

CLI Reference Guide for ArubaOS-CX, ArubaOS-Switch, and Cisco IOS

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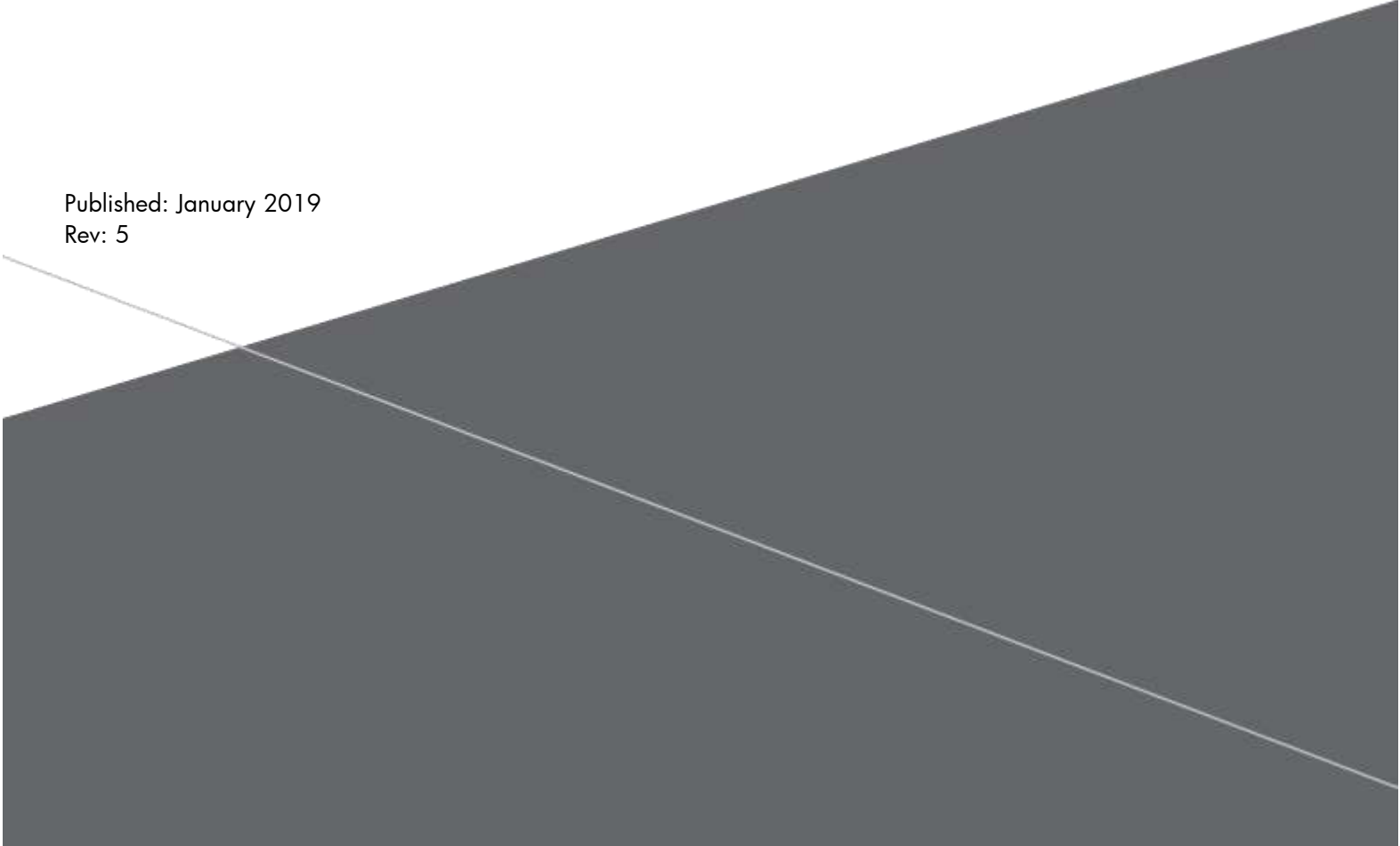


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CLI Reference Guide for ArubaOS-CX, ArubaOS-Switch and Cisco IOS

Introduction

Aruba designed this CLI Reference Guide to help Hewlett Packard Enterprise partners and customers who:

- Manage multi-vendor networks that include HPE/Aruba and Cisco core and aggregation switches
- Have experience deploying Cisco switches and are now deploying HPE/Aruba switches

This CLI Reference Guide compares many of the common commands in three switch operating systems: ArubaOS-CX, ArubaOS-switch and Cisco IOS.

In this guide, we refer to 8400 as ArubaOS-CX, HPE ProVision as ArubaOS-Switch, and Cisco IOS is referenced as Cisco.

The ArubaOS-CX operating system runs on the 8400, 8320 and 8325 switches. The ArubaOS-switch operating system runs on Aruba 2530, Aruba 2920, Aruba 2930F, Aruba 2930M, Aruba 3810M, Aruba 5400R, HPE 2620, HPE 3500, HPE 5400 and HPE 3800 switch platforms.

The commands included in this guide were tested on the following:

- Aruba 8400 – 8 slot chassis with dual management modules running ArubaOS-CX 10.01.0001
- Aruba 3810M-24G-PoE+ switch running ArubaOS-Switch KB.16.03.0003
- Cisco switch running Cisco IOS Software 15.0(1)SE

Additional Aruba and Cisco switches and/or routers were used to provide systems connectivity and operational support as necessary. Likewise, various computers and Voice over IP (VoIP) phones were used to help test functionality and provide output for commands such as **show** or **display**.

Using This Guide

This CLI Reference Guide provides CLI command comparisons in two different formats:

- Side-by-side comparison—Provides a table of the basic commands required to execute a given function in each of the operating systems. In this side-by-side comparison, each platform's commands do not always start at the top of the column. Instead, commands that have similar functions are aligned side by side so that you can easily “translate” the commands on one platform with similar commands on another platform.
- Detailed comparison—Beneath the side-by-side comparison, this guide provides a more in-depth comparison, displaying the output of the command and its options.

Occasionally, the commands required to execute a function or feature in each operating system are completely different. In these instances, each column has the commands necessary to implement the specific function or feature, and the side-by-side comparison does not apply.

Navigation Differences Among CLIs

Basic CLI navigation on all three platforms is very similar, with one notable difference:

- With ArubaOS-CX switches, you can use the **Tab** key for command completion; but you use the **?** key to find more command options. Using tab key also displays the further suboptions without the help description.
- With ArubaOS-Switch, you can use the **Tab** key for command completion; you can also use the **Tab** key or the **?** key to find more command options. In addition, typing “help” at the end of a command may provide additional descriptive information about the command.
- With Cisco, you can use the **Tab** key for command completion, but you use the **?** key to find more command options.

Configuration Differences Among CLIs

For interface IP addressing and interface-specific routing protocol configuration, you execute most commands differently depending on the platform:

- On ArubaOS-CX, you configure the aforementioned components in an interface (VLAN for switch) context. An Interface context can act as layer 3 after assigning an IP address converting it to a Switch Virtual Interface (SVI) of switch ports. There is no physical interface for the VLAN and the SVI provides the Layer 3 processing for packets from all switch ports associated with the VLAN. There is a one-to-one mapping between a VLAN and SVI, thus only a single SVI can be mapped to a VLAN.
- On ArubaOS-Switch, you configure the aforementioned components in a VLAN context. A virtual LAN (VLAN) is any broadcast domain that is partitioned and isolated in a computer network at the data link layer (OSI layer 2). VLANs can keep network applications separate despite being connected to the same physical network, and without requiring multiple sets of cabling and networking devices to be deployed.
- On Cisco, you configure the aforementioned components in an interface (VLAN for switch) context.

Terminology Differences

Among the three operating systems, there are some differences in the terms used to describe features. The table below lists three such terms that could be confusing.

In ArubaOS-CX Switches and Cisco, for example, the term *trunk* refers to an interface that you configure to support 802.1Q VLAN tagged frames. That is, an interface that you configure to support multiple VLANs is a *trunk* interface in each VLAN. In the ArubaOS-Switch operating system, an interface that supports multiple VLANs is a *tagged* interface in each VLAN.

In addition, ArubaOS-CX-Switch refers to aggregated interfaces as a Link Aggregation Group (LAG). ArubaOS-Switch refers to aggregated interfaces as a trunk.

Interface use	ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
Non-802.1Q interfaces (such as used for computers or printers)	access	untagged	access
802.1Q interfaces (such as used for switch-to-switch, switch-to-server, and switch-to-VoIP phones)	trunk	tagged	trunk
Aggregated interfaces	lag	trunk	Etherchannel/ Port-Channel
Hybrid port	N/A	hybrid (default)	N/A

Disclaimer

Although Aruba conducted extensive testing to create this guide, it is impossible to test every possible configuration and scenario. Do not assume, therefore, that this document is complete for every environment or each manufacturer's complete product portfolio and software versions. For complete and detailed information on all commands and their options, refer to each manufacturer's documentation accordingly.

Comparing View and Configuration Prompts

The table below compares the differences in each system's display for view and configuration prompts.

Context Legend	ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
U = User Exec / User View	ArubaOS-CX-Switch>	ArubaOS-Switch>	Cisco>
P = Privileged Exec	ArubaOS-CX-Switch#	ArubaOS-Switch#	Cisco#
C = Configuration S = System View	ArubaOS-CX-Switch(config)#	ArubaOS-Switch(config)#	Cisco(config)#

Comparing Frequently Used Commands

The table below lists frequently used commands for each operating system.

	ArubaOS-CX-Switch		ArubaOS-Switch		Cisco
Configuration commands					
C	hostname	C	hostname	C	hostname
C	logging	C	logging	C	logging
C	Not supported	C	router rip	C	router rip
C	access-list	C	access-list	C	access-list
User Exec / Privileged Exec Commands					
U	enable	U	enable	U	enable
P	configure	P	configure	U	configure terminal
U/P	Show images	U/P/C	show flash	U/P	show flash
U/P	show version	U/P/C	show version	U/P	show version
P	show run	P/C	show run	P	show run
U/P	show vlan	P/C	show vlan	P	show vlan
P	show history	U/P/C	show history	U/P	show history
U/P	show events	U/P/C	show logging	U/P	show logging
U/P	show ip route	U/P/C	show ip route	U/P	show ip route
U/P	show ip interface brief	U/P/C	show ip	U/P	show ip interface brief
U/P	show interface brief	U/P/C	show interface brief	U/P	show interfaces status
P	erase startup-config	P/C	erase startup-config	P	erase start
U/P	show checkpoint <checkpoint-name>	P/C	show config <filename>	P	more flash: /<filename>
P	boot system	P/C	reload	P	reload
P	write memory	P/C	write memory	P	write memory
U/P	show tech	P	show tech	U/P	show tech-support
U/P	show	U/P/C	show	U/P	show
U/P/C	no	U/P/C	no	P	no
P/C	end	C	end	C	end
U/P/C	exit	U/P/C	exit	U/P/C	exit
P	erase	P/C	erase	P	erase
P	copy	P/C	copy	P	copy
P	Traceroute6	P/C	Traceroute6	P	Traceroute6
P	traceroute	P/C	traceroute	P	traceroute
P/C	ping / do ping	P/C	ping	P	ping

Chapter 1 Basic Switch Management

This chapter compares commands primarily used for device navigation, device information, and device management.

- Management access
- Configuration and Virtual Terminal access
- Console access
- Reload & Timed reload
- USB
- System and environment
- Remote management sessions (viewing and terminating)
- Tech support output
- Motd
- Source interface for management communications

Management Access CLI comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
ArubaOS-CX-Switch> enable	ArubaOS-Switch> enable	Cisco> enable
ArubaOS-CX-Switch#	ArubaOS-Switch#	Cisco#

Management Access Configurable options

ArubaOS-CX-Switch
ArubaOS-CX-Switch> enable
ArubaOS-CX-Switch#
ArubaOS-Switch
ArubaOS-Switch> enable
ArubaOS-Switch#
Cisco
Cisco> enable
Cisco#

Configuration Access CLI comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
ArubaOS-CX-Switch# configure	ArubaOS-Switch# configure	Cisco# configure terminal Enter configuration commands, one per line. End with CNTL/Z.
ArubaOS-CX-Switch(config)#	ArubaOS-Switch(config)#	Cisco(config)#

Configuration Access Configurable options

ArubaOS-CX-Switch
ArubaOS-CX-Switch# configure ? terminal Optional keyword of the configure command. <cr> ArubaOS-CX-Switch# configure ArubaOS-CX-Switch(config)#
ArubaOS-Switch
ArubaOS-Switch# configure ? terminal Optional keyword of the configure command. <cr> ArubaOS-Switch# configure ArubaOS-Switch(config)#
Cisco
Cisco# configure ? confirm Confirm replacement of running-config with a new config file memory Configure from NV memory network Configure from a TFTP network host overwrite-network Overwrite NV memory from TFTP network host replace Replace the running-config with a new config file revert Parameters for reverting the configuration terminal Configure from the terminal <cr> Cisco#configure terminal Enter configuration commands, one per line. End with CNTL/Z. Cisco(config)#

Console and Virtual Terminal Access—Timeout CLI comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
Configuration commands		
session-timeout 0	console inactivity-timer	line console 0
		exec-timeout
		line vty 0
		exec-timeout
Note: session works for ssh sessions as well.	Note: console inactivity-timer works for telnet and ssh sessions as well.	

Console and Virtual Terminal Access—Timeout Configurable options

ArubaOS-CX-Switch
<pre>ArubaOS-CX-Switch(config)# session-timeout ? <0-43200> Idle timeout range in minutes. Value 0 disables the timeout (30 is the default configuration setting) ArubaOS-CX-Switch(config)# session-timeout 120 ArubaOS-CX-switch(config)#</pre> Note: session-timeout works for ssh sessions as well.
ArubaOS-Switch
<pre>ArubaOS-Switch(config)# console inactivity-timer ? <0-120> Enter an integer number. (0 is the default configuration setting) ArubaOS-Switch(config)# console inactivity-timer 120 ArubaOS-Switch(config)#</pre> Note: console inactivity-timer works for telnet and ssh sessions as well.

Cisco
<pre>Cisco(config)#line console 0 Cisco(config-line)#exec-timeout ? <0-35791> Timeout in minutes (10 is the default configuration setting) Cisco(config-line)#exec-timeout 20 ? <0-2147483> Timeout in seconds (0 is the default configuration setting) Cisco(config-line)#exec-timeout 20 10 Cisco(config-line)#</pre>

[also]

```
Cisco(config)#line vty 0
```

```
Cisco(config-line)#exec-timeout 20 10
```

Reload & Timed Reload CLI comparision

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
boot system	reload	reload
boot system '?' <i>Displays further sub-options to boot the system</i>	reload	
show boot-history show boot-history all		show reload
	show reload	

Reload & Timed Reload Configurable options

ArubaOS-CX-Switch
<pre> ArubaOS-CX-Switch# boot set-default primary Set the default boot image to primary for future reboots secondary Set the default boot image to secondary for future reboots ArubaOS-CX-Switch# boot fabric-module SLOT-ID The slot ID of the fabric module (e.g., 1/1) ArubaOS-CX-Switch# boot line-module SLOT-ID The slot ID of the line module (e.g., 1/1) ArubaOS-CX-Switch# boot management-module SLOT_ID Reboot a management module by slot number (e.g. 1/5) active Reboot the active management module standby Reboot the standby management module ArubaOS-CX-Switch# boot system primary Reboot the system to the primary image secondary Reboot the system to the secondary image serviceos Reboot both MMs to ServiceOS <cr> ArubaOS-CX-Switch# boot system primary <cr> ArubaOS-CX-Switch# boot system primary Default boot image set to primary. Do you want to save the current configuration (y/n)? y The running configuration was saved to the startup configuration. This will reboot the entire switch and render it unavailable until the process is complete. Continue (y/n)? y The system is going down for reboot. ArubaOS-CX-Switch# boot system primary Reboot the system to the primary image secondary Reboot the system to the secondary image serviceos Reboot both MMs to ServiceOS <cr> ArubaOS-CX-Switch# boot system secondary issu Perform an in service system upgrade to the secondary image <cr> </pre>

```
ArubaOS-CX-Switch# boot system secondary
Default boot image set to secondary.
```

```
Do you want to save the current configuration (y/n)? y
The running configuration was saved to the startup configuration.
```

```
This will reboot the entire switch and render it unavailable
until the process is complete.
Continue (y/n)? y
The system is going down for reboot.
```

ArubaOS-Switch

```
ArubaOS-Switch# reload
System will be rebooted from primary image. Do you want to continue [y/n]?
```

[for timed reboot]

```
ArubaOS-Switch# reload ?
after          Warm reboot in a specified amount of time.
at             Warm reboot at a specified time; If the mm/dd/yy is left blank,
               the current day is assumed.
<cr>
```

```
ArubaOS-Switch# reload at ?
HH:MM[:SS]     Time on given date to do a warm reboot.
```

```
ArubaOS-Switch# reload at 23:00 ?
MM/DD[/[YY]YY] Date on which a warm reboot is to occur.
<cr>
```

```
ArubaOS-Switch# reload at 23:00 03/04/2015 ?
<cr>
```

```
ArubaOS-Switch# reload at 23:00 03/04/2015
Reload scheduled at 23:00:13 03/04/2015
                (in 0 days, 23 hours, 12 minutes)
System will be rebooted at the scheduled time from primary image.
Do you want to continue [y/n]? y
ArubaOS-Switch#
```

-or-

```
ArubaOS-Switch# reload after
[[DD:]HH:]MM   Enter a time.
```

```
ArubaOS-Switch# show reload ?
after          Shows the time until a warm reboot is scheduled.
at             Shows the time and date a warm reboot is scheduled.
```

```
ArubaOS-Switch# show reload after
Reload scheduled for 23:00:57 03/04/2015
                (in 0 days, 23 hours, 9 minutes)
```

```
ArubaOS-Switch(config)# no reload
```

```
ArubaOS-Switch(config)# show reload after
reload is not scheduled
```

Cisco

```
Cisco#reload
Proceed with reload? [confirm]
```

[for timed reboot]

```
Cisco#reload ?
/noverify  Don't verify file signature before reload.
/verify    Verify file signature before reload.
LINE      Reason for reload
at         Reload at a specific time/date
cancel     Cancel pending reload
in         Reload after a time interval
slot       Slot number card
standby-cpu Standby RP
<cr>
```

```
Cisco#reload at ?
hh:mm      Time to reload (hh:mm)
```

```
Cisco#reload at 23:00 ?
<1-31>     Day of the month
LINE       Reason for reload
MONTH      Month of the year
<cr>
```

```
Cisco#reload at 23:00 march ?
<1-31>     Day of the month
```

```
Cisco#reload at 23:00 march 5 ?
LINE       Reason for reload
<cr>
```

```
Cisco#reload at 23:00 march 5
```

```
System configuration has been modified. Save? [yes/no]: y
```

```
Building configuration...
```

```
[OK]
```

```
Reload scheduled for 23:00:00 central Thu Mar 5 2015 (in 22 hours and 16 minutes) by console
```

```
Proceed with reload? [confirm]
```

```
Cisco#
```

```
Mar  5 06:43:40.282: %SYS-5-SCHEDULED_RELOAD: Reload requested for 23:00:00 central Thu Mar 5 2015 at 00:43:27 central Thu Mar 5 2015 by console.
```

```
Cisco#
```

-or-

```
Cisco#reload in ?
Delay before reload (mmm or hhh:mm)
```

```
Cisco#reload in 23:10 ?
LINE       Reason for reload
<cr>
```

```
Cisco#show reload
```

```
Reload scheduled for 23:00:00 central Thu Mar 5 2015 (in 22 hours and 15 minutes) by console
```

```
Cisco#reload cancel
```

```
Cisco#
```

```

***
*** --- SHUTDOWN ABORTED ---
***

Mar  5 06:45:38.016: %SYS-5-SCHEDULED_RELOAD_CANCELLED:  Scheduled reload cancelled at
00:45:38 central Thu Mar 5 2015

```

USB CLI comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
	dir	dir usb
usb usb mount		
copy usb: /<filename> primary	copy usb flash <filename> primary	copy run usbflash0:test.cfg
show usb	show usb-port	

USB CLI comparison Configurable options

ArubaOS-CX-Switch
<pre> ArubaOS-CX-Switch# usb mount Make an inserted USB drive available unmount Make an inserted USB drive unavailable to prepare for removal ArubaOS-CX-Switch(config)#usb mount ArubaOS-CX-Switch# sh usb Enabled: Yes Mounted: No </pre>
ArubaOS-Switch
<pre> ArubaOS-Switch# dir ? PATHNAME-STR Display a list of the files and subdirectories in a directory on a USB device. <cr> ArubaOS-Switch# dir Listing Directory /ufa0: -rwxrwxrwx 1 16719093 Nov 19 15:21 K_15_16_0005.swi -rwxrwxrwx 1 16208437 Sep 11 19:10 K_15_15_0008.swi -rwxrwxrwx 1 849 Mar 03 17:52 ArubaOS-Switch-config.cfg ArubaOS-Switch# show usb-port USB port status: enabled USB port power status: power on (USB device detected in port) </pre>
Cisco
<pre> Cisco# dir usbflash0: Directory of usbflash0:/ 1 ---- 0 Feb 4 2015 07:21:52 +00:00 System Volume Information 2 -rw- 36326184 Feb 4 2015 08:07:24 +00:00 c1841-adventerprisek9-mz.124- 15.T17.bin </pre>


```

1000062976 bytes total (963723264 bytes free)
Cisco#copy run usbflash0:test.cfg
Destination filename [test.cfg]?

1419 bytes copied in 1.556 secs (912 bytes/sec)

```

System and Environment CLI comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
show system <i>Or abbreviations also works like:</i> sh sys	show system information show modules	show inventory show version
show environment fan	show system fans	show env fan
show system resource-utilization	show system power-supply	show env power
show environment led	show system temperature	show env temperature
show system error-counter-monitor		
show environment power-supply	Show running-config v3-specific	

System and Environment Configurable options

ArubaOS-CX-Switch
<pre> ArubaOS-CX-Switch# show system error-counter-monitor Monitor error counters resource-utilization Utilization metrics of various system resources <cr> ArubaOS-CX-Switch# show system Hostname : System Description : System Contact : System Location : Vendor : Aruba Product Name : 8400 Base Cbl Mgr X462 Bndl Chassis Serial Nbr : SG78K2G00G Base MAC Address : 94:f1:28:1e:65:00 ArubaOS-CX Version : XL.10.00.0002C-1-g1b84ef2 Time Zone : UTC Up Time : up 39 minutes CPU Util (%) : 10 Memory Usage (%) : 3 ArubaOS-CX-Switch# show system resource-utilization System Resources: Processes: 179 CPU usage(%): 10 </pre>

