Upgrading Field-Programmable Device

An FPD is a field programmable logic device which contains non-volatile, re-programmable memory to define its internal wiring and functionality. The contents of this non-volatile memory are called the FPD image or FPD firmware. Over the lifespan of an FPD, FPD firmware images may need upgrades for bug fixes or functionality improvements. These upgrades are performed in the field with minimum system impact.

Prerequisites for FPD Image Upgrades

You must install the FPD pie before you install the SMUs or Service Packs. If you install the SMU or Service Packs before the FPD pie, the FPDs on the line card may not upgrade. In such cases, you must remove the SMUs and Service Packs and reload the router.

Overview of FPD Image Upgrade Support

An FPD image is used to upgrade the software on an FPD.

FPD versions must be compatible with the Cisco IOS XR software that is running on the router; if an incompatibility exists between an FPD version and the Cisco IOS XR software, the device with the FPGA may not operate properly until the incompatibility is resolved.

Note Downgrade of FPDs is not recommended.

Note FPD auto upgrade is not supported on this router.

FPD upgrade service

The main tasks of the FPD upgrade service are:

- Check FPD image version to decide if a specific firmware image needs an upgrade or not.
- Manual FPD Image Upgrade using the **upgrade hw-module fpd** command.
- Invoke the appropriate device driver with a name of the new image to load.

An FPD image package is used to upgrade FPD images. The **install activate** command is used to place the FPD binary files into the expected location on the boot devices.

Supported Upgrade Methods

Method	Remarks
Manual Upgrade	Upgrade using CLI, force upgrade supported.

Important FPD auto upgrade is not supported on this router.

Determining Upgrade Requirement

Use the **show hw-module fpd** command to determine if an FPD upgrade is required. Check for NEED UPGD in the Status column.

Example

```
Router: #show hw - module fpd

Wed Dec 14 07:08:08.424 UTC

Auto-upgrade:Disabled
                                                                          FPD Versions
                                                                          ==============
Location   Card type             HWver FPD device       ATR Status     Running   Programd
-------------------------------------------------------------------------------------------

0/0        NC55-18H18F           1.0   MIFPGA               NEED UPGD   7.01      7.01

0/0        NC55-18H18F           1.0   Bootloader           CURRENT     1.14      1.14
0/0        NC55-18H18F           1.0   IOFPGA               CURRENT     0.07      0.07
0/0        NC55-18H18F           1.0   SATA-M600-MCT        CURRENT     0.23      0.23
```

Use the **show fpd package** command to find out which FPGAs are supported with your current software release and minimum hardware requirements for each module.

Manual FPD upgrade

Manual FPD upgrade is performed using the **upgrade hw-module fpd** command. All cards or all FPGA in a card can be upgraded. If reload is required to activate FPD, the upgrade should be complete. Interface module (IMs) and RSPs cannot be reloaded during the process of the FPD upgrade.

FPD upgrade is transaction-based:

- Each fpd upgrade CLI execution is one transaction.
- Only one transaction is allowed at any given time.
- One transaction may include one or many FPD upgrades

The **force** option can be used to forcibly upgrade the FPD (regardless of whether it is required or not). It triggers all FPDs to be upgraded or downgraded. The **force** option can also be used to downgrade or upgrade the FPGAs even after the version check. However, the **force** option must be used cautiously and only to recover a component from a failed upgrade.

Note

- Sometimes, FPDs can have primary and backup images.
- Force FPD upgrade with **upgrade hw-module location all fpd all force** command affects forwarding over BVI interface. You must reload involved locations to recover.
- The use of the **force** option when performing an FPD upgrade is not recommended except under explicit direction from Cisco engineering or TAC for a one-time purpose only.
- FPD upgrade should be performed in Admin mode only.
- A new FPD upgrade should be issued only when previous FPD upgrades have been completed on the same FPD with the following syslog message:

```
RP/0/RP0/CPU0:May 10 10:11:44.414 UTC: fpd-serv[205]: %INFRA-FPD_Manager-1-UPGRADE_ALERT
 : FPD Upgrade Completed (use "show hw-module fpd" to check upgrade status)
```

How to Upgrade FPD Images

- Migrate the software to a later Cisco IOS XR software release.
- Swap IMs or RSPs from a system running a different Cisco IOS XR software release.
- Insert a new IM or RSP.

In the event of an FPD incompatibility with your card, you might receive the following error message:

```
LC/0/0/CPU0:Jul 5 03:00:18.929 UTC: optics_driver[220]: %L2-OPTICS-3-BAD_FPGA_IMAGE :
Detected bad MI FPGA image programmed in MI FPGA SPI flash in 0/0/CPU0 location: Failed to
 validate meta data CRC
LC/0/0/CPU0:Jul 5 03:00:19.019 UTC: optics_driver[220]: %L2-OPTICS-3-BACKUP_FPGA_LOADED :
Detected Backup FPGA image running on 0/0/CPU0 - primary image corrupted (@0x8c = 0x44)
RP/0/RP0/CPU0:Jul 5 03:00:48.987 UTC: fpd-serv[301]: %PKT_INFRA-FM-3-FAULT_MAJOR : ALARM_MAJOR
 :FPD-NEED-UPGRADE :DECLARE :0/0:
```

Upgrades to the Cisco IOS XR software might result in an FPD incompatibility. Ensure that you perform the FPD upgrade procedure and resolve all incompatibilities, for the cards to function properly.

