



Cisco Catalyst 3850 Switch

Deployment Guide

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Preface

Purpose

The purpose of this guide is to explain the basic concepts and provide general procedures and commands to deploy Cisco® Catalyst® 3850 Switches. It does not provide detailed information about these commands.

Audience

This guide is for networking professionals who are responsible for designing, implementing, or administering a network that includes a standalone Cisco Catalyst 3850 Switch or a Cisco Catalyst 3850 Switch stack, referred to as the switch. Readers of this guide are expected to have prior experience working with the Cisco IOS® Software and familiarity with the concepts and terminology of local area networking, wireless local area networking, and Layer 2 and Layer 3 switching.

Conventions

This publication uses these conventions to convey instructions and information:

- Command names are in **boldface** text.
- System displays are in screen font.

Introduction

The next-generation Cisco Catalyst 3850 Switch meets the current and future demands of enterprise access-layer networks. As these networks incorporate ever more technologies, they must be secure, scalable, and resilient. The Cisco Catalyst 3850 Switch offers operational simplicity, scalability, and superb performance. The new Cisco StackWise-480 stack architecture delivers the industry's best-in-class stack bandwidth and resiliency.

The Cisco Catalyst 3850 Switch supports the powerful next-generation Cisco IOS XE Software. The modular Cisco IOS XE Software architecture enables rich, scalable, and cost-effective integrated borderless networking services.

The Cisco Catalyst 3850 Switch is the first stackable access-layer switch that provides both wired and wireless services on a single Cisco IOS XE Software-based platform.

This guide describes the procedures required to deploy a Cisco Catalyst 3850 Switch:

1. Initializing the Cisco Catalyst 3850 Switch
2. Cisco Catalyst 3850 Switch right-to-use (RTU) licensing model
3. Cisco Catalyst 3850 Switch stacking
4. Cisco Catalyst 3850 Switch Database Manager (SDM) template

Initializing the Cisco Catalyst 3850 Switch

- Console setup
- Cisco IOS XE Software bundle and packages overview
- Booting Cisco IOS XE Software
- Updating Cisco IOS XE Software
- Software rollback
- Software clean
- Boot loader upgrade
- Migration to installed mode

Console Setup

The Cisco Catalyst 3850 Switch (similar to the Cisco Catalyst 3750-X Switch) has two console ports: a USB mini console port in the front and an RJ45 console port in the rear. You can use either port (but not both) for input. However, both ports always display the switch output.

The default console port speed setting is 9600 baud, 8 data bits, no parity, 1 stop bit, and no flow control.

Using the USB Console Port

Figure 1. USB Console Port



The USB console port is the default management port and is supported in both install and boot loader modes.

Before using the USB port, download the required driver to your PC from Cisco.com:

<http://software.cisco.com/download/release.html?mdfid=282979369&softwareid=282855122&release=3.1>.

The USB console port has a configurable inactivity timer that automatically disables the port after a specified period from 1 to 240 minutes. Use this command to configure the inactivity timeout interval:

```
Switch(config)# line console 0
Switch(config-line)# usb-inactivity-timeout switch 1 ?
<1-240> Inactivity minutes before console reverts to RJ45
```

Using the RJ45 Port

Figure 2. RJ45 Console Port



To use the RJ45 port, you must configure precedence for it by using these commands:

```
Switch(config)# line console 0
Switch(config-line)# media-type rj45 switch 1
```

Configuring precedence for the RJ45 port enables it for input and disables input on the USB console port. However, switch output is always displayed on both ports.

Cisco IOS XE Software Bundle and Packages Overview

The Cisco Catalyst 3850 Switch uses Cisco IOS XE Software. Cisco IOS XE Software is delivered as a bundle that contains a set of packages. The Cisco IOS XE Software bundle uses this image name convention:

<platform_name>_<bundle_feature_set>.<key_ver>.<IOS-XE_version>.<IOS_image_version> .bin

Example: cat3k_caa-universalk9.SPA.03.07.00.E.152-3.E.bin

Explanation of bundle naming convention:

Image Name Element	Explanation	Example
platform_name	The name of the platform supported by the Cisco IOS XE Software bundle; caa represents converged access architecture	cat3k_caa
bundle_feature set	The feature set provided by the Cisco IOS XE Software bundle	universalk9
key_ver	A three-character string indicating that the Cisco IOS XE Software bundle (or the packages it contains, or both) is digitally signed	SPA
IOS_XE_version	The bundle's Cisco IOS XE Software release number	3.7.0SE
IOS_image_version	The Cisco IOS Software image version of the Cisco IOS Software package contained in the bundle	15.2(3)E

The Cisco IOS XE Software bundle contains a set of packages and a provisioning file, called **packages.conf**, that is created automatically during the install process.

The **show version running EXEC** command displays the current running package(s) version:

```
Switch# show version running
Package: Base, version: 03.07.00E, status: active
  File: cat3k_caa-base.SPA.03.07.00E.pkg, on: Switch1
  Built: Mon Dec 08 00:30:04 PST 2014, by: gereddy

Package: Drivers, version: 03.07.00E, status: active
  File: cat3k_caa-drivers.SPA.03.07.00E.pkg, on: Switch1
  Built: Mon Dec 08 00:34:53 PST 2014, by: gereddy

Package: Infra, version: 03.07.00E, status: active
  File: cat3k_caa-infra.SPA.03.07.00E.pkg, on: Switch1
  Built: Mon Dec 08 00:31:51 PST 2014, by: gereddy

Package: IOS, version: 152-3.E, status: active
  File: cat3k_caa-iosd-universalk9.SPA.152-3.E.pkg, on: Switch1
  Built: Mon Dec 08 00:33:09 PST 2014, by: gereddy

Package: Platform, version: 03.07.00E, status: active
  File: cat3k_caa-platform.SPA.03.07.00E.pkg, on: Switch1
  Built: Mon Dec 08 00:32:37 PST 2014, by: gereddy

Package: WCM, version: 10.3.100.0, status: active
  File: cat3k_caa-wcm.SPA.10.3.100.0.pkg, on: Switch1
  Built: Mon Dec 08 00:34:17 PST 2014, by: gereddy
```

The Cisco IOS XE Software bundle includes these packages:

Package Name	File Name	Contents
Base	cat3k_caa-base.SPA.03.07.00E.pkg	Kernel distribution
Drivers	cat3k_caa-drivers.SPA.03.07.00.E.pkg	Platform drivers
Infra	cat3k_caa-infra.SPA.03.07.00E.pkg	Infrastructure software, including system manager, installer, HA manager, and more
Cisco IOS Software	cat3k_caa-iosd-universalk9.SPA.152-3.E.pkg	Cisco IOS Software image
Platform	cat3k_caa-platform.SPA.03.07.00.E.pkg	Software not specific to the Cisco IOS Software platform and stack manager, platform manager, and more
WCM	cat3k_caa-wcm.SPA.10.3.100.0.pkg	Wireless controller software

Booting Cisco IOS XE Software

You can boot and run the Cisco IOS XE Software on the Cisco Catalyst 3850 Switch in either of two modes:

- Install mode (recommended mode of operation)
- Bundle mode

Booting the Switch in Install Mode

Cisco Catalyst 3850 Switches shipped to customers from manufacturing boot up in install mode. The Cisco Catalyst 3850 Switch is booted in install mode using a package provisioning file **packages.conf**. Do not modify this file.

In this example, the Cisco Catalyst 3850 Switch is configured to autoboot from the built-in flash memory:

```
Switch# show boot
-----
Switch 1
-----
Current Boot Variables:
BOOT variable does not exist

Boot Variables on next reload:
BOOT variable = flash:packages.conf
Allow Dev Key = yes
Manual Boot = no
Enable Break = no
```

The **show version** command output displays the Cisco Catalyst 3850 Switch mode of operation:

```
Switch# show version | begin Switch Ports
Switch  Ports  Model          SW Version    SW Image      Mode
-----  -
*  1      32      WS-C3850-24U  03.07.00.E   cat3k_caa-universalk9  INSTALL
Configuration register is 0x102
```

The packages and the provisioning file reside in the flash.

Note: Booting in install mode from a USB flash drive or using Trivial File Transfer Protocol (TFTP) is not supported.

Booting the Cisco Catalyst 3850 Switch in Bundle Mode

Booting a Cisco Catalyst 3850 Switch in bundle mode is just like booting a monolithic Cisco IOS Software image on a Cisco Catalyst 3750-X Switch.

This command boots the switch in bundle mode:

```
switch: boot flash:cat3k_caa-universalk9.SPA.03.07.00.E.152-3.E.bin
Reading full image into
memory.....done
Bundle Image
<Output Truncated>
```

Note: Booting the switch in bundle mode consumes more memory than booting in install mode because the packages are extracted from the bundle and copied to the RAM.

