Upgrading Field-Programmable Hardware Devices for Cisco 1000 Series ISRs

From Cisco IOS XE Fuji 16.8.1 Release, Cisco 1000 Series Integrated Services Routers (ISRs) allow users to perform upgrades in the field on programmable hardware devices. Field-programmable hardware devices include the complex programmable logic device (CPLD). This document describes the procedures to perform an upgrade on a field-programmable hardware device.

Feature Information for Upgrading Field-Programmable Hardware Devices for Cisco 1000 Series ISRs

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator at www.cisco.com/go/cfn to find information about platform support and Cisco software image support. An account on Cisco.com is not required.

Table 1: Feature Information for Upgrading Field-Programmable Hardware Devices for Cisco 1000 Series ISRs

Feature Name	Releases	Feature Information
Upgrading Field-Programmable Hardware Devices for Cisco 1000 Series ISRs	Cisco IOS XE Fuji 16.8.1 Release	In Cisco IOS XE Fuji 16.8.1 Release, support for upgrading field-programmable hardware devices was introduced for the Cisco 1000 Series ISRs. The following commands were introduced: **upgrade hw-programmable, show hw-programmable,** show upgrade hw-programmable progress, show upgrade hw-programmable file.

Upgrading Field-Programmable Hardware Devices Overview

The hardware-programmable firmware is upgraded when Cisco 1000 Series ISR contains an incompatible version of the hardware-programmable firmware. To do this upgrade, a hardware-programmable firmware package is released to customers.

Generally, an upgrade is necessary only when a system message indicates one of the field-programmable devices on the Cisco 1000 Series ISR needs an upgrade, or a Cisco technical support representative suggests an upgrade.

From Cisco IOS XE Fuji 16.8.1 Release onwards, you must upgrade the CPLD firmware to support the incompatible versions of the firmware on the Cisco 1000 Series ISR. For upgrade procedures, see the CPLD Field Programmable Upgrade section.

⚠️

Caution   Do not power down the router during the field-programmable upgrade. Although, the Cisco 1000 Series ISR should be able to recover from most interruptions during the upgrade, certain scenarios may cause unpredictable problems.

Displaying the CPLD Version

If you receive an error message indicating that the device needs an upgrade, and you have an incompatible CPLD version on the device, use the show platform command to display the status of your active Cisco 1000 Series ISR. The following example shows the output of the show platform command on a Cisco ISR 1000 Series Router:

```
Router# show platform
Chassis type: ISR4451-X/K9
Slot      Type              State               Insert time (ago)
--------- ----------------- ------------------- ----------------
0         C1111/K9          ok                  00:14:41
0/0       C1111-4x1GE       ok                  00:14:06
1         C1111/K9          ok                  00:14:41
2         C1111/K9          ok                  00:14:41
R0        C1111/K9          ok, active          00:14:41
F0        C1111/K9          ok, active          00:14:41
P0        Unknown           ps, fail            never
P1        XXX-XXXX-XX       ok                  00:14:26
```

```
P2          ACS-1111-FANASSY    ok                    00:14:26
Slot        CPLD Version        Firmware Version
---------   ------------------  -------------------------------------
0           13041228            15.3(2r)S1
1           13041228            15.3(2r)S1
2           13041228            15.3(2r)S1
R0          13041228            15.3(2r)S1
F0          13041228            15.3(2r)S1
```

For more information on upgrading, see the CPLD Field-Programmable Upgrade section.

CPLD Field-Programmable Upgrade, Cisco IOS XE Fuji 16.8.1 Release

This section covers the following topics:

CPLD Field-Programmable Upgrade Overview

CPLD field-programmable upgrade can be performed on a need basis to address any specific issues with the hardware-programmable devices.The subsequent sections describe how to upgrade the Cisco 1000 Series ISRs.

To determine if one of the components has an incompatible CPLD version, use the **show platform** command.

From Cisco IOS XE Fuji 16.8.1 Release onwards, a hardware-programmable package is released to customers whose devices require a CPLD upgrade.

Downloading the Hardware-Programmable Firmware Package

To download the hardware programmable firmware package from Cisco.com, perform these steps:

Step 1   Log in to the Download Software page https://software.cisco.com/download/navigator.html.

Step 2   From the Select a Software Product Category area, select > **Routers** > **Branch Routers** > **Cisco 1000 Series Integrated Services Routers**, and select the appropriate router from the list.