Memory usage(%): 3
Open FD's: 3808

Process	CPU Usage(%)	Memory Usage(%)	Open FD's
-----	-----	-----	-----
kworker/5:0H	0	0	0
portd	0	0	12
kworker/1:2	0	0	0
kworker/2:0H	0	0	0
hpe-powerd	0	0	13
vrfmgrd	0	0	11
kworker/5:1	0	0	0
hpe-cardd	0	0	25
hpe-buttond	0	0	11
hpe-udldd	0	0	12
hpe-dnsclient	0	0	9
hpe-mgmdd	0	0	12
hpe-logd	0	0	14
kworker/2:1H	0	0	0
crond	0	0	6
ksoftirqd/1	0	0	0
kworker/6:0	0	0	0
hpe-pspod	0	0	10
xcopy_wq	0	0	0
ops-classifierd	0	0	10
kworker/7:0	0	0	0
migration/3	0	0	0
rsyslogd	0	0	9
hpe-rdntmgmt	0	0	17
ops-switchd	0	1	127
jbd2/sda4-8	0	0	0
kswapd0	0	0	0
kworker/5:1H	0	0	0
l2macd	0	0	10
hpe-hw_monitor	0	0	11
kdevtmpfs	0	0	0
hpe-vrrpd	0	0	11
ksoftirqd/7	0	0	0
lag1	0	0	0
ntpd	0	0	20
kworker/6:0H	0	0	0
hpe-logsyncd	0	0	12
acpi_thermal_pm	0	0	0
hpe-kfibapp	0	0	11
ksoftirqd/3	0	0	0
ops-sysd	0	0	10
kworker/4:2	0	0	0
hpe-mstpd	0	0	11
bond0	0	0	0
dune_agent_9	0	0	72
lldpd	0	0	24
hpe-tsdbd	0	0	8
jbd2/sda5-8	0	0	0
systemd-resolve	0	0	17
scsi_eh_0	0	0	0
writeback	0	0	0
lacpd	0	0	12
kworker/3:2	0	0	0
kworker/5:0	0	0	0
kworker/0:0H	0	0	0
dune_agent_8	0	0	72
ksoftirqd/2	0	0	0

hpe-entityd	0	0	10
kworker/1:0H	0	0	0
perf	0	0	0
kworker/3:0H	0	0	0
hpe-rdiscd	0	0	13
ksoftirqd/0	0	0	0
kworker/0:2	0	0	0
kworker/4:0H	0	0	0
hpe-relay	0	0	10
hpe-restd	0	0	10
(sd-pam)	0	0	7
systemd-udevd	0	0	14
hpe-mclagkad	0	0	13
kworker/1:1	0	0	0
nfsiod	0	0	0
crash-handler	0	0	9
rcu_bh	0	0	0
hpe-tempd	0	0	11
kworker/2:0	0	0	0
login	0	0	5
kworker/u16:0	0	0	0
hpe-isp	0	0	8
systemd-journal	0	0	10
kauditd	0	0	0
kworker/2:1	0	0	0
systemd	0	0	14
chronyd	0	0	11
scsi_tmf_2	0	0	0
kworker/4:1	0	0	0
ksoftirqd/5	0	0	0
kworker/7:1	0	0	0
kworker/0:3	0	0	0
ksoftirqd/6	0	0	0
kblockd	0	0	0
migration/7	0	0	0
hpe-policyd	0	0	8
hpe-sshd	0	0	7
deferwq	0	0	0
jbd2/sda3-8	0	0	0
scsi_tmf_5	0	0	0
intfd	0	0	11
migration/0	0	0	0
ksoftirqd/4	0	0	0
hpe-mclagd	0	0	29
migration/2	0	0	0
migration/5	0	0	0
scsi_eh_4	0	0	0
rcu_sched	0	0	0
mcelog	0	0	5
kworker/4:1H	0	0	0
kworker/7:0H	0	0	0
snmpd_wrapper	0	0	8
bioset	0	0	0
kworker/4:0	0	0	0
hpe-profiled	0	0	10
lsyncd	0	0	4
kworker/6:2	0	0	0
scsi_tmf_3	0	0	0
ipv6_addrconf	0	0	0
scsi_tmf_1	0	0	0
tmr-rd_mcp	0	0	0
scsi_eh_2	0	0	0
kworker/3:0	0	0	0

hpe-fand	0	0	12
migration/6	0	0	0
vland	0	0	10
crypto	0	0	0
rpciod	0	0	0
migration/4	0	0	0
migration/1	0	0	0
rcu_preempt	5	0	0
fsnotify_mark	0	0	0
hpe-mgmtmd	0	0	18
hpe-mgmtmd	0	0	15
nginx	0	0	16
scsi_eh_3	0	0	0
ext4-rsv-conver	0	0	0
hpe-config	0	0	7
hpe-repld	0	0	10
hpe-pvstd	0	0	12
hpe-lpd	0	0	14
ops-ledd	0	0	12
prometheus	0	0	24
hpe-routing	5	0	43
scsi_eh_5	0	0	0
hpe-sysmond	0	0	11
smartd	0	0	3
systemd-logind	0	0	12
ovsdb-server	0	0	91
pimd	0	0	16
vttysh	0	0	14
jbd2/sda2-8	0	0	0
pmd	0	0	36
dbus-daemon	0	0	14
aautilspamcfg	0	0	9
kworker/4:3	0	0	0
kworker/6:1H	0	0	0
hpe-cpurx-filte	0	0	10
acpid	0	0	6
scsi_eh_1	0	0	0
kworker/5:2	0	0	0
netns	0	0	0
kworker/6:1	0	0	0
kworker/0:1H	0	0	0
kworker/u16:4	0	0	0
kworker/7:2	0	0	0
kworker/2:2	0	0	0
hpe-ledarbd	0	0	10
target_completi	0	0	0
bridge_normal	0	0	0
scsi_tmf_0	0	0	0
kworker/3:1	0	0	0
arpngrd	0	0	13
hpe-credmgr	0	0	13
kthreadd	0	0	0
vmstat	0	0	0
auditd	0	0	8
scsi_tmf_4	0	0	0
kworker/u16:5	0	0	0
hpe-mvrpd	0	0	11
kworker/1:1H	0	0	0
mtmd	0	0	12
ArubaOS-CX-Switch# show system error-counter-monitor			
[IFNAME] physical interface name			
<cr>			

```
ArubaOS-CX-Switch# show system error-counter-monitor
Counter monitoring poll is disabled
```

```
ArubaOS-CX-Switch# show environment
fan          Show system fan status information
led          Show locator LED information
power-consumption Show module power consumption information
power-supply Power supply information
rear-display-module Show rear display module information
temperature  Show temperature sensor information
<cr>
```

```
ArubaOS-CX-Switch# show environment fan
Fan tray information
```

Mbr/Tray	Description	Status	Serial Number	Fans
1/1	JL369A Aruba X731 Fan Tray	ready	SG78K2800R	6
1/2	JL369A Aruba X731 Fan Tray	ready	SG78K2806M	6
1/3	JL369A Aruba X731 Fan Tray	ready	SG78K2807K	6

```
Fan information
```

Mbr/Tray/Fan	Serial Number	Speed	Direction	Status	RPM
1/1/1	SG77K290FY	slow	front-to-back	ok	5957
1/1/2	SG77K29140	slow	front-to-back	ok	6003
1/1/3	SG77K290GY	slow	front-to-back	ok	5994
1/1/4	SG77K29127	slow	front-to-back	ok	5975
1/1/5	SG77K29139	slow	front-to-back	ok	6021
1/1/6	SG77K290JK	slow	front-to-back	ok	5985
1/2/1	SG77K290TX	slow	front-to-back	ok	5966
1/2/2	SG77K291CG	slow	front-to-back	ok	5975
1/2/3	SG77K290H4	slow	front-to-back	ok	5966
1/2/4	SG77K290TV	slow	front-to-back	ok	5957
1/2/5	SG77K291RJ	slow	front-to-back	ok	6003
1/2/6	SG77K290ZV	slow	front-to-back	ok	5966
1/3/1	SG77K291T8	slow	front-to-back	ok	6003
1/3/2	SG77K291TB	slow	front-to-back	ok	5994
1/3/3	SG77K290QF	slow	front-to-back	ok	6012
1/3/4	SG77K291SY	slow	front-to-back	ok	5966
1/3/5	SG77K2918L	slow	front-to-back	ok	5966
1/3/6	SG77K291VN	slow	front-to-back	ok	5966

```
ArubaOS-CX-Switch# show environment led
Name      State      Status
```

```
locator    off        ok
```

```
ArubaOS-CX-Switch# show environment power-consumption
```

Name	Type	Description	Power Usage
1/5	management-module	JL368A 8400 Mgmt Mod	49
1/6	management-module	JL368A 8400 Mgmt Mod	49
1/1	line-card-module	JL363A 8400X 32P 10G SFP/SFP+ Msec Mod	137
1/2	line-card-module	N/A N/A	0
1/3	line-card-module	N/A N/A	0
1/4	line-card-module	N/A N/A	0
1/7	line-card-module	N/A N/A	0
1/8	line-card-module	N/A N/A	0
1/9	line-card-module	N/A N/A	0
1/10	line-card-module	N/A N/A	0
1/1	fabric-card-module	JL367A 8400X 7.2Tbps Fab Mod	94

1/2	fabric-card-module	JL367A	8400X 7.2Tbps Fab Mod	96
1/3	fabric-card-module	N/A	N/A	0
Module Total Power Usage				425
Chassis Total Power Usage				516
Chassis Total Power Available				2700
Chassis Total Power Allocated (total of all max wattages)				1560
Chassis Total Power Unallocated				1140

Aruba OS-Switch

```
ArubaOS-Switch# show system ?
chassislocate      Show information about the Locator LED.
fans               Show system fan status.
information         Show global configured and operational system parameters.If
                  stacking is enabled it shows system information of all the stack
                  members.
power-consumption  Show switch blade power consumption information.
power-supply       Show Chassis Power Supply info and settings.If stacking is
                  enabled, shows power supply info and settings of all the stack
                  members.
temperature        Show current temperature sensor information.
<cr>
```

```
ArubaOS-Switch# show system information

Status and Counters - General System Information

System Name       : ArubaOS-Switch
System Contact    :
System Location   :

MAC Age Time (sec) : 300

Time Zone        : -360
Daylight Time Rule : Continental-US-and-Canada

Software revision : KA.15.16.0005      Base MAC Addr   : 009c02-d53980
ROM Version      : KA.15.09           Serial Number   : xxxxxxxxxxxx

Up Time          : 34 mins             Memory  - Total  : 795,353,088
CPU Util (%)     : 0                  Free      : 665,924,808

IP Mgmt  - Pkts Rx : 199              Packet  - Total  : 6750
          Pkts Tx  : 220              Buffers  Free   : 4830
                                   Lowest   : 4810
                                   Missed    : 0
```

```
ArubaOS-Switch# show modules
Status and Counters - Module Information

Chassis: 3800-24G-PoE+-2SFP+  J9573A      Serial Number:  xxxxxxxxxxxx
```

Slot	Module Description	Serial Number	Status
-----	-----	-----	-----

```
ArubaOS-Switch# show system fans
```

Fan Information

Num	State	Failures
Fan-1	Fan OK	0
Fan-2	Fan OK	0
Fan-3	Fan OK	0
Fan-4	Fan OK	0

0 / 4 Fans in Failure State

0 / 4 Fans have been in Failure State

```
ArubaOS-Switch# show system power-supply
```

Power Supply Status:

PS#	Model	State	AC/DC + V	Wattage	Max
1	J9580A	Powered	AC 120V/240V	71	1000
2	Unknwn	Not Present		0	0

1 / 2 supply bays delivering power.

Currently supplying 71 W / 1000 W total power.

```
ArubaOS-Switch# show system temperature
```

System Air Temperature

Temp	Current	Max	Min		
Sensor	Temp	Temp	Temp	Threshold	OverTemp
Chassis	28C	28C	0C	55C	NO

Cisco

```
Cisco#show inventory
```

NAME: "1", DESCR: "WS-C3750E-24TD"

PID: WS-C3750E-24TD-S , VID: V02 , SN: xxxxxxxxxxxx

NAME: "Switch 1 - Power Supply 0", DESCR: "FRU Power Supply"

PID: C3K-PWR-265WAC , VID: V01Q , SN: xxxxxxxxxxxx

```
Cisco#show version
```

Cisco IOS Software, C3750E Software (C3750E-UNIVERSALK9-M), Version 15.0(1)SE, RELEASE SOFTWARE (fc1)

...

Cisco uptime is 1 hour, 9 minutes

System returned to ROM by power-on

System restarted at 23:56:02 central Wed Mar 4 2015

System image file is "flash:c3750e-universalk9-mz.150-1.SE.bin"

...

cisco WS-C3750E-24TD (PowerPC405) processor (revision F0) with 262144K bytes of memory.

Processor board ID FD01231V0US

Last reset from power-on

1 Virtual Ethernet interface

1 FastEthernet interface

28 Gigabit Ethernet interfaces

2 Ten Gigabit Ethernet interfaces

The password-recovery mechanism is enabled.

512K bytes of flash-simulated non-volatile configuration memory.

Base ethernet MAC Address : 00:22:91:AB:43:80
Motherboard assembly number : 73-10313-11
Motherboard serial number : xxxxxxxxxxxx
Model revision number : F0
Motherboard revision number : A0
Model number : WS-C3750E-24TD-S
Daughterboard assembly number : 800-28590-01
Daughterboard serial number : xxxxxxxxxxxx
System serial number : xxxxxxxxxxxx
Top Assembly Part Number : 800-27546-03
Top Assembly Revision Number : A0
Version ID : V02
CLEI Code Number : xxxxxxxxxxxx
Hardware Board Revision Number : 0x01

Switch	Ports	Model	SW Version	SW Image
-----	-----	-----	-----	-----
*	1 30	WS-C3750E-24TD	15.0(1) SE	C3750E-UNIVERSALK9-M

Cisco#sh env ?

all Show all environment status
fan Show fan status
power Show power supply status
rps Show RPS status
stack Show Stack-wide all environment status
temperature Show temperature status
xps Show XPS status

Cisco#show env fan

FAN is OK

Cisco#sh env power ?

all All power supplies
switch Switch number
| Output modifiers

<cr>

Cisco#show env power

SW	PID	Serial#	Status	Sys Pwr	PoE Pwr	Watts
---	-----	-----	-----	-----	-----	-----
1	C3K-PWR-265WAC	xxxxxxxxxxx	OK	Good	N/A	265/0

Cisco#show env temperature ?

status Show Temperature status and threshold values
| Output modifiers
<cr>

Cisco#show env temperature

SYSTEM TEMPERATURE is OK

Remote Management Sessions—Viewing CLI comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
show user information	show telnet	show users

Remote Management Sessions—Viewing CLI Configurable options

ArubaOS-CX-Switch
<pre>ArubaOS-CX-Switch# show user WORD Specify the username. Maximum length is 32 characters. information Show information about logged in user ArubaOS-CX-Switch# sh user information Username : admin Authentication type : local User group : administrators User privilege level : 15</pre>
ArubaOS-Switch
<pre>ArubaOS-Switch# show telnet ? <cr> ArubaOS-Switch# show telnet Telnet Activity Source IP Selection: Outgoing Interface ----- Session : ** 1 Privilege: Manager From : Console To : ----- Session : 2 Privilege: Manager From : 10.0.100.87 To : ----- Session : 3 Privilege: Manager From : 10.0.100.84 To :</pre>

Cisco
<pre>Cisco#show users ? all Include information about inactive ports wide use wide format Output modifiers <cr> Cisco#show users</pre>
<pre>Line User Host(s) Idle Location * 0 con 0 manager idle 00:00:00 1 vty 0 manager idle 00:08:29 10.0.100.84 2 vty 1 manager idle 00:00:44 10.0.100.87</pre>
<pre>Interface User Mode Idle Peer Address</pre>

```
Cisco#show users wide ?
|   Output modifiers
<cr>
```

```
Cisco#show users wide

Line      User      Host(s)      Idle      Location
*  0 con 0    manager    idle        00:00:00
  1 vty 0    manager    idle        00:00:09  10.0.100.84
  2 vty 1    manager    idle        00:05:37  10.0.100.87
  3 vty 2
  4 vty 3
  5 vty 4
  6 vty 5
  7 vty 6
  8 vty 7
  9 vty 8
 10 vty 9
 11 vty 10
 12 vty 11
 13 vty 12
 14 vty 13
 15 vty 14
 16 vty 15
Idle        00:00:00
```

Interface	User	Mode	Idle	Peer Address
-----------	------	------	------	--------------

Tech Support Information Output Listing CLI comparision

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
show tech	show tech	show tech-support

Tech Support Information Output Listing CLI Configurable options

ArubaOS-CX-Switch

```
ArubaOS-CX-Switch# show tech

aaa                Authentication Authorization and Accounting
acl                Access Control Lists
arp                Address Resolution Protocol
basic              Show Tech Basic
bgp                Border Gateway Protocol
copp               Control Plane Policing
dhcp-relay         Dynamic Host Configuration Protocol Relay
dhcpv6-relay       Dynamic Host Configuration Protocol Version 6 Relay
dns-client         DNS client
gre                Generic Routing Encapsulation
hw-health-monitor  Hardware Health Monitor
igmp               IGMP
interface          Interfaces
ip-statistics      Show IP Errors Statistics
ipv6-ra            IPv6 Router Advertisement
irdp               ICMP Router Discovery Protocol
isp                Show versions of programmable devices
isplog             Show log of programmable device updates
l2mac              L2 MAC Table
lacp               Link Aggregation Control Protocol
lldp               Link Layer Discovery Protocol
local-file         Capture command-output into a local-file
log-rotate         Log Rotation
loop-protect       Loop Protect
loopback           Loopback Interface
mclag              Multi-Chassis Link Aggregation Group
```

mgmt	Management interface
mirror	Mirroring
mstp	Multiple Spanning Tree Protocol
mvrp	Multiple VLAN Registration Protocol
ntp	Network Time Protocol
ospfv2	Open Shortest Path First version 2 Protocol
ospfv3	Open Shortest Path First version 3 Protocol
pim	Protocol-Independent Multicast (PIM Sparse)
policy	Classifier Policies
qos	Quality of Service
rpvst	Per VLAN Spanning Tree Protocol
sflow	sFlow
snmp	SNMP
source-interface-selection	Source Interface Selection
ssh	SSH Server
ucast-routing	Unicast Routing Information
udld	Unidirectional Link Detection Protocol
udpfwd	UDP Broadcast Forwarder
vlan	Virtual Local Area Network
vrf	Virtual Rounting and Forwarding
vrrp	Virtual Router Redundancy Protocol
xcvr	Show Transceiver Information
<cr>	

ArubaOS-Switch

ArubaOS-Switch# show tech ?

all	Display output of a predefined command sequence used by technical support.
buffers	Display output of a predefined command sequence used by technical support.
custom	Display output of a predefined command sequence used by technical support.
igmp	Display output of a predefined command sequence used by technical support.
instrumentation	Display output of a predefined command sequence used by technical support.
mesh	Display output of a predefined command sequence used by technical support.
mstp	Display output of a predefined command sequence used by technical support.
oobm	Display output of a predefined command sequence used by technical support.
rapid-pvst	Display output of a predefined command sequence used by technical support.
route	Display output of a predefined command sequence used by technical support.
smart-link	Display output of a predefined command sequence used by technical support.
statistics	Display output of a predefined command sequence used by technical support.
transceivers	Display output of a predefined command sequence used by technical support.
tunnel	Display output of a predefined command sequence used by technical support.
vrrp	Display output of a predefined command sequence used by technical support.
<cr>	

Cisco

```

Cisco#show tech-support ?

cef          CEF related information
ipc          IPC related information
ipmulticast  IP multicast related information
ospf         OSPF related information
page         Page through output
password     Include passwords
rsvp         IP RSVP related information
|           Output modifiers

<cr>

```

Motd CLI comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
banner motd # Enter TEXT message. End with the character'#'	banner motd # Enter TEXT message. End with the character'#'	banner motd # Enter TEXT message. End with the character '#'.

Motd CLI Configurable options

ArubaOS-CX-Switch
<pre> ArubaOS-CX-Switch(config)# banner motd # Enter TEXT message. End with the character'#' This is a secure lab network, do not connect to any production systems. Authorized users only! # </pre>
ArubaOS-Switch
<pre> ArubaOS-Switch(config)# banner motd # Enter TEXT message. End with the character'#' This is a secure lab network, do not connect to any production systems. Authorized users only! # </pre>
Cisco
<pre> Cisco(config)#banner motd # Enter TEXT message. End with the character '#'. This is a secure lab network, do not connect to any production systems. Authorized users only! # </pre>

Source Interface for Management Communications CLI comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
Configuration commands		

ip source-interface tftp interface 1/1/1 ip source-interface tftp 10.0.0.1	ip source-interface	ip <service> source-interface
ip source-interface all interface 1/1/1 ip source-interface all 10.0.0.1	ip source-interface all 10.0.111.21	
	ip source-interface syslog vlan 1	logging source-interface vlan 1
	ip source-interface radius 10.0.111.21	ip radius source-interface vlan 1
	ip source-interface tacacs 10.0.111.21	ip tacacs source-interface vlan 1
		ip ftp source-interface vlan 1
User Exec / Privileged Exec Commands		
show ip source-interface tftp	show ip source-interface	
show ip source-interface		

Source Interface for Management Communications CLI Configurable options

ArubaOS-CX-Switch

```
ArubaOS-CX-Switch(config)# ip source-interface tftp interface 1/1/1
```

```
ArubaOS-CX-Switch(config)# ip source-interface
all    All the defined protocols
tftp   TFTP protocol
```

```
ArubaOS-CX-Switch(config)# ip source-interface tftp
A.B.C.D    Specify an IP address
interface  Interface information
```

```
ArubaOS-CX-Switch(config)# ip source-interface tftp interface
IFNAME    Interface name (e.g. 1/1/1)
```

```
ArubaOS-CX-Switch(config)# ip source-interface tftp interface 1/1/1
```

```
ArubaOS-CX-Switch(config)# ip source-interface tftp 10.0.0.1
<cr>
```

```
ArubaOS-CX-Switch(config)# ip source-interface tftp 10.0.0.1
```

```
ArubaOS-CX-Switch(config)# ip source-interface
all    All the defined protocols
tftp   TFTP protocol
```

```
ArubaOS-CX-Switch(config)# ip source-interface all
A.B.C.D    Specify an IP address
interface  Interface information
```

```
ArubaOS-CX-Switch(config)# ip source-interface all interface
IFNAME    Interface name (e.g. 1/1/1)
```

```
ArubaOS-CX-Switch(config)# ip source-interface all interface 1/1/1
```

```
ArubaOS-CX-Switch(config)# ip source-interface all 10.0.0.1
<cr>
```

```
ArubaOS-CX-Switch(config)# ip source-interface all 10.0.0.1
```

```
ArubaOS-CX-Switch# show ip source-interface
Source-interface Configuration Information
```

```
-----
Protocol      Source Interface
-----
tftp          10.0.0.1
```

ArubaOS-Switch

```
ArubaOS-Switch(config)# ip source-interface ?
```

```
radius        The RADIUS protocol.
snmp          The SNMP protocol.
syslog        The syslog protocol.
tacacs        The TACACS+ protocol.
telnet        The Telnet protocol.
tftp          The TFTP protocol.
sflow         The sFlow protocol.
all           All protocols above.
```

```
ArubaOS-Switch(config)# ip source-interface all ?
```

[note, same options for

```
all]
IP-ADDR       Specify an IP address.
loopback      Specify a loopback interface.
vlan          Specify a VLAN interface.
```

[protocols as seen in above]

```
ArubaOS-Switch(config)# ip source-interface all 10.0.111.21
```

```
ArubaOS-Switch(config)# ip source-interface telnet vlan 1
```

```
ArubaOS-Switch(config)# snmp-server trap-source ?
```

```
IP-ADDR       IP Address for the source ip address field in the trap
pdu.
loopback      For the specified loopback interface, lexicographically
minimum configured ip address will be used as the source
ip address in the trap pdu.
```

```
ArubaOS-Switch(config)# snmp-server trap-source 10.0.111.21
```

```
ArubaOS-Switch# show ip source-interface ?
```

```
detail        Show detailed source IP information.
radius        Specify the protocol.
sflow         Specify the protocol.
snmp          Specify the protocol.
status        Show source IP information.
syslog        Specify the protocol.
tacacs        Specify the protocol.
telnet        Specify the protocol.
tftp          Specify the protocol.
<cr>
```

```
ArubaOS-Switch# show ip source-interface
```

```
Source-IP Configuration Information
```

```
Protocol | Admin Selection Policy  IP Interface  IP Address
----- + -----
```

Tacacs		Configured IP Address	vlan-1	10.0.111.21
Radius		Configured IP Address	vlan-1	10.0.111.21
Syslog		Configured IP Interface	vlan-1	
Telnet		Configured IP Interface	vlan-1	
Tftp		Configured IP Interface	vlan-1	
Sntp		Configured IP Interface	vlan-1	
Sflow		Configured IP Address	vlan-1	10.0.111.21
Cisco				
Cisco(config)#logging source-interface ?				
Async		Async interface		
Auto-Template		Auto-Template interface		
BVI		Bridge-Group Virtual Interface		
CTunnel		CTunnel interface		
Dialer		Dialer interface		
FastEthernet		FastEthernet IEEE 802.3		
Filter		Filter interface		
Filtergroup		Filter Group interface		
GigabitEthernet		GigabitEthernet IEEE 802.3z		
GroupVI		Group Virtual interface		
Lex		Lex interface		
Loopback		Loopback interface		
Null		Null interface		
Port-channel		Ethernet Channel of interfaces		
Portgroup		Portgroup interface		
Pos-channel		POS Channel of interfaces		
TenGigabitEthernet		Ten Gigabit Ethernet		
Tunnel		Tunnel interface		
Vif		PGM Multicast Host interface		
Virtual-Template		Virtual Template interface		
Virtual-TokenRing		Virtual TokenRing		
Vlan		Catalyst Vlans		
fcpa		Fiber Channel		
Cisco(config)#logging source-interface vlan 1 ?				
<cr>				
Cisco(config)#logging source-interface vlan 1				
(the following service commands are similar the above logging example)				
Cisco(config)#ip radius source-interface vlan 1				
Cisco(config)#ip tacacs source-interface vlan 1				
Cisco(config)#ip ftp source-interface vlan 1				
Cisco(config)#ip tftp source-interface vlan 1				
Cisco(config)#ntp source vlan 1				
Cisco(config)#ip telnet source-interface vlan 1				
Cisco(config)#ip ssh source-interface vlan 1				
Cisco(config)#snmp-server source-interface traps vlan 1				

Chapter 2 Switch User ID and Password, and Console Access

This chapter focuses on:

- Configuring local user ID (uid) and password (pw) options
- Recovering from a lost password
- Protecting the local password
- Role based management
- Password complexity

For network access, Cisco requires at least pw, while ArubaOS-Switch does not require either.