You can boot the switch in bundle mode from the built-in flash memory, an external USB drive (usbflash0), or TFTP. Bundle mode is used to boot a Cisco Catalyst 3850 Switch from the boot loader prompt.

Updating Cisco IOS XE Software

When the switch is in install mode, you can install any new Cisco IOS XE Software bundle by using the **software install** command.

Note: This command works only when the Cisco Catalyst 3850 Switch is booted in install mode.

Use the **show switch** command to check the status of the switch or switch stack. This example shows the status of a two-switch stack, where switch 1 is active:

```
Switch# show switch
Switch/Stack Mac Address : 00e1.6d52.c600 - Local Mac Address
Mac persistency wait time: Indefinite

Switch#   Role      Mac Address      Priority  H/W      Current
-----
*1        Active    00e1.6d52.c600  15       V03      Ready
2         Standby   44ad.d96d.b480  1         V01      Ready
```

This example shows the command syntax and the console log from a software install in a stack of two switches:

```
Switch# software install file flash: cat3k_caa-universalk9.SPA.03.07.00.E.152-3.E.bin
Preparing install operation ...
[2]: Copying software from active switch 1 to switch 2
[2]: Finishing copying software to switch 2
[1 2]: Starting install operation
[1 2]: Expanding bundle flash: cat3k_caa-universalk9.SPA.03.07.00.E.152-3.E.bin
[1 2]: Copying package files
[1 2]: Package files copied
[1 2]: Finished expanding bundle flash: cat3k_caa-universalk9.SPA.03.07.00.E.152-3.E.bin
[1 2]: Verifying and copying expanded package files to flash:
[1 2]: Verified and copied expanded package files to flash:
[1 2]: Starting compatibility checks
[1 2]: Finished compatibility checks
[1 2]: Starting application pre-installation processing
[1 2]: Finished application pre-installation processing
[1]: Old files list:
    Removed cat3k_caa-base.SPA.03.03.03SE.pkg
    Removed cat3k_caa-drivers.SPA.03.03.03SE.pkg
    Removed cat3k_caa-infra.SPA.03.03.03SE.pkg
    Removed cat3k_caa-iosd-universalk9.SPA.150-1.EZ3.pkg
    Removed cat3k_caa-platform.SPA.03.03.03SE.pkg
    Removed cat3k_caa-wcm.SPA.10.1.130.0.pkg
[2]: Old files list:
    Removed cat3k_caa-base.SPA.03.03.03SE.pkg
    Removed cat3k_caa-drivers.SPA.03.03.03SE.pkg
    Removed cat3k_caa-infra.SPA.03.03.03SE.pkg
    Removed cat3k_caa-iosd-universalk9.SPA.150-1.EZ3.pkg
    Removed cat3k_caa-platform.SPA.03.03.03SE.pkg
    Removed cat3k_caa-wcm.SPA.10.1.130.0.pkg
[1]: New files list:
    Added cat3k_caa-base.SPA.03.07.00E.pkg
    Added cat3k_caa-drivers.SPA.03.07.00E.pkg
    Added cat3k_caa-infra.SPA.03.07.00E.pkg
    Added cat3k_caa-iosd-universalk9.SPA.152-3.E.pkg
    Added cat3k_caa-platform.SPA.03.07.00E.pkg
    Added cat3k_caa-wcm.SPA.10.3.100.0.pkg
[2]: New files list:
    Added cat3k_caa-base.SPA.03.07.00E.pkg
    Added cat3k_caa-drivers.SPA.03.07.00E.pkg
    Added cat3k_caa-infra.SPA.03.07.00E.pkg
    Added cat3k_caa-iosd-universalk9.SPA.152-3.E.pkg
```



```
Added cat3k_caa-platform.SPA.03.07.00E.pkg
Added cat3k_caa-wcm.SPA.10.3.100.0.pkg
[1 2]: Creating pending provisioning file
[1 2]: Finished installing software. New software will load on reboot.
[1 2]: Committing provisioning file
[1 2]: Do you want to proceed with reload? [yes/no]: yes
[1 2]: Reloading
```

Software Rollback

The **software rollback** command allows you to revert to an earlier Cisco IOS XE Software package after a software install. Software rollback is functional only when at least one rollback package with the file name `packages.conf.00-` is present. The rollback file is created automatically during the Cisco Catalyst 3850 Switch Cisco IOS XE Software image update process.

This example shows the flash directory of a switch with an available rollback package:

```
Switch# dir flash:
Directory of flash:/
38738  -rw-          856  Apr 14 2015 21:06:25 +00:00  vlan.dat
12    -rw-          1248  Jul 7 2014 07:07:46 +00:00  packages.conf.00-
<Output Truncated>
```

To revert to an earlier software image, use the **software rollback** command with the rollback package name:

```
Switch# software rollback provisioning-file flash:packages.conf.00-
```

Software Clean

Flash space in a Cisco Catalyst 3850 Switch can be recovered safely by using the **software clean** command. This command deletes any redundant package files (.pkg), bundle files (.bin), or provisioning files (packages.conf*), without deleting the active .pkg and .conf file.

Do not use the **delete** command to remove unnecessary files from flash, because you might also delete the active .pkg or .conf files that are required for booting the switch.

Note: After you use the **software clean** command, the switch cannot revert to an earlier software image, because the required rollback files are deleted by this operation.

This example shows the results of the **software clean** command on a stack of two Cisco Catalyst 3850 Switches:

```
Switch# software clean
Preparing clean operation ...
[1 2]: Cleaning up unnecessary package files
[1 2]: No path specified, will use booted path flash:packages.conf
[1 2]: Cleaning flash:
[1]: Preparing packages list to delete ...
      In use files, will not delete:
          cat3k_caa-base.SPA.03.07.00E.pkg
          cat3k_caa-drivers.SPA.03.07.00E.pkg
```

```

cat3k_caa-infra.SPA.03.07.00E.pkg
cat3k_caa-iosd-universalk9.SPA.152-3.E.pkg
cat3k_caa-platform.SPA.03.07.00E.pkg
cat3k_caa-wcm.SPA.10.3.100.0.pkg
packages.conf
[2]: Preparing packages list to delete ...
In use files, will not delete:
cat3k_caa-base.SPA.03.07.00E.pkg
cat3k_caa-drivers.SPA.03.07.00E.pkg
cat3k_caa-infra.SPA.03.07.00E.pkg
cat3k_caa-iosd-universalk9.SPA.152-3.E.pkg
cat3k_caa-platform.SPA.03.07.00E.pkg
cat3k_caa-wcm.SPA.10.3.100.0.pkg
packages.conf
[1]: Files that will be deleted:
cat3k_caa-base.SPA.03.03.03SE.pkg
cat3k_caa-drivers.SPA.03.03.03SE.pkg
cat3k_caa-infra.SPA.03.03.03SE.pkg
cat3k_caa-iosd-universalk9.SPA.150-1.EZ3.pkg
cat3k_caa-platform.SPA.03.03.03SE.pkg
cat3k_caa-universalk9.SPA.03.07.00.E.152-3.E.bin
cat3k_caa-wcm.SPA.10.1.130.0.pkg
packages.conf.00-
[2]: Files that will be deleted:
cat3k_caa-base.SPA.03.03.03SE.pkg
cat3k_caa-drivers.SPA.03.03.03SE.pkg
cat3k_caa-infra.SPA.03.03.03SE.pkg
cat3k_caa-iosd-universalk9.SPA.150-1.EZ3.pkg
cat3k_caa-platform.SPA.03.03.03SE.pkg
cat3k_caa-universalk9.SPA.03.07.00.E.152-3.E.bin
cat3k_caa-wcm.SPA.10.1.130.0.pkg
packages.conf.00-
[1 2]: Do you want to proceed with the deletion? [yes/no]: y
[1 2]: Clean up completed

```

Boot Loader Upgrade

The Cisco Catalyst 3850 Switch shipped from manufacturing is configured to autoboot Cisco IOS XE Software from the built-in flash and display the autoconfiguration dialog. In special circumstances a boot loader upgrade might be necessary for a Cisco IOS XE Software image upgrade.

These are the steps to upgrade a Cisco Catalyst 3850 Switch boot loader image:

Step 1. Enable manual boot and power cycle the switch.

