Shells and Scripting

About Bash

In addition to the Cisco NX-OS CLI, Cisco Nexus Series switches support access to the Bourne-Again SHell (Bash). Bash interprets commands that you enter or commands that are read from a shell script. Using Bash enables access to the underlying Linux system on the device and to manage the system.

Guidelines and Limitations

The Bash shell has the following guidelines and limitations:

- When you define a link-local address for an interface, Netstack installs a /64 prefix on the net device in the kernel.

  When a new link-local address is configured on the kernel, the kernel installs a /64 route in the kernel routing table.

  If the peer box's interface is not configured with a link-local address that falls in the same /64 subnet, the **ping** is not successful from the bash prompt. A Cisco NX-OS **ping** works fine.

- The binaries in the `/isan` folder are meant to be run in an environment which is set up differently from the environment of the shell that you enter by the **run bash** command. It is advisable not to use these binaries from the Bash shell as the behavior within this environment isn't predictable.
- When importing Cisco Python modules, don't use Python from the Bash shell. Instead use the more recent Python in NX-OS VSH.
- Some processes and **show** commands can cause a large amount of output. If you are running scripts, and need to terminate long-running output, use Ctrl+C (not Ctrl+Z) to terminate the command output. If you use Ctrl+Z, this key command can generate a SIGCONT (signal continuation) message, which can cause the script to halt. Scripts that are halted through SIGCONT messages require user intervention to resume operation.
- If the **show tech support** command is running and you must kill it, don't use the **clear tech-support lock** command. Use Ctrl+C.

  The reason is that **clear tech-support lock** doesn't kill the background VSH session where the actual collection of tech-support information happens. Instead, **clear tech-support lock** command kills only the foreground VSH session where the **show tech support** CLI is called.

  To correctly kill the show tech-support session, use Ctrl+C.

  If you accidentally used **clear tech-support lock**, perform the following steps to kill the background VSH process:

  1. Enter the Bash shell.
  2. Locate the VSH session (**ps -l | more**) for the **show tech support** command.
  3. Kill the PID associated with the VSH for the **show tech support** session, for example, **kill -9** *PID*.

- Beginning with Cisco NX-OS Release 10.3(2)F, the consent token for bash access feature provides support for consent token to enable shell access on NX-OS. However, this feature works only in Trust Anchor Module (TAM) based devices. This feature is supported on all Cisco Nexus 9000 Series platform switches except Cisco Nexus 9808 platform switches. The following limitations are applicable:
  - Write-Erase reload is required to disable this configuration.
  - ISSD is supported only on a release that has the consent token feature.
  - When this configuration is enabled, NX-API/Netconf/Restconf do not work and an error indicating the reason appears.
  - Config-replace is allowed only if the command is present in the new configuration or file.
  - Changing boot-variable, copying running-config startup-config, and reloading the device is not recommended when consent token is enabled.

Enabling Consent Token

To enable the consent token that restricts the Bash access, perform the following command.

system security consent-token shell-access [<*timeout*>] [**force**]

If you do not provide any value to the timeout parameter, then the default value of 5 minutes is considered. The maximum value for the timeout parameter is 2880 minutes, that is, 2 days.

After the command enables the feature, the device will be in the consent-token secure mode, and access to the shell is granted to the user for the time-period specified in the <*timeout*> parameter of this command.

By default, the command is interactive. Use the **force** keyword to enable the consent-token mode forcefully (noninteractive).

Note The **no** form of this command cannot be used to disable the command (for security reason). Hence, to disable this command, perform write-erase-reload on the device.

To verify the status of the consent token feature, use the **show system security consent-token** command.

Accessing Bash

In Cisco NX-OS, Bash is accessible from user accounts that are associated with the Cisco NX-OS dev-ops role or the Cisco NX-OS network-admin role.

The following example shows the authority of the dev-ops role and the network-admin role:

```
switch# show role name dev-ops

Role: dev-ops
  Description: Predefined system role for devops access. This role
  cannot be modified.
  Vlan policy: permit (default)
  Interface policy: permit (default)
  Vrf policy: permit (default)
  ----------------------------------------------------------------------
  Rule    Perm    Type        Scope               Entity
  ----------------------------------------------------------------------
  4       permit  command                         conf t ; username *
  3       permit  command                         bcm module *
  2       permit  command                         run bash *
  1       permit  command                         python *

switch# show role name network-admin

Role: network-admin
  Description: Predefined network admin role has access to all commands
  on the switch
  ----------------------------------------------------------------------
  Rule    Perm    Type        Scope               Entity
  ----------------------------------------------------------------------
  1       permit  read-write
switch#
```

Bash is enabled by running the **feature bash-shell** command.

The **run bash** command loads Bash and begins at the home directory for the user.

The following examples show how to enable the Bash shell feature and how to run Bash.

```
switch# configure terminal
switch(config)# feature bash-shell

switch# run?
  run         Execute/run program
  run-script  Run shell scripts
```

```
switch# run bash?
  bash  Linux-bash

switch# run bash
bash-4.2$ whoami
admin
bash-4.2$ pwd
/bootflash/home/admin
bash-4.2$
```

Note You can also execute Bash commands with **run bash** *command*.

For instance, you can run **whoami** using **run bash** *command*:

```
run bash whoami
```

You can also run Bash by configuring the user **shelltype**:

```
username foo shelltype bash
```

This command puts you directly into the Bash shell upon login. This does not require **feature bash-shell** to be enabled.

Escalate Privileges to Root

The privileges of an admin user can escalate their privileges for root access.

The following are guidelines for escalating privileges:

- admin privilege user (network-admin / vdc-admin) is equivalent of Linux root privilege user in NX-OS
- Only an authenticated admin user can escalate privileges to root, and password is not required for an authenticated admin privilege user *
- Bash must be enabled before escalating privileges.
- SSH to the switch using `root` username through a non-management interface will default to Linux Bash shell-type access for the root user. Type **vsh** to return to NX-OS shell access.

* From Cisco NX-OS Release 9.2(3) onward, if password prompting is required for some use case even for admin (user with role network-admin) privilege user, enter the **system security hardening sudo prompt-password** command.

NX-OS network administrator users must escalate to root to pass configuration commands to the NX-OS VSH if:

- The NX-OS user has a shell-type Bash and logs into the switch with a shell-type Bash.
- The NX-OS user that logged into the switch in Bash continues to use Bash on the switch.

Run **sudo su 'vsh -c "<configuration commands>"'** or **sudo bash -c 'vsh -c "<configuration commands>"'**.

