6-AUTOINSTALL: [chars] AUTOINSTALL

**Explanation** The auto install and Smart Install processes stopped or continued. [chars] is the status of the processes, which can be either *aborted* or *continued*.

**Recommended Action** No action is required.

**Error Message** SMI-6-CLIENT\_CONN\_FAILED: Device (IP address: [inet]) failed to connect to Director (IP address : [inet])

**Explanation** A Smart Install client did not connect to the director because it did not have the IP address of the director or could not reach the director for other reasons. The first [inet] is the IP address of the client, and the second [inet] is the IP address of the director.

**Recommended Action** Verify that the IP address of the director is correctly configured on the client.

**Error Message** SMI-6-INCORRECT\_CFG: No image and config configured for this [chars] [chars]

**Explanation** The Smart Install director does not have a configuration for the device. The first [chars] is the type of device (*switch*, *switch-stack*, or *sku type*). If the type of device is *sku type*, the second [chars] is the model number.

**Recommended Action** Configure a group with a configuration for the device.

**Error Message** SMI-6-SMI\_CLIENT\_BACKUP\_SUCCESS: Client Device startup configuration backup successful on repository

**Explanation** The Smart Install client switch has successfully backed up its startup configuration to the repository. (This message appears only on the client switch.)

**Recommended Action** No action is required.

**Error Message** SMI-6-SMI\_CLIENT\_BACKUP\_SUCCESS: Client Device startup configuration backup successful on repository

**Explanation** The Smart Install client switch has successfully backed up its startup configuration to the repository. [inet] is the IP address of the client switch. [chars] is the repository path. (This message appears only on the director switch.)

**Recommended Action** No action is required.

**Error Message** SMI-6-SMI\_INVALID\_MESSAGE: Received invalid message from [chars] (IP Address : [inet]), SMI Version : [dec] Message Type : [dec]

**Explanation** The Smart Install client or director received an invalid message type. This occurs when a newer version of the Smart Install Protocol interoperates with an older version of the protocol that does not support the new message. [chars] is the Smart Install device, which can be either the client or the director, and [inet] it the IP address of that device. The first [dec] is the Smart Install Protocol version on the device that sent the invalid message, and the second [dec] is the type of invalid message.

**Recommended Action** Make sure that the director switch runs the latest version of the Smart Install Protocol. A director switch that runs

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the latest version of the protocol can interoperate with a client switch that runs an older version, but not the other way around.

**Error Message** SMI-6-SMI\_JOIN\_WINDOW\_MESSAGE: SMI Join window [chars] on IBD(IP address: [inet])

**Explanation** A Smart Install join window was opened or closed. [chars] is the status of the window, which can be either *Start* or *End*, and [inet] is the IP address of the device on which the join window was opened or closed.

**Recommended Action** No action is required.

**Error Message** SMI-6-SWITCH\_ADD: New Device detected by Director with mac address: [enet]

**Explanation** The Smart Install director detected a new device and added it to the database. [enet] is the Ethernet address of the new device.

**Recommended Action** No action is required.

**Error Message** SMI-6-SWITCH\_REMOVE: Device [enet] removed from the Director Database

**Explanation** A device stopped communicating and was removed from the Smart Install director database. The device might have also been removed from the Smart Install network. [enet] is the Ethernet address of the device.

**Recommended Action** No action is required.

**Error Message** SMI-6-SWITCH\_REPLACE: Device [enet] is being replaced by [enet] Device

**Explanation** A device was replaced by another device in a Smart Install network. The first [enet] is the Ethernet address of the device that was replaced, and the second [enet] is the Ethernet address of the replacement device.

**Recommended Action** No action is required.

**Error Message** SMI-6-UPGRD\_STARTED: Device (IP address: [inet]) [chars] upgrade has started

**Explanation** An image or configuration file upgrade started on the Smart Install client. [inet] is the IP address of the client, and [chars] is the name of the image or configuration file.

**Recommended Action** No action is required.

**Error Message** SMI-6-UPGRD\_SUCCESS: Device (IP address: [inet]) [chars] has upgraded successfully

**Explanation** The Smart Install client was upgraded with a new image or configuration file. [inet] is the IP address of the client, and [chars] is the name of the new image or configuration file.