Step 3   From the **Select a Software Type** area select **IOS XE Hardware Programmable Devices**.

Step 4   Click **Download or Add to Cart** the IOS XE Software hardware programmable firmware package and follow the prompts.

Note   A CPLD upgrade is necessary only when a system message indicates that the Cisco 1000 Series ISR needs an upgrade. Cisco 1000 Series ISRs are shipped with Cisco IOS XE 16.8(1r)S1 image pre-installed and that ROMMON upgrade is necessary only starting with Cisco IOS XE 16.8.1 Release.

Upgrading an Active Cisco 1000 Series ISRs

You can upgrade the CPLD firmware on Cisco 1000 Series ISRs using the upgrade hw-programmable command. The CPLD upgrade can take up to ten minutes for each component. You can perform the upgrade on the Cisco 1000 Series ISRs any time as long as you can access the privileged EXEC mode prompt on the router.

To upgrade a Cisco 1000 Series ISRs, perform these steps:

Step 1   Cold boot the active Cisco 1000 Series ISR.

Step 2   Copy the hardware-programmable upgrade package to your bootflash:

Example:

```
copy tftp:/...isr-hw-programmables.03.13.00.S.154-3.S-ext.SPA.pkg bootflash
```

Step 3   Run the hw-programmable cpld filename command from the EXEC mode:

Example:

```
Router#upgrade hw-programmable cpld filename
bootflash:isr-hw-programmables.03.13.00.S.154-3.S-ext.SPA.pkg R0
```

Step 4   If you are using Cisco IOS XE 16.8.1 Release or later, then skip to Step 5. At the system prompt, press Enter to start the upgrade:

Example:

```
Upgrade CPLD on Route-Processor 0 from current version 13041228 to 14061635 [Press Enter to confirm]

This command could take up to 10 minutes, please wait and do not power-cycle the chassis or the card.
 Otherwise, hardware may be unrecoverable. It is recommended that all cards are running the same
version IOS-XE software prior to the upgrade. At the end of upgrade you will be asked to reload the
 chassis. [Press Enter to confirm]

Upgrade cpld hw-programmable on Route-Processor 0
The cpld has been successfully upgraded on Route-Processor/0.
PLEASE RELOAD THE CHASSIS NOW.
Router#
```

Caution   Do not power down or interrupt the router during the CPLD upgrade. Although, the Cisco 1000 Series ISR should be able to recover from most interruptions during the CPLD upgrade, certain scenarios may cause unpredictable problems.

Example:

a) From the IOS console, use the reload command to gracefully shutdown the system.

b) Turn OFF and turn ON the router. After the router restarts, use the show platform command to check the version of the CPLD:

Example:

```
C1111-8PW#show platform
Chassis type: C1111-8PWE

Slot Type State Insert time (ago)
--------- ------------------ -------------------- ----------------
0 C1111-8PWE ok 00:02:49
0/0 C1111-2x1GE ok 00:00:44
0/1 C1111-ES-8 ok 00:00:44
0/2 ISR-AP1100AC-E ok 00:00:44
R0 C1111-8PWE ok, active 00:02:49
F0 C1111-8PWE ok, active 00:02:49
P0 PWR-12V ok 00:02:26
```

```
Slot CPLD Version Firmware Version
--------- ------------------ --------------------------------------
0 17122001 16.8(1r)
R0 17122001 16.8(1r)
F0 17122001 16.8(1r)
```

c) This example show that the router is upgraded successfully.

Step 5 At the system prompt, press Enter to start the upgrade:

Example:

```
Upgrade CPLD on Route-Processor 0 from current version 14062321 to 14101324 [Press Enter to confirm]

This command could take up to 10 minutes, please wait and do not power-cycle the chassis or the card.
 Otherwise, hardware may be unrecoverable. The system will be automatically power-cycled upon
completion. [Press Enter to confirm]

Upgrade cpld hw-programmable on Route-Processor 0
Powercycling the chassis for upgrade to take effect


Initializing Hardware ....
```

a) After the router restarts automatically, use the show platform command to check the version of CPLD:

Example:

```
Router#show platform
Chassis type: C1111/K9

Slot Type State Insert time (ago)
--------- ------------------ -------------------- -----------------
0 C1111/K9 ok 00:01:52
0/0 C1111 ok 00:01:18
1 C1111/K9 ok 00:01:52
2 C1111/K9 ok 00:01:52
R0 C1111/K9 ok, active 00:01:52
F0 C1111/K9 ok, active 00:01:52
P0 Unknown ps, fail never
P1 XXX-XXXX-XX ok 00:01:37
P2 ACS-C1111-FANASSY ok 00:01:37

Slot CPLD Version Firmware Version
--------- ------------------ --------------------------------------
0 14061635 15.3(2r)S1
1 14061635 15.3(2r)S1
2 14061635 15.3(2r)S1
R0 14061635 15.3(2r)S1
F0 14061635 15.3(2r)S1
```

b) This example shows that the router is upgraded successfully.