The following example demonstrates with network administrator user MyUser with a default shell type Bash using **sudo** to pass configuration commands to the NX-OS:

```
ssh -l MyUser 1.2.3.4
-bash-4.2$ sudo vsh -c "configure terminal ; interface eth1/2 ; shutdown ; sleep 2 ; show
interface eth1/2 brief"

--------------------------------------------------------------------------------
Ethernet      VLAN    Type Mode   Status  Reason                   Speed     Port
Interface                                                                    Ch #
--------------------------------------------------------------------------------
Eth1/2        --      eth  routed down    Administratively down      auto(D) --
```

The following example demonstrates with network administrator user MyUser with default shell type Bash entering the NX-OS and then running Bash on the NX-OS:

```
ssh -l MyUser 1.2.3.4
-bash-4.2$ vsh -h
Cisco NX-OS Software
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*  the Nexus 9000v Software or Documentation to any third party for any      *
*  purposes is expressly prohibited except as otherwise authorized by     *
*  Cisco in writing.                                                         *
*******************************************************************************
switch# run bash
bash-4.2$ vsh -c "configure terminal ; interface eth1/2 ; shutdown ; sleep 2 ; show interface
 eth1/2 brief"

--------------------------------------------------------------------------------
Ethernet      VLAN    Type Mode   Status  Reason                   Speed     Port
Interface                                                                    Ch #
--------------------------------------------------------------------------------
Eth1/2        --      eth  routed down    Administratively down      auto(D) --
```

Note Do not use **sudo su -** or the system hangs.

The following example shows how to escalate privileges to root and how to verify the escalation:

```
switch# run bash
bash-4.2$ sudo su root
bash-4.2# whoami
root
```

```
bash-4.2# exit
exit
```

Examples of Bash Commands

This section contains examples of Bash commands and output.

Displaying System Statistics

The following example displays system statistics:

```
switch# run bash
bash-4.2$ cat /proc/meminfo
<snip>
MemTotal:       16402560 kB
MemFree:        14098136 kB
Buffers:           11492 kB
Cached:          1287880 kB
SwapCached:            0 kB
Active:          1109448 kB
Inactive:         717036 kB
Active(anon):     817856 kB
Inactive(anon):   702880 kB
Active(file):     291592 kB
Inactive(file):    14156 kB
Unevictable:           0 kB
Mlocked:               0 kB
SwapTotal:             0 kB
SwapFree:              0 kB
Dirty:                32 kB
Writeback:             0 kB
AnonPages:        527088 kB
Mapped:            97832 kB
<\snip>
```

Running Bash from CLI

The following example runs **ps** from Bash using **run bash** *command*:

```
switch# run bash ps -el
F S   UID   PID  PPID  C PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
4 S     0     1     0  0  80   0 -   528 poll_s ?        00:00:03 init
1 S     0     2     0  0  80   0 -     0 kthrea ?        00:00:00 kthreadd
1 S     0     3     2  0  80   0 -     0 run_ks ?        00:00:56 ksoftirqd/0
1 S     0     6     2  0 -40   - -     0 cpu_st ?        00:00:00 migration/0
1 S     0     7     2  0 -40   - -     0 watchd ?        00:00:00 watchdog/0
1 S     0     8     2  0 -40   - -     0 cpu_st ?        00:00:00 migration/1
1 S     0     9     2  0  80   0 -     0 worker ?        00:00:00 kworker/1:0
1 S     0    10     2  0  80   0 -     0 run_ks ?        00:00:00 ksoftirqd/1
```

Managing Feature RPMs

RPM Installation Prerequisites

Use these procedures to verify that the system is ready before installing or adding an RPM.

SUMMARY STEPS

1. switch# **show logging logfile | grep -i "System ready"**
2. switch# **run bash sudo su**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	switch# **show logging logfile	grep -i "System ready"**	Before running Bash, this step verifies that the system is ready before installing or adding an RPM. Proceed if you see output similar to the following: **2018 Mar 27 17:24:22 switch %ASCII-CFG-2-CONF_CONTROL: System ready**

Step 2	switch# **run bash sudo su**
	Example:
	`switch# run bash sudo su`
	`bash-4.2#`
		Loads Bash.

Installing Feature RPMs from Bash

Procedure

	Command or Action	Purpose
Step 1	**sudo dnf installed	grep** *platform*	Displays a list of the NX-OS feature RPMs installed on the switch.
Step 2	**dnf list available**	Displays a list of the available RPMs.
Step 3	**sudo dnf -y install** *rpm*	Installs an available RPM.

Example

The following is an example of installing the **bfd** RPM:

```
bash-4.2$ dnf list installed | grep n9000
base-files.n9000                          3.0.14-r74.2                installed
bfd.lib32_n9000                           1.0.0-r0                    installed
core.lib32_n9000                          1.0.0-r0                    installed
eigrp.lib32_n9000                         1.0.0-r0                    installed
eth.lib32_n9000                           1.0.0-r0                    installed
isis.lib32_n9000                          1.0.0-r0                    installed
lacp.lib32_n9000                          1.0.0-r0                    installed
linecard.lib32_n9000                      1.0.0-r0                    installed
lldp.lib32_n9000                          1.0.0-r0                    installed
ntp.lib32_n9000                           1.0.0-r0                    installed
nxos-ssh.lib32_n9000                      1.0.0-r0                    installed
ospf.lib32_n9000                          1.0.0-r0                    installed
perf-cisco.n9000_gdb                      3.12-r0                     installed
platform.lib32_n9000                      1.0.0-r0                    installed
shadow-securetty.n9000_gdb                4.1.4.3-r1                  installed
snmp.lib32_n9000                          1.0.0-r0                    installed
svi.lib32_n9000                           1.0.0-r0                    installed
sysvinit-inittab.n9000_gdb                2.88dsf-r14                 installed
tacacs.lib32_n9000                        1.0.0-r0                    installed
task-nxos-base.n9000_gdb                  1.0-r0                      installed
tor.lib32_n9000                           1.0.0-r0                    installed
vtp.lib32_n9000                           1.0.0-r0                    installed
bash-4.2$ dnf list available
bgp.lib32_n9000                           1.0.0-r0
bash-4.2$ sudo dnf -y install bfd
```

Note Upon switch reload during boot up, use the **rpm** command instead of **dnf** for persistent RPMs. Otherwise, RPMs initially installed using **dnf bash** or **install cli** shows `reponame` or `filename` instead of `installed`.

Upgrading Feature RPMs

Before you begin

There must be a higher version of the RPM in the dnf repository.

SUMMARY STEPS

1. **sudo dnf -y upgrade***rpm*

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**sudo dnf -y upgrade***rpm*	Upgrades an installed RPM.

Example

The following is an example of upgrading the **bfd** RPM:

```
bash-4.2$ sudo dnf -y upgrade bfd
```

Downgrading a Feature RPM

SUMMARY STEPS

1. **sudo dnf -y downgrade***rpm*

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**sudo dnf -y downgrade***rpm*	Downgrades the RPM if any of the dnf repositories has a lower version of the RPM.

Example

The following example shows how to downgrade the **bfd** RPM:

```
bash-4.2$ sudo dnf -y downgrade bfd
```

Erasing a Feature RPM

Note The SNMP RPM and the NTP RPM are protected and cannot be erased.

You can upgrade or downgrade these RPMs. It requires a system reload for the upgrade or downgrade to take effect.

For the list of protected RPMs, see `/etc/dnf/protected.d/protected_pkgs.conf`.

SUMMARY STEPS

1. **sudo dnf -y erase***rpm*

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**sudo dnf -y erase***rpm*	Erases the RPM.