Note The use of the **force** option when performing a FPD upgrade is not recommended except under explicit direction from Cisco engineering or TAC for a one-time purpose only.

Before you begin

- The FPD upgrade procedure is performed while the card is online. At the end of the procedure the card must be reloaded before the FPD upgrade is complete. To reload the card, you can use the **hw-module location <location> reload** command in Admin mode, during the next maintenance window. The upgrade procedure is not complete until the card is reloaded.
- During the FPD upgrade, you *must not* do the following:
  - Reload, perform an online insertion and removal (OIR) of a line card (LC), or power down the chassis. Doing so may cause the node to enter an unusable state.
  - Press **Ctrl-C** if the console appears to hang without any output. Doing so may abort the upgrade.
- If you are not sure whether a card requires an FPD upgrade, you can install the card and use the **show hw-module fpd** command to determine if the FPD image on the card is compatible with the currently running Cisco IOS XR software release.

Configuration Examples for FPD Image Upgrade

The following examples indicates the use of commands associated with the FPD image upgrade procedure.

show fpd package Command Output: Example

Use the **show fpd package** command in System Admin EXEC mode to find out which IMs and RSPs are supported with your current Cisco IOS XR software release, which FPD image package you need for each IM or RSP, and what the minimum hardware requirements are for each module. If multiple FPD images are available for your card, they are listed as Subtype fpga2, fpga3, and so on.

Note The FPD name used in the FPD Description column of the output of the `show fpd package` command includes the last ten characters of DCO-PID. Depending on the slot and port numbers, the FPD name is appended with DCO_0, DCO_1, or DCO_2. For example, the FPD names for `CFP2-WDM-D-1HL` in port 0 and port 1 are `-WDM-D-1HL_DCO_0` and `WDM-D-1HL_DCO_1` respectively.

The following example shows a sample output from the **show fpd package** command:

```
sysadmin_vm:0_RP0# show fpd package
Fri Oct 16 07:20:50.021 UTC

=============================== ==============================================
                                        Field Programmable Device Package
                                ==============================================
                                              Req     SW      Min Req   Min Req
Card Type             FPD Description         Reload  Ver     SW Ver  Board Ver
==================== ========================== ====== ======= ======== =========
--------------------------------------------------------------------------------
A900-IMA8CS1Z-CC      IMFPGA                    YES     1.96    1.96    0.0
--------------------------------------------------------------------------------
A900-IMA8CS1Z-M       IMFPGA                    YES     1.96    1.96    0.0
--------------------------------------------------------------------------------
A900-IMA8Z            IMFPGA                    YES    17.05   17.05    0.0
--------------------------------------------------------------------------------
A900-IMA8Z-CC         IMFPGA                    YES    17.05   17.05    0.0
--------------------------------------------------------------------------------
A900-IMA8Z-L          IMFPGA                    YES     1.45    1.45    0.0
```

A900-PWR1200-A	DCA-PriMCU(A)	NO	0.11	0.11	0.0
	DCA-SecMCU(A)	NO	1.04	1.04	0.0
A900-PWR1200-D	LIT-PriMCU(A)	NO	2.04	0.04	0.0
	LIT-SecMCU(A)	NO	1.23	1.23	0.0
A907-FAN-E	PSOC(A)	NO	1.65	1.65	0.0
	PSOC(A)	NO	1.66	1.66	0.4
N560-4-FAN-H	PSOC(A)	NO	177.02	177.02	0.0
N560-4-FAN-H-CC	PSOC(A)	NO	177.02	177.02	0.0
N560-4-PWR-FAN	PSOC(A)	NO	177.08	177.08	0.0
N560-4-PWR-FAN-CC	PSOC(A)	NO	177.08	177.08	0.0
N560-4-RSP4	ADM(A)	NO	1.06	1.06	0.0
	IOFPGA(A)	YES	0.64	0.64	0.0
	PRIMARY-BIOS(A)	YES	0.17	0.17	0.0
	SATA(A)	YES	2.10	2.10	0.0
N560-4-RSP4-CC	ADM(A)	NO	1.06	1.06	0.0
	IOFPGA(A)	YES	0.64	0.64	0.0
	PRIMARY-BIOS(A)	YES	0.17	0.17	0.0
	SATA(A)	YES	2.10	2.10	0.0
N560-4-RSP4E	ADM(A)	NO	1.06	1.06	0.0
	IOFPGA(A)	YES	0.64	0.64	0.0
	PRIMARY-BIOS(A)	YES	0.17	0.17	0.0
	SATA(A)	YES	2.10	2.10	0.0
N560-4-RSP4E-CC	ADM(A)	NO	1.06	1.06	0.0
	IOFPGA(A)	YES	0.64	0.64	0.0
	PRIMARY-BIOS(A)	YES	0.17	0.17	0.0
	SATA(A)	YES	2.10	2.10	0.0
N560-FAN-H	PSOC(A)	NO	2.02	2.02	0.0
N560-IMA-8Q/4L	IMFPGA	YES	1.08	1.08	0.0
N560-IMA1W	CFP2-D-DCO	NO	38.273	38.273	0.0
	CFP2-DE-DCO	NO	38.273	38.273	0.0
	CFP2-DET-DCO	NO	38.273	38.273	0.0
	CFP2-DETS-DCO	NO	38.273	38.273	0.0
	CFP2-DS-DCO	NO	38.273	38.273	0.0
	CFP2-DS100-DCO	NO	38.273	38.273	0.0
	IMFPGA	YES	1.24	1.24	0.0
N560-IMA2C-CC	IMFPGA	YES	5.04	5.04	0.0
N560-PWR1200-D-E	QCS-PriMCU(A)	NO	1.82	1.82	0.0
	QCS-SecMCU(A)	NO	1.84	1.84	0.0
N560-RSP4	ADM(A)	NO	1.06	1.06	0.0
	IOFPGA(A)	YES	0.64	0.64	0.0
	PRIMARY-BIOS(A)	YES	0.17	0.17	0.0
	SATA(A)	YES	2.10	2.10	0.0
N560-RSP4-E	ADM(A)	NO	1.06	1.06	0.0
	IOFPGA(A)	YES	0.64	0.64	0.0
	PRIMARY-BIOS(A)	YES	0.17	0.17	0.0
	SATA(A)	YES	2.10	2.10	0.0

```
--------------------------------------------------------------------------------
NCS560-IMA2C         IMFPGA                    YES     5.04    5.04    0.0
--------------------------------------------------------------------------------
NCS560-IMA2C-DD      IMFPGA                    YES     1.24    1.24    0.0
--------------------------------------------------------------------------------
NCS560-IMA2C-L       IMFPGA                    YES     1.24    1.24    0.0
```