Enter the **boot manual** command, along with the switch name or number:

```
Switch(config)# boot manual switch 1
Switch(config)#^Z
Switch#wr mem

*Mar 17 22:34:15.142: %SYS-5-CONFIG_I: Configured from console by console
Building configuration...
Compressed configuration from 8910 bytes to 3178 bytes[OK]
Switch# reload
```

This is a sample of the switch display following a manual boot:

```
Booting...Initializing RAM ++++++@@@@@@@@...+++++
Base ethernet MAC Address: f8:4f:57:6f:e1:00

Interface GE 0 link down***ERROR: PHY link is down
Initializing Flash...

flashfs[7]: 0 files, 1 directories
flashfs[7]: 0 orphaned files, 0 orphaned directories
flashfs[7]: Total bytes: 6784000
flashfs[7]: Bytes used: 1024
flashfs[7]: Bytes available: 6782976
flashfs[7]: flashfs fsck took 1 seconds....done Initializing Flash.

The system is not configured to boot automatically. The
following command will finish loading the operating system
software:

    boot

switch:
```

There is a limited set of commands that are supported at the boot loader command prompt. Enter a question mark to view the available commands.

Note: Appendix A of this guide shows the complete list of boot loader commands.

Use the **version** boot loader command to display the current boot loader version:

```
switch: ver
CAT3K_CAA Boot Loader (CAT3K_CAA-HBOOT-M) Version 1.3, RELEASE SOFTWARE (P)
Compiled Thu Jun  6 08:04:54 PDT 2013 by rel
```

Step 2. Load the new boot loader image from a TFTP server.

This example shows how to establish TFTP connectivity to the switch from the boot loader prompt:

```
switch: IP_ADDR=10.1.104.130/255.255.255.0
switch: DEFAULT_ROUTER=10.1.104.1
switch: MANUAL_BOOT=yes
switch: ping 10.1.104.211
ping 10.1.104.211 with 32 bytes of data ...
Up 1000 Mbps Full duplex (port 0) (SGMII)
Host 10.1.104.211 is alive.
```

This example shows how to copy the boot loader image from TFTP:

```
switch: copy tftp://10.1.104.211/cat3850_loader.img.12Sep12.SSA bs:
Up 1000 Mbps Full duplex (port 0) (SGMII)
.....
.....
File "tftp://10.1.104.211/cat3850_loader.img.12Sep12.SSA" successfully copied
to"bs:"
```

Note: You can also copy the boot loader image from a USB flash drive.

Step 3. Reset the switch.

The **reset** command reloads the switch, and it starts up with the new boot loader image:

```
switch: reset
```

To install the Cisco IOS XE Software, migrate from the boot loader prompt to the install mode.

Migration to Install Mode from the Bootloader Prompt

The Cisco IOS XE Software image for the Cisco Catalyst 3850 Switch is distributed as a bundle image. You cannot copy this bundle directly to the flash and then boot the switch. You must install the Cisco IOS XE Software bundle into the flash and then boot the switch from the installed software using the install mode. Perform this procedure if the Cisco IOS XE Software image that resides in the flash memory becomes corrupted.

Use the **ping** command to confirm TFTP connectivity from the boot loader prompt:

```
switch: ping 10.1.104.211
ping 10.1.104.211 with 32 bytes of data ...
Up 1000 Mbps Full duplex (port 0) (SGMII)
Host 10.1.104.211 is alive.
```

Boot the switch from TFTP:

```
switch: boot tftp://10.1.104.211/switch/cat3k_caa-universalk9.SPA.03.07.00.E.152-
3.E.bin
Reading full image into memory...
<Output Truncated>
```

Use the **show version** command to display the software image version and the mode:

```
Switch#show version | begin Switch Ports
```

Switch	Ports	Model	SW Version	SW Image	Mode
-----	-----	-----	-----	-----	----
* 1	32	WS-C3850-24U	03.07.00.E	cat3k_caa-universalk9	BUNDLE

The display shows bundle mode because the switch booted by loading the bundle either from TFTP or from a USB flash drive.

Copy the final bundle image to the flash either from the TFTP server or from a USB flash drive.

Use the **software expand** command to expand the bundle image in the flash:

```
Switch#$software expand file flash:cat3k_caa-universalk9.SPA.03.07.00.E.152-3.E.bin
Preparing expand operation ...
[1]: Expanding bundle flash:cat3k_caa-universalk9.SPA.03.07.00.E.152-3.E.bin
[1]: Copying package files
[1]: A different version of provisioning file packages.conf already exists in flash:.
      The provisioning file from the expanded bundle will be saved as
      flash:cat3k_caa-universalk9.SPA.03.07.00.E.152-3.E.conf
[1]: Package files copied
[1]: Finished expanding bundle flash:cat3k_caa-universalk9.SPA.03.07.00.E.152-3.E.bin
```

Confirm that the bundle is expanded and packages.conf file is present in the flash memory:

```
Switch# dir flash:
Directory of flash:/

7753  -rw-          1242   Mar 17 2013 22:29:11 +00:00  packages.conf
7746  -rw-           796   Mar 12 2015 00:07:01 +00:00  vlan.dat
38727 -rw-      82245716   Mar 17 2015 22:28:39 +00:00  cat3k_caa-
base.SPA.03.07.00E.pkg
38728 -rw-      7019196   Mar 17 2015 22:28:51 +00:00  cat3k_caa-
drivers.SPA.03.07.00E.pkg
38729 -rw-      36901896  Mar 17 2015 22:28:41 +00:00  cat3k_caa-
infra.SPA.03.07.00E.pkg
38730 -rw-      45841724  Mar 17 2015 22:28:45 +00:00  cat3k_caa-iosd-
universalk9.SPA.152-3.E.pkg
38731 -rw-      26858380  Mar 17 2015 22:28:42 +00:00  cat3k_caa-
platform.SPA.03.07.00E.pkg
38726 -rw-          1234   Mar 17 2015 22:29:08 +00:00  cat3k_caa-
universalk9.SPA.03.07.00.E.152-3.E.conf
38732 -rw-      111475520  Mar 17 2015 22:28:51 +00:00  cat3k_caa-
wcm.SPA.10.3.100.0.pkg

<Output Truncated>
```

```
1621966848 bytes total (719454208 bytes free)
Switch#
```

Reload the switch and boot with the newly created flash:packages.conf:

```
switch: boot flash:packages.conf
Getting rest of image
Reading full image into memory....done
Reading full base package into memory...: done = 79331128
<Output Truncated>
Switch#show version | begin Switch Ports
Switch  Ports  Model          SW Version  SW Image          Mode
-----  -
*  1      32      WS-C3850-24U  03.07.00.E  cat3k_caa-universalk9  INSTALL

Configuration register is 0x102
```

By default, when the **software expand** command is executed in the active switch of a switch stack, it is executed on all switches in the stack.

To autoload the installed image, perform these steps:

Use the **no boot manual** command to disable manual boot:

```
Switch(config)# no boot manual switch 1
```

Use the **boot system** command to modify the boot command to boot from flash:

```
Switch(config)# boot system switch 1 flash:packages.conf
```

Use the **copy running-config startup-config** command to save the configuration:

```
Switch# copy running-config startup-config
```

Use the **show boot** command to verify that the switch is configured to boot from flash memory:

```
Switch# show boot
Current Boot Variables:
BOOT variable = flash:packages.conf;

Boot Variables on next reload:
BOOT variable = flash:packages.conf;
Allow Dev Key = yes
Manual Boot = no
Enable Break = no
```

Cisco Catalyst 3850 Switch Right-to-Use Licensing Model

The Cisco Catalyst 3850 Switch right-to-use (RTU) is a trust-based licensing model designed to give customers the flexibility to upgrade, downgrade, or move the license for RMA purposes by using simple EXEC commands. The RTU licensing model allows customers to specify the desired image-based licensing level (LAN Base, IP Base, and IP Services) and AP-Count on the switch or switch stack through EXEC commands.

About the Cisco Catalyst 3850 Switch RTU license:

- The RTU license is purchased along with the Cisco Catalyst 3850 Switch (or separately) and is NOT tied to the unique device identifier (product ID + serial number) of a switch.
- When you purchase a switch, the license you specified in the purchase order is preinstalled.
- To upgrade the license, you can order an upgrade license and receive an electronic or printed license. After accepting the end-user license agreement (EULA), you enable the upgrade by using a simple CLI command.
- To transfer RTU licenses from one switch to another, deactivate the license on one switch and activate it on another.

RTU License Types

There are two main categories of Cisco Catalyst 3850 Switch RTU license: a permanent RTU license and a 90-day evaluation RTU license.

Permanent RTU License

This is a paid license that does not expire. You can activate permanent RTU licenses after you accept the EULA. The EULA assumes you have purchased the permanent license. There are two types of permanent RTU licenses:

- Image-based (or feature set) license
- Adder AP-Count license

Image-based license: This license is activated by Cisco before the switch is shipped and requires no customer configuration to enable it. Supported license levels include LAN Base, IP Base, and IP Services.

You can upgrade, disable, or move image-based licenses by using the license right-to-use command, either for individual switches or for all switches in a stack. Reload the switch or stack to activate the highest level license. For example, if you upgrade the license level from IP Base to IP Services, then the IP services license is activated by reloading the switch.