Example

The following example shows how to erase the **bfd** RPM:

```
bash-4.2$ sudo dnf -y erase bfd
```

Support for DME Modularity

Beginning with NX-OS release 9.3(1), the Cisco NX-OS image supports DME modularity, which interoperates with the switch's RPM manager to enable non-intrusive upgrade or downgrade of DME RPMs. Non-intrusive upgrade or downgrade enables installing RPMs without performing a system restart and prevents disturbing other applications that have their configs in the DME database. DME Modularity enables you to apply model changes to the switch without an ISSU or system reload.

Note After loading the DME RPM, you must restart VSH to enable querying the new MOs.

Beginning with Cisco NX-OS Release 10.3(1)F, DME Infra is supported on the Cisco Nexus 9808 platform switches.

Installing the DME RPMs

By default, the base DME RPM, which is a mandatory upgradeable RPM package, is installed and active when you upgrade to NX-OS release 9.3(1). The DME RPM is installed in the default install directory for RPM files, which is `/rpms`.

If you make code or model changes, you will need to install the DME RPM. To install it, use either the NX-OS RPM manager, which uses the **install** command, or standard RPM tools, such as **dnf**. If you use **dnf**, you will need access to the switch's Bash shell.

Procedure

Step 1 **copy** *path-to-dme-rpm* **bootflash:** [*//sup-#*][*/path*]

Example:

```
switch-1# copy scp://test@10.1.1.1/dme-2.0.1.0-9.3.1.lib32_n9000.rpm bootflash://
switch-1#
```

Copies the DME RPM to bootflash through SCP.

Step 2 Choose any of the following methods to install or upgrade the DME RPM.

To use the NX-OS **install** command:

- **install add** *path-to-dme-rpm* **activate**

  Example:

```
switch-1#install add dme-2.0.1.0-9.3.1.lib32_n9000.rpm activate
Adding the patch (/dme-2.0.1.0-9.3.1.lib32_n9000.rpm)
[####################] 100%
Install operation 90 completed successfully at Fri Jun  7 07:51:58 2019

Activating the patch (/dme-2.0.1.0-9.3.1.lib32_n9000.rpm)
[####################] 100%
Install operation 91 completed successfully at Fri Jun  7 07:52:35 2019
switch-1#
```

- **install add** *path-to-dme-rpm* **activate upgrade**

  Example:

```
switch-1#install add dme-2.0.1.0-9.3.1.lib32_n9000.rpm activate upgrade
Adding the patch (/dme-2.0.1.0-9.3.1.lib32_n9000.rpm)
[####################] 100%
Install operation 87 completed successfully at Fri Jun  7 07:18:55 2019

Activating the patch (/dme-2.0.1.0-9.3.1.lib32_n9000.rpm)
[####################] 100%
Install operation 88 completed successfully at Fri Jun  7 07:19:35 2019
switch-1#
```

- **install add** *path-to-dme-rpm* then **install activate** *path-to-dme-rpm*

  Example:

```
switch-1#install add bootflash:dme-2.0.1.0-9.3.1.lib32_n9000.rpm
[####################] 100%
Install operation 92 completed successfully at Fri Jun  7 09:31:04 2019
switch-1#install activate dme-2.0.1.0-9.3.1.lib32_n9000.rpm
[####################] 100%
Install operation 93 completed successfully at Fri Jun  7 09:31:55 2019
switch-1#
```

To use **dnf install**:

- **dnf install --add** *path-to-dme-rpm*

```
switch-1# dnf install --add bootflash:///dme-2.0.10.0-9.3.1.lib32_n9000.rpm
Loaded plugins: downloadonly, importpubkey, localrpmDB, patchaction, patching,
              : protect-packages
[##################  ] 90%Install operation 96 completed successfully at Fri Jun  7 22:58:50
2019.

[####################] 100%
switch-1#
```

- **dnf install --no-persist --nocommit***path-to-dme-rpm*

  This option requires user intervention, as shown below.

  Example:

```
switch-1# dnf install --no-persist --nocommit dme-2.0.10.0-9.3.1.lib32_n9000
Loaded plugins: downloadonly, importpubkey, localrpmDB, patchaction, patching,
              : protect-packages
```

```
groups-repo                                              | 1.1 kB     00:00 ...
localdb                                                  |  951 B     00:00 ...
localdb/primary                                          | 6.2 kB     00:00 ...
localdb                                                                2/2
patching                                                 |  951 B     00:00 ...
thirdparty                                               |  951 B     00:00 ...
wrl-repo                                                 |  951 B     00:00 ...
Setting up Install Process
Resolving Dependencies
--> Running transaction check
---> Package dme.lib32_n9000 0:2.0.1.0-9.3.1 will be updated
---> Package dme.lib32_n9000 0:2.0.10.0-9.3.1 will be an update
--> Finished Dependency Resolution

Dependencies Resolved

================================================================================
 Package     Arch                Version                  Repository       Size
================================================================================
Updating:
 dme         lib32_n9000         2.0.10.0-9.3.1           localdb          45 M

Transaction Summary
================================================================================
Upgrade       1 Package

Total download size: 45 M
Is this ok [y/N]: y
Retrieving key from file:///etc/pki/rpm-gpg/arm-Nexus9k-dev.gpg
Downloading Packages:
Running Transaction Check
Running Transaction Test
Transaction Test Succeeded
Running Transaction
/bootflash/.rpmstore/config/etc/pki/rpm-gpg/arm-Nexus9k-dev.gpg
System at HA Standby, running transaction on Standby first
  Updating   : dme-2.0.10.0-9.3.1.lib32_n9000                              1/2
starting pre-install package version mgmt for dme
pre-install for dme complete
ln: failed to create symbolic link /var/run/mgmt/sharedmeta-hash: File exists
ln: failed to create symbolic link /var/run/mgmt/dme-objstores.conf: File exists
ln: failed to create symbolic link /var/run/mgmt/samlog.config: File exists
mgmt/
mgmt/shmetafiles/
mgmt/shmetafiles/sharedmeta-ArgMetaData
mgmt/shmetafiles/sharedmeta-RelsMetaData
mgmt/shmetafiles/sharedmeta-ClassRelMetaData
mgmt/shmetafiles/sharedmeta-ChunkMetaData
mgmt/shmetafiles/sharedmeta-ConstPropMetaData
mgmt/shmetafiles/sharedmeta-ConstIdMetaData
mgmt/shmetafiles/sharedmeta-ClassMetaData
mgmt/shmetafiles/sharedmeta-PropRefsMetaData
mgmt/shmetafiles/sharedmeta-SvcMetaData
mgmt/shmetafiles/sharedmeta-ActionContextMetaData
mgmt/shmetafiles/sharedmeta-ConstDefTypeMetaData
mgmt/shmetafiles/sharedmeta-ConstArgMetaData
mgmt/shmetafiles/sharedmeta-ClassNamingMetaData
mgmt/shmetafiles/sharedmeta-ConstMetaData
mgmt/shmetafiles/sharedmeta-PropMetaData
mgmt/shmetafiles/sharedmeta-DnMetaData
  Cleanup    : dme-2.0.1.0-9.3.1.lib32_n9000                               2/2

Updated:
  dme.lib32_n9000 0:2.0.10.0-9.3.1
```

```
Complete!
switch-1#
```

Verifying the Installed RPM

You can verify that the DME RPM is installed by using either the NX-OS **show install** command or **dnf list**.

