Cisco 3850: IOS-XE/Firmware Upgrade
(Install Mode)

NOTE:
- This procedure is aimed at Cisco 3850 switch ONLY.
- IOS-XE Bundle Mode is not covered.
- 9300, 9500 (vanilla & high-performance), ISR 1k, ISR 4k and ASR is not covered.
- Router(s) & switch(es) running "classic" IOS is not covered.

A Word from our Sponsors:
There is a very fine line between writing something short-and-sweet and writing something comprehensive while losing the target "market" in the process. I have done all I can to make this document as "digestible" as possible without losing much of the important content but still maintaining some forward momentum.

Introduction:
Switch and/or router firmware had (past tense) a simple procedure, however, for IOS-XE each platform has different commands, process & procedures, and "gotchas". Because of this, I have broken up the process into different sections: 9300, 9500 & routers.

Section 1: General Procedure
Section 2: Install SMU
Section 3: GOTCHA
Section 4: Emergency-Install

Section 1: General Procedure
1. Read the Release Notes very carefully.
2. IOS-XE firmware and SMU files have a filename extension of "bin".
3. Clean the flash: `install remove inactive`

NOTE: Switch/stack on IOS-XE version 3.X.X, uses a different command:

`software clean force`

4. Copy the file into the switch/stack.
5. Make sure the boot-variable string is pointing to "packages.conf" file.

```
Switch#sh boot

---------------------------

Switch 1

---------------------------

Current Boot Variables:
BOOT variable does not exist


Boot Variables on next reload:
BOOT variable = flash:packages.conf
Manual Boot = no
Enable Break = no
Boot Mode = DEVICE
iPXE Timeout = 0
```

6. Initiate Install Mode (**Non-Disruptive/Do NOT Reboot**):

    `request platform software package install switch all file flash:`**`filename.bin`** `on-reboot new auto-copy verbose`

NOTE: If upgrading *from* 3.X.X, the command is different:

    `software install file flash:` **`filename.bin`** `new force verb on-reboot`

IMPORTANT:

- If the file extraction is successful (or not), the last two lines will display the result.
- Go to the GOTCHA section if the following (image below) appears:

```
              #request plat soft package expand file bootflash:c1100-universalk9.16.12.05.SPA.bin over verb
Jun 22 09:15:23.615 %INSTALL-5-OPERATION_START_INFO: R0/0: packtool: Started expand package bootflash:c1100-universalk9.16.12.05.SPA.bin
Verifying parameters
Expanding superpackage bootflash:c1100-universalk9.16.12.05.SPA.bin
... parameters verified
Validating package type
... package type validated
Copying package files
    c1100-firmware_c1100_gfast.16.12.05.SPA.pkg
    c1100-firmware_c1100_shdsl.16.12.05.SPA.pkg
    c1100-firmware_c1100_vadsl.16.12.05.SPA.pkg
    c1100-firmware_p_1t.16.12.05.SPA.pkg
    c1100-mono-universalk9.16.12.05.SPA.pkg
    c1100-rpboot.16.12.05.SPA.pkg
  WARNING: Overwrite option specified, running subpackage mode, skip the overwrite
  WARNING: A different version of provisioning file packages.conf already exists in bootflash:
  WARNING: The provisioning file from the expanded bundle will be saved as
  WARNING: bootflash:c1100-universalk9.16.12.05.SPA.conf
... package files copied
SUCCESS: Finished expanding all-in-one software package.
Jun 22 09:17:44.367 %INSTALL-5-OPERATION_COMPLETED_INFO: R0/0: packtool: Completed expand package bootflash:c1100-universalk9.16.12.05.SPA.bin
```