This command enables the ipservices license and accepts the EULA on all switches in the stack:

```
Switch# license right-to-use activate ipservices all acceptEULA
% switch-1:stack-mgr:Reboot the switch to invoke the highest activated License
level

Switch#
*Feb 25 23:54:40.909: %SMN_HBL_LICENSE-6-LIC_ACT: 1 stack-mgr: ipservices
license is activated successfully on switch 1
*Feb 25 23:54:40.909: %SMN_HBL_LICENSE-6-LIC_CHANGE: 1 stack-mgr: Switch 1
reboot license level changed from lanbase to ipservices. Reboot the switch to
invoke the new license level.
```

```
Switch# show license right-to-use summary
  License Name   Type           Count    Period left
-----
  ipbase        permanent     N/A      Lifetime
  apcount       base          0        Lifetime
  apcount       adder         0        Lifetime
-----
```

License Level In Use: ipbase

License Level on Reboot: ipservices

Evaluation AP-Count: Disabled

Total AP Count Licenses: 0

AP Count Licenses In-use: 0

AP Count Licenses Remaining: 0

Adder AP-Count license: The adder AP-Count license is an “add as you grow” license. You can add access point licenses as your network grows. You activate an adder AP-count license by using EXEC commands, and it is activated without a switch reload.

This example shows the license summary display for a switch with an activated adder AP-Count license:

```
Switch# show license right-to-use summary
  License Name   Type           Count    Period left
-----
  ipservices     permanent     N/A      Lifetime
  apcount       base          0        Lifetime
  apcount       adder         10       Lifetime
-----
```

License Level In Use: ipservices

License Level on Reboot: ipservices

Evaluation AP-Count: Disabled

Total AP Count Licenses: 10

AP Count Licenses In-use: 0

AP Count Licenses Remaining: 10

```
Switch# license right-to-use activate apcount 25 slot 1 acceptEULA
```

```
Switch#
```

```
*Mar 19 00:28:50.506: %SMN_HBL_LICENSE-6-AP_ADD: 1 stack-mgr: 25 adder AP-count licenses are added
```

```
Switch# show license right-to-use summary
  License Name   Type           Count    Period left
-----
  ipservices     permanent     N/A      Lifetime
  apcount       base          0        Lifetime
-----
```



```

apcount      adder      35    Lifetime
-----

License Level In Use: ipservices
License Level on Reboot: ipservices
Evaluation AP-Count: Disabled
Total AP Count Licenses: 35
AP Count Licenses In-use: 0
AP Count Licenses Remaining: 25

```

This example shows the license summary display for a switch with a deactivated adder AP-Count license:

```

Switch# license right-to-use deactivate apcount 25 slot 1
Switch#
*Mar 19 00:32:10.186: %SMN_HBL_LICENSE-6-AP_DEL: 1 stack-mgr: 25 adder AP-count
licenses are removed.

Switch# show license right-to-use summary
  License Name      Type          Count    Period left
-----
  ipservices        permanent     N/A      Lifetime
  apcount           base          0        Lifetime
  apcount           adder         10       Lifetime
-----

License Level In Use: ipservices
License Level on Reboot: ipservices
Evaluation AP-Count: Disabled
Total AP Count Licenses: 10
AP Count Licenses In-use: 0
AP Count Licenses Remaining: 10

```

Image-Based License in a Stack

In a Cisco Catalyst 3850 Switch stack, all switches **must be at the same image-based license (IP Services/IP Base/LAN Base) level**. The active switch license level is considered the reference, and the member switch licenses are compared to it. If there is a mismatch, the active switch displays a syslog message saying that the stack configuration was unsuccessful.

This is an example of the display on the active switch console:

```

%STACKMGR-1-STACK_LINK_CHANGE: Stack port 1 on switch 2 is up
Switch 2 has a license mismatch with the stack. Only on activating a compatible
license will the switch join the stack.

Switch# show switch

```

```
Switch/Stack Mac Address : 00e1.6d52.c600 - Local Mac Address
Mac persistency wait time: Indefinite
```

Switch#	Role	Mac Address	Priority	H/W Version	Current State
*1	Active	00e1.6d52.c600	15	V03	Ready
2	Member	44ad.d96d.b480	1	0	Lic-Mismatch
3	Member	0000.0000.0000	0	0	Provisioned

This message appears on the member switch console:

```
Switch# show license right-to-use mismatch
Slot#    License Name    Adder AP Count    Base AP Count
-----
2        ipbase           50                0
```

```
Switch# show license right-to-use summary
License Name    Type        Count    Period left
-----
ipservices      permanent  N/A      Lifetime
apcount         base        0        Lifetime
apcount         adder       0        Lifetime
```

```
-----
License Level In Use: ipservices
License Level on Reboot: ipservices
Evaluation AP-Count: Disabled
Total AP Count Licenses: 0
AP Count Licenses In-use: 0
AP Count Licenses Remaining: 0
```

To enable the member switch to join the stack, change the license level of the member switch (switch 2) by activating the license from the active switch console:

```
Switch# license right-to-use activate ipservices slot 1 acceptEULA
% switch-1:stack-mgr:Reboot the switch to invoke the highest activated License
level

Switch#
*Mar  3 21:03:58.309: %SMN_HBL_LICENSE-6-LIC_ACT: 1 stack-mgr:  ipservices
license is activated successfully on switch 1
*Mar  3 21:03:58.309: %SMN_HBL_LICENSE-6-LIC_CHANGE: 1 stack-mgr:  Switch 1
reboot license level changed from lanbase to ipservices. Reboot the switch to
invoke the new license level.
```

```
Switch# reload
Reload command is being issued on Active unit, this will reload the whole stack
Proceed with reload? [confirm]
```

After switch 2 reloads successfully, it joins the stack with the active switch.

```
Switch# show switch
Switch/Stack Mac Address : 00e1.6d52.c600 - Local Mac Address
Mac persistency wait time: Indefinite
```

Switch#	Role	Mac Address	H/W Priority	Current Version	State
*1	Active	00e1.6d52.c600	15	V03	Ready
2	Standby	44ad.d96d.b480	1	V03	Ready
3	Member	0000.0000.0000	0	0	Provisioned

AP-Count License in a Stack

AP-Count license is available only with IP Base and IP Services licenses. A Cisco Catalyst 3850 Switch stack can support a maximum of 50 access points. An AP-Count license is required only if a Cisco Catalyst 3850 Switch is configured as both a mobility controller and a mobility agent. An AP-Count license is not needed if the Cisco Catalyst 3850 Switch is configured only as a mobility agent, which is the default configuration.

The total AP-Count license of a Cisco Catalyst 3850 Switch stack is equal to the sum of all the individual member AP-Count licenses, up to a maximum of 50 AP-Counts. The total AP-Count license of the stack is affected when stack members are added or removed:

- When new members are added to the stack, the total AP-Count license of the stack is automatically recalculated.
- When members are removed from the stack, the AP-Count license contributed by the removed switch is decremented from the total available AP-Count license in the stack.
- If more AP-Counts are connected than the available AP-Count license, a syslog warning message indicates this fact without disconnecting the excess connected AP-Counts until a stack reload.
- After the stack reload, the surplus AP-Count s are removed from the total AP-Count. The following examples explain the process.

Stack member addition example: A Cisco Catalyst 3850 Switch stack includes 3 switches, each with an AP-Count license that allows 10 AP-Counts, for a total of 30 supported AP-Counts. When a new Cisco Catalyst 3850 Switch (switch 4) is added to the stack with an AP-Count license allowing 25 AP-Counts, the stack supports a total of 50 AP-Counts because the total number of 55 access points (30+25) exceeds the stack limit.

Stack member removal example: In the preceding example, if switch 4 is removed from the stack, the AP-Count license remains at 50 AP-Counts until the stack is reloaded, if 50 AP-Counts are connected and active in the stack. After reload, the stack returns to its original value of 30 AP-Counts.