Procedure

Choose the method:

- For NX-OS:

  show install active

  Example:

```
switch-1# show install active
Boot Image:
        NXOS Image: bootflash:///<boot_image.bin>

Active Packages:
        dme-2.0.1.0-9.3.1.lib32_n9000
switch-1#
```

- For **dnf list**, you must log in to the switch's Bash shell (**run bash**) before issuing the **dnf** commands.

  dnf list --patch-only installed | grep dme

  Example:

```
switch-1# dnf list --patch-only installed | grep dme
dme.lib32_n9000                         2.0.1.0-9.3.1                   @localdb
```

Querying for the RPM in the Local Repo

You can query the on-switch (local) repo to verify that the RPM is present.

Procedure

Step 1 **run bash**

Example:

```
switch-1# run bash
bash-4.3$
```

Logs in to the switch's Bash shell.

Step 2 **ls /bootflash/.rpmstore/patching/localrepo/dme-2.0.1.0-9.3.1.lib32_n9000.rpm**

Example:

```
bash-4.3$ ls /bootflash/.rpmstore/patching/localrepo/dme-2.0.1.0-9.3.1.lib32_n9000.rpm
inactive_feature_rpms.inf
repodata

bash-4.3$
```

When the base DME RPM is installed, it is in `/rpms`.

Downgrading Between Versions of DME RPM

You can downgrade from a higher version of DME RPM to a lower version through either the NX-OS **install** command or **dnf**. By downgrading, you retain the DME Modularity functionality.

The DME RPM is protected, so **install deactivate** and **install remove** are not supported.

Procedure

Choose the downgrade method:

For NX-OS:

- **install add** *path-to-dme-rpm* **activate downgrade**

  Example:

```
switch-1# install add bootflash:dme-2.0.1.0-9.3.1.lib32_n9000.rpm activate downgrade
Adding the patch (/dme-2.0.1.0-9.3.1.lib32_n9000.rpm)
[####################] 100%
Install operation 94 completed successfully at Fri Jun  7 22:48:34 2019

Activating the patch (/dme-2.0.1.0-9.3.1.lib32_n9000.rpm)
[####################] 100%
Install operation 95 completed successfully at Fri Jun  7 22:49:12 2019
switch-1#
```

- **show install active | include dme**

  Example:

```
switch-1# show install active | include dme
        dme-2.0.1.0-9.3.1.lib32_n9000
switch-1#
```

In this example, the DME RPM was downgraded to version 2.0.1.0-9.3.1.

For **dnf**, you must run commands in Bash shell as root user (**run bash sudo su**):

- In Bash, run **dnf downgrade dme** *dme-rpm*.

  This option enables you download directly to a lower version of DME RPM in the repository.

  This option option requires user intervention to complete as highlighted in the following command output.

  Example:

```
bash-4.3# dnf downgrade dme 2.0.1.0-9.3.1
Loaded plugins: downloadonly, importpubkey, localrpmDB, patchaction, patching,
              : protect-packages
Setting up Downgrade Process
groups-repo                                                | 1.1 kB     00:00 ...
localdb                                                    |  951 B     00:00 ...
patching                                                   |  951 B     00:00 ...
thirdparty                                                 |  951 B     00:00 ...
wrl-repo                                                   |  951 B     00:00 ...
Resolving Dependencies
--> Running transaction check
---> Package dme.lib32_n9000 0:2.0.1.0-9.3.1 will be a downgrade
---> Package dme.lib32_n9000 0:2.0.10.0-9.3.1 will be erased
--> Finished Dependency Resolution

Dependencies Resolved
================================================================================
 Package     Arch                Version                   Repository       Size
================================================================================
Downgrading:
 dme         lib32_n9000         2.0.10.0-9.3.1            localdb          45 M

Transaction Summary
================================================================================
Downgrade     1 Package

Total download size: 45 M
Is this ok [y/N]: y
Retrieving key from file:///etc/pki/rpm-gpg/arm-Nexus9k-dev.gpg
Downloading Packages:
Running Transaction Check
Running Transaction Test
Transaction Test Succeeded
Running Transaction
/bootflash/.rpmstore/config/etc/pki/rpm-gpg/arm-Nexus9k-dev.gpg
System at HA Standby, running transaction on Standby first
  Installing : dme-2.0.1.0-9.3.1.lib32_n9000                                1/2
starting pre-install package version mgmt for dme
pre-install for dme complete
ln: failed to create symbolic link /var/run/mgmt/sharedmeta-hash: File exists
ln: failed to create symbolic link /var/run/mgmt/dme-objstores.conf: File exists
ln: failed to create symbolic link /var/run/mgmt/samlog.config: File exists
mgmt/
mgmt/shmetafiles/
mgmt/shmetafiles/sharedmeta-ArgMetaData
mgmt/shmetafiles/sharedmeta-RelsMetaData
mgmt/shmetafiles/sharedmeta-ClassRelMetaData
mgmt/shmetafiles/sharedmeta-ChunkMetaData
mgmt/shmetafiles/sharedmeta-ConstPropMetaData
mgmt/shmetafiles/sharedmeta-ConstIdMetaData
mgmt/shmetafiles/sharedmeta-ClassMetaData
mgmt/shmetafiles/sharedmeta-PropRefsMetaData
mgmt/shmetafiles/sharedmeta-SvcMetaData
mgmt/shmetafiles/sharedmeta-ActionContextMetaData
mgmt/shmetafiles/sharedmeta-ConstDefTypeMetaData
mgmt/shmetafiles/sharedmeta-ConstArgMetaData
mgmt/shmetafiles/sharedmeta-ClassNamingMetaData
mgmt/shmetafiles/sharedmeta-ConstMetaData
mgmt/shmetafiles/sharedmeta-PropMetaData
mgmt/shmetafiles/sharedmeta-DnMetaData
  Cleanup    : dme-2.0.10.0-9.3.1.lib32_n9000                               2/2

Removed:
  dme.lib32_n9000 0:2.0.10.0-9.3.1
```

```
Installed:
  dme.lib32_n9000 0:2.0.1.0-9.3.1

Complete!
```

Downgrades from one version of DME RPM to a lower version. In this example, version 2.0.10.0-9.3.1 is downgraded to version 2.0.1.0-9.3.1.

- **dnf list --patch-only installed | grep dme**

  Example:

```
bash-4.3# dnf list --patch-only installed | grep dme
dme.lib32_n9000                         2.0.1.0-9.3.1               @groups-repo
bash-4.3#
```

  Displays the installed version of DME RPM.

Downgrading to the Base RPM

You can downgrade from a higher version of the DME RPM to the base DME RPM by either installing the base DME RPM through the NX-OS **install** command or using **dnf downgrade**.