7. Inspect the contents "packages.conf" file. Is this the intended version or not? If NO, go to the GOTCHA section. Command: `more flash:packages.conf | begin for NOVA`

```
Switch#more flash:packages.conf | begin for NOVA
# This is for NOVA
iso   rp 0 0   rp_base      cat3k_caa-rpbase.16.09.05.SPA.pkg
iso   rp 0 0   rp_core      cat3k_caa-rpcore.16.09.05.SPA.pkg
iso   rp 0 0   rp_daemons   cat3k_caa-rpcore.16.09.05.SPA.pkg
iso   rp 0 0   rp_iosd      cat3k_caa-rpcore.16.09.05.SPA.pkg
iso   rp 0 0   rp_webui     cat3k_caa-webui.16.09.05.SPA.pkg
iso   rp 0 0   srdriver     cat3k_caa-srdriver.16.09.05.SPA.pkg
iso   rp 0 0   rp_security  cat3k_caa-rpcore.16.09.05.SPA.pkg
iso   rp 0 0   guestshell   cat3k_caa-guestshell.16.09.05.SPA.pkg

iso   fp 0 0   fp           cat3k_caa-rpcore.16.09.05.SPA.pkg
```

IMPORTANT:

- If the switches are in a stack, inspect the "packages.conf" of each switch stack member.

  ```
  more flash-1:packages.conf | begin for NOVA
  more flash-2:packages.conf | begin for NOVA
  more flash-3:packages.conf | begin for NOVA
  ...
  more flash-8:packages.conf | begin for NOVA
  ```

- If the switch is standalone, the command is:

  ```
  more flash:packages.conf | begin for NOVA
  ```

8. REBOOT the switch/stack.
9. [RECOMMENDED][OPTIONAL] Clean the flash: `install remove inactive`
10. DONE.

Section 2: Install SMU
Software Maintenance Update (aka "patch")

WARNING:

- Only routers and switches running IOS-XE support SMU.
- Router(s) & switch(es) running "classic" IOS do not support SMU.
- **IMPORTANT**: Always treat SMU update as disruptive (reboots the switch/stack).
- **IMPORTANT**: SMU file is platform-specific.
- **IMPORTANT**: SMU file is version-specific.

Image (above): Sample SMU filename

Image (above): Attempting to install an SMU meant for a different version.

Proceedure

1. Read the Release Notes very carefully.
2. SMU firmware have a filename extension of "bin".
3. Copy the SMU file into the switch.
4. Install the SMU:

   `install add file flash:SMU_filename.bin activate commit`

> **WARNING**: Immediately after entering "y" may/will cause the router &/or switch to reboot.
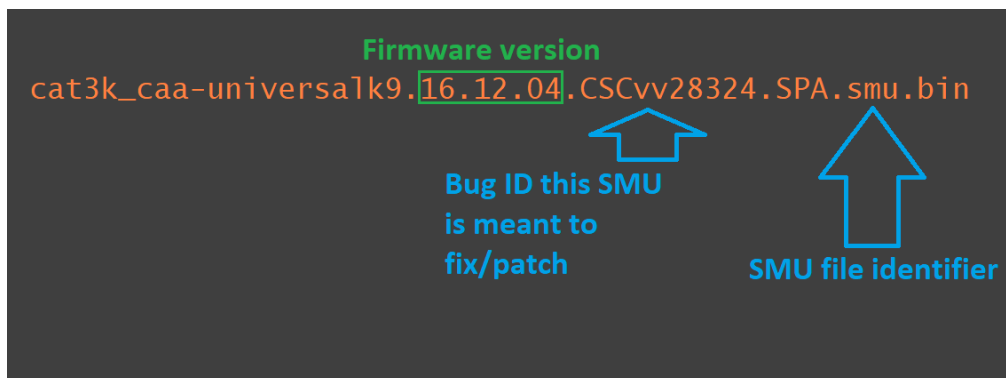
```
Switch#$a-universalk9.16.12.04.CSCvv28324.SPA.smu.bin activate commit
install_add_activate_commit: START Fri Jun 25 03:41:51 UTC 2021
install_add_activate_commit: Adding SMU
install_add_activate_commit: Checking whether new add is allowed ....

 Jun 25 03:41:58.260: %INSTALL-5-INSTALL_START_INFO: Switch 1 R0/0: install_engine: Started install one-shot flash:cat3k_caa-universalk9.16.12.04.CSCvv28324.SPA.smu.bin
--- Starting initial file syncing ---
Info: Finished copying flash:cat3k_caa-universalk9.16.12.04.CSCvv28324.SPA.smu.bin to the selected switch(es)
Finished initial file syncing

--- Starting SMU Add operation ---
Performing SMU_ADD on all members
  [1] SMU_ADD package(s) on switch 1
  [1] Finished SMU_ADD on switch 1
Checking status of SMU_ADD on [1]
SMU_ADD: Passed on [1]
Finished SMU Add operation

install_add_activate_commit: Activating SMU

This operation may require a reload of the system. Do you want to proceed? [y/n]y
Executing pre scripts....
Executing pre sripts done.

--- Starting SMU Activate operation ---
Performing SMU_ACTIVATE on all members
  [1] SMU_ACTIVATE package(s) on switch 1
  [1] Finished SMU_ACTIVATE on switch 1
Checking status of SMU_ACTIVATE on [1]
SMU_ACTIVATE: Passed on [1]
Finished SMU Activate operation

install_add_activate_commit: Reloading the box to complete activation of the SMU...
install_activate will reload the system now!
```