**Recommended Action** No action is required.

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### Unsupported Services Error Messages

| Problem  | Example  | Cause  | Solution               |
|--|--|--|------------------------|
| Enum:<br>PNP_ERROR_UN<br>SUPPORTED_R<br>EQUEST             | Error string: "SMI<br>PROXY:Not<br>supported service<br>request"                               | If the PnP Server requests a service not in this list, SMI<br>Proxy sends this error message   | No action<br>required. |
| Enum:<br>XSVC_ERROR_C<br>ONFIG_UPGRAD<br>E_UNSUPPORTE<br>D | Error string: "SMI<br>PROXY: Config<br>upgrade apply to<br>Running Config is<br>not supported" | When a configuration upgrade request is sent from a PnP<br>service, by default, the PnP server sends a request to the<br>SMI Proxy, to copy the configuration upgrade to the<br>running configuration. As SMI supports only copying the<br>configuration upgrade to the startup configuration on<br>proxied SMI clients, the SMI Proxy sends an error message.<br>Once the PnP server receives this error message, it sends<br>a request to copy the configuration upgrade to the startup<br>configuration to SMI Proxy, which is then forwarded to the<br>SMI client. | No action<br>required. |
| Enum:<br>XSVC_ERROR_D<br>EVICE_INFO_UN<br>SUPPORTED        | Error string: "SMI<br>PROXY:Client<br>device hardware<br>info not supported"                   | SMI proxy does not support device hardware information<br>requests and device file information requests and the PnP<br>service sends the following enum and error strings:   | No action<br>required. |
| Enum:<br>XSVC_ERROR_D<br>EVICE_INFO_UN<br>SUPPORTED        | Error string: "SMI<br>PROXY:Client<br>device filesystem<br>info not supported"                 |  | No action<br>required. |

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## General Prevention

### SNMP MIBs

Simple Management Network Protocol (SNMP) development and use is centered around the Management Information Base (MIB). An SNMP MIB is an abstract database, which is a conceptual specification for information that a management application may read and modify in a certain form. This does not imply that the information is kept in the managed system in that same form. The SNMP agent translates between the internal data structures and formats of the managed system and the external data structures and formats defined for the MIB.

- The SNMP MIB is conceptually a tree structure with conceptual tables. Relative to this tree structure, the term MIB has two functions:
- It is actually a MIB branch, usually containing information for a single aspect of technology, such as a transmission medium or a routing protocol. A MIB used this way is more accurately called a MIB module, and is usually defined in a single document.

A MIB is a collection of such branches. This collection might comprise, for example, all the MIB modules implemented by a given agent or the entire collection of MIB modules defined for SNMP.

A MIB is a tree where the leaves are individual items of data called objects. An object may be a counter or a protocol status. MIB objects are also sometimes called variables.

### Cisco Smart Install MIB

The CISCO-SMART-INSTALL-MIB.my MIB module defines managed objects that facilitate the management of the Smart Install feature. Smart Install is a plug-and-play image and configuration management feature that enables zero-touch deployment of Cisco network devices in an enterprise branch network.

This MIB module is supported only on the director and is designed for the following:

- Checks most of the Smart Install configurations on the director.
- Supports monitoring of client devices discovered by the director.
- Provides status of the deployed client image and configuration as a result of operator-defined profiles.
- Provides notifications for these events:
  - New client joined
  - Client removed
  - Upgrade failure
  - Director functionality enabled or disabled

### Note

SNMP set is not supported in this release.

### Guidelines for Working with MIBs

While working with MIBs, consider the following guidelines:

- Mismatches on datatype definitions might cause compiler errors or warning messages. Although Cisco MIB datatype definitions are not

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mismatched, some standard RFC MIBs do mismatch.

For example:

MIB A defines: SomeDatatype ::= INTEGER(0..100)

MIB B defines: SomeDatatype ::= INTEGER(1..50)

This example is considered to be a trivial error and the MIB loads successfully with a warning message.

The next example is considered as a nontrivial error (even though the two definitions are essentially equivalent), and the MIB is not successfully parsed.

MIB A defines: SomeDatatype ::= DisplayString

MIB B defines: SomeDatatype ::= OCTET STRING (SIZE(0..255))

If your MIB compiler treats these as errors, or you want to delete the warning messages, edit one of the MIBs that define this same datatype so that the definitions match.