Procedure

Choose the downgrade method:

For NX-OS:

- **install activate** *dme-rpm*

  Example:

```
switch-1# install activate dme-2.0.0.0-9.2.1.lib32_n9000.rpm
[####################] 100%
Install operation 89 completed successfully at Fri Jun  7 07:21:45 2019
switch-1#
```

- **show install active | dme**

  Example:

```
switch-1# show install active | include dme
        dme-2.0.0.0-9.2.1.lib32_n9000
switch-1#
```

For **dnf**, you must run commands in Bash shell as root user (**run bash sudo su**):

- In Bash, run **dnf downgrade dme** *dme-rpm*.

  This option enables downgrading directly to the base DME RPM.

  This option requires user intervention to complete as highlighted in the following command output.

  Example:

```
bash-4.3# dnf downgrade dme-2.0.0.0-9.3.1.lib32_n9000
Loaded plugins: downloadonly, importpubkey, localrpmDB, patchaction, patching,
              : protect-packages
Setting up Downgrade Process
groups-repo                                              | 1.1 kB     00:00 ...
localdb                                                  |  951 B     00:00 ...
patching                                                 |  951 B     00:00 ...
thirdparty                                               |  951 B     00:00 ...
wrl-repo                                                 |  951 B     00:00 ...
Resolving Dependencies
--> Running transaction check
---> Package dme.lib32_n9000 0:2.0.0.0-9.3.1 will be a downgrade
---> Package dme.lib32_n9000 0:2.0.10.0-9.3.1 will be erased
--> Finished Dependency Resolution

Dependencies Resolved

================================================================================
Package    Arch               Version                 Repository          Size
================================================================================
Downgrading:
dme        lib32_n9000        2.0.0.0-9.3.1           groups-repo         44 M

Transaction Summary
================================================================================
Downgrade     1 Package

Total download size: 44 M
Is this ok [y/N]: y
Downloading Packages:
Running Transaction Check
Running Transaction Test
Transaction Test Succeeded
Running Transaction
  Installing : dme-2.0.0.0-9.3.1.lib32_n9000                               1/2
starting pre-install package version mgmt for dme
pre-install for dme complete
mgmt/
mgmt/shmetafiles/
mgmt/shmetafiles/sharedmeta-ChunkMetaData
mgmt/shmetafiles/sharedmeta-ClassMetaData
mgmt/shmetafiles/sharedmeta-ArgMetaData
mgmt/shmetafiles/sharedmeta-ConstMetaData
mgmt/shmetafiles/sharedmeta-ConstIdMetaData
mgmt/shmetafiles/sharedmeta-ConstDefTypeMetaData
mgmt/shmetafiles/sharedmeta-ConstPropMetaData
mgmt/shmetafiles/sharedmeta-ConstArgMetaData
mgmt/shmetafiles/sharedmeta-ClassRelMetaData
mgmt/shmetafiles/sharedmeta-DnMetaData
mgmt/shmetafiles/sharedmeta-PropRefsMetaData
mgmt/shmetafiles/sharedmeta-PropMetaData
mgmt/shmetafiles/sharedmeta-RelsMetaData
mgmt/shmetafiles/sharedmeta-ActionContextMetaData
mgmt/shmetafiles/sharedmeta-SvcMetaData
mgmt/shmetafiles/sharedmeta-ClassNamingMetaData
  Cleanup    : dme-2.0.10.0-9.3.1.lib32_n9000                              2/2

Removed:
  dme.lib32_n9000 0:2.0.10.0-9.3.1

Installed:
  dme.lib32_n9000 0:2.0.0.0-9.3.1
```

```
Complete!
bash-4.3#
```

Installs the base DME RPM.

- **dnf list --patch-only installed | grep dme**

  Example:

```
bash-4.3# dnf list --patch-only installed | grep dme
dme.lib32_n9000                         2.0.0.0-9.3.1                @groups-repo
bash-4.3#
```

  Displays the installed base DME RPM.

Managing Patch RPMs

RPM Installation Prerequisites

Use these procedures to verify that the system is ready before installing or adding an RPM.

SUMMARY STEPS

1. switch# **show logging logfile | grep -i "System ready"**
2. switch# **run bash sudo su**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	switch# **show logging logfile | grep -i "System ready"**	Before running Bash, this step verifies that the system is ready before installing or adding an RPM. Proceed if you see output similar to the following: **2018 Mar 27 17:24:22 switch %ASCII-CFG-2-CONF_CONTROL: System ready**

Step 2	switch# **run bash sudo su**
	Example:
	`switch# run bash sudo su`
	`bash-4.2#`
		Loads Bash.

Adding Patch RPMs from Bash

Procedure

	Command or Action	Purpose
Step 1	**dnf list --patch-only**	Displays a list of the patch RPMs present on the switch.
Step 2	**sudo dnf install --add** *URL_of_patch*	Adds the patch to the repository, where *URL_of_patch* is a well-defined format, such as **bootflash:/*patch***, not in standard Linux format, such as **/bootflash/*patch***.
Step 3	**dnf list --patch-only available**	Displays a list of the patches that are added to the repository but are in an inactive state.

Example

The following is an example of installing the **nxos.CSCab00001-n9k_ALL-1.0.0-7.0.3.I7.3.lib32_n9000** RPM:

```
bash-4.2# dnf list --patch-only
Loaded plugins: downloadonly, importpubkey, localrpmDB, patchaction, patching,
              : protect-packages
groups-repo                                              | 1.1 kB     00:00 ...
localdb                                                  |  951 B     00:00 ...
patching                                                 |  951 B     00:00 ...
thirdparty                                               |  951 B     00:00 ...
bash-4.2#
bash-4.2# sudo dnf install --add
bootflash:/nxos.CSCab00001-n9k_ALL-1.0.0-7.0.3.I7.3.lib32_n9000.rpm
Loaded plugins: downloadonly, importpubkey, localrpmDB, patchaction, patching,
              : protect-packages
groups-repo                                                | 1.1 kB     00:00 ...
localdb                                                    |  951 B     00:00 ...
patching                                                   |  951 B     00:00 ...
thirdparty                                                 |  951 B     00:00 ...
[###############     ] 70%Install operation 135 completed successfully at Tue Mar 27 17:45:34
 2018.

[####################] 100%
bash-4.2#
```

Once the patch RPM is installed, verify that it was installed properly. The following command lists the patches that are added to the repository and are in the inactive state:

```
bash-4.2# dnf list --patch-only available
Loaded plugins: downloadonly, importpubkey, localrpmDB, patchaction, patching,
              : protect-packages
groups-repo                                                | 1.1 kB     00:00 ...
localdb                                                    |  951 B     00:00 ...
patching                                                   |  951 B     00:00 ...
thirdparty                                                 |  951 B     00:00 ...
nxos.CSCab00001-n9k_ALL.lib32_n9000    1.0.0-7.0.3.I7.3    patching
bash-4.2#
```