upgrade hw-module fpd Command Output: Example

Use the **upgrade hw-module fpd** command to upgrade the FPD image. The upgrade can be executed for all FPDs or for specific FPDs that need an upgrade. To upgrade all FPDs, use **upgrade hw-module fpd all location all** command. To upgrade a specific FPD image type, use the FPD subtype value in the **upgrade hw-module fpd** command.

```
RP/0/RP0/CPU0:ios# upgrade hw-module location 0/RP0 fpd ADM
Wed Oct 28 07:46:49.805 UTC
upgrade command issued (use "show hw-module fpd" to check upgrade status)
RP/0/RP0/CPU0:ios#RP/0/RP0/CPU0:Oct 28 07:46:51.949 UTC: optics_driver[222]:
%PKT_INFRA-FM-2-FAULT_CRITICAL : ALARM_CRITICAL :OPTICS RX POWER LANE-0 LOW ALARM :CLEAR :
 Optics0/11/0/1:  Optics0/11/0/1
0/RP0/ADMIN0:Oct 28 07:46:54.154 UTC: fpdserv[4899]: %INFRA-FPD_Manager-1-UPGRADE_ALERT :
Upgrade for the following FPDs has been committed:
0/RP0/ADMIN0:Oct 28 07:46:54.154 UTC: fpdserv[4899]: %INFRA-FPD_Manager-1-UPGRADE_ALERT :
Location           FPD name             Force
0/RP0/ADMIN0:Oct 28 07:46:54.154 UTC: fpdserv[4899]: %INFRA-FPD_Manager-1-UPGRADE_ALERT :
================================================
0/RP0/ADMIN0:Oct 28 07:46:54.154 UTC: fpdserv[4899]: %INFRA-FPD_Manager-1-UPGRADE_ALERT :
0/RP0              ADM                  FALSE
0/RP0/ADMIN0:Oct 28 07:46:59.203 UTC: control_driver[3690]: %INFRA-FPD_Driver-6-UPGRADE_RESULT
 : Upgrade completes 20 percent for fpd ADM@location 0/RP0.
RP/0/RP0/CPU0:ios#0/RP0/ADMIN0:Oct 28 07:47:09.204 UTC: control_driver[3690]:
%INFRA-FPD_Driver-6-UPGRADE_RESULT : Upgrade completes 70 percent for fpd ADM@location
0/RP0.
0/RP0/ADMIN0:Oct 28 07:47:10.854 UTC: control_driver[3690]: %INFRA-FPD_Driver-1-UPGRADE_ALERT
 : FPD ADM@0/RP0 image programming completed with UPGRADE DONE state Info: [image 1.05 to
1.06 version]
0/RP0/ADMIN0:Oct 28 07:47:10.855 UTC: control_driver[3690]: %INFRA-FPD_Driver-1-UPGRADE_ALERT
 : FPD ADM @location 0/RP0 FPD upgraded and activated!
0/RP0/ADMIN0:Oct 28 07:47:10.857 UTC: shelf_mgr[3705]: %INFRA-SHELF_MGR-6-CARD_SW_OPERATIONAL
 : Card: 0/RP0 software state going to Operational
0/RP0/ADMIN0:Oct 28 07:47:10.857 UTC: shelf_mgr[3705]: %INFRA-SHELF_MGR-6-CARD_HW_OPERATIONAL
 : Card: 0/RP0 hardware state going to Operational
RP/0/RP0/CPU0:Oct 28 07:47:17.931 UTC: fpd-serv[393]: %INFRA-FPD_Manager-1-UPGRADE_ALERT :
  FPD Upgrade Completed(use "show hw-module fpd" to check upgrade status)
0/RP0/ADMIN0:Oct 28 07:47:19.155 UTC: fpdserv[4899]: %INFRA-FPD_Manager-1-UPGRADE_ALERT :
 FPD Upgrade Completed(use "show hw-module fpd" to check upgrade status)
RP/0/RP0/CPU0:ios#
```