Network access methods for device management are covered in Chapters 8 and 9. Configuration details for Telnet and SSH are found in Chapter 8, and HTTP and HTTPS are found in Chapter 9.

Local User ID and Password, and console access CLI comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
		enable password 0 <password>
		enable secret 0 <password>
user word group administrators password		
user user-name password	password manager user-name <name> plaintext <password>	
user user-name password	password operator user-name <name> plaintext <password>	username <name> privilege 15 password <password>
user user-name password		username <name> privilege 0 password <password>
user <username> group operators password	password configuration- control	
	password configuration history	password <password>
user <username> authorized-key PUBKEY		aaa common-criteria policy policy1
	password configuration aging	username username common- criteria-policy policy- name password <password>
	password configuration alert-before-expiry 10	config switchconfig strong- pwd {case-check consecutive- check default-check username- check all-checks} {enable disable}

	password configuration update-interval-time 0	
	password configuration expired-user-login 30	service password-encryption

Local User ID and Password, and console access CLI Configurable options

ArubaOS-CX-Switch
<pre> ArubaOS-CX-Switch(config)# user WORD Specify the username. Maximum length is 32 characters. ArubaOS-CX-Switch(config)# user word authorized-key Add SSH client's authorized-key. group Adding user to the group password Update user password ArubaOS-CX-Switch(config)# user word authorized-key PUBKEY SSH client's authorized-key. ArubaOS-CX-Switch(config)# user word authorized-key pubkey PUBKEY SSH client's authorized-key. <cr> ArubaOS-CX-Switch(config)# user word authorized-key pubkey Failed to add client-public-key. Invalid key format. ArubaOS-CX-Switch(config)# user word authorized-key Add SSH client's authorized-key. group Adding user to the group password Update user password ArubaOS-CX-Switch(config)# user word password ciphertext Update ciphertext password <cr> ArubaOS-CX-Switch(config)# user word password Changing password for user word Enter password: ***** Confirm new password: ***** ArubaOS-CX-Switch(config)# user word password ciphertext Update ciphertext password <cr> ArubaOS-CX-Switch(config)# user word password ciphertext WORD User's ciphertext password QBapX4naW+gHsHPz9lucBMuGy1+OMKXsSJhhYaLA8rqLY9FZgAAAOL2ov5BSFDUgVwU3sua4Ekk/k1t cIvX2pJVyTfPep6SLY0MnQBfL3RggNJ6TshDrQ3HtGjpDyUioQ3JcNSHUK8FaDGTeVTEfw9IO9T4C5aKLcrnB GR4mhTNEpTqQ8DYomfYUvtg== </pre>
ArubaOS-Switch
<pre> ArubaOS-Switch(config)# password ? operator Configure operator access. manager Configure manager access. all Configure all available types of access. minimum-length Configure minimum password length. </pre>

```

ArubaOS-Switch(config)# password manager ?
plaintext      Enter plaintext password.
user-name      Set username for the specified user category.
<cr>

ArubaOS-Switch(config)# password manager user-name ?
OCTET-STR      Enter an octet string.

ArubaOS-Switch(config)# password manager user-name manager ?
plaintext      Enter plaintext password.
<cr>

ArubaOS-Switch(config)# password manager user-name manager plaintext ?
PASSWORD      Specify the password.If in enhanced secure-mode, you will be
               prompted for the password.

ArubaOS-Switch(config)# password manager user-name manager plaintext password ?
<cr>

ArubaOS-Switch(config)# password manager user-name manager plaintext password

ArubaOS-Switch(config)# password operator user-name operator plaintext password

Note: If 'user-name' is not configured for either the manager or operator category, then "manager" and "operator" are the
default user names respectively.

```

Cisco

```

Cisco(config)#enable ?
last-resort    Define enable action if no TACACS servers respond
password      Assign the privileged level password (MAX of 25 characters)
secret        Assign the privileged level secret (MAX of 25 characters)
use-tacacs     Use TACACS to check enable passwords

Cisco(config)#enable password ?
0             Specifies an UNENCRYPTED password will follow
7             Specifies a HIDDEN password will follow
LINE         The UNENCRYPTED (cleartext) 'enable' password
level        Set exec level password

Cisco(config)#enable password 0 ?
LINE         The UNENCRYPTED (cleartext) 'enable' password

Cisco(config)#enable password 0 password ?
LINE         <cr>

Cisco(config)#enable password 0 password

Cisco(config)#enable secret ?
0             Specifies an UNENCRYPTED password will follow
5             Specifies an ENCRYPTED secret will follow
LINE         The UNENCRYPTED (cleartext) 'enable' secret
level        Set exec level password

Cisco(config)#enable secret 0 ?
LINE         The UNENCRYPTED (cleartext) 'enable' secret

Cisco(config)#enable secret 0 secret ?
LINE         <cr>

Cisco(config)#enable secret 0 secret

Cisco(config)#username ?

```

WORD User name

```
Cisco(config)#username manager ?
aaa                AAA directive
access-class       Restrict access by access-class
autocommand        Automatically issue a command after the user logs in
callback-dialstring Callback dialstring
callback-line      Associate a specific line with this callback
callback-rotary    Associate a rotary group with this callback
dnis               Do not require password when obtained via DNIS
mac                This entry is for MAC Filtering where username=mac
nocallback-verify  Do not require authentication after callback
noescape           Prevent the user from using an escape character
nohangup           Do not disconnect after an automatic command
nopassword         No password is required for the user to log in
password           Specify the password for the user
privilege          Set user privilege level
secret             Specify the secret for the user
user-maxlinks      Limit the user's number of inbound links
view              Set view name
<cr>
```

```
Cisco(config)#username manager privilege ?
<0-15> User privilege level
```

```
Cisco(config)#username manager privilege 15 ?
aaa                AAA directive
access-class       Restrict access by access-class
autocommand        Automatically issue a command after the user logs in
callback-dialstring Callback dialstring
callback-line      Associate a specific line with this callback
callback-rotary    Associate a rotary group with this callback
dnis               Do not require password when obtained via DNIS
mac                This entry is for MAC Filtering where username=mac
nocallback-verify  Do not require authentication after callback
noescape           Prevent the user from using an escape character
nohangup           Do not disconnect after an automatic command
nopassword         No password is required for the user to log in
password           Specify the password for the user
privilege          Set user privilege level
secret             Specify the secret for the user
user-maxlinks      Limit the user's number of inbound links
view              Set view name
<cr>
```

```
Cisco(config)#username manager privilege 15 password ?
0      Specifies an UNENCRYPTED password will follow
7      Specifies a HIDDEN password will follow
LINE   The UNENCRYPTED (cleartext) user password
```

```
Cisco(config)#username manager privilege 15 password password ?
LINE    <cr>
```

```
Cisco(config)#username manager privilege 15 password password
```

```
Cisco(config)#username operator privilege 0 password password
```

[the next command sets the use of uid/pw for login via console]

```
Cisco(config)#line console 0
```

```
Cisco(config-line)#login ?
```

```
local    Local password checking
<cr>

Cisco(config-line)#login local ?
<cr>
Cisco(config-line)#login local

[the next command sets the use of password for login via console]

Cisco(config)#line console 0

Cisco(config-line)#login
% Login disabled on line 0, until 'password' is set

Cisco(config-line)#password ?
0        Specifies an UNENCRYPTED password will follow
7        Specifies a HIDDEN password will follow
LINE     The UNENCRYPTED (cleartext) line password

Cisco(config-line)#password 0 password ?
LINE     <cr>

Cisco(config-line)#password 0 password
```

Recover lost password CLI comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
See details below	See details below	See details below

Each procedure requires direct access to the switch through a console cable.

Recover lost password CLI Configurable options

ArubaOS-CX-Switch
<pre>switch login: admin Password: <forgot-password> One Time Token for password reset (valid for 30 mins) : AAEAAQABAAEAgI79uC8K+JJkJvxSu+U3JH7iLw8SqqaN/UdKYZeZw0WdXxKnhUQVamggmN5ZqJCLfXUnXAGvOES4eyBX5 p/FwcoYvBFF2dIJ5g5FeYOC862NTL95wmEX01e5V4VqhSVtxeMYOeuanzlmzSfkBZa0FWXVOWYHou3ptfj1JjPLjbz3</pre> Login to MNP portal @ www.hpe.com/networking/register to generate the One-Time-Password. Copy the OTP and input at the prompt below. Enter the One-Time-Password:
ArubaOS-Switch
Requires direct access to the switch (option 3 requires console cable). Default front panel security settings has all three options enabled. Option 1) erase local usernames/passwords by depressing front panel clear button for one second. Requires physical access to switch. Option 2) execute a factory reset by using a combination/sequence of the “clear” button and the “reset” button (reference product documentation for details). Requires physical access to switch. Option 3) password recovery procedure requires direct access to the switch (with console cable) and calling HPE Networking technical support (reference product documentation for details).
Cisco
Depending on configuration of the “password-recovery” feature (see section c, Protect Local Password), there are two methods available; both require direct access to the switch (with console cable) and depressing the appropriate front panel button. See the Cisco product documentation for exact procedure.

Role based management CLI comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
		Cisco(config)#aaa new-model
ArubaOS-CX-Switch(config)# aaa authorization commands default group	ArubaOS-Switch(config)# aaa authorization commands local	Cisco(config)#parser view network-admin2 Cisco(config-view)#secret 0 password
ArubaOS-CX-Switch(config)# aaa authorization commands default group none	ArubaOS-Switch(config)# aaa authorization group network-admin2 1 match-command "command:show interface brief" permit log	Cisco(config-view)#commands exec include show interface summary
ArubaOS-CX-Switch(config)# aaa authorization commands default group tacacs	ArubaOS-Switch(config)# aaa authorization group network-admin2 2 match-command "command:show ip" permit log	Cisco(config-view)#commands exec include show ip interface brief
	ArubaOS-Switch# show authorization group network-admin2	(no specific show commands)

Role based management CLI Configurable options

ArubaOS-CX-Switch
Configure a tacacs server before creating a tacacs group. <pre> ArubaOS-CX-Switch(config)# tacacs-server auth-type Set authentication type. (Default: pap) host Specify a TACACS+ server key Set shared secret timeout Set the transmission timeout interval ArubaOS-CX-Switch(config)# tacacs-server host WORD TACACS+ server IP address or hostname ArubaOS-CX-Switch(config)# tacacs-server host 10.0.0.2 auth-type Set authentication type. (Default: global TACACS authentication type) key Set shared secret port Set authentication port timeout Set the transmission timeout interval vrf VRF Configuration <cr> ArubaOS-CX-Switch(config)# tacacs-server host 10.0.0.2 ArubaOS-CX-Switch(config)# aaa authentication User authentication authorization User authorization group Define AAA server group ArubaOS-CX-Switch(config)# aaa authorization commands Command authorization ArubaOS-CX-Switch(config)# aaa authorization commands default Default authorization list ArubaOS-CX-Switch(config)# aaa authorization commands default group Server-group none No authorization </pre>

```

ArubaOS-CX-Switch(config)# aaa authorization commands default
    group    Server-group
    none     No authorization

ArubaOS-CX-Switch(config)# aaa authorization commands default group
    WORD    Group Name or family name (Valid family names: tacacs, none)

ArubaOS-CX-Switch(config)# aaa authorization commands default group none
    WORD    Group Name or family name (Valid family names: tacacs, none)
    <cr>

ArubaOS-CX-Switch(config)# aaa authorization commands default group none

```

ArubaOS-Switch

```

ArubaOS-Switch(config)# aaa authorization ?
    commands      Configure command authorization.
    group          Create or remove an authorization rule.

ArubaOS-Switch(config)# aaa authorization commands ?
    access-level   Configure command authorization level.
    local          Authorize commands using local groups.
    radius         Authorize commands using RADIUS.
    none           Do not require authorization for command access.
    auto           Authorize commands with the same protocol used for authentication.
    tacacs         Authorize commands using TACACS+.

ArubaOS-Switch(config)# aaa authorization commands local ?
    <cr>
ArubaOS-Switch(config)# aaa authorization commands local

ArubaOS-Switch(config)# aaa authorization group ?
    GROUPNAME-STR  The group name.

ArubaOS-Switch(config)# aaa authorization group network-admin2 ?
    <1-2147483647>  The sequence number.

ArubaOS-Switch(config)# aaa authorization group network-admin2 1 ?
    match-command  Specify the command to match.

ArubaOS-Switch(config)# aaa authorization group network-admin2 1 match-command ?
    COMMAND-STR    The command to match.

ArubaOS-Switch(config)# aaa authorization group network-admin2 1 match-command "command:show
interfaces brief" ?

    permit         Permit the specified action.
    deny           Deny the specified action.

ArubaOS-Switch(config)# aaa authorization group network-admin2 1 match-command "command:show
interface brief" permit ?

    log            Generate an event log any time a match happens.
    <cr>

ArubaOS-Switch(config)# aaa authorization group network-admin2 1 match-command "command:show
interface brief" permit log ?

    <cr>

ArubaOS-Switch(config)# aaa authorization group network-admin2 1 match-command "command:show

```

```

interface brief" permit log

ArubaOS-Switch(config)# aaa authorization group network-admin2 2 match-command "command:show
ip
" permit log

ArubaOS-Switch(config)# aaa authentication ?
  allow-vlan          Configure authenticator ports to apply VLAN changes immediately.
  captive-portal      Configure redirection to a captive portal server for additional
                      client authentication.
  console             Configure authentication mechanism used to control access to the
                      switch console.
  disable-username    Bypass the username during authentication while accessing the
                      switch to get Manager or Operator access.
  local-user          Create or remove a local user account.
  lockout-delay       The number of seconds after repeated login failures before a user
                      may again attempt login.
  login               Specify that switch respects the authentication server's privilege
                      level.
  mac-based           Configure authentication mechanism used to control mac-based port
                      access to the switch.
  num-attempts        The number of login attempts allowed.
  port-access         Configure authentication mechanism used to control access to the
                      network.
  ssh                Configure authentication mechanism used to control SSH access to
                      the switch.
  telnet              Configure authentication mechanism used to control Telnet access
                      to the switch.
  web                 Configure authentication mechanism used to control web access to
                      the switch.
  web-based           Configure authentication mechanism used to control web-based port
                      access to the switch.

ArubaOS-Switch(config)# aaa authentication local-user ?
  USERNAME-STR       The username.

ArubaOS-Switch(config)# aaa authentication local-user test1 ?
  aging-period        Configures the password aging time for a user.
  clear-history-record Clears the history of the password for a user.
  group               Specify the group for a username.
  min-pwd-length      Configures the minimum password length for a user.

ArubaOS-Switch(config)# aaa authentication local-user test1 group ?
  GROUPNAME-STR       The group name.

ArubaOS-Switch(config)# aaa authentication local-user test1 group network-admin2 ?
  password            Specify the password.
  <cr>

ArubaOS-Switch(config)# aaa authentication local-user test1 group network-admin2 password ?
  plaintext           Use plain text password.
  sha1                Use SHA-1 hash.

ArubaOS-Switch(config)# aaa authentication local-user test1 group network-admin2 password
plaint
ext ?

  <cr>

ArubaOS-Switch(config)# aaa authentication local-user test1 group network-admin2 password
plaint
ext
New password for test1: *****

```


Please retype new password for test1: *****

```
ArubaOS-Switch# show authorization group ?
GROUPNAME-STR      The group name.
<cr>
```

```
ArubaOS-Switch# show authorization group network-admin2
```

Local Management Groups - Authorization Information

```
Group Name           : network-admin2
Group Privilege Level : 4
```

Users

```
-----
test1
```

Seq. Num.	Permission	Rule Expression	Log
1	Permit	command:show interfaces brief	Enable
2	Permit	command:show ip	Enable

Cisco

```
Cisco(config)#aaa new-model
```

```
Cisco(config)#parser ?
cache      Configure parser cache
command    Configure command serialization
config     Configure config generation
maximum    specify performance maximums for CLI operations
view       View Commands
```

```
Cisco(config)#parser view ?
WORD       View Name
```

```
Cisco(config)#parser view network-admin2 ?
superview  SuperView Commands
<cr>
```

```
Cisco(config)#parser view network-admin2
```

```
Cisco(config-view)#?
```

View commands:

```
commands  Configure commands for a view
default    Set a command to its defaults
exit       Exit from view configuration mode
no         Negate a command or set its defaults
secret     Set a secret for the current view
```

```
Cisco(config-view)#secret ?
```

```
0          Specifies an UNENCRYPTED password will follow
5          Specifies an ENCRYPTED secret will follow
LINE       The UNENCRYPTED (cleartext) view secret string
```

```
Cisco(config-view)#secret 0 ?
```

```
LINE       The UNENCRYPTED (cleartext) view secret string
```

```
Cisco(config-view)#secret 0 password ?  
LINE      <cr>
```

```
Cisco(config-view)#secret 0 password
```

```
Cisco(config-view)#commands ?
```

SASL-profile	SASL profile configuration mode
aaa-attr-list	AAA attribute list config mode
aaa-user	AAA user definition
acct_mlist	AAA accounting methodlist definitions
address-family	Address Family configuration mode
archive	Archive the router configuration mode
arp-nacl	ARP named ACL configuration mode
bgp address-family	Address Family configuration mode
call-home	call-home config mode
call-home-profile	call-home profile config mode
cc-policy	policy-map config mode
cfg-af-topo	Configure non-base topology mode
cns-connect-config	CNS Connect Info Mode
cns-connect-intf-config	CNS Connect Intf Info Mode
cns-tmpl-connect-config	CNS Template Connect Info Mode
conf-attr-map	LDAP attribute map config mode
conf-ldap-server	LDAP server config mode
conf-ldap-sg	LDAP server group config mode
conf-rad-filter	RADIUS filter config mode
conf-rad-server	RADIUS server config mode
conf-tac-server	Tacacs Server Definition
config-sensor-cdplist	Subscriber CDP attribute list
config-sensor-dhcp	Subscriber DHCP attribute list
config-sensor-lldp	Subscriber LLDP attribute list
configure	Global configuration mode
crypto-identity	Crypto identity config mode
crypto-ipsec-profile	IPSec policy profile mode
crypto-keyring	Crypto Keyring command mode
crypto-map	Crypto map config mode
crypto-map-fail-close	Crypto map fail close mode
crypto-transform	Crypto transform config mode
dhcp	DHCP pool configuration mode
dhcp-class	DHCP class configuration mode
dhcp-guard	IPv6 dhcp guard configuration mode
dhcp-pool-class	Per DHCP pool class configuration mode
dhcp-relay-info	DHCP class relay agent info configuration mode
dhcp-subnet-secondary	Per DHCP secondary subnet configuration mode
dot1x	CTS dot1x configuration mode
dot1x-credential-mode	dot1x credential profile configuration mode
eap-mprofile-mode	eap method profile configuration mode
eap-profile-mode	eap profile configuration mode
eigrp_af_classic_submode	Address Family configuration mode
eigrp_af_intf_submode	Address Family interfaces configuration mode
eigrp_af_submode	Address Family configuration mode
eigrp_af_topo_submode	Address Family Topology configuration mode
eigrp_sf_intf_submode	Service Family interfaces configuration mode
eigrp_sf_submode	Service Family configuration mode
eigrp_sf_topo_submode	Service Family Topology configuration mode
exec	Exec mode
extcomm-list	IP Extended community-list configuration mode
fallback-profile-mode	fallback profile configuration mode
fh_applet	FH Applet Entry Configuration
fh_applet_trigger	FH Applet Trigger Configuration
filterserver	AAA filter server definitions
flow-cache	Flow aggregation cache config mode
flow-sampler-map	Flow sampler map config mode

flowexp	Flow Exporter configuration mode
flowmon	Flow Monitor configuration mode
flowrec	Flow Record configuration mode
identity-policy-mode	identity policy configuration mode
identity-profile-mode	identity profile configuration mode
if-topo	Configure interface topology parameters
interface	Interface configuration mode
ip-sla	IP SLAs entry configuration
ip-sla-dhcp	IP SLAs dhcp configuration
ip-sla-dns	IP SLAs dns configuration
ip-sla-ftp	IP SLAs ftp configuration
ip-sla-http	IP SLAs http configuration
ip-sla-http-rr	IP SLAs HTTP raw request Configuration
ip-sla-icmpEcho	IP SLAs icmpEcho configuration
ip-sla-pathEcho	IP SLAs pathEcho configuration
ip-sla-pathJitter	IP SLAs pathJitter configuration
ip-sla-tcp	IP SLAs tcpConnect configuration
ip-sla-udpEcho	IP SLAs udpEcho configuration
ip-sla-udpJitter	IP SLAs udpJitter configuration
ip-sla-video	IP SLAs video configuration
ipczone	IPC Zone config mode
ipczone-assoc	IPC Association config mode
ipenacl	IP named extended access-list configuration mode
iprbac1	IP role-based access-list configuration mode
ipsnacl	IP named simple access-list configuration mode
ipv6-router	IPv6 router configuration mode
ipv6-snooping	IPv6 snooping mode
ipv6acl	IPv6 access-list configuration mode
ipv6dhcp	IPv6 DHCP configuration mode
ipv6dhcups	IPv6 DHCP Vendor-specific configuration mode
ipv6rbac1	IPv6 role-based access-list configuration mode
isakmp-profile	Crypto ISAKMP profile command mode
kron-occurrence	Kron Occurrence SubMode
kron-policy	Kron Policy SubMode
line	Line configuration mode
log_config	Log configuration changes made via the CLI
mac-enacl	MAC named extended ACL configuration mode
mac_address_config	MAC address group configuration mode
macro_auto_trigger_cfg	Configuration mode for autosmartport user triggers
manual	CTS manual configuration mode
map-class	Map class configuration mode
map-list	Map list configuration mode
mka-policy	MKA Policy config mode
mmon-fmon	Flow Monitor configuration mode
mmon-fmon-if-inline	Flow Monitor inline configuration mode under inline policy
mmon-fmon-pmap-inline	Flow Monitor inline configuration mode under policy class
mstp_cfg	MSTP configuration mode
mt-flowspec	mt flow specifier
mt-path	mt path-config
mt-prof-perf	mt profile perf-monitor
mt-prof-perf-params	mt profile perf-monitor parameters
mt-prof-perf-rtp-params	mt profile perf-monitor rtp parameters
mt-prof-sys	mt profile system
mt-prof-sys-params	mt profile system parameters
mt-sesparam	mt session-params
multicast-flows-classmap	multicast-classmap config mode
nd-inspection	IPv6 NDP inspection configuration mode
nd-raguard	IPv6 RA guard configuration mode
null-interface	Null interface configuration mode

parser_test	Test mode for internal test purposes
policy-list	IP Policy List configuration mode
preauth	AAA Preauth definitions
profile-map	profile-map config mode
radius-attrl	Radius Attribute-List Definition
radius-da-locsvr	Radius Application configuration
radius-locsvr-client	Radius Client configuration
radius-policy-device-locsvr	Radius Application configuration
radius-proxy-locsvr	Radius Application configuration
radius-sesm-locsvr	Radius Application configuration
rib_rwatch_test	RIB_RWATCH test configuration mode
route-map	Route map config mode
router	Router configuration mode
router-af-topology	Topology configuration mode
router_eigrp_classic	EIGRP Router configuration classic mode
router_eigrp_named	EIGRP Router configuration named mode
rsvp-local-if-policy	RSVP local policy interface configuration mode
rsvp-local-policy	RSVP local policy configuration mode
rsvp-local-subif-policy	RSVP local policy sub-interface configuration mode
saf_ec_cfg	Saf external-clients configuration mode
saf_ec_client_cfg	Saf external-client configuration mode
sampler	Sampler configuration mode
scope	scope configuration mode
scope address-family	Address Family configuration mode
scope address-family topology	Topology configuration mode
sep-init-config	WSMA Initiator profile Mode
sep-listen-config	WSMA Listener profile Mode
sf_client_reg_mode	service-family exec test mode
sg-radius	Radius Server-group Definition
sg-tacacs+	Tacacs+ Server-group Definition
sisf-sourceguard	IPv6 sourceguard mode
ssh-pubkey	SSH public key identification mode
ssh-pubkey-server	SSH public key entry mode
ssh-pubkey-user	SSH public key entry mode
subscriber-policy	Subscriber policy configuration mode
tcl	Tcl mode
template	Template configuration mode
template-peer-policy	peer-policy configuration mode
template-peer-session	peer-session configuration mode
top-af-base	AF base topology configuration mode
top-talkers	Netflow top talkers config mode
tracking-config	Tracking configuration mode
transceiver	Transceiver type config mode
vc-class	VC class configuration mode
view	View configuration mode
vrf	Configure VRF parameters
vrf-af	Configure IP VRF parameters
wsma-config-agent	WSMA Config Agent Profile configuration mode
wsma-exec-agent	WSMA Exec Agent Profile configuration mode
wsma-filesys-agent	WSMA FileSys Agent Profile configuration mode
wsma-notify-agent	WSMA Notify Agent Profile configuration mode
xml-app	XML Application configuration mode
xml-transport	XML Transport configuration mode

Cisco(config-view)#commands exec ?

exclude	Exclude the command from the view
include	Add command to the view
include-exclusive	Include in this view but exclude from others

Cisco(config-view)#commands exec include ?