You can also add patches to a repository from a tar file, where the RPMs are bundled in the tar file. The following example shows how to add two RPMs that are part of the nxos.CSCab00002_CSCab00003-n9k_ALL-1.0.0-7.0.3.I7.3.lib32_n9000 tar file to the patch repository:

```
bash-4.2# sudo dnf install --add
bootflash:/nxos.CSCab00002_CSCab00003-n9k_ALL-1.0.0-7.0.3.I7.3.lib32_n9000.tar
Loaded plugins: downloadonly, importpubkey, localrpmDB, patchaction, patching,
              : protect-packages
groups-repo                                                | 1.1 kB     00:00 ...
localdb                                                    |  951 B     00:00 ...
patching                                                   |  951 B     00:00 ...
thirdparty                                                 |  951 B     00:00 ...
[###############     ] 70%Install operation 146 completed successfully at Tue Mar 27 21:17:39
 2018.

[####################] 100%
bash-4.2#
bash-4.2# dnf list --patch-only
Loaded plugins: downloadonly, importpubkey, localrpmDB, patchaction, patching,
              : protect-packages
groups-repo                                                | 1.1 kB     00:00 ...
localdb                                                    |  951 B     00:00 ...
patching                                                   |  951 B     00:00 ...
patching/primary                                           |  942 B     00:00 ...
patching                                                                     2/2
thirdparty                                                 |  951 B     00:00 ...
nxos.CSCab00003-n9k_ALL.lib32_n9000    1.0.0-7.0.3.I7.3    patching
nxos.CSCab00002-n9k_ALL.lib32_n9000    1.0.0-7.0.3.I7.3    patching
bash-4.2#
```

Activating a Patch RPM

Before you begin

Verify that you have added the necessary patch RPM to the repository using the instructions in #unique_68.

Procedure

	Command or Action	Purpose
Step 1	**sudo dnf install** *patch_RPM* **--nocommit**	Activates the patch RPM, where *patch_RPM* is a patch that is located in the repository. Do not provide a location for the patch in this step. **Note** Adding the --nocommit flag to the command means that the patch RPM is activated in this step, but not committed. See Committing a Patch RPM, on page 22 for instructions on committing the patch RPM after you have activated it.

Example

The following example shows how to activate the **nxos.CSCab00001-n9k_ALL-1.0.0-7.0.3.I7.3.lib32_n9000** patch RPM:

```
bash-4.2# sudo dnf install nxos.CSCab00001-n9k_ALL-1.0.0-7.0.3.I7.3.lib32_n9000 --nocommit
Loaded plugins: downloadonly, importpubkey, localrpmDB, patchaction, patching,
              : protect-packages
groups-repo                                                | 1.1 kB     00:00 ...
localdb                                                    |  951 B     00:00 ...
patching                                                   |  951 B     00:00 ...
thirdparty                                                 |  951 B     00:00 ...
Setting up Install Process
Resolving Dependencies
--> Running transaction check
---> Package nxos.CSCab00001-n9k_ALL.lib32_n9000 0:1.0.0-7.0.3.I7.3 will be installed
--> Finished Dependency Resolution

Dependencies Resolved

================================================================================
 Package                    Arch           Version               Repository   Size
================================================================================
Installing:
 nxos.CSCab00001-n9k_ALL    lib32_n9000    1.0.0-7.0.3.I7.3      patching     28 k

Transaction Summary
================================================================================
Install       1 Package

Total download size: 28 k
Installed size: 82 k
Is this ok [y/N]: y
Downloading Packages:
Running Transaction Check
Running Transaction Test
Transaction Test Succeeded
Running Transaction
  Installing : nxos.CSCab00001-n9k_ALL-1.0.0-7.0.3.I7.3.lib32_n9000            1/1
[##################  ] 90%error: reading
/var/sysmgr/tmp/patches/CSCab00001-n9k_ALL/isan/bin/sysinfo manifest, non-printable characters
 found

Installed:
  nxos.CSCab00001-n9k_ALL.lib32_n9000 0:1.0.0-7.0.3.I7.3

Complete!
Install operation 140 completed successfully at Tue Mar 27 18:07:40 2018.

[####################] 100%
bash-4.2#
```

Enter the following command to verify that the patch RPM was activated successfully:

```
bash-4.2# dnf list --patch-only
Loaded plugins: downloadonly, importpubkey, localrpmDB, patchaction, patching,
              : protect-packages
groups-repo                                                | 1.1 kB     00:00 ...
localdb                                                    |  951 B     00:00 ...
patching                                                   |  951 B     00:00 ...
thirdparty                                                 |  951 B     00:00 ...
```

```
nxos.CSCab00001-n9k_ALL.lib32_n9000    1.0.0-7.0.3.I7.3    installed
bash-4.2#
```

Committing a Patch RPM

Procedure

	Command or Action	Purpose
Step 1	**sudo dnf install** *patch_RPM* **--commit**	Commits the patch RPM. The patch RPM must be committed to keep it active after reloads.

Example

The following example shows how to commit the **nxos.CSCab00001-n9k_ALL-1.0.0-7.0.3.I7.3.lib32_n9000** patch RPM:

```
bash-4.2# sudo dnf install nxos.CSCab00001-n9k_ALL-1.0.0-7.0.3.I7.3.lib32_n9000 --commit
Loaded plugins: downloadonly, importpubkey, localrpmDB, patchaction, patching,
              : protect-packages
groups-repo                                                | 1.1 kB     00:00 ...
localdb                                                    |  951 B     00:00 ...
patching                                                   |  951 B     00:00 ...
thirdparty                                                 |  951 B     00:00 ...
Install operation 142 completed successfully at Tue Mar 27 18:13:16 2018.

[####################] 100%
bash-4.2#
```

Enter the following command to verify that the patch RPM was committed successfully:

```
bash-4.2# dnf list --patch-only committed
Loaded plugins: downloadonly, importpubkey, localrpmDB, patchaction, patching,
              : protect-packages
groups-repo                                                | 1.1 kB     00:00 ...
localdb                                                    |  951 B     00:00 ...
patching                                                   |  951 B     00:00 ...
thirdparty                                                 |  951 B     00:00 ...
nxos.CSCab00001-n9k_ALL.lib32_n9000    1.0.0-7.0.3.I7.3    installed
bash-4.2#
```

Deactivating a Patch RPM

Procedure

	Command or Action	Purpose
Step 1	**sudo dnf erase** *patch_RPM* **--nocommit**	Deactivates the patch RPM. **Note** Adding the --nocommit flag to the command means that the patch RPM is only deactivated in this step.

	Command or Action	Purpose
Step 2	**sudo dnf install** *patch_RPM* **--commit**	Commits the patch RPM. You will get an error message if you try to remove the patch RPM without first committing it.