5. Verify the SMU has been successfully installed.
   - Fast Method: `sh version | begin Active SMU`

```
Switch#sh version | begin Active SMU
Active SMU Information:
  State (St):  C - Committed, U - Uncommitted
-------------------------------------------------------------------------------
Type  Defect_ID     Version    St Filename
-------------------------------------------------------------------------------
SMU   CSCvv22101    16.12.4.0  C  cat3k_caa-universalk9.16.12.04.CSCvv22101.SPA
SMU   CSCvv28324    16.12.4.0  C  cat3k_caa-universalk9.16.12.04.CSCvv28324.SPA
-------------------------------------------------------------------------------
```

   - Slow Method: `sh install summary`

```
Switch#sh install summary
[ Switch 1 ] Installed Package(s) Information:
State (St): I - Inactive, U - Activated & Uncommitted,
            C - Activated & Committed, D - Deactivated & Uncommitted
-------------------------------------------------------------------------------
Type  St   Filename/Version
-------------------------------------------------------------------------------
SMU   C    flash:cat3k_caa-universalk9.16.12.04.CSCvv22101.SPA.smu.bin
SMU   C    flash:cat3k_caa-universalk9.16.12.04.CSCvv28324.SPA.smu.bin
IMG   C    16.12.4.0.4480


-------------------------------------------------------------------------------
Auto abort timer: inactive
-------------------------------------------------------------------------------
```

6. DONE.

Section 3: GOTCHA

1. If the message (image below) appears at the end of the package extraction process THIS IS NOT A FALSE POSITIVE.

```
            #request plat soft package expand file bootflash:c1100-universalk9.16.12.05.SPA.bin over verb
Jun 22 09:15:23.615 %INSTALL-5-OPERATION_START_INFO: R0/0: packtool: Started expand package bootflash:c1100-universalk9.16.12.05.SPA.bin
Verifying parameters
Expanding superpackage bootflash:c1100-universalk9.16.12.05.SPA.bin
... parameters verified
Validating package type
... package type validated
Copying package files
    c1100-firmware_c1100_gfast.16.12.05.SPA.pkg
    c1100-firmware_c1100_shdsl.16.12.05.SPA.pkg
    c1100-firmware_c1100_vadsl.16.12.05.SPA.pkg
    c1100-firmware_p_1t.16.12.05.SPA.pkg
    c1100-mono-universalk9.16.12.05.SPA.pkg
    c1100-rpboot.16.12.05.SPA.pkg
    WARNING: Overwrite option specified, running subpackage mode, skip the overwrite
    WARNING: A different version of provisioning file packages.conf already exists in bootflash:
    WARNING: The provisioning file from the expanded bundle will be saved as
    WARNING: bootflash:c1100-universalk9.16.12.05.SPA.conf
... package files copied
SUCCESS: Finished expanding all-in-one software package.
Jun 22 09:17:44.367 %INSTALL-5-OPERATION_COMPLETED_INFO: R0/0: packtool: Completed expand package bootflash:c1100-universalk9.16.12.05.SPA.bin
```

