



# Bash

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## About Bash

In addition to the NX-OS CLI, Cisco Nexus 3600 devices 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:

- The binaries located in the `/isan` folder are meant to be run in an environment which is setup differently from that of the shell entered from the **run bash** command. It is advisable not to use these binaries from the Bash shell as the behavior within this environment is not predictable.

## 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.

# Escalate Privileges to Root

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

The following are guidelines for escalating privileges:

- Only an admin user can escalate privileges to root.
- Bash must be enabled before escalating privileges.
- Escalation to root is password protected.
- 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.

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 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 example below demonstrates with network administrator user MyUser with a default shelltype 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 example below demonstrates with network administrator user MyUser with default shelltype 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
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```

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*****
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
-----
Eth1/2        --        eth  routed down  Administratively down                auto(D) --

```

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
```

## Running Python from Bash

The following example shows how to load Python and configure a switch using Python objects:

```
switch# run bash
bash-4.2$ python
Python 2.7.5 (default, Oct 8 2013, 23:59:43)
[GCC 4.7.2] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>> from cisco import *
>>> from cisco.vrf import *
>>> from cisco.interface import *
>>> vrfobj=VRF('myvrf')
>>> vrfobj.get_name()
'myvrf'
>>> vrfobj.add_interface('Ethernet1/3')
True
>>> intf=Interface('Ethernet1/3')
>>> print intf.config()

!Command: show running-config interface Ethernet1/3
!Time: Mon Nov 4 13:17:56 2013

version 6.1(2)I2(1)

interface Ethernet1/3
  vrf member myvrf

>>>
```

# Managing RPMs

## Installing RPMs from Bash

### Procedure

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

### Example

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

```
bash-4.2$ sudo yum list installed | grep n3600
base-files.n3600                3.0.14-r74.2                installed
bfd.lib32_n3600                1.0.0-r0                    installed
core.lib32_n3600               1.0.0-r0                    installed
eigrp.lib32_n3600              1.0.0-r0                    installed
eth.lib32_n3600                1.0.0-r0                    installed
isis.lib32_n3600               1.0.0-r0                    installed
lACP.lib32_n3600               1.0.0-r0                    installed
linecard.lib32_n3600           1.0.0-r0                    installed
lldp.lib32_n3600               1.0.0-r0                    installed
ntp.lib32_n3600                1.0.0-r0                    installed
nxos-ssh.lib32_n3600           1.0.0-r0                    installed
ospf.lib32_n3600               1.0.0-r0                    installed
perf-cisco.n3600_gdb           3.12-r0                     installed
platform.lib32_n3600           1.0.0-r0                    installed
shadow-securetty.n3600_gdb     4.1.4.3-r1                  installed
snmp.lib32_n3600               1.0.0-r0                    installed
svi.lib32_n3600                1.0.0-r0                    installed
sysvinit-inittab.n3600_gdb     2.88dsf-r14                 installed
tacacs.lib32_n3600             1.0.0-r0                    installed
task-nxos-base.n3600_gdb       1.0-r0                       installed
tor.lib32_n3600                1.0.0-r0                    installed
vtp.lib32_n3600                1.0.0-r0                    installed
bash-4.2$ sudo yum list available
bgp.lib32_n3600                 1.0.0-r0
bash-4.2$ sudo yum -y install bfd
```



#### Note

Upon switch reload during boot up, use the **rpm** command instead of **yum** for persistent RPMs. Otherwise, RPMs initially installed using **yum bash** or **install CLI** will show **reponame** or **filename** instead of **installed**.

## Upgrading RPMs

### Before you begin

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

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<code>sudo yum -y upgrade rpm</code>	Upgrades an installed RPM.

### Example

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

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

## Downgrading an RPM

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<code>sudo yum -y downgrade rpm</code>	Downgrades the RPM if any of the Yum repositories has a lower version of the RPM.

### Example

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

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

## Erasing an 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/yum/protected.d/protected_pkgs.conf`.

**Procedure**

	Command or Action	Purpose
<b>Step 1</b>	<code>sudo yum -y erase rpm</code>	Erases the RPM.

**Example**

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

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

## 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 above 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#
```

## 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#
```