show platform Command Output: Example

Use the **show platform** command to verify that the IM is up and running.

```
RP/0/RP1/CPU0:router# show platform
Tue Oct 20 04:42:31.936 UTC
Node              Type                       State             Config state
--------------------------------------------------------------------------------
0/0/CPU0          A900-IMA8CS1Z-M            OPERATIONAL       NSHUT
0/1/CPU0          A900-IMA8CS1Z-M            OPERATIONAL       NSHUT
0/2/CPU0          A900-IMA8CS1Z-M            OPERATIONAL       NSHUT
0/4/CPU0          A900-IMA8Z-L               OPERATIONAL       NSHUT
0/5/CPU0          A900-IMA8Z-L               OPERATIONAL       NSHUT
0/7/CPU0          N560-IMA1W                 OPERATIONAL       NSHUT
0/9/CPU0          N560-IMA2C-DD              OPERATIONAL       NSHUT
```

```
0/10/CPU0          A900-IMA8Z                 OPERATIONAL       NSHUT
0/11/CPU0          A900-IMA8Z-L               OPERATIONAL       NSHUT
0/RP0/CPU0         N560-RSP4-E(Standby)       UNKNOWN           NSHUT
0/RP1/CPU0         N560-RSP4-E(Active)        IOS XR RUN        NSHUT
0/FT0/CPU0         N560-FAN-H                 OPERATIONAL       NSHUT
0/PM2/CPU0         A900-PWR1200-A             OPERATIONAL       NSHUT
```

Auto FPD Upgrade

Table 1: Feature History Table

Feature Name	Release Information	Feature Description
Auto FPD Upgrade	Release 7.3.2	This functionality enables automatic upgrade and reload for field-programmable devices (FPDs) whenever the Cisco IOS XR image has a newer FPD version. This functionality upgrades all route processors and line card FPDs simultaneously while displaying upgrade triggers on the console.

Effective Cisco IOS XR Release 7.3.2, you can enable automatic upgrade of FPD by using the "fpd auto-upgrade enable" command.

Note Automatic upgrade of FPD is not supported in Cisco IOS XR Release 7.4.1.

To automatically upgrade all FPDs, use:

```
RP/0/RP0/CPU0:IOS(config)#fpd auto-upgrade enable
```

To reload the interface modules following the fpd auto-upgrade, use:

```
RP/0/RP0/CPU0:IOS(config)#fpd auto-reload enable
```

Limitations and Usage Guidelines

Limitations

- FPD auto-upgrade should be enabled only in the XR VM and *not* in the System Admin VM.
- With auto-upgrade enabled, if any card is in RELOAD REQUIRED state, auto-upgrade is re-triggered during any SSO or FPD-serv process restart.
- When an interface module (IM) or route processor (RP) is in RELOAD REQUIRED state and auto-upgrade is enabled, FPD upgrades are triggered again.
- With auto-upgrade enabled, if line card is inserted, an auto-upgrade is triggered. During this phase optics alarms are generated. If auto-reload is not enabled, you must reload the line cards manually to clear these alarms.

- SATA allows you to upgrade or downgrade when an FPD version change is available. Therefore, when auto-upgrade is enabled, the system automatically downgrades if lower versions are available. This behavior is specific only to SATA FPDs.
- FPD auto-reload is applicable for line cards only. Line cards are automatically reloaded after the fpd auto-upgrade process is completed.
-
- TimingICs do not support **auto fpd upgrade** on NCS5500 Series Routers as the TimingIC requires a card reload immediately after upgrade. For the same reason, the TimingICs are not upgraded if the user specifies **location all** in the **auto fpd upgrade** command. To upgrade a TimingIC FPD, specify the FPD name along with the card location. For example, **upgrade hw-module fpd TimngIC-A location 0/RP0/cpu0.**

Usage Guidelines—Online Insertion of Line Cards

When a line card with a lower FPD version is inserted, one of the following scenarios apply:

- If fpd auto-upgrade and auto-reload are enabled, and a new line card is inserted, the system upgrades the line card FPDs automatically with the latest FPDs and reloads the line cards.
- If fpd auto-upgrade and auto-reload are both disabled, no action is required.
- If fpd auto-upgrade is enabled and auto-reload is disabled, the following alarms are displayed on the console:

```
RP/0/RP1/CPU0:Jun 1 10:05:46.095 UTC: optics_driver[231]: %PKT_INFRA-FM-3-FAULT_MAJOR
: ALARM_MAJOR :OPTICS SUPPORTED_ERROR :DECLARE : Optics0/5/0/6: Optics0/5/0/6
RP/0/RP1/CPU0:Jun 1 10:05:46.096 UTC: optics_driver[231]: %PKT_INFRA-FM-2-FAULT_CRITICAL
 : ALARM_CRITICAL :OPTICS NOT SUPPORTED :DECLARE : Optics0/5/0/6: Optics0/5/0/6
```

  You must reload the line cards manually to clear these alarms

Usage Guidelines—Online Insertion of RPs

When fpd auto-upgrade is enabled and a new RP is inserted, the system upgrades the RP FPDs automatically with the latest FPDs.