Field-Programmable Hardware Device Commands

You can use the following field-programmable commands to perform a CPLD upgrade, display the package file version, or display progress during the upgrade:

- **upgrade hw-programmable**—Performs a CPLD upgrade on a Cisco ISR 1000 Series Router.

- **show hw-programmable**—Displays the current CPLD or FPGA version in a particular line card.

- **show upgrade hw-programmable file**—Displays the names and versions of individual files in the hardware-programmable package file in a Cisco 1000 Series ISR.

For command syntax and detailed information, see the Cisco IOS Interface and Hardware Component Command Reference.

ROMMON Overview

The ROMMON on an Cisco 1000 Series ISR must be upgraded if a system message on the router indicates that the ROMMON on the router requires an upgrade, or a Cisco technical support representative suggests a ROMMON upgrade.

The ROM Monitor is a bootstrap program that initializes the hardware and boots the Cisco IOS XE software when you power on or reload a router. When you connect a terminal to the router that is in ROM Monitor mode, the ROM Monitor command-line interface (CLI) prompt is displayed.

Checking the Current ROMMON Version

If you are unsure whether a ROMMON upgrade is required, use the show rom-monitor command or the show platform command.

```
Router# show rom-monitor r0

Router#show rom-monitor r0

System Bootstrap, Version 15.4(3r)S, RELEASE SOFTWARE (fc1)
Copyright (c) 1994-2014 by cisco Systems, Inc.
.

Router#show platform
Chassis type: C1111/K9


Slot Type State Insert time (ago)
--------- ------------------ -------------------- ----------------
0 C1111/K9 ok 00:03:25
0/0 C1111-4x1GE ok 00:02:46
1 C1111/K9 ok 00:03:25
2 C1111/K9 ok 00:03:25
R0 C1111/K9 ok, active 00:03:25
F0 C1111/K9 ok, active 00:03:25
P0 PWR-4450-10 ok 00:03:10
P1 Unknown ps, fail never
P2 ACS-4450-FANASSY ok 00:03:10
Slot CPLD Version Firmware Version
--------- ------------------ --------------------------------------
0 14061635 15.4(3r)S
1 14061635 15.4(3r)S
2 14061635 15.4(3r)S
R0 14061635 15.4(3r)S
F0 14061635 15.4(3r)S

Router#show rom-monitor r0
System Bootstrap, Version 15.4(3r)S1, RELEASE SOFTWARE (fc1)
Copyright (c) 1994-2014 by cisco Systems, Inc.
```

```
Router#show platform
Chassis type: C1111/K9
Slot Type      State    Insert time (ago)
--------- ------------------ -------------------- -----------------
0  C1111/K9    ok    02:16:41
0/0 C1111-3x1GE     ok    02:15:47
1  C1111/K9    ok    02:16:41
2  C1111/K9    ok    02:16:41
R0  C1111/K9    ok, active 02:16:41
F0  C1111/K9    ok, active 02:16:41
P0  PWR-C1111-AC    ok never
P2  ACS-C1111-FANASSY ok never
Slot CPLD Version    Firmware Version
--------- ------------------ --------------------------------------
0  14080523    15.4(3r)S1
1  14080523    15.4(3r)S1
2  14080523    15.4(3r)S1
R0  14080523    15.4(3r)S1
F0 14080523 15.4(3r)S1

Router# show romvar
ROMMON variables:
PS1 = rommon ! >
TFTP_FILE = /noash/overlord_627.bin
DEFAULT_GATEWAY = 50.0.0.1
TFTP_SERVER = 172.18.40.12
IP_SUBNET_MASK = 255.255.255.0
MCP_STARTUP_TRACEFLAGS = 00000000:00000000
RET_2_RTS =
? = 0
LICENSE_BOOT_LEVEL = adventerprise,all:esg;
IP_ADDRESS = 172.18.40.56
BSI = 0
RET_2_RCALTS =
RANDOM_NUM = 1707176976
Router# reload


rommon 1 > set
PS1=rommon ! >
SR_INIT_SHELL=aux_do_system_shell
TFTP_FILE=/noash/overlord_627.bin
DEFAULT_GATEWAY=50.0.0.1
TFTP_SERVER=172.18.40.12
IP_SUBNET_MASK=255.255.255.0
MCP_STARTUP_TRACEFLAGS=00000000:00000000
RET_2_RTS=
?=0
LICENSE_BOOT_LEVEL=adventerprise,all:esg;
IP_ADDRESS=172.18.40.56
BSI=0
RANDOM_NUM=1707176976
RET_2_RCALTS=1350127173
```