2. Check the contents of the flash/bootflash and compare the date stamp of the extracted packages against the date stamp of the "packages.conf" file (see image below).

```
            # dir
Directory of bootflash:/

    11  drwx          16384  May 27 2020 07:30:14 +10:00  lost+found
104417  drwx           4096   Dec 3 2020 16:56:23 +11:00  .prst_sync
    12  -rw-         132108  Jun 21 2021 09:56:07 +10:00  memleak.tcl
  8033  drwx           4096  Apr 27 2021 05:23:31 +10:00  virtual-instance
 40161  drwx           4096  Jun 21 2021 09:55:20 +10:00  .installer
 96385  drwx           4096  Jun 22 2021 06:20:43 +10:00  core
 32129  drwx           4096   Dec 3 2020 16:10:23 +11:00  .rollback_timer
112449  drwx           4096  May 27 2020 07:45:55 +10:00  gs_script
 48193  drwx          16384  Jun 22 2021 09:27:04 +10:00  tracelogs
152609  drwx           4096   Dec 3 2020 16:16:25 +11:00  .dbpersist
    13  -rw-             30  Jun 21 2021 09:56:31 +10:00  throughput_monitor_params
128513  drwx           4096  May 27 2020 07:47:15 +10:00  onep
    14  -rw-             34   Dec 3 2020 16:15:36 +11:00  pnp-tech-time
    15  -rw-          62849   Dec 3 2020 16:15:48 +11:00  pnp-tech-discovery-summary
    16  -rw-      542525852   Dec 3 2020 16:03:53 +11:00  c1100-universalk9.16.12.04.SPA.bin
    17  -rw-           1136  Jun 21 2021 09:56:42 +10:00  vlan.dat
160643  -rw-       14763020   Dec 3 2020 16:06:42 +11:00  c1100-firmware_c1100_gfast.16.12.04.SPA.pkg
160644  -rw-       11527180   Dec 3 2020 16:06:42 +11:00  c1100-firmware_c1100_shdsl.16.12.04.SPA.pkg
160645  -rw-        6337548   Dec 3 2020 16:06:42 +11:00  c1100-firmware_c1100_vadsl.16.12.04.SPA.pkg
160646  -rw-        8455172   Dec 3 2020 16:06:42 +11:00  c1100-firmware_p_1t.16.12.04.SPA.pkg
160647  -rw-      497972248   Dec 3 2020 16:06:44 +11:00  c1100-mono-universalk9.16.12.04.SPA.pkg
160648  -rw-       41960840   Dec 3 2020 16:07:37 +11:00  c1100-rpboot.16.12.04.SPA.pkg
160642  -rw-           7141   Dec 3 2020 16:07:38 +11:00  packages.conf
 80321  drwx           4096  Apr 27 2021 05:24:05 +10:00  .attrib
120481  drwx           4096  Jun 21 2021 09:56:43 +10:00  license_evlog
    18  -rw-      542410228  Jun 22 2021 09:10:23 +10:00  c1100-universalk9.16.12.05.SPA.bin
144579  -rw-       14763020  Jun 22 2021 09:16:39 +10:00  c1100-firmware_c1100_gfast.16.12.05.SPA.pkg
144580  -rw-       11527180  Jun 22 2021 09:16:39 +10:00  c1100-firmware_c1100_shdsl.16.12.05.SPA.pkg
144581  -rw-        6337548  Jun 22 2021 09:16:39 +10:00  c1100-firmware_c1100_vadsl.16.12.05.SPA.pkg
144582  -rw-        8455172  Jun 22 2021 09:16:39 +10:00  c1100-firmware_p_1t.16.12.05.SPA.pkg
144583  -rw-      497845272  Jun 22 2021 09:16:41 +10:00  c1100-mono-universalk9.16.12.05.SPA.pkg
144584  -rw-       41939424  Jun 22 2021 09:17:43 +10:00  c1100-rpboot.16.12.05.SPA.pkg
144578  -rw-           7141  Jun 22 2021 09:17:43 +10:00  c1100-universalk9.16.12.05.SPA.conf

2991816704 bytes total (582332416 bytes free)
```