When the AP-Count for a stack exceeds 50, a syslog message appears in the active and member switches to indicate the excess AP-Count:

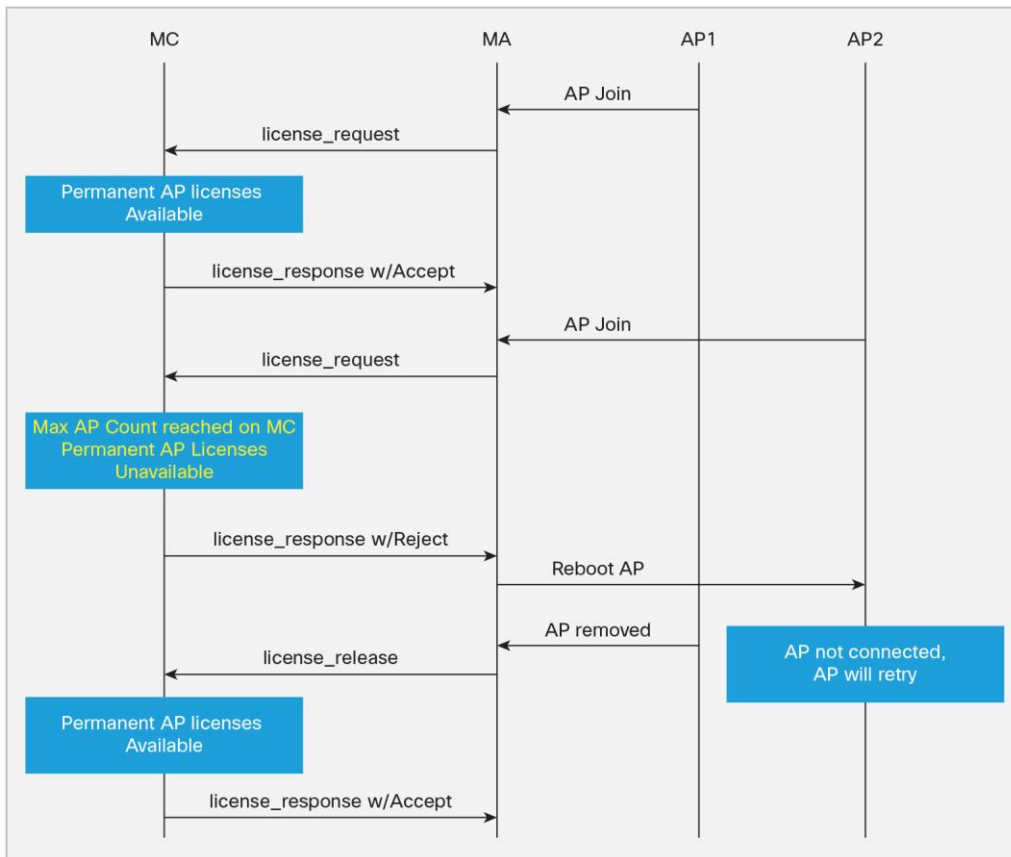
```
%SMN_HBL_LICENSE-1-EXCESS_AP_LIC: Total AP Count Licenses available have exceeded
the Maximum supported AP Count by 60
Switch# show license right-to-use summary
  License Name      Type          Count   Period left
-----
  ipservices        permanent    N/A     Lifetime
  apcount           base         0       Lifetime
  apcount           adder        110     Lifetime
-----

License Level In Use: ipservices
License Level on Reboot: ipservices
Evaluation AP-Count: Disabled
Total AP Count Licenses: 50
AP Count Licenses In-use: 0
AP Count Licenses Remaining: 50
```

By default the Cisco Catalyst 3850 Switch stack is configured as a mobility agent. In the wireless licensing model, a mobility agent is the access point count enforcement point. A mobility controller is the access point count management point. A Cisco Catalyst 3850 Switch stack can be configured as either a mobility controller or a mobility agent, or both, depending on the deployment requirement.

Figure 3 shows a typical licensing protocol interaction between an AP-Count, a mobility agent, and a mobility controller:

Figure 3. Licensing Protocol Call Flow



In a large deployment, a Cisco Catalyst 3850 Switch stack is the mobility agent, and a 5760 wireless controller is the mobility controller. In a split mobility agent-mobility controller deployment, the AP-Count is managed at the mobility controller level.

License Migration between Switches

You can easily migrate RTU licenses between Cisco Catalyst 3850 Switches. Both image-based and AP-Count licenses can be deactivated from one switch and activated on another switch. To deactivate a license, use the **license right-to-use deactivate EXEC** command. To activate a license, use the **license right-to-use activate EXEC** command.

These examples illustrate the process:

Example: Switch1 and Switch2 are nonstacked independent Cisco Catalyst 3850 Switches. To move the IP Services image-based license and 50 AP-Count license from Switch1 to Switch2:

Step 1. Verify the current licenses in Switch:

```
Switch# show license right-to-use summary
License Name      Type          Count    Period left
-----
ipservices        permanent    N/A      Lifetime
apcount           base         0        Lifetime
apcount           adder        50       Lifetime
-----
```

Step 2. Deactivate the image-based license and the AP-Count license from Switch:

```
Switch# license right-to-use deactivate ipservices slot 1
% switch-1:stack-mgr:Reboot the switch to invoke the highest activated License
level

Switch#
*Mar  3 20:41:51.024: %SMN_HBL_LICENSE-6-LIC_EULA_CLEAR: 1 stack-mgr:  EULA for
ipservices license has been cleared.
*Mar  3 20:41:51.024: %SMN_HBL_LICENSE-6-LIC_CHANGE: 1 stack-mgr:  Switch 1
reboot license level changed from ipservices to lanbase. Reboot the switch to
invoke the new license level.
Switch# license right-to-use deactivate apcount 50 slot 1
Switch#
*Mar  3 20:42:27.538: %SMN_HBL_LICENSE-6-AP_DEL: 1 stack-mgr:  0 adder AP-count
licenses are removed.
```

Step 3. Reload Switch and verify that the licenses are cleared:

```
Switch# show license right-to-use summary
License Name      Type          Count    Period left
-----
lanbase           permanent    N/A      Lifetime
apcount           base         0        Lifetime
apcount           adder        0        Lifetime
-----

License Level In Use: lanbase
License Level on Reboot: lanbase
Evaluation AP-Count: Disabled
Total AP Count Licenses: 0
AP Count Licenses In-use: 0
AP Count Licenses Remaining: 0
```

Step 4. Enable the licenses in Switch 2:

```
Switch# license right-to-use activate ipservices slot 2 acceptEULA
% switch-2:stack-mgr:Reboot the switch to invoke the highest activated License
level
*Apr 14 21:02:31.317: %SMN_HBL_LICENSE-6-LIC_ACT: 2 stack-mgr: ipservices
license is activated successfully on switch 2
*Apr 14 21:02:31.317: %SMN_HBL_LICENSE-6-LIC_CHANGE: 2 stack-mgr: Switch 2
reboot license level changed from lanbase to ipservices. Reboot the switch to
invoke the new license level.

Switch# license right-to-use activate apcount 50 slot 2 acceptEULA
*Apr 14 21:03:30.648: %SMN_HBL_LICENSE-6-AP_ADD: 2 stack-mgr: 50 adder AP-count
licenses are added
```

Step 5. Reload Switch 2 and confirm the active licenses:

```
Switch# show license right-to-use summary
  License Name      Type      Count  Period left
-----
  ipservices        permanent  N/A    Lifetime
  apcount           base      0      Lifetime
  apcount           adder     50     Lifetime
-----

License Level In Use: ipservices
License Level on Reboot: ipservices
Evaluation AP-Count: Disabled
Total AP Count Licenses: 50
AP Count Licenses In-use: 0
AP Count Licenses Remaining: 50
```

Evaluation RTU License

An evaluation license allows you to evaluate any license for 90 days free of charge. To activate an evaluation license, accept the EULA. The evaluation license EULA assumes that you will purchase a permanent license within 90 days; if you do not purchase a permanent license, the evaluation license is deactivated after 90 days. You receive a syslog message warning about deactivation 10 days before the evaluation license expires and another message 5 days before expiration. After the 90-day period expires, syslog messages appear every day until you reload the switch:

```
%SMN_HBL_LICENSE-1-EVAL_EXP: Evaluation Period of apcount eval license expired 10
days ago. Purchase the permanent license.
%SMN_HBL_LICENSE-1-EVAL_EXP: Evaluation Period of apcount eval license expired 11
days ago. Purchase the permanent license.
```

Note: You can activate a 90-day evaluation license only once on each Cisco Catalyst 3850 Switch. After the 90 days have expired, you cannot activate another 90-day evaluation license on the same switch.