LINE	Keywords of the command
all	wild card support

```
Cisco(config-view)#commands exec include show interface summary ?  
LINE      <cr>  
  
Cisco(config-view)#commands exec include show interface summary  
  
Cisco(config-view)#commands exec include show ip interface brief  
  
Cisco(config-view)#exit  
  
Cisco(config)#username test1 privilege 15 view network-admin2 password 0 password
```

Chapter 3 Time Service

This chapter compares commands to configure and synchronize the switch time with a trusted time source, using time protocols such as Network Time Protocol (NTP) and Simple NTP (SNTP).

Using time synchronization ensures a uniform time among interoperating devices. This helps to manage and troubleshoot switch operation by attaching meaningful time data to event and error messages.

NTP CLI Comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
ntp server 10.0.100.251	ntp server 10.0.100.251 ntp unicast ntp enable	ntp server 10.0.100.251
clock timezone us/central	clock timezone us central	clock timezone US-Cent -6
	clock summer-time	
ntp server {ip-address} [key key-id] [maxpoll max-poll] [minpoll min-poll] [prefer] [version] ntp vrf mgmt default	ntp server <IP-ADDR> ntp server <IPV6-ADDR>	ntp server {ip-address ipv6-address dns-name} [key key-id] [maxpoll max-poll] [minpoll min-poll] [prefer] ntp server vrf <>
show ntp associations	show ntp association	show ntp associations
show ntp status	show ntp status	show ntp status
show clock	show time	show clock show clock detail

NTP Service configurable options

ArubaOS-CX-Switch
<pre> ArubaOS-CX-Switch(config)# ntp authentication NTP Authentication configuration authentication-key NTP Authentication Key configuration server NTP Association configuration trusted-key NTP Trusted Key configuration vrf NTP VRF to use for NTP server connections ArubaOS-CX-Switch(config)# ntp authentication authentication NTP Authentication configuration authentication-key NTP Authentication Key configuration ArubaOS-CX-Switch(config)# ntp authentication <cr> ArubaOS-CX-Switch(config)# ntp authentication-key <1-65534> NTP Key Number ArubaOS-CX-Switch(config)# ntp authentication-key 33 md5 MD5 Password configuration ArubaOS-CX-Switch(config)# ntp authentication-key 33 md5 WORD NTP MD5 Password <8-16> chars </pre>

```

ciphertext  NTP cipher-password is encoded cipher-text

ArubaOS-CX-Switch(config)# ntp authentication-key 44 md5 ciphertext222
    trusted  NTP Key is trusted
    <cr>

ArubaOS-CX-Switch(config)# ntp authentication-key 44 md5 ciphertext222

ArubaOS-CX-Switch(config)# ntp  server
    WORD  NTP Association server name or IP Address

ArubaOS-CX-Switch(config)# ntp  server 10.0.0.2
    burst  NTP Association use burst mode
    iburst  NTP Association use iburst mode
    key-id  NTP Key ID
    maxpoll  NTP maximum poll time to use configuration
    minpoll  NTP minimum poll time to use configuration
    prefer  NTP Association preference configuration
    version  NTP Association version configuration
    <cr>

ArubaOS-CX-Switch(config)# ntp  server 10.0.0.2 minpoll
    <4-17>  NTP minimum poll time as a power of 2 (default 6)

ArubaOS-CX-Switch(config)# ntp  server 10.0.0.2 minpoll 5
    burst  NTP Association use burst mode
    iburst  NTP Association use iburst mode
    key-id  NTP Key ID
    maxpoll  NTP maximum poll time to use configuration
    prefer  NTP Association preference configuration
    version  NTP Association version configuration
    <cr>

ArubaOS-CX-Switch(config)# ntp  server 10.0.0.2 minpoll 5 maxpoll
    <4-17>  NTP maximum poll time as a power of 2 (default 10)

ArubaOS-CX-Switch(config)# ntp  server 10.0.0.2 minpoll 5 maxpoll 10
    burst  NTP Association use burst mode
    iburst  NTP Association use iburst mode
    key-id  NTP Key ID
    prefer  NTP Association preference configuration
    version  NTP Association version configuration
    <cr>

ArubaOS-CX-Switch(config)# ntp  server 10.0.0.2 minpoll 5 maxpoll 10

ArubaOS-CX-Switch# show ntp
    associations          Show NTP Association summary
    authentication-keys  Show NTP Authentication Keys information
    servers               Show NTP Servers information
    statistics            Show NTP Statistics information
    status                Show NTP Status information

ArubaOS-CX-Switch# show ntp associations
    detail               Show NTP Association column header information
    vsx-peer             Displays VSX peer switch information

ArubaOS-CX-Switch# show ntp authentication-keys
    vsx-peer             Displays VSX peer switch information
    <cr>

ArubaOS-CX-Switch# show ntp servers
    vsx-peer             Displays VSX peer switch information

```

<cr>

```
ArubaOS-CX-Switch# show ntp statistics
vsx-peer  Displays VSX peer switch information
<cr>
```

```
ArubaOS-CX-Switch# show ntp status
vsx-peer  Displays VSX peer switch information
<cr>
```

ArubaOS-Switch

```
ArubaOS-Switch(config)# ntp ?
authentication  Configure NTP authentication.
broadcast       Operate in broadcast mode.
enable         Enable/disable NTP.
max-association Maximum number of Network Time Protocol (NTP) associations.
server         Configure a NTP server to poll for time synchronization.
trap           Enable/disable NTP traps.
unicast        Operate in unicast mode.
```

```
ArubaOS-Switch(config)# ntp server ?
IP-ADDR        The IPv4 address of the server
IPV6-ADDR      The IPv6 address of the server
```

```
ArubaOS-Switch(config)# ntp server 10.0.100.251 ?
burst          Enables burst mode.
iburst         Enables initial burst (iburst) mode.
key-id         Set the authentication key to use for this server.
max-poll       Configures the maximum time intervals in seconds.
min-poll       Configures the minimum time intervals in seconds.
oobm          Use the OOBM interface to connect to the server.
<cr>
```

```
ArubaOS-Switch(config)# ntp server 10.0.100.251
```

```
ArubaOS-Switch(config)# ntp unicast ?
<cr>
```

```
ArubaOS-Switch(config)# ntp unicast
```

```
ArubaOS-Switch(config)# timesync ?
ntp           Update the system clock using NTP.
sntp          Update the system clock using SNTP.
timep         Update the system clock using TIMEP.
timep-or-sntp Update the system clock using TIMEP or SNTP.
```

```
ArubaOS-Switch(config)# timesync ntp ?
<cr>
```

```
ArubaOS-Switch(config)# timesync ntp
```

```
ArubaOS-Switch(config)# show ntp associations
```

NTP Associations Entries

Remote	St	T	When	Poll	Reach	Delay	Offset	Dispersion
10.0.100.251	2	u	497	6	177	0.000	0.000	8.02417

```
ArubaOS-Switch# show ntp status
```

NTP Status Information


```

NTP Status           : Enabled           NTP Mode           : Unicast
Synchronization Status : Synchronized Peer Dispersion : 0.00000 sec
Stratum Number       : 3                 Leap Direction    : 0
Reference Assoc ID   : 0                 Clock Offset     : -490.51406 sec
Reference ID         : 10.0.100.251      Root Delay       : 0.09215 sec
Precision            : 2**-18           Root Dispersion  : 490.54954 sec
NTP Up Time         : 0d 0h 20m         Time Resolution  : 440 nsec
Drift                : 0.00000 sec/sec

System Time          : Wed Apr 27 17:43:49 2016
Reference Time       : Wed Apr 27 16:21:27 2016

```

```

ArubaOS-Switch(config)# clock ?
datetime             Specify the time and date
set                  Set current time and/or date.
summer-time          Enable/disable daylight-saving time changes.
timezone             Set the number of hours your location is to the West(-) or East(+)
                    of GMT.
<cr>

```

```

ArubaOS-Switch(config)# clock timezone ?
gmt                  Number of hours your timezone is to the West(-) or East(+) of GMT.
us                   Timezone for US locations.

```

```

ArubaOS-Switch(config)# clock timezone us
alaska
aleutian
arizona
central
east_indiana
eastern
hawaii
michigan
mountain
pacific
samoa

```

```

ArubaOS-Switch(config)# clock timezone us central
<cr>

```

```

ArubaOS-Switch(config)# clock summer-time
<cr>

```

```

ArubaOS-Switch(config)# time ?
begin-date           The begin date of daylight savings time
MM/DD[/[YY]YY]       New date
daylight-time-rule   The daylight savings time rule for your location
end-date             The end date of daylight savings time
HH:MM[:SS]           New time
timezone             The number of minutes your location is West(-) or East(+) of GMT
<cr>

```

```

ArubaOS-Switch(config)# time daylight-time-rule ?
none
alaska
continental-us-and-canada
middle-europe-and-portugal
southern-hemisphere
western-europe
user-defined

```

```

ArubaOS-Switch(config)# time daylight-time-rule continental-us-and-canada ?
begin-date      The begin date of daylight savings time
MM/DD[/[YY]YY]  New date
end-date        The end date of daylight savings time
HH:MM[:SS]      New time
timezone        The number of minutes your location is West(-) or East(+) of GMT
<cr>

```

```

ArubaOS-Switch(config)# time daylight-time-rule continental-us-and-canada

```

```

ArubaOS-Switch# show time
Wed Apr 27 17:45:52 2016

```

Cisco

```

Cisco(config)#ntp ?
access-group      Control NTP access
allow             Allow processing of packets
authenticate      Authenticate time sources
authentication-key Authentication key for trusted time sources
broadcastdelay    Estimated round-trip delay
clock-period      Length of hardware clock tick
logging           Enable NTP message logging
master           Act as NTP master clock
max-associations  Set maximum number of associations
maxdistance       Maximum Distance for synchronization
passive           NTP passive mode
peer             Configure NTP peer
server           Configure NTP server
source           Configure interface for source address
trusted-key       Key numbers for trusted time sources

```

```

Cisco(config)#ntp server ?
A.B.C.D          IP address of peer
WORD             Hostname of peer
X:X:X:X::X       IPv6 address of peer
ip              Use IP for DNS resolution
ipv6            Use IPv6 for DNS resolution

```

```

Cisco(config)#ntp server 10.0.100.251 ?
burst           Send a burst when peer is reachable
iburst          Send a burst when peer is unreachable
key            Configure peer authentication key
maxpoll         Maximum poll interval
minpoll         Minimum poll interval
prefer          Prefer this peer when possible
source          Interface for source address
version         Configure NTP version
<cr>

```

```

Cisco(config)#ntp server 10.0.100.251

```

```

Cisco#show ntp ?
associations     NTP associations
status           NTP status

```

```

Cisco#show ntp associations

```

address	ref clock	st	when	poll	reach	delay	offset	disp
*~10.0.100.251	216.218.192.20	2	25	64	177	2.322	2.130	64.390

* sys.peer, # selected, + candidate, - outlier, x falseticker, ~ configured

Cisco#show ntp status

Clock is synchronized, stratum 3, reference is 10.0.100.251
nominal freq is 119.2092 Hz, actual freq is 119.2092 Hz, precision is 2**17
reference time is D8A9E976.CDEA704C (22:06:46.804 UTC Tue Mar 10 2015)
clock offset is 2.1303 msec, root delay is 102.49 msec
root dispersion is 447.09 msec, peer dispersion is 64.39 msec
loopfilter state is 'CTRL' (Normal Controlled Loop), drift is 0.000000007 s/s
system poll interval is 64, last update was 178 sec ago.

Cisco(config)#clock ?

initialize Initialize system clock on restart
save backup of clock with NVRAM
summer-time Configure summer (daylight savings) time
timezone Configure time zone

Cisco(config)#clock timezone ?

WORD name of time zone

Cisco(config)#clock timezone US-Central ?

<-23 - 23> Hours offset from UTC

Cisco(config)#clock timezone US-Central -6 ?

<0-59> Minutes offset from UTC

<cr>

Cisco(config)#clock timezone US-Central -6

%Time zone name is limited to 7 characters

Cisco(config)#clock timezone US-Cent -6

Cisco(config)#clock summer-time ?

WORD name of time zone in summer

Cisco(config)#clock summer-time US-Cent ?

date Configure absolute summer time

recurring Configure recurring summer time

Cisco(config)#clock summer-time US-Cent date ?

<1-31> Date to start

MONTH Month to start

Cisco(config)#clock summer-time US-Cent date mar ?

<1-31> Date to start

Cisco(config)#clock summer-time US-Cent date mar 8 ?

<1993-2035> Year to start

Cisco(config)#clock summer-time US-Cent date mar 8 2015 ?

hh:mm Time to start (hh:mm)

Cisco(config)#clock summer-time US-Cent date mar 8 2015 02:00 ?

<1-31> Date to end

MONTH Month to end

Cisco(config)#clock summer-time US-Cent date mar 8 2015 02:00 nov ?

<1-31> Date to end

Cisco(config)#clock summer-time US-Cent date mar 8 2015 02:00 nov 1 ?

<1993-2035> Year to end

Cisco(config)#clock summer-time US-Cent date mar 8 2015 02:00 nov 1 2015 ?

hh:mm Time to end (hh:mm)

```

Cisco(config)#clock summer-time US-Cent date mar 8 2015 02:00 nov 1 2015 02:00 ?
<1-1440> Offset to add in minutes
<cr>
Cisco(config)#clock summer-time US-Cent date mar 8 2015 02:00 nov 1 2015 02:00 60 ?
<cr>
Cisco(config)#clock summer-time US-Cent date mar 8 2015 02:00 nov 1 2015 02:00 60

Cisco#show clock
17:16:15.928 US-Cent Tue Mar 10 2015

Cisco#show clock detail

17:16:45.950 US-Cent Tue Mar 10 2015
Time source is NTP
Summer time starts 02:00:00 US-Cent Sun Mar 8 2015
Summer time ends 02:00:00 US-Cent Sun Nov 1 2015

```

Chapter 4 CLI Management Access – SSH

This chapter compares the commands to enable and configure Secure Shell (SSH) services for device management via unencrypted and encrypted network access.

Note: ssh on Cisco does not support 'local' (password only) on vty interfaces and must be configured for 'login local'.

You can find configuration details for User ID's and Password's in Chapter 2.

SSH CLI Comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
Configuration commands		
hostname ArubaOS-CX-Switch		hostname Cisco
ip dns domain-name HPE-Aruba		ip domain-name test
ssh host-key ed25519	crypto key generate ssh	crypto key generate
ssh known-host remove all		username <name> privilege 15 password <password>
ssh server vrf mgmt		
Show/display commands		
show ssh server all-vrfs	show ip ssh	show ip ssh show ssh <0-97>
show ssh authentication-method		
show ssh host-key	show crypto host-public-key	show crypto key mypubkey rsa

SSH Service configurable options

ArubaOS-CX-Switch
ArubaOS-CX-Switch(config)# ssh
host-key SSH server host-keys.
known-host Client trusted servers list.

```

password-authentication Password authentication method enabled by default.
public-key-authentication Publickey authentication method enabled by default.
server Configure SSH server.

```

```

ArubaOS-CX-Switch(config)# ssh known-host
remove Delete client trusted servers list.

```

```

ArubaOS-CX-Switch(config)# ssh known-host remove
A.B.C.D Specify the host IPv4 address of the remote system.
WORD Specify the hostname of the remote system.
X:X::X:X Specify the host IPv6 address of the remote system.
all Delete client all trusted servers list.

```

```

ArubaOS-CX-Switch(config)# ssh known-host remove all
<cr>

```

```

ArubaOS-CX-Switch(config)# ssh known-host remove all

```

```

ArubaOS-CX-Switch(config)# ssh server
vrf Configure SSH server for VRF.

```

```

ArubaOS-CX-Switch(config)# ssh server vrf
VRF-NAME Enter the VRF instance. 'default' or 'mgmt' or a configured VRF instance.

```

```

ArubaOS-CX-Switch(config)# ssh server vrf mgmt.

```

```

ArubaOS-CX-Switch(config)# do show ssh
authentication-method Show authentication method.
host-key Show SSH server host-keys.
server Show SSH server details.

```

```

ArubaOS-CX-Switch(config)# do show ssh host-key
ecdsa Show SSH server ECDSA host-key.
ed25519 Show SSH server ED25519 host-key.
rsa Show SSH server RSA host-key.
<cr>

```

```

ArubaOS-CX-Switch(config)# do show ssh host-key

```

```

Key Type : ECDSA Curve : ecdsa-sha2-nistp256
ecdsa-sha2-nistp256
AAAAE2VjZHNhLXNoYTItbmlzdHAyNTYAAAAIbmlzdHAyNTYAAABBLwI/ekxuJQxGvPviDCWsK2fp1c
fqJwdkzKFspuVOML85LI6zFBlJtOfJLG3K6nAY0h4OSVFM2iuBrPlqa8+KFY=

```

```

Key Type : ED25519
ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIAvOajmFM4bL/0mydg+a82EnpreKuholDj5Qj7fw/oZY

```

```

Key Type : RSA Key Size : 2048
ssh-rsa
AAAAB3NzaC1yc2EAAAADAQABAAQCA4TfLYwYz4t8C8UV4mk7lUbyzQs15mxhJnlpXdgv5T6fPkSr5pJtfFXZ1iSk8
/4AbjJ
928KXmfBRVCOJLCYn98fqGF1A7OWhRk6ul5MewA4I63Doc1VxL/nGzkje5nT/26r96wLwI9l/A3FLjVJio9cSs4aIGZ
h6EV7c
1lWYXvvkGQAIMDumKyLhzLsX09Sr6lCZmltRsES1KLjYk9bwdY7BgvsS0rv4Gj6s/FEZ03HOW6S+M5bAmb3IqVlnTKz
+hn8nK
3DwyZBM42tJyr+txRMgU9G2LDt66+lp/lsPaprQkYf7NU9bIyAOKrOwDKES+Tqw5aOHgTX00odlFSTsWv

```

ArubaOS-Switch

```

ArubaOS-Switch(config)# crypto ?
key Install/remove RSA key file for ssh.

```

```

pki                                Public Key Infrastructure management

ArubaOS-Switch(config)# crypto key ?
generate                          Generate a new key.
zeroize                           Delete existing key.

ArubaOS-Switch(config)# crypto key generate ?
autorun-key                       Install RSA key file for autorun
ssh                               Install host key file for ssh server.

ArubaOS-Switch(config)# crypto key generate ssh ?
dsa                               Install DSA host key.
rsa                               Install RSA host key.
<cr>

ArubaOS-Switch(config)# crypto key generate ssh
Installing new key pair.  If the key/entropy cache is
depleted, this could take up to a minute.

ArubaOS-Switch(config)# ip ssh ?
cipher                            Specify a cipher to enable/disable.
filetransfer                      Enable/disable secure file transfer capability.
listen                           Specify in which mode daemon should listen in.
mac                              Specify a mac to enable/disable.
port                             Specify the TCP port on which the daemon should listen for SSH
                                connections.
public-key                       Configure a client public-key.
timeout                          Specify the maximum length of time (seconds) permitted for
                                protocol negotiation and authentication.
<cr>

ArubaOS-Switch(config)# ip ssh

ArubaOS-Switch(config)# no telnet-server

ArubaOS-Switch# show ip ssh

SSH Enabled      : Yes                Secure Copy Enabled : No
TCP Port Number : 22                 Timeout (sec)       : 120
Host Key Type    : RSA                Host Key Size       : 2048

Ciphers : aes256-ctr,aes256-cbc,rijndael-cbc@lysator.liu.se,aes192-ctr,
         aes192-cbc,aes128-ctr,aes128-cbc,3des-cbc
MACs     : hmac-sha1-96,hmac-md5,hmac-sha1,hmac-md5-96

Ses Type      | Source IP                                Port
---+-----+-----
1  console    |                                           |
2  telnet     |                                           |
3  ssh        | 10.0.100.80                             | 59987
4  inactive   |                                           |
5  inactive   |                                           |
6  inactive   |                                           |
7  inactive   |                                           |

ArubaOS-Switch# show crypto host-public-key

SSH host public key:

```

```
ssh-rsa AAAAB3NzaC1yc2EAAAABIwAAAQEA2tfJ6jJIdewRSD8D5YV8/wqWPLa0leK5VDBDBZeqmAIJ
GL7JQmO+N+WgPVvbIm8V20QCqR1WHVsVNUAE6O6ErFybFk098Y089HuA7v6ej8lTF9r0U0BMQuNLp5C4
++92wCh/mWJmwTUBIqY2w2tfq4rtNxap123456789054/6o5wIHHC8fNjUf5pwil+nxYOk/migsklDAG
CyH6OdUWWO2Rb2J/nouBOyz/VKLLuT4kO8LF728rxPBQfk7m/a3cKBKkSAM9O+cuTDzT1u3hOnc3zKGh
Q38nMfTPvCCQZLTljhGGywh10uGxzHbSFShRyIRyIrMpvQtX85GcLcZLhw==
```

-or-

```
ArubaOS-Switch# show ip host-public-key
```

SSH host public key:

```
ssh-rsa AAAAB3NzaC1yc2EAAAABIwAAAQEA2tfJ6jJIdewRSD8D5YV8/wqWPLa0leK5VDBDBZeqmAIJ
GL7JQmO+N+WgPVvbIm8V20QCqR1WHVs123456789054FybFk098Y0HuA7v6ej8lTF9r0U0BMQuNLp5C4
++92wCh/mWJmwTUBIqY2w2tfq4rtNxapHN+NTQAIpQIc/6o5wIHHC8fNjUf5pwil+nxYOk/migsklDAG
CyH6OdUWWO2Rb2J/nouBOyz/VKLLuT4kO8LF728rxPBQfk7m/a3cKBKkSAM9O+cuTDzT1u3hOnc3zKGh
Q38nMfTPvCCQZLTljhGGywh10uGxzHbSFShRyIRyIrMpvQtX85GcLcZLhw==
```

Cisco

Note: must configure the hostname and default domain before the 'crypto key generate' process.

```
Cisco(config)#hostname Cisco
```

```
Cisco(config)#ip domain-name test
```

```
Cisco(config)#crypto ?
```

```
ca    Certification authority
key   Long term key operations
pki   Public Key components
```

```
Cisco(config)#crypto key ?
```

```
decrypt      Decrypt a keypair.
encrypt      Encrypt a keypair.
export       Export keys
generate     Generate new keys
import       Import keys
move         Move keys
pubkey-chain Peer public key chain management
storage      default storage location for keypairs
zeroize      Remove keys
```

```
Cisco(config)#crypto key generate ?
```

```
rsa  Generate RSA keys
<cr>
```

```
Cisco(config)#crypto key generate
```

The name for the keys will be: Cisco.test

Choose the size of the key modulus in the range of 360 to 2048 for your
General Purpose Keys. Choosing a key modulus greater than 512 may take
a few minutes.

How many bits in the modulus [512]:

% Generating 512 bit RSA keys, keys will be non-exportable...[OK]

```
Cisco(config)#ip ssh ?
```

authentication-retries	Specify number of authentication retries
break-string	break-string
dh	Diffie-Hellman
dscp	IP DSCP value for SSH traffic
logging	Configure logging for SSH
maxstartups	Maximum concurrent sessions allowed
port	Starting (or only) Port number to listen on
precedence	IP Precedence value for SSH traffic
pubkey-chain	pubkey-chain
rsa	Configure RSA keypair name for SSH
source-interface	Specify interface for source address in SSH connections
stricthostkeycheck	Enable SSH Server Authentication
time-out	Specify SSH time-out interval
version	Specify protocol version to be supported

Cisco(config)#ip ssh version ?

<1-2> Protocol version

Cisco(config)#ip ssh version 2

Cisco(config)#line vty 0 15

Cisco(config-line)#login ?

local Local password checking
<cr>

Cisco(config-line)#login local ?