3. Look in the flash/bootflash directory for two (2) files with an extension of "conf". (Image below)

```
154739  -rw-          14763020  Sep 11 2020 15:22:45 +10:00  c1100-firmware_c1100_gfast.16.12.04.SPA.pkg
57014   -rw-           8455172  Jun 23 2021 11:42:36 +10:00  c1100-firmware_p_1t.16.12.05.SPA.pkg
57015   -rw-         497845272  Jun 23 2021 11:42:38 +10:00  c1100-mono-universalk9.16.12.05.SPA.pkg
154740  -rw-          11527180  Sep 11 2020 15:22:45 +10:00  c1100-firmware_c1100_shdsl.16.12.04.SPA.pkg
154741  -rw-           6337548  Sep 11 2020 15:22:45 +10:00  c1100-firmware_c1100_vadsl.16.12.04.SPA.pkg
154742  -rw-           8455172  Sep 11 2020 15:22:45 +10:00  c1100-firmware_p_1t.16.12.04.SPA.pkg
154743  -rw-         497972248  Sep 11 2020 15:22:47 +10:00  c1100-mono-universalk9.16.12.04.SPA.pkg
154744  -rw-          41960840  Sep 11 2020 15:23:53 +10:00  c1100-rpboot.16.12.04.SPA.pkg
57010   -rw-              7141  Jun 23 2021 11:43:40 +10:00  c1100-universalk9.16.12.05.SPA.conf

2885718016 bytes total (807911424 bytes free)
```

4. First, rename "packages.conf" to, say, "packages.conf.bak".
5. Next, rename the firmware.conf to "packages.conf" (see below).

```
          #rename flash:packages.conf flash:packages.conf.bak
Destination filename [packages.conf.bak]?
          #rename flash:c1100-universalk9.16.12.05.SPA.conf flash:packages.conf
Destination filename [packages.conf]?
          #
```

6. Check the contents of the new "packages.conf" file. *Is this the target version?*

```
Switch# more flash:packages.conf | begin for NOVA
# This is for NOVA
iso    rp 0 0     rp_base         cat3k_caa-rpbase.16.12.04.SPA.pkg
iso    rp 0 0     rp_core         cat3k_caa-rpcore.16.12.04.SPA.pkg
iso    rp 0 0     rp_daemons      cat3k_caa-rpcore.16.12.04.SPA.pkg
iso    rp 0 0     rp_iosd         cat3k_caa-rpcore.16.12.04.SPA.pkg
iso    rp 0 0     rp_webui        cat3k_caa-webui.16.12.04.SPA.pkg
iso    rp 0 0     srdriver        cat3k_caa-srdriver.16.12.04.SPA.pkg
iso    rp 0 0     rp_security     cat3k_caa-rpcore.16.12.04.SPA.pkg
iso    rp 0 0     guestshell      cat3k_caa-guestshell.16.12.04.SPA.pkg

iso    fp 0 0     fp              cat3k_caa-rpcore.16.12.04.SPA.pkg
```

7. Inspect the contents of each "packages.conf" file of every member of the stack.
8. Make sure the boot-variable string is pointing to the "packages.conf" file.
9. DONE.