Use these commands to enable an evaluation license:

```
Switch# license right-to-use activate ipservices evaluation all acceptEULA
% switch-4:stack-mgr:Reboot the switch to invoke the highest activated License
level

Switch#
*Mar 19 00:52:42.054: %SMN_HBL_LICENSE-6-LIC_ACT: 4 stack-mgr: ipservices eval
license is activated successfully on switch 4
*Mar 19 00:52:42.054: %SMN_HBL_LICENSE-6-LIC_CHANGE: 4 stack-mgr: Switch 4
reboot license level changed from lanbase to ipservices eval. Reboot the switch
to invoke the new license level.
```

After a reload:

```
Switch# show license right-to-use summary
License Name      Type          Count      Period left
-----
 ipservices       evaluation    N/A        90
 apcount          base         0          Lifetime
 apcount          adder        0          Lifetime
-----

License Level In Use: ipbase
License Level on Reboot: ipservices eval
Evaluation AP-Count: Disabled
Total AP Count Licenses: 0
AP Count Licenses In-use: 0
AP Count Licenses Remaining: 0
```

Use these commands to deactivate an evaluation license:

```
Switch# license right-to-use deactivate ipservices evaluation all
% switch-4:stack-mgr:Reboot the switch to invoke the highest activated License
level

Switch#
*Mar 19 00:56:12.682: %SMN_HBL_LICENSE-6-LIC_EULA_CLEAR: 4 stack-mgr: EULA for
ipservices eval license has been cleared.
*Mar 19 00:56:12.683: %SMN_HBL_LICENSE-6-LIC_CHANGE: 4 stack-mgr: Switch 4
reboot license level changed from ipservices eval to lanbase. Reboot the switch
to invoke the new license level.
```

Note: You must reload the switch to activate the correct license level.

License Usage Monitoring

The license usage record is maintained in the Cisco Catalyst 3850 Switch or switch stack for individual switches. The usage information is maintained from the initial boot and across reloads and includes the status of the EULA, in-use condition, and type of license. Deactivating a license resets the EULA status. The license information is updated daily for active in-use licenses and can be displayed by using the **show license right-to-use usage** command:

```
Switch# show license right-to-use usage
```

Slot#	License Name	Type	usage-duration(y:m:d)	In-Use	EULA
1	ipservices	permanent	0 :0 :9	yes	yes
1	ipservices	evaluation	0 :0 :0	no	no
1	ipbase	permanent	0 :0 :0	no	yes
1	ipbase	evaluation	0 :0 :0	no	yes
1	lanbase	permanent	0 :0 :3	no	yes
1	apcount	evaluation	0 :0 :0	no	no
1	apcount	base	0 :0 :0	no	no
1	apcount	adder	0 :0 :9	yes	yes

Slot#	License Name	Type	usage-duration(y:m:d)	In-Use	EULA
2	ipservices	permanent	0 :0 :0	yes	yes
2	ipservices	evaluation	0 :0 :0	no	no
2	ipbase	permanent	0 :0 :0	no	yes
2	ipbase	evaluation	0 :0 :0	no	no
2	lanbase	permanent	0 :0 :0	no	yes
2	apcount	evaluation	0 :0 :0	no	no
2	apcount	base	0 :0 :0	no	no
2	apcount	adder	0 :0 :0	yes	yes

Slot#	License Name	Type	usage-duration(y:m:d)	In-Use	EULA
3	ipservices	permanent	0 :0 :0	yes	yes
3	ipservices	evaluation	0 :0 :0	no	no
3	ipbase	permanent	0 :0 :0	no	yes
3	ipbase	evaluation	0 :0 :0	no	no
3	lanbase	permanent	0 :0 :0	no	yes
3	apcount	evaluation	0 :0 :0	no	no
3	apcount	base	0 :0 :0	no	no
3	apcount	adder	0 :0 :0	yes	yes

Slot#	License Name	Type	usage-duration(y:m:d)	In-Use	EULA
4	ipservices	permanent	0 :0 :2	yes	yes
4	ipservices	evaluation	0 :0 :0	no	no

4	ipbase	permanent	0 :0 :0	no	yes
4	ipbase	evaluation	0 :0 :0	no	no
4	lanbase	permanent	0 :0 :0	no	yes
4	apcount	evaluation	0 :0 :0	no	no
4	apcount	base	0 :0 :0	no	no
4	apcount	adder	0 :0 :2	yes	yes

License Storage Management

The license information is stored in two hidden flash partitions: active and backup. The following information describes how the license information is stored and managed in the flash:

- Customer-ordered image-level license information is stored in the factory default license file, initially created by Cisco manufacturing.
- The license detail file maintains the license information for all the supported licenses, including license type, absolute usage, EULA acceptance status, and in-use state.
- License usage of the active licenses is updated once daily in the license detail file. The **license right-to-use activate** and **license right-to-use deactivate** commands also update the license detail file.
- A checksum is maintained and verified to prevent any tampering with the license files.
- Following activation, a license remains activated during reloads and image upgrades and downgrades.
- Erasing the configuration does not affect the license file because it is hidden in the flash.
- If the license file in the primary partition is corrupted or tampered with, the license file from the backup partition is used.
- If both the partitions are corrupted, Cisco can recreate the license files using the factory default files.

Cisco Catalyst 3850 Switch Stacking

Overview

Cisco Catalyst 3K switches define stacking architecture for enterprise networks to expand form factors, switching capacity, and redundancy in the wiring closet. Cisco StackWise® Plus is a proven and widely deployed cost-effective solution that delivers scale, performance, resiliency, and operational simplicity. To build the next-generation modular stack product, Cisco made significant changes to the StackWise Plus hardware and software architecture for the Cisco Catalyst 3850 Switch. The new Cisco Catalyst 3850 Switch is built upon high-speed next-generation Cisco application-specific integrated circuit (ASIC) technology and combined with the feature-rich and powerful Cisco IOS XE Software operating system.

The new StackWise-480 architecture allows you to build a high-speed stack ring with superior features and services scalability compared with StackWise Plus. The initial software version supports physically stacking up to four Cisco Catalyst 3850 Switches to form a stack ring. To accommodate varying port density requirements, the hardware can support both 48- and 24-port switches in a single stack ring. The Cisco Catalyst 3850 Switch deployed in stack mode is designed to deliver deterministic nonblocking switching performance to as many as 208 ports, including both wired and wireless network devices. The Cisco Catalyst 3850 Switch delivers uncompromised hardware-accelerated, rich integrated borderless network services and enterprise-class system resiliency. (See Figures 4 and 5).

Figure 4. Cisco Catalyst 3850 StackWise-480 Switch Stack Front View



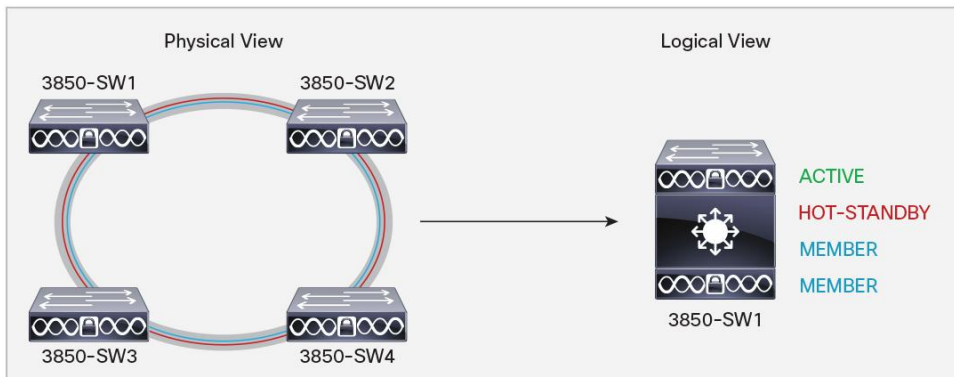
Figure 5. Cisco Catalyst 3850 StackWise-480 Switch Stack Rear View



The system architecture of the Cisco Catalyst 3850 Switch is designed to evolve as a solution engine that enables converged access infrastructure and rich integrated technologies with unparalleled application performance. This new Cisco switch delivers the simplified system operation tools that network administrators need to manage increasingly complex and feature-rich networks.

Cisco StackWise-480 provides a robust distributed forwarding architecture through each stack member switch and a unified, fully centralized control and management plane to simplify operation in a large-scale network design. One switch in a stack ring is elected to be the active switch. The active switch controls the management plane of the entire stack from both the network and user perspective. Figure 6 illustrates the physical versus logical view of a system in stack configuration mode.

Figure 6. Simplified Cisco Catalyst 3850 Switch Physical Versus Logical View



The system roles in the new resilient StackWise-480 architecture can be verified using the show switch EXEC command. The network administrator can check the current state of each member switch in the stack ring and identify the switch that is in hot-standby mode. The hot-standby switch assumes the active role when it detects a failure of the primary active switch.

This example shows the output of the **show switch** command used to display the switch roles in a configuration:

```
Switch#show switch
Switch/Stack Mac Address : f84f.576f.e100 - Local Mac Address
Mac persistency wait time: Indefinite
```

Switch#	Role	Mac Address	H/W Priority	Current Version	State
1	Standby	c472.954f.5380	1	V01	Ready
*2	Active	44ad.d96d.b480	1	V01	Ready
3	Member	00e1.6d52.c600	1	V03	Ready
4	Member	f84f.576f.e100	1	V01	Ready

Plug-and-Play Stack Deployment

Stack architecture allows network expansion when additional ports are required in the wiring closet. The hardware and software architecture of the Cisco Catalyst 3850 Switch allows you to insert new Cisco Catalyst 3850 Switches in a stack ring without major network disruption. The system and management operation, network configuration, and topologies remain transparent to the network, providing nonstop business communication during the upgrade.