<cr>

Cisco(config-line)#login local

Cisco(config-line)#transport ?

input Define which protocols to use when connecting to the terminal server
output Define which protocols to use for outgoing connections
preferred Specify the preferred protocol to use

Cisco(config-line)#transport input ?

all All protocols
none No protocols
ssh TCP/IP SSH protocol
telnet TCP/IP Telnet protocol

Cisco(config-line)#transport input ssh ?

telnet TCP/IP Telnet protocol
<cr>

Cisco(config-line)#transport input ssh

Cisco(config)#username <name> privilege 15 password <password>

Cisco#show ip ssh

SSH Enabled - version 2.0
Authentication timeout: 120 secs; Authentication retries: 3


```
Minimum expected Diffie Hellman key size : 1024 bits
IOS Keys in SECSH format(ssh-rsa, base64 encoded):
ssh-rsa AAAAB3NzaClyc2EAAAADAQABAAQgQDEbwH5h57hZcqQbC07QmgIUC7icCexxBtx52vejCnp
ZAsaZzXMXahBSiGYs+GTZePb12345678905Zrk1BwpoZIC005S8Fk7Gu0e9ilfRdETAstz01YmboasSJ
5rUp3sIasRHGMp3CZHQt520Dv22bDH0CBGEQ8+JF5IJ0kgYkhw==
```

```
Cisco#show ssh
```

Connection	Version	Mode	Encryption	Hmac	State	Username
0	2.0	IN	aes256-cbc	hmac-shal	Session started	manager
0	2.0	OUT	aes256-cbc	hmac-shal	Session started	manager

%No SSHv1 server connections running.

```
Cisco#show crypto key mypubkey rsa
```

```
% Key pair was generated at: 18:03:26 US-Cent Feb 28 1993
Key name: TP-self-signed-2443920256
Storage Device: private-config
Usage: General Purpose Key
Key is not exportable.
```

```
Key Data:
```

```
30819F30 0D06092A 864886F7 0D010101 05000381 8D003081 89028181 00C46F01
F9879EE1 65CA906C 2D3B4268 08502EE2 7027B1C4 1B71E76B DE8C29E9 640B1A67
35CC5DA8 414A2198 B3E19365 E312384E 9A386D0D D80699AE 4D41C29A 1920238E
E52F0593 B1AED1EF 6295F45D 11302CB7 3D356266 E86A4569 E6B529DE C21AB111
C6329DC2 64742DE7 6D03BF6D 9B0C7A02 046110F3 E245E482 74920624 87020301 0001
```

```
% Key pair was generated at: 01:34:01 US-Cent Mar 27 2015
```

```
Key name: TP-self-signed-2443920256.server
Temporary key
Usage: Encryption Key
Key is not exportable.
```

```
Key Data:
```

```
307C300D 06092A86 4886F70D 01010105 00036B00 30680261 00B51791 797FFD80
F0484B82 1F944989 BF12382B 035B1DC4 92B6C4D9 F9FF1AE8 B8D6CDFF B6AF6BDF
A9764C7B CB1B9E58 C711892E 1C2B11F5 D1A38AA2 1C456427 2D3F2A49 5757F8D4
8F9D0DA4 FBD0AD43 CC513CA3 91F790F1 0B57EBC6 2164D46E 85020301 0001
```

```
% Key pair was generated at: 02:28:42 US-Cent Mar 27 2015
```

```
Key name: Cisco.test
Storage Device: not specified
Usage: General Purpose Key
Key is not exportable.
```

```
Key Data:
```

```
305C300D 06092A86 4886F70D 01010105 00034B00 30480241 00AB1487 78C90D6E
3332E08F AD4B26DB 541233F8 1D56986A 5F89DB27 074456AD 07022442 F6DB3765
4CF3E3FE 7C55A9A7 F958A17C 2CDFCD8B 1E7F86C6 B41894EB 6B020301 0001
```

Chapter 5 GUI Management Access – HTTPS

This chapter compares the commands used to enable and configure browser-based applications to manage the switch via unencrypted and encrypted network access methods.

Enable standard TCP port 80 access for unencrypted management access to the switch.

For encrypted management access to the switch use TCP port 443, and must configure Secure Sockets Layer (SSL).

You can find configuration details for User ID's and Password's in Chapter 2.

HTTPS CLI Comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
HTTP access is disabled by default and is available as soon as it is enabled manually using CLI To control HTTPS access with UID/PW or PW (only), see Ch2 for configuring UID/PW or PW only.	HTTP access is enabled by default and is available as soon as an IP addr is assigned to a VLAN, without UID/PW access control. To control HTTPS access with UID/PW or PW (only), see Ch2 for configuring UID/PW or PW only.	HTTP server is enabled by default, but must configure http authentication type. Must have all the device web files for full functionality.
user admin password		username <name> privilege 15 password <password>
https-server vrf <mgmt/default>	web-management plaintext	ip http server
https-server rest access-mode read-only		ip http authentication local
https-server rest access-mode read-write		
show https-server		show ip http server connection

HTTPS Service configurable options

ArubaOS-CX-Switch
ArubaOS-CX-Switch(config)# https-server rest REST API configuration vrf Configure HTTPS Server for VRF ArubaOS-CX-Switch(config)# https-server rest access-mode REST API access-mode configuration ArubaOS-CX-Switch(config)# https-server rest access-mode read-only Allow reads only (default) read-write Allow reads and writes ArubaOS-CX-Switch(config)# https-server rest access-mode read-only <cr>

```
ArubaOS-CX-Switch(config)# https-server rest access-mode read-only
ArubaOS-CX-Switch(config)# https-server rest access-mode read-write
ArubaOS-CX-Switch(config)# do sh https-server
<cr>
```

```
ArubaOS-CX-Switch(config)# do sh https-server
```

```
HTTPS Server Configuration
-----
VRF                : <none>

REST Access Mode   : read-write
```

ArubaOS-Switch

HTTP access is enabled by default and is available as soon as an IP addr is assigned to a VLAN, without UID/PW access control. If passwords are assigned to the operator and/or manager users, then those will be used during HTTP access.

```
ArubaOS-Switch(config)# web-management
idle-timeout          Set the idle timeout for web management sessions.
listen                Specify in which mode HTTP Server should listen in
management-url        Specify URL for web interface [?] button.
plaintext              Enable/disable the http server (insecure).
ssl                   Enable/disable the https server (secure).
support-url            Specify URL for web interface Support page.
<cr>
```

```
ArubaOS-Switch(config)# web-management plaintext
<cr>
```

```
ArubaOS-Switch(config)# web-management plaintext
```

Note, even though the above command can be entered to enable HTTP access, it is the default state and will not appear in the configuration.

Cisco

HTTP server is enabled by default, but must configure http authentication type.

Note: must have all the device web files (these are in addition to IOS) on the switch for full functionality.

```
Cisco(config)#username manager privilege 15 password password
```

```
Cisco(config)#ip http ?
access-class           Restrict http server access by access-class
active-session-modules Set up active http server session modules
authentication          Set http server authentication method
client                 Set http client parameters
help-path              HTML help root URL
max-connections        Set maximum number of concurrent http server
                        connections
path                   Set base path for HTML
port                   Set http server port
secure-active-session-modules Set up active http secure server session
                        modules
secure-ciphersuite     Set http secure server ciphersuite
secure-client-auth     Set http secure server with client
                        authentication
secure-port            Set http secure server port number for
                        listening
```

secure-server	Enable HTTP secure server
secure-trustpoint	Set http secure server certificate trustpoint
server	Enable http server
session-module-list	Set up a http(s) server session module list
timeout-policy	Set http server time-out policy parameters

```

Cisco(config)#ip http authentication ?
aaa      Use AAA access control methods
enable   Use enable passwords
local    Use local username and passwords

Cisco(config)#ip http authentication local ?
<cr>

Cisco(config)#ip http authentication local

Cisco(config)#ip http server ?
<cr>

Cisco(config)#ip http server

Cisco#show ip http server connection

HTTP server current connections:
local-ipaddress:port  remote-ipaddress:port  in-bytes  out-bytes
10.0.111.41:80        10.1.1.108:55648 1612      70843

```

Chapter 6 Discovery Protocols – LLDP

Link Layer Discovery Protocol (LLDP) and Cisco Discovery Protocol (CDP) , both are link layer protocols which helps to discover directly connected LLDP and CDP-capable neighbors

- Link Layer Discovery Protocol (LLDP), an industry standard protocol for device discovery
- Cisco Discovery Protocol (CDP), a Cisco-specific protocol for device discovery.

This chapter covers the commands required to configure LLDP.

ArubaOS-Switch provide limited support for CDP.

In a heterogeneous network, a standard configuration exchange platform ensures that different types of network devices from different vendors can discover one another and exchange configuration for the sake of interoperability and management.

LLDP CLI Comparision

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
(Enabled by default, both globally and per port)	(Enabled by default, both globally and per port)	(Not enabled by default)
lldp lldp reinit 10	lldp run	lldp run
lldp < holdtime- multiplier management-ipv4-	lldp admin-status oobm [txonly rxonly tx_rx disable]	lldp < holdtime reinit run timer tlv-select >

address management- ipv6-address reinit select-tlv timer txdelay >		lldp tlv-select < 4-wire-power- management mac-phy-cfg management-address port-description port-vlan power-management system-capabilities system-description system-name >
show lldp neighbor- info show lldp neighbor- info 1/1/1	show lldp info remote-device show lldp info remote-device 1	show lldp neighbors show lldp neighbors g1/0/1 detail
show lldp statistics	show lldp stats	show lldp traffic show lldp errors
show lldp tlv		
show lldp configuration	show lldp config	
show lldp local-device	show lldp info local-device oobm show lldp stats oobm	show lldp entry *

LLDP configurable options

ArubaOS-CX-Switch

```

ArubaOS-CX-Switch(config)# lldp
  holdtime-multiplier    The multiplier to apply for the total hold period for a neighbor.
  management-ipv4-address LLDP management IPv4 address to be sent in TLV
  management-ipv6-address LLDP management IPv6 address to be sent in TLV
  reinit                 Time delay to initialize LLDP on an interface in seconds.
  select-tlv             Specifies the TLVs to send and receive in LLDP packets.
  timer                  Time interval for transmitting LLDP status updates in seconds.
  txdelay                Time delay to send a LLDP advertisement upon an update in
seconds.
  <cr>

ArubaOS-CX-Switch(config)# lldp reinit
  <1-10> Set the Reinitialization timer. Default is 2 seconds.

ArubaOS-CX-Switch(config)# lldp reinit 10
  <cr>

ArubaOS-CX-Switch(config)# lldp reinit 10

ArubaOS-CX-Switch(config)# lldp timer
  <5-32768> Set lldp timer. Default is 30 seconds.

ArubaOS-CX-Switch(config)# lldp timer 222
  <cr>

ArubaOS-CX-Switch(config)# lldp timer 222

ArubaOS-CX-Switch(config)# lldp holdtime-multiplier
  <2-10> Set the Hold-Time multiplier. Default is 4.

ArubaOS-CX-Switch(config)# lldp holdtime-multiplier 4
  <cr>

```

```

ArubaOS-CX-Switch(config)# lldp holdtime-multiplier 4

ArubaOS-CX-Switch(config)# lldp
  holdtime-multiplier      The multiplier to apply for the total hold period for a neighbor.
  management-ipv4-address  LLDP management IPv4 address to be sent in TLV
  management-ipv6-address  LLDP management IPv6 address to be sent in TLV
  reinit                   Time delay to initialize LLDP on an interface in seconds.
  select-tlv               Specifies the TLVs to send and receive in LLDP packets.
  timer                    Time interval for transmitting LLDP status updates in seconds.
  txdelay                  Time delay to send a LLDP advertisement upon an update in
seconds.
  <cr>

ArubaOS-CX-Switch(config)# lldp management-ipv
  management-ipv4-address  LLDP management IPv4 address to be sent in TLV
  management-ipv6-address  LLDP management IPv6 address to be sent in TLV

ArubaOS-CX-Switch(config)# lldp management-ipv4-address
  A.B.C.D LLDP management IPv4 address

ArubaOS-CX-Switch(config)# lldp management-ipv4-address 10.0.0.1
  <cr>
ArubaOS-CX-Switch(config)# lldp management-ipv4-address 10.0.0.1

ArubaOS-CX-Switch(config)# lldp txdelay
  <1-8192> Set the TxDelay timer. Default is 2 seconds.

ArubaOS-CX-Switch(config)# lldp txdelay 33
  <cr>

ArubaOS-CX-Switch(config)# lldp txdelay 33

ArubaOS-CX-Switch(config)# do show lldp
  configuration Show LLDP configuration
  local-device  Show LLDP local device information
  neighbor-info Show global LLDP neighbor information
  statistics    Show LLDP statistics
  tlv           Show TLVs advertised by LLDP

ArubaOS-CX-Switch(config)# do show lldp local-device
  <cr>

ArubaOS-CX-Switch(config)# do show lldp local-device

Global Data
=====

Chassis-ID       : f4:03:43:7f:ad:00
System Name      : switch
System Description : Aruba JL375A XL.10.00.0002
Management Address : 10.0.0.1
Capabilities Available : Bridge, Router
Capabilities Enabled : Bridge, Router
TTL              : 888

ArubaOS-CX-Switch(config)# do show lldp neighbor-info

LLDP Neighbor Information
=====

Total Neighbor Entries      : 0
Total Neighbor Entries Deleted : 0

```

```
Total Neighbor Entries Dropped : 0
Total Neighbor Entries Aged-Out : 0
```

LOCAL-PORT	CHASSIS-ID	PORT-ID	PORT-DESC	TTL	SYS-NAME
------------	------------	---------	-----------	-----	----------

```
-----
ArubaOS-CX-Switch(config)# do show lldp local-device
```

```
Global Data
=====
```

```
Chassis-ID       : f4:03:43:7f:ad:00
System Name      : switch
System Description : Aruba JL375A  XL.10.00.0002
Management Address : 10.0.0.1
Capabilities Available : Bridge, Router
Capabilities Enabled : Bridge, Router
TTL              : 888
```

```
ArubaOS-CX-Switch(config)# do show lldp statistics
```

```
LLDP Global Statistics
=====
```

```
Total Packets Transmitted      : 0
Total Packets Received          : 0
Total Packets Received And Discarded : 0
Total TLVs Unrecognized        : 0
```

```
LLDP Port Statistics
=====
```

PORT-ID	TX-PACKETS	RX-PACKETS	RX-DISCARDED	TLVS-UNKNOWN
1/1/1	0	0	0	0
1/1/2	0	0	0	0
1/1/3	0	0	0	0
1/1/4	0	0	0	0
1/1/5	0	0	0	0
1/1/6	0	0	0	0
1/1/7	0	0	0	0
1/1/8	0	0	0	0
1/1/9	0	0	0	0
1/1/10	0	0	0	0
1/1/11	0	0	0	0
1/1/12	0	0	0	0
1/1/13	0	0	0	0
1/1/14	0	0	0	0
1/1/15	0	0	0	0
1/1/16	0	0	0	0
1/1/17	0	0	0	0
1/1/18	0	0	0	0
1/1/19	0	0	0	0
1/1/20	0	0	0	0
1/1/21	0	0	0	0
1/1/22	0	0	0	0
1/1/23	0	0	0	0
1/1/24	0	0	0	0
1/1/25	0	0	0	0
1/1/26	0	0	0	0
1/1/27	0	0	0	0
1/1/28	0	0	0	0
1/1/29	0	0	0	0
1/1/30	0	0	0	0

```

1/1/31      0      0      0      0
1/1/32      0      0      0      0

```

ArubaOS-CX-Switch(config)# do show lldp tlv

TLVs Advertised
=====

Management Address
Port Description
Port VLAN-ID
System Capabilities
System Description
System Name

ArubaOS-CX-Switch(config)# do show lldp configuration

LLDP Global Configuration
=====

LLDP Enabled : Yes
LLDP Transmit Interval : 222
LLDP Hold Time Multiplier : 4
LLDP Transmit Delay Interval : 33
LLDP Reinit Time Interval : 10

TLVs Advertised
=====

Management Address
Port Description
Port VLAN-ID
System Capabilities
System Description
System Name

LLDP Port Configuration
=====

PORT	TX-ENABLED	RX-ENABLED
-----	-----	-----
1/1/1	Yes	Yes
1/1/2	Yes	Yes
1/1/3	Yes	Yes
1/1/4	Yes	Yes
1/1/5	Yes	Yes
1/1/6	Yes	Yes
1/1/7	Yes	Yes
1/1/8	Yes	Yes
1/1/9	Yes	Yes
1/1/10	Yes	Yes
1/1/11	Yes	Yes
1/1/12	Yes	Yes
1/1/13	Yes	Yes
1/1/14	Yes	Yes
1/1/15	Yes	Yes
1/1/16	Yes	Yes
1/1/17	Yes	Yes
1/1/18	Yes	Yes
1/1/19	Yes	Yes
1/1/20	Yes	Yes
1/1/21	Yes	Yes
1/1/22	Yes	Yes
1/1/23	Yes	Yes

1/1/24	Yes	Yes
1/1/25	Yes	Yes
1/1/26	Yes	Yes
1/1/27	Yes	Yes
1/1/28	Yes	Yes
1/1/29	Yes	Yes
1/1/30	Yes	Yes
1/1/31	Yes	Yes
1/1/32	Yes	Yes

ArubaOS-Switch

(Enabled by default, both globally and per port)

(if needed)

```
ArubaOS-Switch(config)# lldp
admin-status          Set the port operational mode.
auto-ArubaOS-Switch   Configure various parameters related to lldp automatic
                      ArubaOS-Switching.
config               Set theTLV parameters to advertise on port.
enable-notification   Enable or disable notification on port.
fast-start-count      Set the MED fast-start count in seconds.
holdtime-multiplier   Set the holdtime multipler.
refresh-interval      Set refresh interval/transmit interval in seconds.
run                  Start or stop LLDP on the device.
top-change-notify     Enable or disable LLDP MED topology change notification.

ArubaOS-Switch(config)# lldp run ?
<cr>

ArubaOS-Switch(config)# lldp run

ArubaOS-Switch# show lldp ?
auto-ArubaOS-Switch   Show LLDP auto-ArubaOS-Switch related info for radio-ports.
config               Show LLDP configuration information.
info                 Show LLDP information about the local or remote device.
stats                Show LLDP statistics.

ArubaOS-Switch# show lldp info ?
local-device          Show LLDP local device information.
remote-device         Show LLDP remote device information.

ArubaOS-Switch# show lldp info remote-device ?
[ethernet] PORT-LIST Show local or remote device information for the specified ports.
<cr>

ArubaOS-Switch# show lldp info remote-device

LLDP Remote Devices Information

  LocalPort | ChassisId                PortId PortDescr SysName
  ----- + -----
  1          | c0 91 34 83 8d 80        3      3        2520G-1

ArubaOS-Switch# show lldp info remote-device 1

LLDP Remote Device Information Detail

Local Port      : 1
ChassisType     : mac-address
```

```
ChassisId      : c0 91 34 83 8d 80
PortType       : local
PortId         : 3
SysName        : 2520G-1
System Descr   : ProCurve J9299A Switch 2520G-24-PoE, revision J.14.54, RO...
PortDescr      : 3
Pvid           :
```

```
System Capabilities Supported : bridge
System Capabilities Enabled   : bridge
```

```
Remote Management Address
Type      : ipv4
Address   : 10.0.111.2
```

Cisco

(Not enabled by default)

```
Cisco(config)#lldp run
```

```
Cisco#show lldp ?
```

```
entry      Information for specific neighbor entry
errors     LLDP computational errors and overflows
interface  LLDP interface status and configuration
neighbors  LLDP neighbor entries
traffic    LLDP statistics
|          Output modifiers
<cr>
```

```
Cisco#show lldp neighbors ?
```

```
FastEthernet      FastEthernet IEEE 802.3
GigabitEthernet   GigabitEthernet IEEE 802.3z
TenGigabitEthernet Ten Gigabit Ethernet
detail            Show detailed information
|                Output modifiers
<cr>
```

```
Cisco#show lldp neighbors
```

Capability codes:

(R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device
(W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other

Device ID	Local Intf	Hold-time	Capability	Port ID
2520G-1	Gi1/0/1	120	B	15

Total entries displayed: 1

```
Cisco#show lldp neighbors g1/0/1 ?
```

```
detail  Show detailed information
|       Output modifiers
<cr>
```

```
Cisco#show lldp neighbors g1/0/1
```

```

Capability codes:
  (R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device
  (W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other

Device ID           Local Intf      Hold-time  Capability    Port ID
2520G-1             Gi1/0/1        120        B             15

Total entries displayed: 1

Cisco#show lldp neighbors g1/0/1 detail

-----
Chassis id: c091.3483.8d80
Port id: 15
Port Description: 15
System Name: 2520G-1

System Description:
ProCurve J9299A Switch 2520G-24-PoE, revision J.14.54, ROM J.14.05
(/sw/code/build/walle(J_t4b))

Time remaining: 99 seconds
System Capabilities: B
Enabled Capabilities: B
Management Addresses:
  IP: 10.0.111.2
Auto Negotiation - supported, enabled
Physical media capabilities:
  1000baseT(FD)
  100base-TX(FD)
  100base-TX(HD)
  10base-T(FD)
  10base-T(HD)

Media Attachment Unit type: 30
Vlan ID: - not advertised

Total entries displayed: 1

```

Chapter 7 Out-of-Band Management

One of the first key questions about securing a network switch is “Is my management traffic in-band or out-of-band?” The differences can be described as follows:

- In-band – switch management traffic travels with the network data traffic on the data plane and can be impacted when communication problems arise on the data plane
- Out-of-band – switch management traffic travels on a different plane than the network data traffic and is not impacted when communication problems arise on the data plane.

In documentation, it is common to describe “out-of-band” connections as being associated with the Management Plane and “in-band” connections as being associated with the Data Plane.

Management Plane

Serial Console: For the out-of-band, switches supports a serial console allowing a computer or console server to connect. This connection is speed limited and limited to the Command Line Interface. In addition, the serial interface doesn't support other types of management traffic – like RADIUS, SNMP, or Syslog – where the switch is acting like a client.

Out-of-band Management (OOBM) and Management ports generally refer to an Ethernet port that is dedicated to management. A variety of protocols can be supported over the management port based on available features by product/operating system.

Data Plane

A management Virtual Local Area Network (VLAN) is a VLAN with severe network configuration restrictions focused only on switch management.

A loopback interface can be protected using Access Control Lists, and when combined with other security settings, can offer a high degree of security confidence when a management VLAN is too restrictive.

A Data Plane configuration for switch management may be necessary if you need to manage the switch via a Fiber connection since OOBM ports are RJ-45 or if there is no OOBM ports on the switch. In addition, using the Loopback interface method, you can have and control access from multiple VLANs in the network. Of course the downside is that such connections are in the Data Plane and subject to interruption by Data Plane troubles.

Out-Of-Band CLI Comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
Configuration commands		
interface mgmt. ip static 10.0.0.1/24	Oobm ip address 10.199.111.21/24	interface fastEthernet 0 ip address 10.199.111.41 255.255.255.0
ssh server vrf mgmt	ip ssh listen oobm	ip ssh source-interface <>
https-server vrf mgmt	web-management listen oobm	
Show/display commands		
ping <target-ip> vrf mgmt	ping <taget-ip> source oobm	Ping -a <source-ip> <target-ip>
copy tftp://10.120.0.9/halon/<file>.swi primary vrf mgmt	copy tftp flash 10.199.111.200 KA_16_01_0006.swi primary oobm	copy tftp://10.199.111.200/c3750e-universalk9-mz.150-2.SE7.bin flash:/boot/c3750e-universalk9-mz.150-2.SE7.bin

Out-Of-Band configurable options

ArubaOS-CX-Switch
ArubaOS-CX-Switch(config)# interface mgmt

```

<cr>
ArubaOS-CX-Switch(config)# interface mgmt.

ArubaOS-CX-Switch(config-if-mgmt)# ip
dhcp      Set the mode as dhcp
static    Set the mode as static

ArubaOS-CX-Switch(config-if-mgmt)# ip static
A.B.C.D/M  Enter the IPv4 address
X:X::X:X/M Enter the IPv6 address

ArubaOS-CX-Switch(config-if-mgmt)# ip static 10.0.0.1/24
<cr>

ArubaOS-CX-Switch(config-if-mgmt)# ip static 10.0.0.1/24

ArubaOS-CX-Switch(config-if-mgmt)# exit

ArubaOS-CX-Switch(config)# ssh
host-key          SSH server host-keys.
known-host        Client trusted servers list.
password-authentication Password authentication method enabled by default.
public-key-authentication Publickey authentication method enabled by default.
server            Configure SSH server.

ArubaOS-CX-Switch(config)# ssh server vrf
VRF-NAME Enter the VRF instance. 'default' or 'mgmt' or a configured VRF instance.

ArubaOS-CX-Switch(config)# ssh server vrf mgmt
<cr>

ArubaOS-CX-Switch(config)# ssh server vrf mgmt.

ArubaOS-CX-Switch(config)# https-server
rest  REST API configuration
vrf   Configure HTTPS Server for VRF
ArubaOS-CX-Switch(config)# https-server vrf
NAME Specify VRF name

ArubaOS-CX-Switch(config)# https-server vrf mgmt
<cr>

ArubaOS-CX-Switch(config)# https-server vrf mgmt
Failed to enable https-server on VRF mgmt. 'admin' password is not set.

ArubaOS-CX-Switch(config)# user admin password
Changing password for user admin
Enter password: *****
Confirm new password: *****

ArubaOS-CX-Switch(config)# https-server vrf mgmt.

ArubaOS-CX-Switch(config)# do show interface mgmt
Management interface is disabled

ArubaOS-CX-Switch(config)# interface mgmt.

ArubaOS-CX-Switch(config-if-mgmt)# no shut

ArubaOS-CX-Switch(config-if-mgmt)# exit

ArubaOS-CX-Switch(config)# do show interface mgmt

```

```

Address Mode           : static
Admin State            : up
Mac Address            : f4:03:43:7f:ad:01
IPv4 address/subnet-mask : 10.0.0.1/24
Default gateway IPv4    :
IPv6 address/prefix     :
IPv6 link local address/prefix:
Default gateway IPv6    :
Primary Nameserver      :
Secondary Nameserver    :

```

ArubaOS-Switch

```

ArubaOS-Switch(config)# oobm
  disable      Disable OOBM.
  enable       Enable OOBM.
  interface    Configure various interface parameters for OOBM.
  ip           Configure various IP parameters for the OOBM.
  ipv6         Configure various IPv6 parameters for the OOBM.
  ntp          Enable/configure NTP operation on the VLAN/OOBM.
  <cr>

ArubaOS-Switch(oobm)# ip ?
  address      Set IP parameters for communication within an IP network.
  default-gateway Configure the IPv4 default gateway address, which will be used
               when routing is not enabled on the switch.

ArubaOS-Switch(oobm)# ip address ?
  dhcp-bootp   Configure the interface to use DHCP/Bootp server to acquire
               parameters.
  IP-ADDR/MASK-LENGTH Interface IP address/mask.

ArubaOS-Switch(oobm)# ip address 10.199.111.21/24 ?
  <cr>
ArubaOS-Switch(oobm)# ip address 10.199.111.21/24

ArubaOS-Switch(oobm)# ip default-gateway ?
  IP-ADDR      IPv4 address of the default gateway.

ArubaOS-Switch(oobm)# ip default-gateway 10.199.111.1 ?
  <cr>
ArubaOS-Switch(oobm)# ip default-gateway 10.199.111.1

ArubaOS-Switch(config)# telnet-server listen ?
  oobm         Enable Telnet Server on OOBM Interface only.
  data         Enable Telnet Server on Data Plane only.
  both         Enable Telnet Server on both OOBM and Data planes.

ArubaOS-Switch(config)# telnet-server listen oobm

ArubaOS-Switch(config)# ip ssh listen ?
  oobm         Enable SSH on OOBM Interface only.
  data         Enable SSH on Data Plane only.
  both         Enable SSH on both OOBM and Data planes.

ArubaOS-Switch(config)# ip ssh listen oobm

ArubaOS-Switch(config)# web-management listen ?
  oobm         Enable HTTP Server on OOBM Interface only.
  data         Enable HTTP Server on Data Plane only.