- Many MIBs import definitions from other MIBs. If your management application requires MIBs to be loaded, and you experience problems with undefined objects, you might want to load the following MIBs in this order:

RFC1213-MIB.my

IF-MIB.my

CISCO-SMI.my

CISCO-PRODUCTS-MIB.my

CISCO-TC.my

- For information about how to download and compile Cisco MIBs, go to the following URL:

[http://www.cisco.com/en/US/tech/tk648/tk362/technologies\\_tech\\_note09186a00800b4cee.shtml](http://www.cisco.com/en/US/tech/tk648/tk362/technologies_tech_note09186a00800b4cee.shtml)

### *Downloading MIBs*

To download the MIBs onto your system if they are not already there, follow these steps:

Step 1 Review the guidelines in the section Guidelines for Working with MIBs.

Step 2 Search for the CISCO-SMART-INSTALL-MIB.my. If the MIB you want to download is not there, try the other URL and search again.

Go to one of the following Cisco URLs:

<ftp://ftp.cisco.com/pub/mibs/v2>

<ftp://ftp.cisco.com/pub/mibs/v1>

Step 3 Click the link for a MIB to download to your system.

Step 4 Select File > Save or File > Save As to save the MIB on your system.

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## Support Information

### Support for Post-install Operations

Smart Install provides a single point of interaction for assigning IOS images and configurations. Prior to Cisco IOS Release XE 3.6.0E and IOS 15.2(2)E, you could not execute IOS commands like `sdm`, `system mtu`, `vlan`, `vtp`, on a switch via SMI; configurations required manual execution.

Prior to Cisco IOS Release XE 3.6.0E and 15.2(2)E, you need to populate a post-install text file with the list of commands you intend to execute as part of post install operation. You associate this file with each platform on the IBD analogous to how you currently associate config and image.

As part of a Zero-touch upgrade, IBD provides the config, image, and post-install file details to a valid IBC. The IBC downloads the post installation file, reads it, and then reloads causing IBC to run with the new config (or image) and the post install configurations.

#### Note

SMI Director can operate with either Cisco IOS Release XE 3.6.0E and 15.2(2)E.

#### Note

A post install upgrade is possible only with config upgrade or image upgrade or both. Unlike image-only and config-only upgrades, (A script-only upgrade is not possible). Scripts must be incorporated with

either the image, configuration, or both. You must create the post-install text file (for post-install operation) else the post install operation will fail.

Comma's are not required. Each CLI command must be enclosed by double quote(""); a single quote(') is invalid. (The parser execute only those CLIs which are enclosed by double quote("") and all other CLIs/characters are ignored.)

Valid CLI example include:

```
"sdm prefer degault"  
"vlan 12" "name TEST" "exit" and all following examples are  
invalid  
'sdm prefer default'  
'vlan 123' , 'name VLAN' , 'exit'  
>"vlan 123" "name VLAN" "exit"
```

Following is the required format of a post install text file. Notice that each CLI is enclosed by "double quote":.

```
"Cisco IOS CLI" "Cisco IOS CLI" ... "Cisco IOS CLI"  
...  
"Cisco IOS CLI" "Cisco IOS CLI" ... "Cisco IOS CLI"
```

Each line in a text file contains at most 20 CLI commands and all related commands must be written on one line. In the following example, all configuration commands of VLAN 123 must be on the same line in the post install text file:

```
"vlan 123" "name VLAN" "exit"
```

Two distinct CLI commands must not be in same line. For example:

```
"vlan 123" "system mtu 1600"
```



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Following is an example of a well-formatted post install config file:

```
"system mtu 1600"  
"vlan 123" "name VLAN" "exit"  
"sdm prefer default"  
mtu, vlan, sdm and vtp commands are supported. An example of a  
valid vtp command is given below.  
"vtp domain cisco"
```

## Configure a Script for Default Mode

If the network consists of the same type of switches, you must configure the post install in default mode to run post install operations on all switches.