This example shows the output of the **show switch stack-ports summary** command:

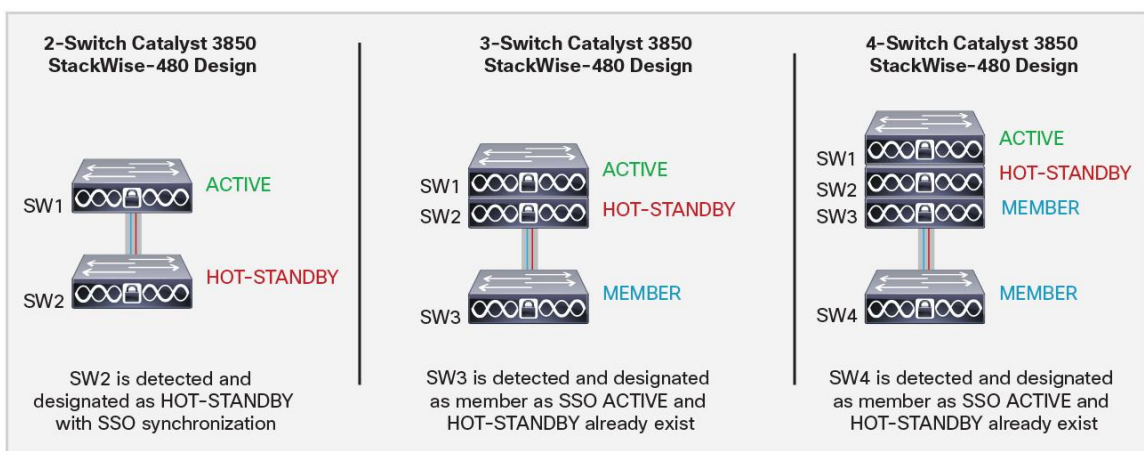
```
Switch#show switch stack-ports summary
```

Sw#/Port#	Port	Status	Neighbor #Changes to LinkOK	In Loopback	Cable Length	Link OK	Link Active	Sync OK
1/1	OK	3	50cm	Yes	Yes	Yes	1	No
1/2	OK	2	50cm	Yes	Yes	Yes	1	No
2/1	OK	1	50cm	Yes	Yes	Yes	1	No
2/2	OK	4	50cm	Yes	Yes	Yes	1	No
3/1	OK	4	50cm	Yes	Yes	Yes	1	No
3/2	OK	1	50cm	Yes	Yes	Yes	1	No
4/1	OK	2	50cm	Yes	Yes	Yes	1	No
4/2	OK	3	50cm	Yes	Yes	Yes	1	No

The Cisco IOS XE Software high-availability framework is enabled by default on Cisco Catalyst 3850 Switches when they are deployed in StackWise-480 mode. The newly provisioned Cisco Catalyst 3850 Switch automatically discovers and dynamically joins the stack ring. The Cisco StackWise-480 technology features system-level N:1 high availability. Adding switches to and removing switches from a stack do not affect the active and hot standby roles already in effect in the stack.

To enable stateful switchover (SSO) resiliency in Cisco StackWise-480 mode, you must configure each switch with the same Cisco IOS XE Software version and license. Figure 7 illustrates system roles and operation of Cisco StackWise-480 when you add Cisco Catalyst 3850 Switches to a stack.

Figure 7. Plug-and-Play Cisco Catalyst 3850 Switch System Role Designation



The unique high-availability architecture in the Cisco StackWise-480 design enables distributed network services, such as flexible NetFlow, quality of service (QoS), and more, as well as providing system-level redundancy for all stack-member switches. During a complete stack reload, all switches participate in an election process to determine assignment of the active and standby roles. Several criteria, including switch priority and MAC addresses, are compared to elect the active and standby switches in the stack.

To view information about switches in the stack (model, serial number etc), you can use **show module** command:

```
Switch# show module
```

Switch	Ports	Model	Serial No.	MAC address	Hw Ver.	Sw Ver.
1	32	WS-C3850-24S	FOC1852U0NR	c472.954f.5380	V01	03.07.00.E
2	56	WS-C3850-48P	FOC1717V0NH	44ad.d96d.b480	V01	03.07.00.E
3	32	WS-C3850-24P	FOC1824X086	00e1.6d52.c600	V03	03.07.00.E
4	32	WS-C3850-24U	FOC1729Z182	f84f.576f.e100	V01	03.07.00.E

To assign the active and standby roles to specific switches, configure the default switch priority for all switches in the stack. You configure the priority once, usually during the initial configuration process, but you can change the configuration at any time. The configured switch priorities are immediately set in the boot loader configuration of each switch in the stack. This means the switch priority configuration cannot be verified from the startup or running configuration because it is programmed into different configuration components. The switch priority configuration in boot loader is parsed during the boot cycle, not read from the startup configuration stored in NVRAM.

To modify the default switch priority, use these EXEC commands:

```
Switch# switch <number> priority 15
!Set priority 15 to elect switch in ACTIVE role

Switch# switch <number> priority 14
!Set priority 14 to elect switch in STANDBY role

Switch# switch <number> priority 13
!Set priority 13 to elect switch in next STANDBY role

Switch# switch <number> priority 12
!Set priority 13 to elect switch in next STANDBY role
```

To configure the switch number, use this command:

```
Switch# switch <number> renumber <number>
!Statically renumber switch in stack ring
```

This example shows the priority of each switch and its role:

```
Switch# show switch
Switch/Stack Mac Address : f84f.576f.e100 - Local Mac Address
Mac persistency wait time: Indefinite
```

Switch#	Role	Mac Address	H/W Priority	Current Version	State
1	Member	c472.954f.5380	12	V01	Ready
2	Standby	44ad.d96d.b480	14	V01	Ready
3	Member	00e1.6d52.c600	13	V03	Ready
*4	Active	f84f.576f.e100	15	V01	Ready

The Cisco Catalyst 3850 Switches support a wide range of Layer 2, Layer 3, and wireless stateful capabilities to provide nonstop network communication. In real time, the Cisco IOS XE Software running on the active switch synchronizes its protocol state machines, software forwarding tables, and system configuration to the Cisco IOS XE Software instance running on the standby switch. The other primary core services hosted by Cisco IOS XE Software are the integrated applications, such as the wireless control module (WCM). In Cisco StackWise-480 mode, the WCM is operational on the active Cisco Catalyst 3850 Switch that communicates with the locally attached Cisco wireless access points (WAPs), wireless clients, and distributed mobility peers to build a roaming network domain. The WCM on the standby switch is in hot-standby state as a Cisco IOS XE Software process. In real time, the active WCM performs the stateful synchronization of wireless protocols and control and provisioning of wireless access points (CAPWAP) tunnel information with the standby switch. If the active switch fails, the standby switch becomes the wireless controller by resynchronizing with the Cisco WAPs and mobility peers.

In the initial software release, the Cisco Catalyst 3850 Switch supports CAPWAP tunnels and Dynamic Transport Layer Security (DTLS), but not high availability for wireless clients. During a switchover, the new active WCM flushes the last-known wireless client and rebuilds the database and forwarding tables. As a result, the wireless client must restart communication with new wireless controller, using the same initial steps (such as 802.1X authentication, Dynamic Host Configuration Protocol [DHCP] request, and so on) to reconnect to the network.