```

```

both                Enable HTTP Server on both OOBM and Data planes.

ArubaOS-Switch(config)# web-management listen oobm

ArubaOS-Switch(config)# ntp server 10.199.111.251 ?
burst               Enables burst mode.
iburst              Enables initial burst (iburst) mode.
key-id              Set the authentication key to use for this server.
max-poll            Configures the maximum time intervals in seconds.
min-poll            Configures the minimum time intervals in seconds.
oobm                Use the OOBM interface to connect to the server.
<cr>

ArubaOS-Switch(config)# ntp server 10.199.111.251 oobm ?
burst               Enables burst mode.
iburst              Enables initial burst (iburst) mode.
key-id              Set the authentication key to use for this server.
max-poll            Configures the maximum time intervals in seconds.
min-poll            Configures the minimum time intervals in seconds.
<cr>

ArubaOS-Switch(config)# ntp server 10.199.111.251 oobm

ArubaOS-Switch# ping 10.199.111.51 ?
ip-option           Specify the IP options to use.
tos                 Specify the Type of Service value to send.
data-fill            Specify the data pattern to send.
data-size            Specify the ping data size.
interval            Specify the interval between pings in seconds.
repetitions         Ping the device multiple times.
source              Specify the ping source.
timeout             Specify the ping timeout in seconds.
<cr>

ArubaOS-Switch# ping 10.199.111.51 source ?
IP-ADDR             The source IPv4 address.
loopback            Specify the source loopback interface.
oobm                Use the OOBM interface.
VLAN-ID             The source VLAN.

ArubaOS-Switch# ping 10.199.111.51 source oobm ?
data-fill            Specify the data pattern to send.
data-size            Specify the ping data size.
interval            Specify the interval between pings in seconds.
repetitions         Ping the device multiple times.
timeout             Specify the ping timeout in seconds.
<cr>

ArubaOS-Switch# ping 10.199.111.51 source oobm
10.199.111.51 is alive, time = 1 ms

ArubaOS-Switch# copy tftp flash 10.199.111.200 KA_16_01_0006.swi primary ?
oobm                Use the OOBM interface to reach TFTP server.
<cr>

ArubaOS-Switch# copy tftp flash 10.199.111.200 KA_16_01_0006.swi primary oobm ?

<cr>
ArubaOS-Switch# copy tftp flash 10.199.111.200 KA_16_01_0006.swi primary oobm

```

```
ArubaOS-Switch# show lldp info remote-device ?
oobm                Show local or remote device information for the OOBM port.
[ethernet] PORT-LIST Show local or remote device information for the specified ports.
<cr>
```

```
ArubaOS-Switch# show lldp info remote-device oobm ?
<cr>
```

```
ArubaOS-Switch# show lldp info remote-device oobm
```

LLDP Remote Device Information Detail

```
Local Port      : OOBM
ChassisType     : mac-address
ChassisId       : 00 25 61 d7 c5 60
PortType        : local
PortId          : 1
SysName         : 2520-8-OOBM
System Descr    : ProCurve J9137A Switch 2520-8-PoE, revision S.14.03, ROM ...
PortDescr       : 1
Pvid            :
```

```
System Capabilities Supported : bridge
System Capabilities Enabled   : bridge
```

Remote Management Address

```
Type      : ipv4
Address   : 10.199.111.2
```

Cisco

```
Cisco(config)#interface fastEthernet 0
```

```
Cisco(config-if)#?
```

Interface configuration commands:

aaa	Authentication, Authorization and Accounting.
access-expression	Build a bridge boolean access expression
arp	Set arp type (arpa, probe, snap) or timeout or log options
bandwidth	Set bandwidth informational parameter
bgp-policy	Apply policy propagated by bgp community string
carrier-delay	Specify delay for interface transitions
cdp	CDP interface subcommands
clns	CLNS interface subcommands
crypto	Encryption/Decryption commands
cts	Configure Cisco Trusted Security
dampening	Enable event dampening
datalink	Interface Datalink commands
default	Set a command to its defaults
delay	Specify interface throughput delay
description	Interface specific description
duplex	Configure duplex operation.
eou	EAPoUDP Interface Configuration Commands
exit	Exit from interface configuration mode
flow-sampler	Attach flow sampler to the interface
flowcontrol	Configure flow operation.
glbp	Gateway Load Balancing Protocol interface commands
help	Description of the interactive help system
history	Interface history histograms - 60 second, 60 minute and 72 hour
hold-queue	Set hold queue depth

ip	Interface Internet Protocol config commands
ipv6	IPv6 interface subcommands
isis	IS-IS commands
iso-igrp	ISO-IGRP interface subcommands
keepalive	Enable keepalive
link	Configure Link
lldp	LLDP interface subcommands
load-interval	Specify interval for load calculation for an interface
location	Interface location information
logging	Configure logging for interface
loopback	Configure internal loopback on an interface
macro	Command macro
max-reserved-bandwidth	Maximum Reservable Bandwidth on an Interface
mka	MACsec Key Agreement (MKA) interface configuration
neighbor	interface neighbor configuration mode commands
network-policy	Network Policy
nmosp	NMSP interface configuration
no	Negate a command or set its defaults
ntp	Configure NTP
pagp	PAGP interface subcommands
power	Power configuration
rate-limit	Rate Limit
routing	Per-interface routing configuration
service-policy	Configure CPL Service Policy
shutdown	Shutdown the selected interface
small-frame	Set rate limit parameters for small frame
snmp	Modify SNMP interface parameters
source	Get config from another source
spanning-tree	Spanning Tree Subsystem
speed	Configure speed operation.
standby	HSRP interface configuration commands
timeout	Define timeout values for this interface
topology	Configure routing topology on the interface
traffic-shape	Enable Traffic Shaping on an Interface or Sub-Interface
transmit-interface	Assign a transmit interface to a receive-only interface
tx-ring-limit	Configure PA level transmit ring limit
vrf	VPN Routing/Forwarding parameters on the interface
vrrp	VRRP Interface configuration commands
vtp	Enable VTP on this interface

Cisco(config-if)#ip ?

Interface IP configuration subcommands:

access-group	Specify access control for packets
accounting	Enable IP accounting on this interface
address	Set the IP address of an interface
admission	Apply Network Admission Control
auth-proxy	Apply authentication proxy
authentication	authentication subcommands
bandwidth-percent	Set EIGRP bandwidth limit
bgp	BGP interface commands
broadcast-address	Set the broadcast address of an interface
cef	Cisco Express Forwarding interface commands
cgmp	Enable/disable CGMP
dampening-change	Percent interface metric must change to cause update
dampening-interval	Time in seconds to check interface metrics
dhcp	Configure DHCP parameters for this interface
directed-broadcast	Enable forwarding of directed broadcasts
flow	NetFlow related commands
header-compression	IPHC options
hello-interval	Configures EIGRP-IPv4 hello interval

helper-address	Specify a destination address for UDP broadcasts
hold-time	Configures EIGRP-IPv4 hold time
igmp	IGMP interface commands
information-reply	Enable sending ICMP Information Reply messages
irdp	ICMP Router Discovery Protocol
load-sharing	Style of load sharing
local-proxy-arp	Enable local-proxy ARP
mask-reply	Enable sending ICMP Mask Reply messages
mrm	Configure IP Multicast Routing Monitor tester
mrout-cache	Enable switching cache for incoming multicast packets
mtu	Set IP Maximum Transmission Unit
multicast	IP multicast interface commands
next-hop-self	Configures EIGRP-IPv4 next-hop-self
ospf	OSPF interface commands
pim	PIM interface commands
policy	Enable policy routing
probe	Enable HP Probe support
proxy-arp	Enable proxy ARP
rarp-server	Enable RARP server for static arp entries
redirects	Enable sending ICMP Redirect messages
rgmp	Enable/disable RGMP
rip	Router Information Protocol
route-cache	Enable fast-switching cache for outgoing packets
router	IP router interface commands
rsvp	RSVP Interface Commands
rtp	RTP parameters
sap	Session Advertisement Protocol interface commands
security	DDN IP Security Option
split-horizon	Perform split horizon
sticky-arp	Allow the creation of sticky ARP entries
summary-address	Perform address summarization
tcp	TCP interface commands
unnumbered	Enable IP processing without an explicit address
unreachables	Enable sending ICMP Unreachable messages
urd	Configure URL Rendezvousing
verify	Enable per packet validation
vrf	VPN Routing/Forwarding parameters on the interface
wccp	WCCP interface commands

Cisco(config-if)#ip address ?

```

A.B.C.D  IP address
dhcp     IP Address negotiated via DHCP
pool     IP Address autoconfigured from a local DHCP pool

```

Cisco(config-if)#ip address 10.199.111.41 255.255.255.0 ?

```

secondary  Make this IP address a secondary address
<cr>

```

Cisco(config-if)#ip address 10.199.111.41 255.255.255.0

Cisco(config)#ip telnet ?

```

comport    Specify RFC 2217 options
hidden     Don't display telnet addresses or hostnames
quiet      Don't display non-error telnet messages
source-interface  Specify source interface
tos        Specify type of service

```

Cisco(config)#ip telnet source-interface ?

Async	Async interface
Auto-Template	Auto-Template interface
BVI	Bridge-Group Virtual Interface
CTunnel	CTunnel interface
Dialer	Dialer interface
FastEthernet	FastEthernet IEEE 802.3
Filter	Filter interface
Filtergroup	Filter Group interface
GigabitEthernet	GigabitEthernet IEEE 802.3z
GroupVI	Group Virtual interface
Lex	Lex interface
Loopback	Loopback interface
Null	Null interface
Port-channel	Ethernet Channel of interfaces
Portgroup	Portgroup interface
Pos-channel	POS Channel of interfaces
TenGigabitEthernet	Ten Gigabit Ethernet
Tunnel	Tunnel interface
Vif	PGM Multicast Host interface
Virtual-Template	Virtual Template interface
Virtual-TokenRing	Virtual TokenRing
Vlan	Catalyst Vlans
fcpa	Fiber Channel

```
Cisco(config)#ip telnet source-interface fastEthernet 0 ?
<cr>
```

```
Cisco(config)#ip telnet source-interface fastEthernet 0
```

```
Cisco(config)#ip ssh ?
```

authentication-retries	Specify number of authentication retries
break-string	break-string
dh	Diffie-Hellman
dscp	IP DSCP value for SSH traffic
logging	Configure logging for SSH
maxstartups	Maximum concurrent sessions allowed
port	Starting (or only) Port number to listen on
precedence	IP Precedence value for SSH traffic
pubkey-chain	pubkey-chain
rekey	Configure rekey values
rsa	Configure RSA keypair name for SSH
source-interface	Specify interface for source address in SSH connections
stricthostkeycheck	Enable SSH Server Authentication
time-out	Specify SSH time-out interval
version	Specify protocol version to be supported

```
Cisco(config)#ip ssh source-interface ?
```

Async	Async interface
Auto-Template	Auto-Template interface
BVI	Bridge-Group Virtual Interface
CTunnel	CTunnel interface
Dialer	Dialer interface
FastEthernet	FastEthernet IEEE 802.3
Filter	Filter interface
Filtergroup	Filter Group interface
GigabitEthernet	GigabitEthernet IEEE 802.3z
GroupVI	Group Virtual interface
Lex	Lex interface
Loopback	Loopback interface

Null	Null interface
Port-channel	Ethernet Channel of interfaces
Portgroup	Portgroup interface
Pos-channel	POS Channel of interfaces
TenGigabitEthernet	Ten Gigabit Ethernet
Tunnel	Tunnel interface
Vif	PGM Multicast Host interface
Virtual-Template	Virtual Template interface
Virtual-TokenRing	Virtual TokenRing
Vlan	Catalyst Vlans
fcpa	Fiber Channel

```
Cisco(config)#ip ssh source-interface fastEthernet 0 ?
<cr>
```

```
Cisco(config)#ip ssh source-interface fastEthernet 0
```

```
Cisco(config)#ntp source ?
```

Async	Async interface
Auto-Template	Auto-Template interface
BVI	Bridge-Group Virtual Interface
CTunnel	CTunnel interface
Dialer	Dialer interface
FastEthernet	FastEthernet IEEE 802.3
Filter	Filter interface
Filtergroup	Filter Group interface
GigabitEthernet	GigabitEthernet IEEE 802.3z
GroupVI	Group Virtual interface
Lex	Lex interface
Loopback	Loopback interface
Null	Null interface
Port-channel	Ethernet Channel of interfaces
Portgroup	Portgroup interface
Pos-channel	POS Channel of interfaces
TenGigabitEthernet	Ten Gigabit Ethernet
Tunnel	Tunnel interface
Vif	PGM Multicast Host interface
Virtual-Template	Virtual Template interface
Virtual-TokenRing	Virtual TokenRing
Vlan	Catalyst Vlans
fcpa	Fiber Channel

```
Cisco(config)#ntp source fastEthernet 0 ?
<cr>
```

```
Cisco(config)#ntp source fastEthernet 0
```

```
Cisco(config)#ip tftp source-interface ?
```

Async	Async interface
Auto-Template	Auto-Template interface
BVI	Bridge-Group Virtual Interface
CTunnel	CTunnel interface
Dialer	Dialer interface
FastEthernet	FastEthernet IEEE 802.3
Filter	Filter interface
Filtergroup	Filter Group interface
GigabitEthernet	GigabitEthernet IEEE 802.3z
GroupVI	Group Virtual interface
Lex	Lex interface

Loopback	Loopback interface
Null	Null interface
Port-channel	Ethernet Channel of interfaces
Portgroup	Portgroup interface
Pos-channel	POS Channel of interfaces
TenGigabitEthernet	Ten Gigabit Ethernet
Tunnel	Tunnel interface
Vif	PGM Multicast Host interface
Virtual-Template	Virtual Template interface
Virtual-TokenRing	Virtual TokenRing
Vlan	Catalyst Vlans
fcpa	Fiber Channel

```
Cisco(config)#ip tftp source-interface fastEthernet 0 ?
<cr>
```

```
Cisco(config)#ip tftp source-interface fastEthernet 0
```

```
Cisco#ping ?
```

```
WORD  Ping destination address or hostname
clns  CLNS echo
ip     IP echo
ipv6   IPv6 echo
tag    Tag encapsulated IP echo
<cr>
```

```
Cisco#ping 10.199.111.21 ?
```

```
data      specify data pattern
df-bit    enable do not fragment bit in IP header
repeat    specify repeat count
size      specify datagram size
source    specify source address or name
timeout   specify timeout interval
validate  validate reply data
<cr>
```

```
Cisco#ping 10.199.111.21 source ?
```

A.B.C.D	Source address
Async	Async interface
Auto-Template	Auto-Template interface
BVI	Bridge-Group Virtual Interface
CTunnel	CTunnel interface
Dialer	Dialer interface
FastEthernet	FastEthernet IEEE 802.3
Filter	Filter interface
Filtergroup	Filter Group interface
GigabitEthernet	GigabitEthernet IEEE 802.3z
GroupVI	Group Virtual interface
Lex	Lex interface
Loopback	Loopback interface
Null	Null interface
Port-channel	Ethernet Channel of interfaces
Portgroup	Portgroup interface
Pos-channel	POS Channel of interfaces
TenGigabitEthernet	Ten Gigabit Ethernet
Tunnel	Tunnel interface
Vif	PGM Multicast Host interface
Virtual-Template	Virtual Template interface
Virtual-TokenRing	Virtual TokenRing

Vlan	Catalyst Vlans
fcpa	Fiber Channel

Cisco#ping 10.199.111.21 source fastEthernet 0 ?

```

data      specify data pattern
df-bit    enable do not fragment bit in IP header
repeat    specify repeat count
size      specify datagram size
timeout   specify timeout interval
validate  validate reply data
<cr>

```

Cisco#ping 10.199.111.21 source fastEthernet 0

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.199.111.21, timeout is 2 seconds:

Packet sent with a source address of 10.199.111.41

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/8 ms

Cisco#copy tftp:?

tftp: A URL beginning with this prefix

Cisco#copy tftp://10.199.111.200/c3750e-universalk9-mz.150-2.SE7.bin ?

```

flash1:      Copy to flash1: file system
flash:       Copy to flash: file system
null:        Copy to null: file system
nvram:       Copy to nvram: file system
running-config Update (merge with) current system configuration
startup-config Copy to startup configuration
syslog:      Copy to syslog: file system
system:      Copy to system: file system
tmpsys:      Copy to tmpsys: file system

```

Cisco#copy tftp://10.199.111.200/c3750e-universalk9-mz.150-2.SE7.bin flash:/boot/c3750e-universalk9-mz.150-2.SE7.bin

Destination filename [/boot/c3750e-universalk9-mz.150-2.SE7.bin]?

Accessing tftp://10.199.111.200/c3750e-universalk9-mz.150-2.SE7.bin...

Loading c3750e-universalk9-mz.150-2.SE7.bin from 10.199.111.200 (via FastEthernet0):

Cisco#show lldp neighbors ?

```

FastEthernet      FastEthernet IEEE 802.3
GigabitEthernet   GigabitEthernet IEEE 802.3z
TenGigabitEthernet Ten Gigabit Ethernet
detail            Show detailed information
|                Output modifiers
<cr>

```

Cisco#show lldp neighbors fastEthernet 0 ?

```

detail  Show detailed information
|       Output modifiers

```

```

<cr>

Cisco#show lldp neighbors fastEthernet 0

Capability codes:

    (R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device
    (W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other

Device ID           Local Intf      Hold-time  Capability    Port ID
2520-8-OOBM         Fa0             98         B              7

Total entries displayed: 1

```

Chapter 8 Interface or Port Information and Nomenclature

This chapter compares the commands used to collect information about interfaces; configure interface names, speeds, and/or duplex settings; and disable/enable interfaces. It also compares differences between interface and VLAN context.

These commands help on how each operating system references ports. ArubaOS-Switch ASIC chassis-based (modular) switches and stackable switches that have a module slot designate ports using the format “slot/port.” For example, on the HP 8212 zl switch, port 24 on the module in slot A is referred to as interface A24. Stackable switches simply use the port number.

Cisco switches (both chassis-based and stackable) designate ports using the format “interface_type slot/sub-slot/port” or “interface_type slot/port.”

Interface or Port Information CLI Comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
Configuration commands		
interface 1/1/1	Interface 1/1	interface g1/0/1
interface loopback <number>		interface loopback <number>
[configuring a SVI interface:] interface vlan 1		interface vlan <number>
For creating a L2 VLAN: vlan 5	vlan 5	vlan 5
description link-to-core	name link-to-core	description link-to-core
shutdown	disable	shutdown
no shutdown	enable	no shutdown
ip address 10.93.20.10/24		ip address 10.93.20.10 255.255.255.0
		speed auto
Show/display commands		
show interfaces brief	show interfaces brief	show interfaces status
show interfaces 1/1/1	show interfaces brief 1/1	show interfaces g1/0/1 status
show interface 1/1/1	show interfaces 1/1	show interfaces g1/0/1

Interface or Port Information configurable options

ArubaOS-CX-Switch

```
ArubaOS-CX-Switch(config-if)# do show interface
  IFNAME      Interface name (e.g. 1/1/1)
  brief       Show brief info for interfaces
  dom         Show transceiver diagnostics info for interfaces
  loopback    Show details of a loopback interface
  mgmt        Management interface details
  queues      Show tx queue info for interfaces
  transceiver Show transceiver info for interfaces
  tunnel      Show details of a tunnel interface
  <cr>

ArubaOS-CX-Switch(config)#interface
  IFNAME      Interface's name
  IFNAME      PORT identifier range.
  lag         Configure link-aggregation parameters
  loopback    Configure loopback interface
  mgmt        Configure management interface
  tunnel      Tunnel Configuration
  vlan        VLAN configuration

ArubaOS-CX-Switch(config)# interface vlan
  vlan        VLAN configuration

ArubaOS-CX-Switch(config)# interface vlan
  <1-4094>    Vlan id within <1-4094> and should not be an internal vlan

ArubaOS-CX-Switch(config)# interface vlan 2
  <cr>

ArubaOS-CX-Switch(config)# interface vlan 2

ArubaOS-CX-Switch(config-if-vlan)#
  active-gateway Configure active-gateway for the SVI
  arp            Configure ARP commands
  description    Add a description
  end            End current mode and change to enable mode
  exit           Exit current mode and change to previous mode
  ip            IP information
  ipv6          IPv6 information
  list           Print command list
  no            Negate a command or set its defaults
  shutdown       Enable/disable an interface
  track          Track information
  vrf            VRF Configuration
  vrrp           VRRP information

ArubaOS-CX-Switch(config)# do show interface brief
  <cr>
```

```
ArubaOS-CX-Switch(config)# do show interface brief
```

Port	Native VLAN	Mode	Type	Enabled	Status	Reason	Speed (Mb/s)
1/1/1	--	routed	--	no	down	No XCVR installed	--
1/1/2	--	routed	--	no	down	No XCVR installed	--
1/1/3	--	routed	--	no	down	No XCVR installed	--

1/1/4	--	routed	--	no	down	No XCVR installed	--
1/1/5	--	routed	--	no	down	No XCVR installed	--
1/1/6	--	routed	--	no	down	No XCVR installed	--
1/1/7	--	routed	--	no	down	No XCVR installed	--
1/1/8	--	routed	SFP+LR	no	down	Administratively down	--
1/1/9	--	routed	SFP+LR	no	down	Administratively down	--
1/1/10	--	routed	SFP+LR	no	down	Administratively down	--
1/1/11	--	routed	--	no	down	No XCVR installed	--
1/1/12	--	routed	--	no	down	No XCVR installed	--
1/1/13	--	routed	--	no	down	No XCVR installed	--
1/1/14	--	routed	--	no	down	No XCVR installed	--
1/1/15	--	routed	--	no	down	No XCVR installed	--
1/1/16	--	routed	--	no	down	No XCVR installed	--
1/1/17	--	routed	--	no	down	No XCVR installed	--
1/1/18	--	routed	--	no	down	No XCVR installed	--
1/1/19	--	routed	--	no	down	No XCVR installed	--
1/1/20	--	routed	--	no	down	No XCVR installed	--
1/1/21	--	routed	--	no	down	No XCVR installed	--
1/1/22	--	routed	--	no	down	No XCVR installed	--
1/1/23	--	routed	SFP+LR	no	down	Administratively down	--
1/1/24	--	routed	SFP+LR	no	down	Administratively down	--
1/1/25	--	routed	SFP+LR	no	down	Administratively down	--
1/1/26	--	routed	--	no	down	No XCVR installed	--
1/1/27	--	routed	--	no	down	No XCVR installed	--
1/1/28	--	routed	--	no	down	No XCVR installed	--
1/1/29	--	routed	--	no	down	No XCVR installed	--
1/1/30	--	routed	--	no	down	No XCVR installed	--
1/1/31	--	routed	--	no	down	No XCVR installed	--
1/1/32	--	routed	--	no	down	No XCVR installed	--

```
ArubaOS-CX-Switch(config)# do show interface 1/1/1
```

```
Interface 1/1/1 is down (Administratively down)
Admin state is down
State information: No XCVR installed
Description:
Hardware: Ethernet, MAC Address: f4:03:43:7f:ad:00
MTU 1500
Type --
qos trust none
Speed 0 Mb/s
Auto-Negotiation is off
Input flow-control is off, output flow-control is off
Rx
    0 input packets          0 bytes
    0 input error            0 dropped
    0 CRC/FCS
Tx
    0 output packets          0 bytes
    0 input error            0 dropped
    0 collision
```

```
ArubaOS-CX-Switch(config)# interface 1/1/1
```

```
ArubaOS-CX-Switch(config)# vlan {vlan-id | vlan-range}
SW-BA-01(config)# vlan 5
```