Upgrading the ROMMON for a Cisco 1000 Series ISRs

To upgrade the ROMMON, perform these steps:

Step 1 (Optional) To display the current ROMMON version at the IOS prompt, use the following command:

```
Router# show rom-monitor R0
System Bootstrap, Version 16.8(1r), RELEASE SOFTWARE
Copyright (c) 1994-2018 by cisco Systems, Inc.
```

Step 2 From a computer, copy the ROMMON pkg file onto a USB Flash drive and insert it into the usb0: slot, or download the ROMMON pkg file to the bootflash: using the IOS 'copy tftp:' command.

Step 3 (Optional) Use the IOS 'verify /md5 <filesystem>:<pkg filename>' command to verify the MD5 checksum of the ROMMON pkg file. The <filesystem> is usb0 or bootflash:. The <PKG filename> is the downloaded ROMMON pkg file such as C1100-rommon-168-1r-SPA.pkg.

```
Router# verify /md5 bootflash:C1100-rommon-168-1r-SPA.pkg
.............................................................................................Done!
verify /md5 (bootflash:C1100-rommon-168-1r-SPA.pkg) = 5f892952a792a0e6d44d037c0214f493
```

Step 4 Run the IOS 'upgrade rom-monitor' command to begin the ROMMON upgrade process.

```
Router# upgrade rom-monitor filename bootflash:C1100-rommon-168-1r-SPA.pkg R0
```

Caution Do not remove hardware, turn off power, or interrupt the router in any way during the ROMMON upgrade. Although the router should be able to recover from most interruptions during the ROMMON upgrade, certain scenarios may cause unpredictable problems.

Step 5 When the upgrade command is finished, use the IOS reload command to complete the upgrade process.

```
…
ROMMON upgrade complete.
To make the new ROMMON permanent, you must restart the RP.
Router# reload
Proceed with reload? [confirm]

(The ROMMON boots twice; on the second boot, the upgrade ROMMON starts)
```

Step 6 If autoboot is not configured, at the ROMMON prompt, boot an IOS_XE image. The IOS-XE image must successfully boot to an IOS prompt to finalize the ROMMON upgrade process.

```
Rommon 1 > boot bootflash:c1100-universalk9_ias.16.08.01.SPA.bin
```

Step 7 If an autoboot option is not configured, boot an IOS_XE image at the prompt. The IOS-XE image must successfully boot to an IOS prompt to complete the ROMMON upgrade process.

Step 8 At the IOS prompt, use the **show rom-monitor R0** command to verify the ROMMON version matches the ROMMON PKG file version.

```
Router>en
Router#show rom-monitor R0
 System Bootstrap, Version 16.8(1r), RELEASE SOFTWARE
Copyright (c) 1994-2018  by cisco Systems, Inc.
```

Note After a device is upgraded to 16.9(1r) ROMMON release, the ROMMON cannot be downgraded to a release earlier than 16.9(1r). All future ROMMON releases can be downgraded to the 16.9(1r) release.

Resolved Caveats

The following sections list the issues resolved in each ROMMON release:

Resolved Caveats in ROMMON Release 16.8(1r)

All resolved bugs for this release are available in the Cisco Bug Search Tool .

Identifier	Description
CSCvg46562	Free 256MB of reserved memory
CSCvh23316	Missing USB3.0 Flash Drive
CSCvg37458	ISR1K goes into booting loop with "flash:"in boot statement.

Additional References

The following sections provide references related to this function.

Related Documents

Related Topic	Document Title
Cisco IOS XE commands	Cisco IOS Master Commands List, All Releases

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html