Deploying Cisco Catalyst 3850 Switch StackWise-480 NSF and SSO

To maximize availability, the SSO capability is enabled by default when Cisco Catalyst 3850 Switches are deployed in Cisco StackWise-480 mode. No user configuration is required to enable SSO capability on a Cisco Catalyst 3850 Switch stack. You can verify that SSO is configured and operational by using the **show redundancy state** command. This is sample output showing SSO redundancy in a Cisco StackWise-480-based network design:

```
Switch# show redundancy state
    my state = 13 -ACTIVE
    peer state = 8 -STANDBY HOT
        Mode = Duplex
        Unit ID = 4

Redundancy Mode (Operational) = SSO
Redundancy Mode (Configured) = SSO
    Redundancy State = SSO
    Manual Swact = enabled

Communications = Up

    client count = 91
    client_notification_TMR = 360000 milliseconds
        keep_alive TMR = 9000 milliseconds
        keep_alive count = 0
    keep_alive threshold = 9
        RF debug mask = 0
```

In stacking mode, the Cisco Catalyst 3850 active switch automatically performs SSO protocol synchronization with the standby switch. By default, the nonstop forwarding (NSF) subsystem in all the switches in a Cisco Catalyst 3850 Switch stack operates in NSF helper mode and supports nonstop data forwarding and graceful recovery during active to standby (Layer 3) switchover. Implementing NSF capability allows the remaining Cisco Catalyst 3850 Switches in the stack to continue forwarding data while the new active switch gracefully recovers the protocol state machines. To enable the graceful restart capability for supported protocols, you must manually enable graceful-restart capability under a routing instance. This sample configuration shows how to enable NSF capability for Enhanced Interior Gateway Routing Protocol (EIGRP):

```
Switch(config)# ip routing
Switch (config)# router eigrp 100
Switch (config-router)# nsf
Switch # show ip protocols
*** IP Routing is NSF aware ***
```

```
<snip>

Routing Protocol is "eigrp 100"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Default networks flagged in outgoing updates
  Default networks accepted from incoming updates
  EIGRP-IPv4 Protocol for AS(100)
    Metric weight K1=1, K2=0, K3=1, K4=0, K5=0
    Soft SIA disabled
    NSF-aware route hold timer is 240
  EIGRP NSF enabled
    NSF signal timer is 20s
    NSF converge timer is 120s
  Router-ID: No usable Router-ID found
  Topology : 0 (base)
    Active Timer: 3 min
    Distance: internal 90 external 170
    Maximum path: 4
    Maximum hopcount 100
    Maximum metric variance 1

<snip>
```

Cisco Catalyst 3850 Switch Database Manager Template

Cisco Catalyst 3850 switch database manager (SDM) templates allow configuring the hardware resources based on the license level and features enabled in the switch. Two SDM templates are provided in the Cisco Catalyst 3850 Switch:

Advanced: This is the default template for all license levels. The advanced SDM template maximizes system resources for advanced features such as NetFlow, security access control, flow SPAN, multicast groups, and more.

VLAN: This template is available only in the LAN base license level and is enabled when the Cisco Catalyst 3850 Switch is deployed as a Layer 2 switch. Wireless features will not work with this SDM template configuration.

SDM Template Resources: VLAN and Advanced

Table 1 details the resource allocation for VLAN and advanced SDM templates. These resource allocations are based on L2 and IPv4 features. Because IPv6 features consume twice the ternary content addressable memory (TCAM) table size of IPv4 table entries, the switch supports half the number of TCAM table entries for IPv6.

Table 1. SDM Template Resource Allocation

Resource	Advanced Template	VLAN Template	Resource Explained
Number of VLANs	4094	4094	Maximum number of VLANs
Unicast MAC addresses	32768	32768	Maximum number of unicast MAC addresses
Overflow unicast MAC addresses	512	512	Used when the maximum unicast MAC address limit is reached
IGMP and multicast groups	8192	8192	Maximum number of IGMP and multicast groups
Overflow IGMP and multicast groups	512	512	Used when the maximum IGMP and multicast group limit is reached
Directly connected hosts	16384	16384	Maximum supported directly connected host routes
Indirect routes	7168	7168	Maximum supported indirect routes
Security access control entries	3072	3072	Maximum security ACEs
QoS access control entries	2816	3072	Maximum QoS ACEs
Policy-based routing ACEs	1024	0	Maximum PBR ACEs
NetFlow ACEs	768	768	Maximum NetFlow ACEs
Flow SPAN ACEs	256	0	Maximum SPAN ACEs
Tunnels	256	0	Maximum CAPWAP tunnels
Control plane entries	512	512	Internal software parameter
Input NetFlow flows	8192	8192	Maximum ingress NetFlow flows
Output NetFlow flows	16384	16384	Maximum egress NetFlow flows
SGT/DGT entries	4096	4094	Maximum SGT/DGT entries
SGT/DGT Overflow entries	512	512	Maximum SGT/DGT overflow entries

SDM Template Configuration

Use the `sdm prefer` configuration command to change the SDM template:

```
Switch(config)# sdm prefer ?
  advanced  Advanced Template
  vlan      Vlan Template

Switch(config)# sdm prefer vlan
Changes to the running SDM preferences have been stored, but cannot take effect
until the next reload. Use 'show sdm prefer' to see what SDM preference is
currently active.
```

Reload the switch to activate the SDM template change.

```
Switch# show sdm prefer
Showing SDM Template Info

This is the VLAN template (high scale) for a typical Layer 2 network.
Number of VLANs:                               4094
Unicast MAC addresses:                         32768
Overflow Unicast MAC addresses:                512
IGMP and Multicast groups:                    8192
Overflow IGMP and Multicast groups:           512
Directly connected routes:                    16384
```

```

Indirect routes:                               7168
Security Access Control Entries:               3072
QoS Access Control Entries:                   3072
Policy Based Routing ACEs:                    0
Netflow ACEs:                                 768
Wireless Input Microflow policer ACEs:        0
Wireless Output Microflow policer ACEs:        0
Flow SPAN ACEs:                               512
Tunnels:                                       0
Control Plane Entries:                        512
Input Netflow flows:                          8192
Output Netflow flows:                         16384
SGT/DGT entries:                              4096
SGT/DGT Overflow entries:                     512

```

These numbers are typical for L2 and IPv4 features.

Some features such as IPv6, use up double the entry size;
so only half as many entries can be created.

Use the **show sdm prefer** command to confirm the current SDM template setting after the reload:

```

Switch# show sdm prefer
Showing SDM Template Info

This is the Advanced (high scale) template.
Number of VLANs:                               4094
Unicast MAC addresses:                         32768
Overflow Unicast MAC addresses:                 512
IGMP and Multicast groups:                     8192
Overflow IGMP and Multicast groups:             512
Directly connected routes:                     16384
Indirect routes:                               7168
Security Access Control Entries:               3072
QoS Access Control Entries:                    2816
Policy Based Routing ACEs:                     1024
Netflow ACEs:                                  768
Wireless Input Microflow policer ACEs:         256
Wireless Output Microflow policer ACEs:        256
Flow SPAN ACEs:                               512
Tunnels:                                       256
Control Plane Entries:                         512
Input Netflow flows:                           8192
Output Netflow flows:                         16384
SGT/DGT entries:                              4096
SGT/DGT Overflow entries:                     512

```

These numbers are typical for L2 and IPv4 features.

Some features such as IPv6, use up double the entry size;
so only half as many entries can be created.

In a Cisco Catalyst 3850 Switch stack, an SDM template mismatch does NOT matter. As long as the license level matches, SDM mismatches are ignored, and all the stack switches use the active switch SDM template.

Monitoring SDM Resources

SDM template resources are crucial for normal operation of the Cisco Catalyst 3850 Switch. These resources are consumed based on the features/configuration and the traffic profile. Cisco recommends monitoring (for example, with Embedded Event Manager scripts) of TCAM resource utilization.

This example shows resource utilization for ASIC 0:

```
Switch#show platform tcam utilization ASIC 0
CAM Utilization for ASIC# 0
```

Table	Max Values	Used Values
Unicast MAC addresses	32768/512	15/23
Directly or indirectly connected routes	16384/7168	2/91
L2 Multicast groups	8192/512	0/7
L3 Multicast groups	8192/512	0/9
QoS Access Control Entries	2816	52
Security Access Control Entries	3072	184
Netflow ACEs	768	15
Input Microflow policer ACEs	256	7
Output Microflow policer ACEs	256	7
Flow SPAN ACEs	512	13
Control Plane Entries	512	239
Policy Based Routing ACEs	1024	9
Tunnels	256	12
Input Security Associations	256	4
SPD	256	2
Output Security Associations and Policies	256	9
SGT_DGT	4096/512	0/0
CLIENT_LE	4096/64	0/0
INPUT_GROUP_LE	6144	0
OUTPUT_GROUP_LE	6144	0

Appendix A: List of Bootloader Commands

```
switch: ?
    ? -- Present list of available commands
    arp -- Show arp table or arp-resolve an address
    boot -- Load and boot an executable image
    cat -- Concatenate (type) file(s)
    copy -- Copy a file
    delete -- Delete file(s)
    dir -- List files in directories
emergency-install -- Initiate Disaster Recovery
flash_init -- Initialize filesystem(s)
format -- Format a filesystem
fsck -- Check filesystem consistency
help -- Present list of available commands
mgmt_init -- initialize management port
mkdir -- Create dir(s)
more -- Concatenate (display) file(s)
ping -- Send ICMP ECHO_REQUEST packets to a network host
readrtc -- Read RTC
rename -- Rename a file
reset -- Reset the system
rmdir -- Delete empty dir(s)
set -- Set or display environment variables
set_bs -- Set attributes on a boot sector filesystem
set_param -- Set system parameters in flash
type -- Concatenate (type) file(s)
unset -- Unset one or more environment variables
version -- Display boot loader version
writertc -- Write RTC
```




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