Note RPs are not reloaded automatically. You must manually reload the RP or chassis for the latest FPD version to reflect.

Note Reload of active RPs and line cards impacts the network traffic.

```
RP/0/RP0/CPU0:IOS# admin
Mon Jun 28 17:00:39.340 UTC

sysadmin-vm:0_RP1# hw-module location 0/RP1 reload
Mon Jun  28 17:00:52.178 UTC+00:00
Reload hardware module ? [no,yes] yes
#result Card graceful reload request on 0/RP1 succeeded.
RP/0/RP0/CPU0:IOS#

RP/0/RP0/CPU0:ios# show hw-module fpd
Fri Jun  4 10:08:01.784 UTC
```

```
Auto-upgrade:Enabled
                                                                                FPD Versions
                                                                                ============
Location   Card type             HWver FPD device       ATR Status    Running   Programd
-------------------------------------------------------------------------------------------
0/1        N560-IMA2C-DD         0.0   IMFPGA               CURRENT     1.27      1.27
0/3        N560-IMA2C            0.0   IMFPGA               CURRENT     5.01      5.01
0/5        A900-IMA8CS1Z-M       0.0   IMFPGA               CURRENT     1.98      1.98
0/RP0      N560-4-RSP4           0.0   ADM                  CURRENT     1.06      1.06
0/RP0      N560-4-RSP4           0.0   IOFPGA               CURRENT     0.64      0.64
0/RP0      N560-4-RSP4           0.0   PRIMARY-BIOS         CURRENT     0.18      0.18
0/RP0      N560-4-RSP4           0.0   SATA                 CURRENT     2.10      2.10
0/RP1      N560-4-RSP4           0.0   ADM                  CURRENT     1.06      1.06
0/RP1      N560-4-RSP4           0.0   IOFPGA               CURRENT     0.64      0.64
0/RP1      N560-4-RSP4           0.0   PRIMARY-BIOS         CURRENT     0.19      0.19
0/RP1      N560-4-RSP4           0.0   SATA                 CURRENT     2.10      2.10
0/FT0      N560-4-PWR-FAN        0.1   PSOC                 CURRENT   177.08    177.08
0/FT1      N560-4-FAN-H          0.1   PSOC                 CURRENT   177.02    177.02
0/FT2      N560-4-FAN-H          0.1   PSOC                 CURRENT   177.02    177.02
RP/0/RP0/CPU0:ios#
```

Table 2: Action Required on FPDs After Auto Upgrade

FPD	Action Required
IOFPGA	Manual reload required
ADM	Upgraded version available immediately
PRIMARY-BIOS	Manual reload required
SATA	Upgraded version available immediately
PSOC	Upgraded version available immediately
IMFPGA	Manual reload required, if auto-reload is not configured

Configuring Auto FPD During System Upgrade

In case of Software upgrade (without ISSU), configure the **fpd auto-upgrade enable** command. All the FPDs are automatically upgraded in the currently installed image (V1). After the upgrade, the router automatically reloads and comes up with the new image (V2) with the upgraded FPDs already running. No additional reloads are required.

Note System reloads are part of the SU process, therefore you can disable the FPD auto reload functionality by using the **fpd auto-reload disable** command.

1. **Enable FPD auto-upgrade**

```
RP/0/RP0/CPU0:IOS#conf
RP/0/RP0/CPU0:IOS(config)#fpd auto-upgrade enable
RP/0/RP0/CPU0:IOS#commit
```