Section 4: Emergency-Install

WARNING: *Emergency-Install command will erase the flash/bootflash of the appliance*.

(Make sure the config is stored somewhere else.)

1. Emergency-Install is to be used when the switch boots into ROMMON.
2. The "`emergency-install`" command can only be used in ROMMON.
3. Emergency-Install process can only be effectively achieved by using a USB thumb drive.

```
switch: emergency-install flash:cat3k_caa-universalk9.16.12.04.SPA.bin
The bootflash will be erased during install operation, continue (y/n)?y
Starting emergency recovery (flash:cat3k_caa-universalk9.16.12.04.SPA.bin)...
Reading full image into memory........................done
Bundle Image
--------------------------------------
Kernel Address    : 0x537795d4
Kernel Size       : 0x3faa6d/4172397
Initramfs Address : 0x53b74044
Initramfs Size    : 0xdf2c77/14625911
Compression Format: .mzip

Bootable image at @ ram:0x537795d4
Bootable image segment 0 address range [0x81100000, 0x820a0000] is in range [0x80180000, 0x90000000].
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
File "sda9:cat3k_caa-recovery.bin" uncompressed and installed, entry point: 0x816734a0
Loading Linux kernel with entry point 0x816734a0 ...
Bootloader: Done loading app on core_mask: 0xf

### Launching Linux Kernel (flags = 0x5)


Initiating Emergency Installation of bundle flash:cat3k_caa-universalk9.16.12.04.SPA.bin


Emergency Install failed - bundle flash:cat3k_caa-universalk9.16.12.04.SPA.bin does not exist
Restarting system.
```

Image above shows failed "emergency-install" because the firmware is in the flash.

WARNING: *Emergency-Install command will erase the flash/bootflash of the appliance*.

4. Command: `emergency-install usbflash0:filename.bin`

```
switch: emergency-install usbflash0:cat3k_caa-universalk9.16.09.06.SPA.bin
The bootflash will be erased during install operation, continue (y/n)?y
Starting emergency recovery (usbflash0:cat3k_caa-universalk9.16.09.06.SPA.bin)...
Reading full image into memory.......................done
Bundle Image
--------------------------------------
Kernel Address      : 0x534305d4
Kernel Size         : 0x3faa6d/4172397
Initramfs Address   : 0x5382b044
Initramfs Size      : 0xdf2c77/14625911
Compression Format: .mzip

Bootable image at @ ram:0x534305d4
Bootable image segment 0 address range [0x81100000, 0x820a0000] is in range [0x80180000, 0x90000000].
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
File "sda9:cat3k_caa-recovery.bin" uncompressed and installed, entry point: 0x816734a0
Loading Linux kernel with entry point 0x816734a0 ...
Bootloader: Done loading app on core_mask: 0xf

### Launching Linux Kernel (flags = 0x5)


Initiating Emergency Installation of bundle usbflash0:cat3k_caa-universalk9.16.09.06.SPA.bin


Reading bundle usbflash0:cat3k_caa-universalk9.16.09.06.SPA.bin...

Validating bundle usbflash0:cat3k_caa-universalk9.16.09.06.SPA.bin...
Installing bundle usbflash0:cat3k_caa-universalk9.16.09.06.SPA.bin...
Verifying bundle usbflash0:cat3k_caa-universalk9.16.09.06.SPA.bin...
Package cat3k_caa-guestshell.16.09.06.SPA.pkg is Digitally Signed
Package cat3k_caa-rpbase.16.09.06.SPA.pkg is Digitally Signed
Package cat3k_caa-rpcore.16.09.06.SPA.pkg is Digitally Signed
Package cat3k_caa-srdriver.16.09.06.SPA.pkg is Digitally Signed
Package cat3k_caa-webui.16.09.06.SPA.pkg is Digitally Signed
Preparing flash...
Syncing device...
Emergency Install successful... Rebooting
Restarting system.
```

5. DONE.