"This command creates a VLAN or a range of VLANs. If you enter a number that is already assigned to a VLAN, the device puts you into the VLAN configuration submode for that VLAN. If you enter a number that is assigned to an internally allocated VLAN, the system returns an error message. However, if you enter a range of VLANs and one or more of the specified VLANs is outside the range of internally allocated VLANs, the command takes effect on only those VLANs outside the range. The range is from 2 to 4094; VLAN1 is the default VLAN and

cannot be created or deleted. You cannot create or delete those VLANs that are reserved for internal use."

```
ArubaOS-CX-Switch(config-if)# description
LINE 1-64 printable ASCII characters
```

```
ArubaOS-CX-Switch(config-if)# description link-to-core
```

```
ArubaOS-CX-Switch(config-if)# shut
```

```
ArubaOS-CX-Switch(config-if)# no shutdown
```

ArubaOS-Switch

```
ArubaOS-Switch# show interfaces ?
```

```
brief          Show port operational parameters.
config         Show port configuration information.
custom         Show port parameters in a customized table.
display        Show summary of network traffic handled by the ports.
[ethernet] PORT-LIST Show summary of network traffic handled by the ports.
port-utilization Show port bandwidth utilization.
status         Show interfaces tagged or untagged VLAN information.
transceiver    Show the transceiver information.
tunnel         Show tunnel configuration and status information.
<cr>
```

```
ArubaOS-Switch# show interfaces brief ?
```

```
[ethernet] PORT-LIST Show summary of network traffic handled by the ports.
<cr>
```

```
ArubaOS-Switch# show interfaces brief
```

Status and Counters - Port Status

Port	Type	Intrusion Alert	Enabled	Status	Mode	MDI Mode	Flow Ctrl	Bcast Limit
-----	-----	+	-----	-----	-----	-----	-----	-----
1	100/1000T	No	Yes	Up	1000FDx	MDIX	off	0
2	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
3	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
4	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
5	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
6	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
7	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
8	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
9	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
10	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
11	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
12	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
13	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
14	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
15	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
16	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
17	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
18	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
19	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
20	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
21	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
22	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
23	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
24	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
25		No	Yes	Down	.		off	0
26		No	Yes	Down	.		off	0

```
ArubaOS-Switch# show interfaces brief 1
```

Status and Counters - Port Status

Port	Type	Intrusion Alert	Enabled	Status	Mode	MDI Mode	Flow Ctrl	Bcast Limit
1	100/1000T	No	Yes	Up	1000FDx	MDIX off		0

```
ArubaOS-Switch# show interfaces 1 ?
```

```
hc          Show summary of network traffic handled by the ports.  
<cr>
```

```
ArubaOS-Switch# show interfaces 1
```

Status and Counters - Port Counters for port 1

```
Name :  
MAC Address      : 009c02-d539bf  
Link Status      : Up  
Totals (Since boot or last clear) :  
  Bytes Rx       : 2,069,285,321    Bytes Tx       : 214,736,598  
  Unicast Rx     : 1,922,572        Unicast Tx     : 1,283,973  
  Bcast/Mcast Rx : 588,985          Bcast/Mcast Tx : 326,260  
Errors (Since boot or last clear) :  
  FCS Rx         : 0                Drops Tx        : 0  
  Alignment Rx   : 0                Collisions Tx   : 0  
  Runts Rx       : 0                Late Colln Tx   : 0  
  Giants Rx      : 0                Excessive Colln : 0  
  Total Rx Errors : 0                Deferred Tx     : 0  
Others (Since boot or last clear) :  
  Discard Rx     : 0                Out Queue Len   : 0  
  Unknown Protos : 0  
Rates (5 minute weighted average) :  
  Total Rx (bps) : 510824            Total Tx (bps)  : 517072  
  Unicast Rx (Pkts/sec) : 18          Unicast Tx (Pkts/sec) : 20  
  B/Mcast Rx (Pkts/sec) : 0           B/Mcast Tx (Pkts/sec) : 0  
  Utilization Rx : 00.51 %           Utilization Tx  : 00.51 %
```

```
ArubaOS-Switch(config)# interface ?
```

```
loopback      Enter the loopback Configuration Level.  
[ethernet] PORT-LIST Enter the Interface Configuration Level, or execute one command  
               for that level.  
tunnel        Enter a tunnel context.
```

```
ArubaOS-Switch(config)# interface 1
```

```
ArubaOS-Switch(eth-1)#?
```

```
arp-protect    Configure the port as trusted or untrusted.  
bandwidth-min  Enable/disable and configure guaranteed minimum bandwidth  
               settings for outgoing traffic on the port(s).  
broadcast-limit Limit network bandwidth used by broadcast traffic.  
dhcp-snooping  Configure port-specific DHCP snooping parameters.  
dhcpv6-snooping Configure DHCPv6 snooping settings on a port.  
disable        Disable interface.  
enable         Enable interface.  
energy-efficient-e... Enables or disables EEE on each port in the port list.  
flow-control   Enable/disable flow control negotiation on the port(s) during  
               link establishment.  
forbid         Prevent ports from becoming a member of specified VLANs.  
gvrp           Set the GVRP timers for the port.
```

ignore-untagged-mac	Prevent MAC address learning for certain untagged control traffic.
ip	Apply an access control list to inbound packets on port.
ipv6	Configure various IPv6 parameters for the VLAN.
lacp	Define whether LACP is enabled on the port, and whether it is in active or passive mode when enabled.
link-keepalive	Configure UniDirectional Link Detection (UDLD) on the port.
mac-count-notify	Send a trap when the number of MAC addresses learned on the specified ports exceeds the threshold.
mac-notify	Configures SNMP traps for changes in the MAC address table.
mdix-mode	Set port MDI/MDIX mode (default: auto).
monitor	Monitor traffic on the port.
name	Change the interface name.
poe-allocate-by	Configure the power allocation method.
poe-lldp-detect	Enabling this feature causes the port to allocate power based on the link-partner's capabilities via LLDP.
poe-value	Set the maximum power allocation for the port.
power-over-ethernet	Enable per-port power distribution.
qos	Configure port-based traffic prioritization.
rate-limit	Enable rate limiting for various types of traffic.
service-policy	Apply the QoS/Mirror policy on the interface.
smart-link	Configure the control VLANs for receiving flush packets.
speed-duplex	Define mode of operation for the port(s).
tagged	Assign ports to specified VLANs as tagged.
unknown-vlans	Configure the GVRP mode.
untagged	Assign ports to specified VLAN as untagged.
<cr>	

```
ArubaOS-Switch(eth-1)# name ?
PORT-NAME-STR          Specify a port name up to 64 characters length.
```

```
ArubaOS-Switch(eth-1)# name link-to-core
```

```
ArubaOS-Switch(eth-1)# speed-duplex ?
10-half                 10 Mbps, half duplex.
100-half                100 Mbps, half duplex.
10-full                 10 Mbps, full duplex.
100-full                100 Mbps, full duplex.
1000-full               1000 Mbps, full duplex.
auto                    Use Auto Negotiation for speed and duplex mode.
auto-10                 10 Mbps, use Auto Negotiation for duplex mode.
auto-100                100 Mbps, use Auto Negotiation for duplex mode.
auto-1000               1000 Mbps, use Auto Negotiation for duplex mode.
auto-10-100             10 or 100 Mbps, use Auto Negotiation for duplex mode.
auto-10g                10 Gbps, use Auto Negotiation for duplex mode.
```

```
ArubaOS-Switch(eth-1)# speed-duplex auto
```

```
ArubaOS-Switch(eth-1)# disable
```

```
ArubaOS-Switch(eth-1)# enable
```

Cisco

```

Cisco#show interfaces ?
Async Async interface
Auto-Template Auto-Template interface
BVI Bridge-Group Virtual Interface
CTunnel CTunnel interface
Dialer Dialer interface
FastEthernet FastEthernet IEEE 802.3
Filter Filter interface
Filtergroup Filter Group interface
GigabitEthernet GigabitEthernet IEEE 802.3z
GroupVI Group Virtual interface
Loopback Loopback interface
Null Null interface
Port-channel Ethernet Channel of interfaces
Portgroup Portgroup interface
Pos-channel POS Channel of interfaces
TenGigabitEthernet Ten Gigabit Ethernet
Tunnel Tunnel interface
Vif PGM Multicast Host interface
Virtual-Template Virtual Template interface
Virtual-TokenRing Virtual TokenRing
Vlan Catalyst Vlans
accounting Show interface accounting
capabilities Show interface capabilities information
counters Show interface counters
crb Show interface routing/bridging info
dampening Show interface dampening info
debounce Show interface debounce time info
description Show interface description
etherchannel Show interface etherchannel information
fair-queue Show interface Weighted Fair Queueing (WFQ) info
fcpa Fiber Channel
flowcontrol Show interface flowcontrol information
history Show interface history
irb Show interface routing/bridging info
mac-accounting Show interface MAC accounting info
mpls-exp Show interface MPLS experimental accounting info
mtu Show interface mtu
precedence Show interface precedence accounting info
private-vlan Show interface private vlan information
pruning Show interface trunk VTP pruning information
random-detect Show interface Weighted Random Early Detection (WRED)
info
rate-limit Show interface rate-limit info
stats Show interface packets & octets, in & out, by switching
path
status Show interface line status
summary Show interface summary
switchport Show interface switchport information
transceiver Show interface transceiver
trunk Show interface trunk information
| Output modifiers
<cr>

```

```

Cisco#show interfaces status

```

Port	Name	Status	Vlan	Duplex	Speed	Type
Gi1/0/1		connected	1	a-full	a-1000	10/100/1000BaseTX
Gi1/0/2		notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/3		notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/4		notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/5		notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/6		notconnect	1	auto	auto	10/100/1000BaseTX

Gi1/0/7	notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/8	notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/9	notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/10	notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/11	notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/12	notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/13	notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/14	notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/15	notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/16	notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/17	notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/18	notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/19	notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/20	notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/21	notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/22	notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/23	notconnect	1	auto	auto	10/100/1000BaseTX
Gi1/0/24	notconnect	1	auto	auto	10/100/1000BaseTX
Tel/0/1	notconnect	1	full	10G	Not Present
Tel/0/2	notconnect	1	full	10G	Not Present
Fa0	disabled	routed	auto	auto	10/100BaseTX

Cisco#show interfaces gl/0/1 ?

accounting	Show interface accounting
capabilities	Show interface capabilities information
controller	Show interface status, configuration and controller status
counters	Show interface counters
crb	Show interface routing/bridging info
dampening	Show interface dampening info
debounce	Show interface debounce time info
description	Show interface description
etherchannel	Show interface etherchannel information
fair-queue	Show interface Weighted Fair Queueing (WFQ) info
flowcontrol	Show interface flowcontrol information
history	Show interface history
irb	Show interface routing/bridging info
mac-accounting	Show interface MAC accounting info
mpls-exp	Show interface MPLS experimental accounting info
mtu	Show interface mtu
precedence	Show interface precedence accounting info
private-vlan	Show interface private vlan information
pruning	Show interface trunk VTP pruning information
random-detect	Show interface Weighted Random Early Detection (WRED) info
rate-limit	Show interface rate-limit info
stats	Show interface packets & octets, in & out, by switching path
status	Show interface line status
summary	Show interface summary
switchport	Show interface switchport information
transceiver	Show interface transceiver
trunk	Show interface trunk information
users	Show interface users
vlan	Show interface vlan information
	Output modifiers
<cr>	

Cisco#show interfaces gl/0/1 status

Port	Name	Status	Vlan	Duplex	Speed	Type
Gi1/0/1		connected	1	a-full	a-1000	10/100/1000BaseTX

Cisco#show interfaces gl/0/1 status

Port	Name	Status	Vlan	Duplex	Speed	Type
Gil/0/1		connected	1	a-full	a-1000	10/100/1000BaseTX

Cisco#show interfaces gl/0/1

```
GigabitEthernet1/0/1 is up, line protocol is up (connected)
  Hardware is Gigabit Ethernet, address is 0022.91ab.4381 (bia 0022.91ab.4381)
  MTU 1500 bytes, BW 1000000 Kbit/sec, DLY 10 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 1000Mb/s, media type is 10/100/1000BaseTX
  input flow-control is off, output flow-control is unsupported
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:00:01, output 00:00:07, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    1902 packets input, 149768 bytes, 0 no buffer
    Received 1806 broadcasts (1764 multicasts)
    0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
    0 watchdog, 1764 multicast, 0 pause input
    0 input packets with dribble condition detected
  482 packets output, 102102 bytes, 0 underruns
    0 output errors, 0 collisions, 1 interface resets
    0 unknown protocol drops
    0 babbles, 0 late collision, 0 deferred
    0 lost carrier, 0 no carrier, 0 pause output
    0 output buffer failures, 0 output buffers swapped out
```

Cisco(config)#interface ?

Async	Async interface
Auto-Template	Auto-Template interface
BVI	Bridge-Group Virtual Interface
CTunnel	CTunnel interface
Dialer	Dialer interface
FastEthernet	FastEthernet IEEE 802.3
Filter	Filter interface
Filtergroup	Filter Group interface
GigabitEthernet	GigabitEthernet IEEE 802.3z
Group-Async	Async Group interface
GroupVI	Group Virtual interface
Lex	Lex interface
Loopback	Loopback interface
Null	Null interface
Port-channel	Ethernet Channel of interfaces
Portgroup	Portgroup interface
Pos-channel	POS Channel of interfaces
TenGigabitEthernet	Ten Gigabit Ethernet
Tunnel	Tunnel interface
Vif	PGM Multicast Host interface
Virtual-Template	Virtual Template interface
Virtual-TokenRing	Virtual TokenRing
Vlan	Catalyst Vlans
fcpa	Fiber Channel
range	interface range command

```
Cisco(config)#interface g1/0/1
```

```
Cisco(config-if)#?
```

Interface configuration commands:

aaa	Authentication, Authorization and Accounting.
arp	Set arp type (arpa, probe, snap) or timeout or log options
auto	Configure Automation
bandwidth	Set bandwidth informational parameter
bgp-policy	Apply policy propagated by bgp community string
carrier-delay	Specify delay for interface transitions
cdp	CDP interface subcommands
channel-group	Etherchannel/port bundling configuration
channel-protocol	Select the channel protocol (LACP, PAgP)
cts	Configure Cisco Trusted Security
dampening	Enable event dampening
datalink	Interface Datalink commands
default	Set a command to its defaults
delay	Specify interface throughput delay
description	Interface specific description
down-when-looped	Force looped interface down
duplex	Configure duplex operation.
eou	EAPoUDP Interface Configuration Commands
exit	Exit from interface configuration mode
flow-sampler	Attach flow sampler to the interface
flowcontrol	Configure flow operation.
help	Description of the interactive help system
history	Interface history histograms - 60 second, 60 minute and 72 hour
hold-queue	Set hold queue depth
ip	Interface Internet Protocol config commands
keepalive	Enable keepalive
l2protocol-tunnel	Tunnel Layer2 protocols
lACP	LACP interface subcommands
link	Configure Link
lldp	LLDP interface subcommands
load-interval	Specify interval for load calculation for an interface
location	Interface location information
logging	Configure logging for interface
mac	MAC interface commands
macro	Command macro
max-reserved-bandwidth	Maximum Reservable Bandwidth on an Interface
mdix	Set Media Dependent Interface with Crossover
mka	MACsec Key Agreement (MKA) interface configuration
mls	mls interface commands
mvr	MVR per port configuration
neighbor	interface neighbor configuration mode commands
network-policy	Network Policy
nmosp	NMSP interface configuration
no	Negate a command or set its defaults
pagp	PAgP interface subcommands
priority-queue	Priority Queue
queue-set	Choose a queue set for this queue
rmon	Configure Remote Monitoring on an interface
routing	Per-interface routing configuration
rsu	rolling stack upgrade
service-policy	Configure CPL Service Policy
shutdown	Shutdown the selected interface
small-frame	Set rate limit parameters for small frame
snmp	Modify SNMP interface parameters

source	Get config from another source
spanning-tree	Spanning Tree Subsystem
speed	Configure speed operation.
srr-queue	Configure shaped round-robin transmit queues
storm-control	storm configuration
switchport	Set switching mode characteristics
timeout	Define timeout values for this interface
topology	Configure routing topology on the interface
transmit-interface	Assign a transmit interface to a receive-only interface
tx-ring-limit	Configure PA level transmit ring limit
udld	Configure UDLD enabled or disabled and ignore global UDLD setting
vtp	Enable VTP on this interface

Cisco(config-if)#description ?

LINE Up to 200 characters describing this interface

Cisco(config-if)#description link-to-core

Cisco(config-if)#duplex ?

auto Enable AUTO duplex configuration
 full Force full duplex operation
 half Force half-duplex operation

Cisco(config-if)#duplex auto

Cisco(config-if)#speed ?

10 Force 10 Mbps operation
 100 Force 100 Mbps operation
 1000 Force 1000 Mbps operation
 auto Enable AUTO speed configuration

Cisco(config-if)#speed auto

Cisco(config-if)#shutdown

Cisco(config-if)#no shutdown

Chapter 9 Link Aggregation – LACP and Trunk

This chapter compares the commands to configure aggregation interfaces.

The IEEE 802.3ad Link Aggregation Control Protocol (LACP) enables dynamic aggregation of physical links. It uses Link Aggregation Control Protocol Data Units (LACPDU) to exchange aggregation information between LACP-enabled devices.

There are some terminology differences among the operating systems for the terms used to define port aggregation. In ArubaOS-Switch, aggregated links are called *trunks*. In Cisco, the term is *EtherChannel*.

In addition, Cisco Etherchannel has two modes: PAgP (Cisco specific) or LACP. LACP mode is shown in the Cisco configuration examples.

In Cisco, *trunk* refers to an interface that is configured to support multiple VLANs via 802.1Q.

This chapter covers the configuration of LACP port aggregation—sometimes referred to as protocol trunks, which are dynamic in their operation—and non-LACP port aggregation, sometimes referred to as non-protocol trunks, which are basically “on,” because no protocol is used to negotiate the aggregated links.

Generally, execute the configuration steps first then connect the links -or- disable/shutdown the interfaces, execute the configuration steps, then enable/undo or no shutdown the interfaces. Otherwise network loops could accidentally be created and cause other issues/outages.

Link Aggregation Control Protocol (LACP) CLI comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
Configuration commands		
interface lag 1	Trunk 1/20,1/24 trk1 lacp	interface port-channel 1 switchport mode trunk encapsulation dot1q switchport mode access
interface lag 1 vlan trunk allowed all	vlan 220 tagged trk1	interface <> switchport mode trunk switchport trunk allowed vlan <>
interface lag 1 vlan access 1		interface <> switchport mode access switchport access vlan <>
?		Interface gil/0/1 channel-group 1 mode active
Show/display commands		
show lacp configuration	show trunks show lacp	show lacp 1 internal
	show lacp peer	
show lacp interfaces	show lacp peer show lacp counters	show interfaces etherchannel
show lacp aggregates	show vlans 220 show vlans ports trk1 detail	show vlan name test

Link Aggregation Configurable options

ArubaOS-CX-Switch

```
ArubaOS-CX-Switch(config)# interface
  IFNAME      Interface's name
  IFNAME      PORT identifier range.
  lag         Configure link-aggregation parameters
  loopback    Configure loopback interface
  mgmt        Configure management interface
  tunnel      Tunnel Configuration
  vlan        VLAN configuration

ArubaOS-CX-Switch(config)# interface lag
  <1-128>     LAG number ranges from 1 to 128

ArubaOS-CX-Switch(config)# interface lag 1
  multi-chassis  Configure LAG as Multi-chassis
  <cr>

ArubaOS-CX-Switch(config)# interface lag 1

ArubaOS-CX-Switch(config-lag-if)#
  apply        Apply a configuration record
  arp          Configure ARP commands
  description  Add a description
  end          End current mode and change to enable mode
  exit        Exit current mode and change to previous mode
  ip          IP information
  ipv6        IPv6 information
  l3-counters  Enable both Rx and Tx L3 counters
  lacp        Configure LACP parameters
  list        Print command list
  loop-protect  Configure loop protection
  mclag       Configure mclag parameters
  mvrp        Enable the Multiple VLAN Registration Protocol (MVRP)
  no          Negate a command or set its defaults
  qos         Quality of Service configuration
  rate-limit  Apply a rate-limit to a specific traffic type for this port
  routing     Configure interface as L3
  sflow       Enable sFlow
  shutdown    Enable/disable a LAG
  spanning-tree  Spanning-tree configuration
  track       Track information
  vlan        VLAN configuration
  vrf         VRF Configuration
  vrrp        VRRP information

ArubaOS-CX-Switch(config-lag-if)# vlan
  access      Access configuration
  trunk       Trunk configuration

ArubaOS-CX-Switch(config-lag-if)# vlan trunk
  allowed     Allowed VLANs on the trunk port
  native      Native VLAN on the trunk port

ArubaOS-CX-Switch(config-lag-if)# vlan trunk allowed
```

```

<1-4094>      VLAN identifier range. [2, 2-10 or 2,3,4 or 2,3-10]
all           All configured VLANs

ArubaOS-CX-Switch(config-lag-if)# vlan trunk allowed all
<cr>

ArubaOS-CX-Switch(config-lag-if)# vlan trunk allowed all
Operation not allowed on an interface with routing enabled.

ArubaOS-CX-Switch(config-lag-if)# no routing

ArubaOS-CX-Switch(config-lag-if)# vlan trunk allowed all

ArubaOS-CX-Switch(config-lag-if)# vlan access
<1-4094>      VLAN identifier

ArubaOS-CX-Switch(config-lag-if)# vlan access 1
<cr>
ArubaOS-CX-Switch(config-lag-if)# vlan access 1

ArubaOS-CX-Switch(config-lag-if)# end

ArubaOS-CX-Switch# sh lacp
  aggregates      Show LACP aggregates
  configuration    Show LACP system-wide configuration
  interfaces       Show LACP interfaces
ArubaOS-CX-Switch# sh lacp configuration
<cr>

ArubaOS-CX-Switch# sh lacp configuration
System-id        : f4:03:43:7f:ad:00
System-priority   : 65534
Hash              : 13-src-dst

ArubaOS-CX-Switch# sh lacp interfaces
  IFNAME          Interface's name
  multi-chassis    Show MCLAG interfaces
<cr>

ArubaOS-CX-Switch# sh lacp interfaces

State abbreviations :
A - Active          P - Passive          F - Aggregable I - Individual
S - Short-timeout   L - Long-timeout     N - InSync      O - OutofSync
C - Collecting      D - Distributing
X - State m/c expired      E - Default neighbor state

Actor details of all interfaces:
-----
Intf   Aggr   Port   Port   State   System-id           System  Aggr  Forwarding
      Name   Id     Pri    State   Pri                 Key    State
-----

```

Partner details of all interfaces:

Intf	Aggr Name	Port Id	Port Pri	State	System-id	System Pri	Aggr Key
------	--------------	------------	-------------	-------	-----------	---------------	-------------

```
ArubaOS-CX-Switch# sh lacp aggregates
WORD Link-aggregate name
<cr>
```

```
ArubaOS-CX-Switch# sh lacp aggregates
```

```
Aggregate-name      : lag1
Aggregated-interfaces :
Heartbeat rate      : N/A
Aggregate mode      : off
```

ArubaOS-Switch

```
ArubaOS-Switch(config)# trunk 19-20 trk1 lacp
```

```
ArubaOS-Switch(config)# vlan 220 tagged trk1
```

```
ArubaOS-Switch# show trunks
```

Load Balancing Method: L3-based (default)

Port	Name	Type	Group	Type
19	trk1-link-to-Cisco5-1	100/1000T	Trk1	LACP
20	trk1-link-to-Cisco5-1	100/1000T	Trk1	LACP
21	trk2-link-to-Cisco7-1	100/1000T	Trk2	LACP
22	trk2-link-to-Cisco-1	100/1000T	Trk2	LACP
23	trk3-link-to-Cisco1	100/1000T	Trk3	LACP
24	trk3-link-to-Cisco1	100/1000T	Trk3	LACP

```
ArubaOS-Switch# show lacp
```

LACP

Port	LACP Enabled	Trunk Group	Port Status	Partner	LACP Status	Admin Key	Oper Key
19	Active	Trk1	Up	Yes	Success	0	562
20	Active	Trk1	Up	Yes	Success	0	562
21	Active	Trk2	Up	Yes	Success	0	563
22	Active	Trk2	Up	Yes	Success	0	563
23	Active	Trk3	Up	Yes	Success	0	564
24	Active	Trk3	Up	Yes	Success	0	564

```
ArubaOS-Switch# show lacp peer
```

LACP Peer Information.