2. **Check for FPD Versions**

```
RP/0/RP0/CPU0:Router#show hw-module fpd
Mon Jun 28 21:41:19.187 UTC

Auto-upgrade:Enabled
                                                                          FPD Versions
                                                                          ==============
Location   Card type            HWver FPD device       ATR Status    Running   Programd

-------------------------------------------------------------------------------------
0/2        NCS4200-1T16G-PS      0.0   IMFPGA               CURRENT     1.98      1.98
0/3        A900-IMA8CS1Z-M       0.0   IMFPGA               CURRENT     1.95      1.95
0/4        A900-IMA8Z            0.0   IMFPGA               CURRENT    17.05     17.05
0/5        A900-IMA8Z-L          0.0   IMFPGA               CURRENT     1.48      1.48
0/8        NCS4200-1T16G-PS      0.0   IMFPGA               CURRENT     1.98      1.98
0/9       N560-IMA1W           66.32 CFP2-DS-DCO         CURRENT    38.27397  38.27397
0/9        N560-IMA1W            0.0   IMFPGA               CURRENT     1.28      1.28
0/15       NCS4200-1T16G-PS      0.0   IMFPGA               CURRENT     1.98      1.98
0/RP0      N560-RSP4             0.0   ADM                  CURRENT     1.06      1.06
0/RP0      N560-RSP4             0.0   IOFPGA               CURRENT     0.64      0.64
0/RP0      N560-RSP4             0.0   PRIMARY-BIOS         CURRENT     0.19      0.19
0/RP0      N560-RSP4             0.0   SATA                 CURRENT     1.30      1.30
0/RP1      N560-RSP4             0.0   ADM                  CURRENT     1.05      1.05
0/RP1      N560-RSP4             0.0   IOFPGA               CURRENT     0.64      0.64
0/RP1      N560-RSP4             0.0   PRIMARY-BIOS         CURRENT     0.19      0.19
0/RP1      N560-RSP4             0.0   SATA                 CURRENT     1.30      1.30
0/FT0      N560-FAN-H            1.0   PSOC                 CURRENT     2.02      2.02

RP/0/RP0/CPU0:Router#
```