Example

The following example shows how to deactivate the **nxos.CSCab00001-n9k_ALL-1.0.0-7.0.3.I7.3.lib32_n9000** patch RPM:

```
bash-4.2# sudo dnf erase nxos.CSCab00001-n9k_ALL-1.0.0-7.0.3.I7.3.lib32_n9000 --nocommit
Loaded plugins: downloadonly, importpubkey, localrpmDB, patchaction, patching,
              : protect-packages
Setting up Remove Process
Resolving Dependencies
--> Running transaction check
---> Package nxos.CSCab00001-n9k_ALL.lib32_n9000 0:1.0.0-7.0.3.I7.3 will be erased
--> Finished Dependency Resolution

Dependencies Resolved

================================================================================
 Package                    Arch           Version              Repository    Size
================================================================================
Removing:
 nxos.CSCab00001-n9k_ALL    lib32_n9000    1.0.0-7.0.3.I7.3     @patching     82 k

Transaction Summary
================================================================================
Remove        1 Package

Installed size: 82 k
Is this ok [y/N]: y
Downloading Packages:
Running Transaction Check
Running Transaction Test
Transaction Test Succeeded
Running Transaction
[######              ] 30%error: reading
/var/sysmgr/tmp/patches/CSCab00001-n9k_ALL/isan/bin/sysinfo manifest, non-printable characters
 found
  Erasing    : nxos.CSCab00001-n9k_ALL-1.0.0-7.0.3.I7.3.lib32_n9000            1/1
[##################  ] 90%
Removed:
  nxos.CSCab00001-n9k_ALL.lib32_n9000 0:1.0.0-7.0.3.I7.3

Complete!
Install operation 143 completed successfully at Tue Mar 27 21:03:47 2018.

[####################] 100%
bash-4.2#
```

You must commit the patch RPM after deactivating it. If you do not commit the patch RPM after deactivating it, you will get an error message if you try to remove the patch RPM using the instructions in Removing a Patch RPM, on page 24.

```
bash-4.2# sudo dnf install nxos.CSCab00001-n9k_ALL-1.0.0-7.0.3.I7.3.lib32_n9000 --commit
Loaded plugins: downloadonly, importpubkey, localrpmDB, patchaction, patching,
              : protect-packages
```

```
groups-repo                                                     | 1.1 kB     00:00 ...
localdb                                                         |  951 B     00:00 ...
patching                                                        |  951 B     00:00 ...
thirdparty                                                      |  951 B     00:00 ...
Install operation 144 completed successfully at Tue Mar 27 21:09:28 2018.

[####################] 100%
bash-4.2#
```

Enter the following command to verify that the patch RPM has been committed successfully:

```
bash-4.2# dnf list --patch-only
Loaded plugins: downloadonly, importpubkey, localrpmDB, patchaction, patching,
              : protect-packages
groups-repo                                                     | 1.1 kB     00:00 ...
localdb                                                         |  951 B     00:00 ...
patching                                                        |  951 B     00:00 ...
thirdparty                                                      |  951 B     00:00 ...
nxos.CSCab00001-n9k_ALL.lib32_n9000    1.0.0-7.0.3.I7.3    patching
bash-4.2#
```

Removing a Patch RPM

Procedure

	Command or Action	Purpose
Step 1	**sudo dnf install --remove** *patch_RPM*	Removes an inactive patch RPM.

Example

The following example shows how to remove the **nxos.CSCab00001-n9k_ALL-1.0.0-7.0.3.I7.3.lib32_n9000** patch RPM:

```
bash-4.2# sudo dnf install --remove nxos.CSCab00001-n9k_ALL-1.0.0-7.0.3.I7.3.lib32_n9000
Loaded plugins: downloadonly, importpubkey, localrpmDB, patchaction, patching,
              : protect-packages
groups-repo                                                     | 1.1 kB     00:00 ...
localdb                                                         |  951 B     00:00 ...
patching                                                        |  951 B     00:00 ...
thirdparty                                                      |  951 B     00:00 ...
[##########          ] 50%Install operation 145 completed successfully at Tue Mar 27 21:11:05
 2018.

[####################] 100%
bash-4.2#
```

Note If you see the following error message after attempting to remove the patch RPM:

Install operation 11 "failed because patch was not committed". at Wed Mar 28 22:14:05 2018

Then you did not commit the patch RPM before attempting to remove it. See Deactivating a Patch RPM, on page 22 for instructions on committing the patch RPM before attempting to remove it.

Enter the following command to verify that the inactive patch RPM was removed successfully:

```
bash-4.2# dnf list --patch-only
Loaded plugins: downloadonly, importpubkey, localrpmDB, patchaction, patching,
              : protect-packages
groups-repo                                                | 1.1 kB     00:00 ...
localdb                                                    |  951 B     00:00 ...
patching                                                   |  951 B     00:00 ...
patching/primary                                           |  197 B     00:00 ...
thirdparty                                                 |  951 B     00:00 ...
bash-4.2#
```

Persistently Daemonizing an SDK- or ISO-built Third Party Process

Your application should have a startup Bash script that gets installed in `/etc/init.d/`*`application_name`*. This startup Bash script should have the following general format (for more information on this format, see http://linux.die.net/man/8/chkconfig).

```
#!/bin/bash
#
# <application_name> Short description of your application
#
# chkconfig: 2345 15 85
# description: Short description of your application
#
### BEGIN INIT INFO
# Provides: <application_name>
# Required-Start: $local_fs $remote_fs $network $named
# Required-Stop: $local_fs $remote_fs $network
# Description: Short description of your application
### END INIT INFO
# See how we were called.
case "$1" in
start)
# Put your startup commands here
# Set RETVAL to 0 for success, non-0 for failure
;;
stop)
# Put your stop commands here
# Set RETVAL to 0 for success, non-0 for failure
;;
status)
# Put your status commands here
# Set RETVAL to 0 for success, non-0 for failure
;;
restart|force-reload|reload)
# Put your restart commands here
# Set RETVAL to 0 for success, non-0 for failure
;;
*)
echo $"Usage: $prog {start|stop|status|restart|force-reload}"
RETVAL=2
esac

exit $RETVAL
```

Persistently Starting Your Application from the Native Bash Shell

Procedure

Step 1 Install your application startup Bash script that you created into `/etc/init.d/`*application_name*

Step 2 Start your application with `/etc/init.d/`*application_name* start

Step 3 Enter **chkconfig --add** *application_name*

Step 4 Enter **chkconfig --level 3** *application_name* **on**

Run level 3 is the standard multi-user run level, and the level at which the switch normally runs.

Step 5 Verify that your application is scheduled to run on level 3 by running **chkconfig --list** *application_name* and confirm that level 3 is set to on

Step 6 Verify that your application is listed in `/etc/rc3.d`. You should see something like this, where there is an 'S' followed by a number, followed by your application name (`tcollector` in this example), and a link to your Bash startup script in `../init.d/`*application_name*

bash-4.2# ls -l /etc/rc3.d/**tcollector**

lrwxrwxrwx 1 root root 20 Sep 25 22:56 /etc/rc3.d/S15tcollector -> ../init.d/tcollector

bash-4.2#

Synchronize Files from Active Bootflash to Standby Bootflash

Cisco Nexus 9500 platform switches are generally configured with two supervisor modules to provide high availability (one active supervisor module and one standby supervisor module). Each supervisor module has its own bootflash file system for file storage, and the Active and Standby bootflash file systems are generally independent of each other. If there is a need for specific content on the active bootflash, that same content is probably also needed on the standby bootflash in case there is a switchover at some point.

Before the Cisco NX-OS 9.2(2) release, you had to manually manage this content between the Active and Standby supervisor modules. Starting with Cisco NX-OS 9.2(2), certain files and directories on the active supervisor module, or active bootflash (`/bootflash`), can be automatically synchronized to the standby supervisor module, or standby bootflash (`/bootflash_sup-remote`), if the standby supervisor module is up and available. You can select the files and directories to be synchronized by loading Bash on your switch, then adding the files and directories that you would like to have synchronized from the active bootflash to the standby bootflash into the editable file `/bootflash/bootflash_sync_list`.