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Beginning in privileged EXEC mode, perform these steps:

|               | Command                                       | Purpose   |
|---------------|---|---|
| <b>Step 1</b> | config terminal                               | Enters global configuration mode.   |
| <b>Step 2</b> | [no] vstack script <i>path_to_script_file</i> | Configures script file <i>path_to_script_file</i> for the default mode.<br><br><i>path_to_script_file</i> represents the path for the post-install file:<br><br>flash:post_install.txt (similar to the config<br><br>The no form of the command unconfigures the script file; the post install file is no longer configured in default configuration mode and client switches (IBCs) will not download the post install file. |
| <b>Step 3</b> | end   | Exits from global configuration mode.   |

This example shows how to configure the post-install script file flash:post\_install.txt for default mode:

```
Switch# config terminal
Switch(config)# vstack script flash:post_install.txt
Switch(config)# end
```

## Configure a Script for the Built-in Group Mode

You can use built-in groups in a Smart Install network to configure a group of switches that have one product ID with the install file and to configure a second group of switches that have another product ID with another post install file.

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Beginning in privileged EXEC mode, perform these steps:

|               | Command  | Purpose  |
|---------------|--|--|
| <b>Step 1</b> | config terminal  | Enters global configuration mode.  |
| <b>Step 2</b> | [no] vstack group built-in<br><i>switch_family port_config</i> | Identifies the first built-in group product ID and enters Smart Install group configuration mode for the group.  |
| <b>Step 3</b> | [no] script <i>path_to_script_file</i>                         | Configures the script file <b><i>path_to_script_file</i></b> for the built-in group.<br><br><i>path_to_script_file</i> represents the path for the post-install file:<br><br>flash:post_install.txt (similar to the config<br><br>The no form of the command unconfigures the script file. |
| <b>Step 4</b> | exit   | Exits from group mode.   |
| <b>Step 5</b> | end  | Exits from global configuration mode.  |

This example shows how to configure a post install file for a 2960xr 24-2sfp-il built-in group:

```
Switch(config)# vstack group built-in 2960xr 24-2sfp-il
Switch(config-vstack-group)#?
Vstack group configuration commands
config The config file for the group
exit Exit from group-vstack config mode
image The image file for the group
no Negate a command or set its defaults
script The script file for the group
```

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This example shows how to configure a post install file for any built-in group:

```
switch(config-vstack-group)# script flash:post_install.txt
switch(config-vstack-group)# end
```

## Configure a Script for Custom Group Mode

You can configure the post install file for the custom group (i.e., it can be based on mac/connectivity/stack/product-id). In this instance, only member switches of that custom group download the post install file.

Beginning in privileged EXEC mode, perform the following steps:

|               | Command  | Purpose  |
|---------------|--|--|
| <b>Step 1</b> | config terminal  | Enters global configuration mode.  |
| <b>Step 2</b> | vstack group custom <i>group_name</i><br>{mac connectivity stack product-id} | Enables group_mode.<br><br>Use <i>group_name</i> to configure image, config, or script for a particular custom group.  |
| <b>Step 3</b> | [no] script <i>path_to_script_file</i>                                       | Configure script_file <i>path_to_script_file</i> for the custom group.<br><br><i>path_to_script_file</i> represents the path for the post-install file:<br><br>flash:post_install.txt (similar to the config<br><br>The no form of the command unconfigures the script file. |
| <b>Step 4</b> | exit   | Exits from group mode.   |
| <b>Step 5</b> | end  | Exits from global configuration mode.  |

This example shows how to configure post install for a custom group:

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```
Switch# config terminal
Switch(config)# vstack group custom 3k-stack stack
Switch(config-vstack-group)# script flash:post_install.txt
Switch(config-vstack-group)# match 1 3750x 24
Switch(config-vstack-group)# end
```

## Resources

### Related Documentation

Catalyst 3850

[http://www.cisco.com/en/US/products/ps12686/tsd\\_products\\_support\\_series\\_home.html](http://www.cisco.com/en/US/products/ps12686/tsd_products_support_series_home.html)

Catalyst 3650

[http://www.cisco.com/en/US/products/ps13133/products\\_installation\\_and\\_configuration\\_guides\\_list.html](http://www.cisco.com/en/US/products/ps13133/products_installation_and_configuration_guides_list.html)

### Obtaining Documentation, Obtaining Support, and Security Guidelines

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

<http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html>

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starts here.*



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