3. Check that Auto Upgrades are Triggered for FPDs with Newer Versions Available

Note At this step, all RSP, IMs, and fan FPD upgrades are initiated and completed. All cards are upgraded *before* the router reloads.

```
RP/0/RP1/CPU0:UUT-RSP4# copy tftp://<ncs560-mini-x-7.3.2.iso> harddisk:/
RP/0/RP0/CPU0:IOS#install add source harddisk: ncs560-mini-x-7.3.2.iso
ncs560-mcast-2.0.0.0-r732.x86_64.rpm ncs560-mgbl-2.0.0.0-r732.x86_64.rpm
ncs560-mpls-1.0.0.0-r732.x86_64.rpm
RP/0/RP0/CPU0:IOS#install ncs560-mini-x-7.3.2 ncs560-mcast-2.0.0.0-r732.x86_64
ncs560-mgbl-2.0.0.0-r732.x86_64 ncs560-mpls-1.0.0.0-r732.x86_64
RP/0/RP0/CPU0:IOS#install commit

RP/0/RP0/CPU0:ROUTER# install activate ncs560-mini-x-7.3.2.28I
Mon Jun 28 21:30:17.673 UTC
2021-06-28 21:30:20 Install operation 31 started by root123:
```

```
  install activate pkg ncs560-mini-x-7.3.2.28I
2021-06-28 21:30:20 Package list:
2021-06-28 21:30:20     ncs560-mini-x-7.3.2.28I
RP/0/RP0/CPU0:Jun 28 21:32:41.204 UTC: sdr_instmgr[1213]: %PKT_INFRA-FM-6-FAULT_INFO :
INSTALL-IN-PROGRESS :DECLARE :0/RP0/CPU0: INSTALL_IN_PROGRESS Alarm : being DECLARED for
 the system
This install operation will reload the system, continue?
 [yes/no]:[yes] yes
2021-06-28 21:33:01 Install operation will continue in the background
 ...
RP/0/RP0/CPU0:ROUTER#RP/0/RP0/CPU0:Jun 28 21:41:40.910 UTC: fpd-serv[168]:
%PKT_INFRA-FM-3-FAULT_MAJOR : ALARM_MAJOR :FPD-NEED-UPGRADE :DECLARE :0/RP0:
RP/0/RP0/CPU0:Jun 28 21:41:41.159 UTC: fpd-serv[168]: %PKT_INFRA-FM-3-FAULT_MAJOR :
ALARM_MAJOR :FPD-NEED-UPGRADE :CLEAR :0/RP0:
0/RP0/ADMIN0:Jun 28 21:41:42.565 UTC: control_driver[3205]:
%INFRA-FPD_Driver-1-UPGRADE_ALERT : FPD SATA@0/RP0 image programming completed with
UPGRADE DONE state Info: [SDD firmware upgraded from 1.30 to 2.10]
0/RP0/ADMIN0:Jun 28 21:41:42.566 UTC: control_driver[3205]:
%INFRA-FPD_Driver-1-UPGRADE_ALERT : FPD SATA @location 0/RP0 FPD upgraded and activated!

0/RP0/ADMIN0:Jun 28 21:41:42.570 UTC: shelf_mgr[3220]:
%INFRA-SHELF_MGR-6-CARD_SW_OPERATIONAL : Card: 0/RP0 software state going to Operational

0/RP0/ADMIN0:Jun 28 21:41:42.570 UTC: shelf_mgr[3220]:
%INFRA-SHELF_MGR-6-CARD_HW_OPERATIONAL : Card: 0/RP0 hardware state going to Operational

RP/0/RP0/CPU0:Jun 28 21:41:42.486 UTC: fpd-serv[168]: %PKT_INFRA-FM-3-FAULT_MAJOR :
ALARM_MAJOR :FPD-NEED-UPGRADE :DECLARE :0/RP1:
0/RP1/ADMIN0:Jun 28 21:41:44.182 UTC: control_driver[3220]:
%INFRA-FPD_Driver-1-UPGRADE_ALERT : FPD SATA@0/RP1 image programming completed with
UPGRADE DONE state Info: [SDD firmware upgraded from 1.30 to 2.10]
0/RP1/ADMIN0:Jun 28 21:41:44.182 UTC: control_driver[3220]:
%INFRA-FPD_Driver-1-UPGRADE_ALERT : FPD SATA @location 0/RP1 FPD upgraded and activated!

0/RP1/ADMIN0:Jun 28 21:41:48.905 UTC: control_driver[3220]:
%INFRA-FPD_Driver-6-UPGRADE_RESULT : Upgrade completes 20 percent for fpd ADM@location
0/RP1.
0/RP1/ADMIN0:Jun 28 21:41:48.905 UTC: control_driver[3220]:
%INFRA-FPD_Driver-6-UPGRADE_RESULT : Upgrade completes 50 percent for fpd
PRIMARY-BIOS@location 0/RP1.
0/RP1/ADMIN0:Jun 28 21:42:10.160 UTC: control_driver[3220]:
%INFRA-FPD_Driver-1-UPGRADE_ALERT : FPD PRIMARY-BIOS@0/RP1 image programming completed
with UPGRADE DONE state Info: [  Upgrade Complete ]
0/RP1/ADMIN0:Jun 28 21:42:10.161 UTC: control_driver[3220]:
%INFRA-FPD_Driver-1-UPGRADE_ALERT : FPD PRIMARY-BIOS @location 0/RP1 upgrade completed.

0/RP1/ADMIN0:Jun 28 21:42:11.060 UTC: control_driver[3220]:
%INFRA-FPD_Driver-1-UPGRADE_ALERT : FPD ADM@0/RP1 image programming completed with UPGRADE
 DONE state Info: [image 1.05 to 1.06 version]
0/RP1/ADMIN0:Jun 28 21:42:11.061 UTC: control_driver[3220]:
%INFRA-FPD_Driver-1-UPGRADE_ALERT : FPD ADM @location 0/RP1 FPD upgraded and activated!

0/RP0/ADMIN0:Jun 28 21:42:11.062 UTC: shelf_mgr[3220]:
%INFRA-SHELF_MGR-6-CARD_SW_OPERATIONAL : Card: 0/RP1 software state going to Operational

0/RP0/ADMIN0:Jun 28 21:42:11.062 UTC: shelf_mgr[3220]:
%INFRA-SHELF_MGR-6-CARD_HW_OPERATIONAL : Card: 0/RP1 hardware state going to Operational

RP/0/RP0/CPU0:Jun 28 21:45:14.615 UTC: fpd_imfpga[121]: %INFRA-FPD_Driver-6-UPGRADE_RESULT
 : Upgrade completes 50 percent for fpd IMFPGA@location 0/5.
RP/0/RP0/CPU0:Jun 28 21:45:14.616 UTC: fpd_imfpga[121]: %INFRA-FPD_Driver-6-UPGRADE_RESULT
 : Upgrade completes 50 percent for fpd IMFPGA@location 0/3.
RP/0/RP0/CPU0:Jun 28 21:48:24.763 UTC: fpd_imfpga[121]: %INFRA-FPD_Driver-6-UPGRADE_RESULT
 : Upgrade completes 90 percent for fpd IMFPGA@location 0/5.
```

```
RP/0/RP0/CPU0:ROUTER#RP/0/RP0/CPU0:Jun 28 21:48:43.929 UTC: fpd_imfpga[121]:
%INFRA-FPD_Driver-1-UPGRADE_ALERT : FPD IMFPGA@0/5 image programming completed with
UPGRADE DONE state Info: [DONE ]
RP/0/RP0/CPU0:Jun 28 21:48:43.940 UTC: fpd_imfpga[121]: %INFRA-FPD_Driver-1-UPGRADE_ALERT
 : FPD IMFPGA @location 0/5 upgrade completed.
0/RP0/ADMIN0:Jun 28 21:48:45.354 UTC: shelf_mgr[3220]:
%INFRA-SHELF_MGR-6-CARD_HW_OPERATIONAL : Card: 0/5 hardware state going to Operational

0/RP0/ADMIN0:Jun 28 21:48:45.354 UTC: shelf_mgr[3220]:
%INFRA-SHELF_MGR-6-CARD_SW_OPERATIONAL : Card: 0/RP0 software state going to Operational

0/RP0/ADMIN0:Jun 28 21:48:45.354 UTC: shelf_mgr[3220]:
%INFRA-SHELF_MGR-6-CARD_HW_OPERATIONAL : Card: 0/RP0 hardware state going to Operational
P/0/RP0/CPU0:Jun 28 21:50:21.630 UTC: fpd_imfpga[121]: %INFRA-FPD_Driver-1-UPGRADE_ALERT
 : FPD IMFPGA@0/3 image programming completed with UPGRADE DONE state Info: [DONE ]
RP/0/RP0/CPU0:Jun 28 21:50:21.642 UTC: fpd_imfpga[121]: %INFRA-FPD_Driver-1-UPGRADE_ALERT
 : FPD IMFPGA @location 0/3 upgrade completed.
0/RP0/ADMIN0:Jun 28 21:50:23.056 UTC: shelf_mgr[3220]:
%INFRA-SHELF_MGR-6-CARD_HW_OPERATIONAL : Card: 0/3 hardware state going to Operational

0/RP0/ADMIN0:Jun 28 21:50:23.056 UTC: shelf_mgr[3220]:
%INFRA-SHELF_MGR-6-CARD_SW_OPERATIONAL : Card: 0/RP0 software state going to Operational

0/RP0/ADMIN0:Jun 28 21:50:23.057 UTC: shelf_mgr[3220]:
%INFRA-SHELF_MGR-6-CARD_HW_OPERATIONAL : Card: 0/RP0 hardware state going to Operational
```