For example:

```
switch# run bash
bash-4.2# echo "/bootflash/home/admin" | sudo tee --append /bootflash/bootflash_sync_list
bash-4.2# echo "/bootflash/nxos.7.0.3.I7.3.5.bin" | sudo tee --append
/bootflash/bootflash_sync_list
bash-4.2# cat /bootflash/bootflash_sync_list
```

```
/bootflash/home/admin
/bootflash/nxos.7.0.3.I7.3.5.bin
```

When changes are made to the files or directories on the active bootflash, these changes are automatically synchronized to standby bootflash, if the standby bootflash is up and available. If the standby bootflash is rebooted, either as a regular boot, switchover or manual standby reload, a catch-up synchronization of changes to the active bootflash is pushed out to the standby bootflash, once the standby supervisor comes online.

Following are the characteristics and restrictions for the editable `/bootflash/bootflash_sync_list` file:

- The `/bootflash/bootflash_sync_list` file is automatically created on the first run and is empty at that initial creation state.
- Entries in the `/bootflash/bootflash_sync_list` file follow these guidelines:
  - One entry per line
  - Entries are given as Linux paths (for example, `/bootflash/img.bin`)
  - Entries must be within the `/bootflash` file system
- The `/bootflash/bootflash_sync_list` file itself is automatically synchronized to the standby bootflash. You can also manually copy the `/bootflash/bootflash_sync_list` file to or from the supervisor module using the **copy** virtual shell (VSH) command.
- You can edit the `/bootflash/bootflash_sync_list` file directly on the supervisor module with the following command:

  run bash vi /bootflash/bootflash_sync_list

All output from the synchronization event is redirected to the log file `/var/tmp/bootflash_sync.log`. You can view or tail this log file using either of the following commands:

run bash less /var/tmp/bootflash_sync.log

run bash tail -f /var/tmp/bootflash_sync.log

The synchronization script will not delete files from the standby bootflash directories unless it explicitly receives a delete event for the corresponding file on the active bootflash directories. Sometimes, the standby bootflash might have more used space than the active bootflash, which results in the standby bootflash running out of space when the active bootflash is synchronizing to it. To make the standby bootflash an exact mirror of the active bootflash (to delete any extra files on the standby bootflash), enter the following command:

run bash sudo rsync -a --delete /bootflash/ /bootflash_sup-remote/

The synchronization script should continue to run in the background without crashing or exiting. However, if it does stop running for some reason, you can manually restart it using the following command:

run bash sudo /isan/etc/rc.d/rc.isan-start/S98bootflash_sync.sh start

Copy Through Kstack

In Cisco NX-OS release 9.3(1) and later, file copy operations have the option of running through a different network stack by using the **use-kstack** option. Copying files through **use-kstack** enables faster copy times. This option can be beneficial when copying files from remote servers that are multiple hops from the switch. The **use-kstack** option work with copying files from, and to, the switch though standard file copy features, such as **scp** and **sftp.**

Note The **use-kstack** option does not work when the switch is running the FIPS mode feature. If the switch has FIPS mode that is enabled, the copy operation is still successful, but through the default copy method.

To copy through **use-kstack**, append the argument to the end of an NX-OS **copy** command. Some examples:

```
switch-1# copy scp://test@10.1.1.1/image.bin . vrf management use-kstack
switch-1#
switch-1# copy scp://test@10.1.1.1/image.bin bootflash:// vrf management
use-kstack
switch-1#
switch-1# copy scp://test@10.1.1.1/image.bin . use-kstack
switch-1#
switch-1# copy scp://test@10.1.1.1/image.bin bootflash:// vrf default
use-kstack
switch-1#
```

The **use-kstack** option is supported for all NX-OS **copy** commands and file systems. The option is OpenSSL (Secure Copy) certified.

An Example Application in the Native Bash Shell

The following example demonstrates an application in the Native Bash Shell:

```
bash-4.2# cat /etc/init.d/hello.sh
#!/bin/bash

PIDFILE=/tmp/hello.pid
OUTPUTFILE=/tmp/hello

echo $$ > $PIDFILE
rm -f $OUTPUTFILE
while true
do
    echo $(date) >> $OUTPUTFILE
    echo 'Hello World' >> $OUTPUTFILE
    sleep 10
done
bash-4.2#
bash-4.2#
bash-4.2# cat /etc/init.d/hello
#!/bin/bash
#
# hello Trivial "hello world" example Third Party App
#
# chkconfig: 2345 15 85
```

```
# description: Trivial example Third Party App
#
### BEGIN INIT INFO
# Provides: hello
# Required-Start: $local_fs $remote_fs $network $named
# Required-Stop: $local_fs $remote_fs $network
# Description: Trivial example Third Party App
### END INIT INFO

PIDFILE=/tmp/hello.pid

# See how we were called.
case "$1" in
start)
    /etc/init.d/hello.sh &
    RETVAL=$?
;;
stop)
    kill -9 `cat $PIDFILE`
    RETVAL=$?
;;
status)
    ps -p `cat $PIDFILE`
    RETVAL=$?
;;
restart|force-reload|reload)
    kill -9 `cat $PIDFILE`
    /etc/init.d/hello.sh &
    RETVAL=$?
;;
*)
echo $"Usage: $prog {start|stop|status|restart|force-reload}"
RETVAL=2
esac

exit $RETVAL
bash-4.2#
bash-4.2# chkconfig --add hello
bash-4.2# chkconfig --level 3 hello on
bash-4.2# chkconfig --list hello
hello           0:off   1:off   2:on    3:on    4:on    5:on    6:off
bash-4.2# ls -al /etc/rc3.d/*hello*
lrwxrwxrwx 1 root root 15 Sep 27 18:00 /etc/rc3.d/S15hello -> ../init.d/hello
bash-4.2#
bash-4.2# reboot
```

After reload

```
bash-4.2# ps -ef | grep hello
root      8790     1  0 18:03 ?        00:00:00 /bin/bash /etc/init.d/hello.sh
root      8973  8775  0 18:04 ttyS0    00:00:00 grep hello
bash-4.2#
bash-4.2# ls -al /tmp/hello*
-rw-rw-rw- 1 root root 205 Sep 27 18:04 /tmp/hello
-rw-rw-rw- 1 root root   5 Sep 27 18:03 /tmp/hello.pid
bash-4.2# cat /tmp/hello.pid
8790
bash-4.2# cat /tmp/hello
Sun Sep 27 18:03:49 UTC 2015
Hello World
Sun Sep 27 18:03:59 UTC 2015
Hello World
Sun Sep 27 18:04:09 UTC 2015
Hello World
Sun Sep 27 18:04:19 UTC 2015
```

```
Hello World
Sun Sep 27 18:04:29 UTC 2015
Hello World
Sun Sep 27 18:04:39 UTC 2015
Hello World
bash-4.2#
```