4. Check the RP FPD Versions and FPD Status

When the router is operational after the reload, all the RP, IMs, and fan FPDs are upgraded to the latest FPD versions.

```
sysadmin-vm:0_RP1# show hw-module fpd
Mon Jun 28 21:51:20.187 UTC

Auto-upgrade:Enabled
                                                                          FPD Versions
                                                                          ==============
Location   Card type            HWver FPD device       ATR Status    Running   Programd

-----------------------------------------------------------------------------------------
0/2        NCS4200-1T16G-PS      0.0   IMFPGA              CURRENT     1.98      1.98
0/3        A900-IMA8CS1Z-M       0.0   IMFPGA              CURRENT     1.98      1.98
0/4        A900-IMA8Z            0.0   IMFPGA              CURRENT    17.05     17.05
0/5        A900-IMA8Z-L          0.0   IMFPGA              CURRENT     1.49      1.49
0/8        NCS4200-1T16G-PS      0.0   IMFPGA              CURRENT     1.98      1.98
0/9       N560-IMA1W           66.32 CFP2-DS-DCO         CURRENT    38.27397  38.27397
0/9        N560-IMA1W            0.0   IMFPGA              CURRENT     1.28      1.28
0/15       NCS4200-1T16G-PS      0.0   IMFPGA              CURRENT     1.98      1.98
0/RP0      N560-RSP4             0.0   ADM                 CURRENT     1.06      1.06
0/RP0      N560-RSP4             0.0   IOFPGA              CURRENT     0.64      0.64
0/RP0      N560-RSP4             0.0   PRIMARY-BIOS        CURRENT     0.19      0.19
```

```
0/RP0      N560-RSP4            0.0   SATA                CURRENT     2.10       2.10
0/RP1      N560-RSP4            0.0   ADM                 CURRENT     1.05       1.05
0/RP1      N560-RSP4            0.0   IOFPGA              CURRENT     0.64       0.64
0/RP1      N560-RSP4            0.0   PRIMARY-BIOS        CURRENT     0.19       0.96
0/RP1      N560-RSP4            0.0   SATA                CURRENT     2.10       2.10
0/FT0      N560-FAN-H           1.0   PSOC                CURRENT     2.02       2.02
RP/0/RP0/CPU0:ROUTER#
```

Automatic FPD Upgrade for PSU

During the installation and Power Supply Unit (PSU) insertion process, the Field-Programmable Devices (FPD) associated with the PSUs are automatically upgraded.

Note The PSUs are upgraded sequentially, hence the PSU FPD upgrades take longer. You can choose to exclude PSUs from the auto upgrade flow. This restricts the PSUs from being upgraded either upon insertion, or during system upgrade.

To exclude the PSU FPDs from auto upgrading, use the following CLI:

fpd auto-upgrade exclude pm

```
RP/0/RSP0/CPU0:router# show running-config fpd auto-upgrade
Wed Mar 30 20:52:55.079 UTC
fpd auto-upgrade enable
fpd auto-upgrade exclude pm
```

Note When you upgrade from an earlier unsupported version to a version that supports Automatic FPD upgrade for PSU, the PSU upgrade might happen on bootup.

Upgrade Failure

On failure of an FPD upgrade, you get a warning with the following syslog message:

```
LC/0/5/CPU0:Jun 27 05:02:25.742 UTC: optics_driver[216]: %INFRA-FPD_Driver-1-UPGRADE_ALERT
 : FPD MIFPGA@0/5 image programming completed with UPGD FAIL state Info: [Image verification
 failed at offset 0x5c8, flash value = 0x0, image value = 0x40, image size = 4194304]
LC/0/5/CPU0:Jun 27 05:02:26.570 UTC: optics_driver[216]: %INFRA-FPD_Driver-1-UPGRADE_ALERT
 : FPD MIFPGA@0/5 image programming completed with UPGD FAIL state Info: [Image verification
 failed at offset 0x1e, flash value = 0x56, image value = 0xff, image size = 4194304]
```

When you use the **show hw-module fpd**command, the status column displays **UPGD FAIL** to indicate failure of the FPD upgrade.

Note

- Do not reload the line card with a failed FPD upgrade image.
- Upgrade failed FPDs will be fixed with a manual upgrade.
- Contact Cisco TAC or your account representative if the FPD upgrade failure is not repaired.