System ID: 009c02-d53980

Local Port	Local Trunk	System ID	Port	Port Priority	Oper Key	LACP Mode	Tx Timer
19	Trk1	002389-d5a059	23	32768	1	Active	Slow
20	Trk1	002389-d5a059	24	32768	1	Active	Slow
21	Trk2	cc3e5f-73bacb	23	32768	1	Active	Slow
22	Trk2	cc3e5f-73bacb	24	32768	1	Active	Slow
23	Trk3	002291-ab4380	280	32768	1	Active	Slow
24	Trk3	002291-ab4380	281	32768	1	Active	Slow

ArubaOS-Switch# show lacp counters

LACP Port Counters.

Port	Trunk	LACP PDUs Tx	LACP PDUs Rx	Marker Req. Tx	Marker Req. Rx	Marker Resp. Tx	Marker Resp. Rx	Error
19	Trk1	19	18	0	0	0	0	0
20	Trk1	18	17	0	0	0	0	0
21	Trk2	41	40	0	0	0	0	0
22	Trk2	40	39	0	0	0	0	0
23	Trk3	8	8	0	0	0	0	0
24	Trk3	8	8	0	0	0	0	0

ArubaOS-Switch# show vlans 220

Status and Counters - VLAN Information - VLAN 220

VLAN ID : 220
Name : test
Status : Port-based
Voice : No
Jumbo : No

Port	Information Mode	Unknown VLAN	Status
4	Untagged Learn		Down
5	Untagged Learn		Down
6	Tagged Learn		Down
7	Tagged Learn		Down
8	Tagged Learn		Down
Trk1	Tagged Learn		Up
Trk2	Tagged Learn		Up
Trk3	Tagged Learn		Up

ArubaOS-Switch# show vlans ports trk1 detail

Status and Counters - VLAN Information - for ports Trk1

VLAN ID	Name	Status	Voice	Jumbo	Mode
1	DEFAULT_VLAN	Port-based	No	No	Untagged
220	test	Port-based	No	No	Tagged

Cisco

Cisco(config)#interface port-channel 1

Cisco(config-if)#switchport trunk encapsulation dot1q

```

Cisco(config-if)#switchport trunk allowed vlan 220

Cisco(config-if)#switchport mode access

Cisco(config-if)#switchport nonegotiate


Cisco(config)#interface range g1/0/24 - 24

Cisco(config-if-range)#switchport trunk encapsulation dot1q

Cisco(config-if-range)#switchport trunk allowed vlan 220

Cisco(config-if-range)#switchport mode access

Cisco(config-if-range)#switchport nonegotiate

Cisco(config-if-range)#channel-group 1 mode active


Cisco#show lacp 1 internal

Flags:  S - Device is requesting Slow LACPDUs
        F - Device is requesting Fast LACPDUs
        A - Device is in Active mode           P - Device is in Passive mode


Channel group 1

```

Port	Flags	State	LACP port Priority	Admin Key	Oper Key	Port Number	Port State
Fal/0/22	SA	bndl	32768	0x1	0x1	0x18	0x3D
Fal/0/23	SA	bndl	32768	0x1	0x1	0x19	0x3D

```

Cisco#show interfaces etherchannel

----
GigabitEthernet1/0/23:
Port state      = Up Mstr Assoc In-Bndl
Channel group   = 1           Mode = Active           Gcchange = -
Port-channel    = Po1        GC      = -             Pseudo port-channel = Po1
Port index      = 0          Load = 0x00             Protocol  = LACP


Flags:  S - Device is sending Slow LACPDUs    F - Device is sending fast LACPDUs.
        A - Device is in active mode.          P - Device is in passive mode.


Local information:

```

Port	Flags	State	LACP port Priority	Admin Key	Oper Key	Port Number	Port State
Gil/0/23	SA	bndl	32768	0x1	0x1	0x118	0x3D

```

Partner's information:

```

Port	Flags	LACP port Priority	Dev ID	Age	Admin key	Oper Key	Port Number	Port State
Gil/0/23	SA	0	009c.02d5.3980	19s	0x0	0x234	0x17	0x3D

```

Age of the port in the current state: 0d:00h:03m:16s

----
GigabitEthernet1/0/24:
Port state      = Up Mstr Assoc In-Bndl
Channel group   = 1           Mode = Active           Gcchange = -

```

```

Port-channel = Po1          GC = -          Pseudo port-channel = Po1
Port index   = 0           Load = 0x00     Protocol = LACP

Flags:  S - Device is sending Slow LACPDUs   F - Device is sending fast LACPDUs.
        A - Device is in active mode.         P - Device is in passive mode.

```

Local information:

Port	Flags	State	LACP port Priority	Admin Key	Oper Key	Port Number	Port State
Gil/0/24	SA	bndl	32768	0x1	0x1	0x119	0x3D

Partner's information:

Port	Flags	LACP port Priority	Dev ID	Age	Admin key	Oper Key	Port Number	Port State
Gil/0/24	SA	0	009c.02d5.3980	13s	0x0	0x234	0x18	0x3D

Age of the port in the current state: 0d:00h:03m:09s

Port-channell:Port-channell (Primary aggregator)

```

Age of the Port-channel = 0d:00h:06m:29s
Logical slot/port      = 10/1          Number of ports = 2
HotStandBy port = null
Port state              = Port-channel Ag-Inuse
Protocol                = LACP
Port security           = Disabled

```

Ports in the Port-channel:

Index	Load	Port	EC state	No of bits
0	00	Gil/0/23	Active	0
0	00	Gil/0/24	Active	0

Time since last port bundled: 0d:00h:03m:09s Gil/0/24

Cisco#show vlan name test

VLAN Name	Status	Ports
220 test	active	Gil/0/4, Gil/0/5

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
220	enet	100220	1500	-	-	-	-	-	0	0

Remote SPAN VLAN

Disabled

Primary	Secondary	Type	Ports
-----	-----	-----	-----

Chapter 10 MSTP

Developed based on the IEEE 802.1s standard, Multiple Spanning Tree Protocol (MSTP) overcomes the limitations of STP and RSTP. In addition to support for rapid network convergence, it allows data flows of different VLANs to be forwarded along separate paths, providing a better load-sharing mechanism for redundant links.

MSTP uses multiple spanning tree instances with separate forwarding topologies. Each instance is composed of one or more VLANs, which significantly improves network link utilization and the speed of reconvergence after a failure in the network's physical topology. However, MSTP requires more configuration overhead and is more susceptible to dropped traffic due to misconfiguration.

This chapter compares the commands to configure Multiple Spanning Tree Protocol (MSTP). The four operating systems implement MSTP differently:

- ArubaOS-Switch uses MSTP as the default STP version. *MSTP is not enabled by default.* When MSTP is enabled, all ports are auto-edge-ports.
- Cisco uses Per-VLAN Spanning Tree Plus (PVST+) as the default STP version and it *is enabled by default*. If you enable MSTP, all ports are non-edge ports.

MSTP CLI Comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
Configuration commands		
spanning-tree	spanning-tree	spanning-tree mode mst
		spanning-tree mst configuration
spanning-tree mode mstp	spanning-tree config-name ArubaOS-Switch-Cisco	name ArubaOS-Switch-Cisco
spanning-tree config-name MST0 spanning-tree config-revision 40	spanning-tree config-revision 1	revision 1
spanning-tree instance 1 vlan 1	spanning-tree instance 1 vlan 220	instance 1 vlan 220
spanning-tree instance 2 vlan 100	spanning-tree instance 2 vlan 100	instance 2 vlan 100

spanning-tree instance 3 vlan 240	spanning-tree instance 3 vlan 240	instance 3 vlan 240
spanning-tree priority 1	spanning-tree priority 2	spanning-tree mst 0 priority 20480
spanning-tree instance 2 priority 2	spanning-tree instance 1 priority 3	spanning-tree mst 1 priority 16384
spanning-tree instance 2 priority 4	spanning-tree instance 2 priority 4	spanning-tree mst 2 priority 12288
spanning-tree instance 3 priority 5	spanning-tree instance 3 priority 5	spanning-tree mst 3 priority 8192
		Interface gil/0/1 spanning-tree < cost guard link-type mst port- priority port-fast >
Show/display commands		
show spanning-tree	show spanning-tree	show spanning-tree
		show spanning-tree mst
show spanning-tree mst-config show spanning-tree mst <0-64> detail	show spanning-tree mst- config	show spanning-tree mst configuration
	show spanning-tree instance ist	show spanning-tree mst 0
show spanning-tree detail	show spanning-tree instance detail	show spanning-tree mst 1

MSTP CLI Configurable options

ArubaOS-CX-Switch	
ArubaOS-CX-Switch(config)# spanning-tree	
config-name	Set the MST region configuration name
config-revision	Set the MST region configuration revision number
extend-system-id	Enables the extended system-id functionality.
forward-delay	Set the forward delay for the Multiple spanning tree
hello-time	Set the hello interval for the Multiple spanning tree
ignore-pvid-inconsistency	Ignore PVID inconsistencies and allow, RPVST to run on mismatched links.
instance	Create, delete or configure an MST instance
max-age	Set the max age interval for the Multiple spanning tree
max-hops	Set the max hops value for the Multiple spanning tree
mode	Specify the spanning-tree mode
pathcost-type	Specify the path cost type.
priority	Set the device priority multiplier. This value will be multiplied by 4096
transmit-hold-count	Sets the transmit hold count performance parameter in pps
trap	Enable STP/MSTP traps
vlan	VLAN configuration
<cr>	

```

ArubaOS-CX-Switch(config)# spanning-tree

ArubaOS-CX-Switch(config)# spanning-tree mode
    mstp    Multiple spanning tree mode
    rpvst   Rapid PVST mode
ArubaOS-CX-Switch(config)# spanning-tree mode mstp
<cr>

ArubaOS-CX-Switch(config)# spanning-tree priority
    <0-15>  Enter an integer number (Default: 8)

ArubaOS-CX-Switch(config)# spanning-tree priority 1
<cr>

ArubaOS-CX-Switch(config)# spanning-tree priority 1

ArubaOS-CX-Switch(config)# spanning-tree instance
    <1-64>  Enter an integer number

ArubaOS-CX-Switch(config)# spanning-tree instance 2
    priority Set the device priority for MST instance. This value will be multiplied by 4096
    vlan      VLAN configuration

ArubaOS-CX-Switch(config)# spanning-tree instance 2 priority
    <0-15>  Enter an integer number (Default: 8)

ArubaOS-CX-Switch(config)# spanning-tree instance 2 priority 2
<cr>

ArubaOS-CX-Switch(config)# spanning-tree instance 2 priority 2

ArubaOS-CX-Switch(config)# int 1/1/1

ArubaOS-CX-Switch(config-if)# spanning-tree

ArubaOS-CX-Switch(config)# spanning-tree
    config-name          Set the MST region configuration name
    config-revision       Set the MST region configuration revision number
    extend-system-id      Enables the extended system-id functionality.
    forward-delay         Set the forward delay for the Multiple spanning tree
    hello-time            Set the hello interval for the Multiple spanning tree
    ignore-pvid-inconsistency Ignore PVID inconsistencies and allow, RPVST to run on
    mismatched links.
    instance              Create, delete or configure an MST instance
    max-age                Set the max age interval for the Multiple spanning tree
    max-hops              Set the max hops value for the Multiple spanning tree
    mode                  Specify the spanning-tree mode
    pathcost-type          Specify the path cost type.
    priority               Set the device priority multiplier. This value will be
multiplied by 4096
    transmit-hold-count   Sets the transmit hold count performance parameter in pps
    trap                  Enable STP/MSTP traps
    vlan                  VLAN configuration
    <cr>

ArubaOS-CX-Switch(config)# do show spanning-tree
    detail               Show detailed spanning tree information.
    mst                  Show multiple spanning trees information.
    mst-config           Show multiple spanning tree region configuration.
    summary              Summary of RPVST information
    vlan                VLAN configuration
    <cr>

```

```

ArubaOS-CX-Switch(config)# do show spanning-tree
Spanning tree status      : Enabled Protocol: MSTP

MST0
  Root ID    Priority    : 4096
              MAC-Address: f4:03:43:7f:ad:00
              This bridge is the root
              Hello time(in seconds):2  Max Age(in seconds):20
              Forward Delay(in seconds):15

  Bridge ID  Priority    : 4096
              MAC-Address: f4:03:43:7f:ad:00
              Hello time(in seconds):2  Max Age(in seconds):20
              Forward Delay(in seconds):15

Port          Role          State          Cost          Priority    Type
-----
lag1          Disabled        Blocking        20000        64          point_to_point

ArubaOS-CX-Switch(config)# do show spanning-tree mst-config
MST configuration information
  MST config ID      : f4:03:43:7f:ad:00
  MST config revision : 0
  MST config digest   : AC36177F50283CD4B83821D8AB26DE62
  Number of instances : 0

Instance ID    Member VLANs
-----
0              1-4094

ArubaOS-CX-Switch(config)# do show spanning-tree detail
Spanning tree status      : Enabled Protocol: MSTP

MST0
  Root ID    Priority    : 4096
              MAC-Address: f4:03:43:7f:ad:00
              This bridge is the root
              Hello time(in seconds):2  Max Age(in seconds):20
              Forward Delay(in seconds):15

  Bridge ID  Priority    : 4096
              MAC-Address: f4:03:43:7f:ad:00
              Hello time(in seconds):2  Max Age(in seconds):20
              Forward Delay(in seconds):15

Port          Role          State          Cost          Priority    Type
-----
lag1          Disabled        Blocking        20000        64          point_to_point

Topology change flag      : False
Number of topology changes : 0
Last topology change occurred : 2958 seconds ago
Timers:    Hello expiry 0 , Forward delay expiry 0

Port lag1
Designated root has priority      :4096 Address: f4:03:43:7f:ad:00
Designated bridge has priority    :4096 Address: f4:03:43:7f:ad:00
Designated port                   :321
Number of transitions to forwarding state : 0
Bpdus sent 0, received 0

ArubaOS-CX-Switch(config)# spanning-tree forward-delay 6

```

```
ArubaOS-CX-Switch(config)# spanning-tree hello-time 6
```

```
ArubaOS-CX-Switch(config)# spanning-tree transmit-hold-count 5
```

ArubaOS-Switch

```
ArubaOS-Switch(config)# spanning-tree ?
```

bpdu-protection-ti...	Set the time for protected ports to be in down state after receiving unauthorized BPDUs.
bpdu-throttle	Configure BPDU throttling on the device.
clear-debug-counters	Clear spanning tree debug counters.
config-name	Set the MST region configuration name (default is switch's MAC address).
config-revision	Set the MST region configuration revision number (default is 0).
enable	Enable spanning-tree.
disable	Disable spanning-tree.
extend	Enable the extended system ID feature.
force-version	Set Spanning Tree protocol compatibility mode.
forward-delay	Set time the switch waits between transitioning from listening to learning and from learning to forwarding states. Not applicable in RPVST mode.
hello-time	Set time between messages transmission when the switch is root. Not applicable in RPVST mode.
ignore-pvid-incons...	Ignore PVID inconsistencies, allowing Rapid PVST to run on mismatched links.
instance	Create, delete or configure an MST instance.
legacy-mode	Set spanning-tree protocol to operate either in 802.1D legacy mode or in 802.1s native mode.
legacy-path-cost	[Deprecated] Set 802.1D (legacy) or 802.1t (current) default pathcost values.
log	Enable event logging for port state transition information.
max-hops	Set the max number of hops in a region before the MST BPDU is discarded and the information held for a port is aged (default is 20).
maximum-age	Set maximum age of received STP information before it is discarded. Not applicable in RPVST mode.
mode	Specify spanning-tree mode.
pathcost	Specify a standard to use when calculating the default pathcost.
pending	Manipulate pending MSTP configuration.
port	Configure port specific RPVST parameters for the specified VLANs.
[ethernet] PORT-LIST	Configure the port-specific parameters of the spanning tree protocol for individual ports.
priority	Set the device STP priority (the value is in range of 0-61440 divided into steps of 4096 that are numbered from 0 to 15, default is step 8). Not applicable in RPVST mode.
root	Configure root for STP.
trap	Enable/disable STP/MSTP/RPVST traps.
vlan	Specify RPVST VLAN specific parameters.
<cr>	

```
ArubaOS-Switch(config)# spanning-tree
```

```
ArubaOS-Switch(config)# spanning-tree config-name ArubaOS-Switch-Cisco
```

```
ArubaOS-Switch(config)# spanning-tree config-revision 1
```

```
ArubaOS-Switch(config)# spanning-tree instance 1 vlan 220
```

```
ArubaOS-Switch(config)# spanning-tree instance 2 vlan 100
```

```
ArubaOS-Switch(config)# spanning-tree instance 3 vlan 240
```

```
ArubaOS-Switch(config)# spanning-tree priority 2
```

```

(note - multiplier is 4096, default setting is 8)

ArubaOS-Switch(config)# spanning-tree instance 1 priority 3
(note - multiplier is 4096, default setting is 8)

ArubaOS-Switch(config)# spanning-tree instance 2 priority 4
(note - multiplier is 4096, default setting is 8)

ArubaOS-Switch(config)# spanning-tree instance 3 priority 5
(note - multiplier is 4096, default setting is 8)

ArubaOS-Switch(config)# spanning-tree 9 ?
admin-edge-port      Set the administrative edge port status.
auto-edge-port       Set the automatic edge port detection.
bpdu-filter          Stop a specific port or ports from transmitting BPDUs, receiving
                    BPDUs, and assume a continuous forwarding state.
bpdu-protection       Disable the specific port or ports if the port(s) receives STP
                    BPDUs.
hello-time           Set message transmission interval (in sec.) on the port. Not
                    applicable in RPVST mode.
loop-guard           Set port to guard against the loop and consequently to prevent it
                    from becoming Forwarding Port.
mcheck              Force the port to transmit RST BPDUs. Not applicable in RPVST
                    mode.
path-cost            Set port's path cost value. Not applicable in RPVST mode.
point-to-point-mac   Set the administrative point-to-point status.
priority             Set port priority (the value is in range of 0-240 divided into
                    steps of 16 that are numbered from 0 to 15, default is step 8).
                    Not applicable in RPVST mode.
pvst-filter          Stop a specific port or ports from receiving and retransmitting
                    PVST BPDUs. Not applicable in RPVST mode.
pvst-protection       Disable the specific port or ports if the port(s) receives PVST
                    BPDUs. Not applicable in RPVST mode.
root-guard           Set port to ignore superior BPDUs to prevent it from becoming Root
                    Port.
tcn-guard            Set port to stop propagating received topology changes
                    notifications and topology changes to other ports.

ArubaOS-Switch(config)# spanning-tree 9 admin-edge-port

ArubaOS-Switch(config)# spanning-tree 9 path-cost 10000

ArubaOS-Switch(config)# spanning-tree 9 priority 10
(note - multiplier is 16, default setting is 8)

ArubaOS-Switch(config)# spanning-tree instance 1 9 path-cost 10000

ArubaOS-Switch(config)# spanning-tree instance 1 9 priority 10
(note - multiplier is 16, default setting is 8)

ArubaOS-Switch# show spanning-tree ?
bpdu-protection      Show spanning tree BPDU protection status information.
bpdu-throttle        Displays the configured throttle value.
config              Show spanning tree configuration information.
debug-counters       Show spanning tree debug counters information.
detail              Show spanning tree extended details Port, Bridge, Rx, and Tx
                    report.
inconsistent-ports   Show information about inconsistent ports blocked by spanning tree
                    protection functions.
instance            Show the spanning tree instance information.
mst-config           Show multiple spanning tree region configuration.

```

```

pending                Show spanning tree pending configuration.
[ethernet] PORT-LIST   Limit the port information printed to the set of the specified
                        ports.
port-role-change-h... Show the last 10 role change entries on a port in a VLAN/instance.
pvst-filter            Show spanning tree PVST filter status information.
pvst-protection        Show spanning tree PVST protection status information.
root-history           Show spanning tree Root changes history information.
system-limits          Show system limits for spanning-tree
topo-change-history    Show spanning tree topology changes history information.
traps                  Show spanning tree trap information.
vlan                   Show VLAN information for RPVST.
<cr>

```

ArubaOS-Switch# show spanning-tree

Multiple Spanning Tree (MST) Information

```

STP Enabled    : Yes
Force Version  : MSTP-operation
IST Mapped VLANs : 1-99,101-219,221-239,241-4094
Switch MAC Address : 009c02-d53980
Switch Priority   : 8192
Max Age         : 20
Max Hops         : 20
Forward Delay    : 15

```

```

Topology Change Count : 69
Time Since Last Change : 6 mins

```

```

CST Root MAC Address : 009c02-d53980
CST Root Priority     : 8192
CST Root Path Cost    : 0
CST Root Port         : This switch is root

```

```

IST Regional Root MAC Address : 009c02-d53980
IST Regional Root Priority     : 8192
IST Regional Root Path Cost    : 0
IST Remaining Hops             : 20

```

```

Root Guard Ports :
Loop Guard Ports :
TCN Guard Ports :
BPDU Protected Ports :
BPDU Filtered Ports :
PVST Protected Ports :
PVST Filtered Ports :

```

```

Root Inconsistent Ports :
Loop Inconsistent Ports :

```

Port	Type	Cost	Priority	State	Designated Bridge	Hello Time	PtP	Edge
1	100/1000T	20000	128	Forwarding	009c02-d53980	2	Yes	No
2	100/1000T	Auto	128	Disabled		2	Yes	No
3	100/1000T	Auto	128	Disabled		2	Yes	No
4	100/1000T	10000	96	Disabled		2	Yes	Yes
5	100/1000T	20000	128	Forwarding	009c02-d53980	2	Yes	Yes
6	100/1000T	Auto	128	Disabled		2	Yes	No
7	100/1000T	Auto	128	Disabled		2	Yes	No
8	100/1000T	Auto	128	Disabled		2	Yes	No
9	100/1000T	10000	160	Forwarding	009c02-d53980	2	Yes	Yes
10	100/1000T	Auto	128	Disabled		2	Yes	No

11	100/1000T	20000	128	Forwarding	009c02-d53980	2	Yes	No
12	100/1000T	Auto	128	Disabled		2	Yes	No
13	100/1000T	20000	128	Forwarding	009c02-d53980	2	Yes	No
14	100/1000T	Auto	128	Disabled		2	Yes	No
15	100/1000T	20000	128	Forwarding	009c02-d53980	2	Yes	No
16	100/1000T	Auto	128	Disabled		2	Yes	No
17	100/1000T	Auto	128	Disabled		2	Yes	No
18	100/1000T	Auto	128	Disabled		2	Yes	No
25		Auto	128	Disabled		2	Yes	No
26		Auto	128	Disabled		2	Yes	No
Trk1		Auto	64	Disabled		2	Yes	No
Trk2		Auto	64	Disabled		2	Yes	No
Trk3		Auto	64	Disabled		2	Yes	No

ArubaOS-Switch# show spanning-tree mst-config

MST Configuration Identifier Information

MST Configuration Name : ArubaOS-Switch-Cisco
MST Configuration Revision : 1
MST Configuration Digest : 0xC EE7F8D6E076E3201F92550CB1D2CB92

IST Mapped VLANs : 1-99,101-219,221-239,241-4094

Instance ID Mapped VLANs

Instance ID	Mapped VLANs
1	220
2	100
3	240

ArubaOS-Switch# show spanning-tree instance ist

IST Instance Information

Instance ID : 0
Mapped VLANs : 1-99,101-219,221-239,241-4094
Switch Priority : 8192

Topology Change Count : 0
Time Since Last Change : 9 mins

Regional Root MAC Address : 009c02-d53980
Regional Root Priority : 8192
Regional Root Path Cost : 0
Regional Root Port : This switch is root
Remaining Hops : 20

Root Inconsistent Ports :
Loop Inconsistent Ports :

Port	Type	Cost	Priority	Role	State	Designated Bridge
1	100/1000T	20000	128	Designated	Forwarding	009c02-d53980
2	100/1000T	Auto	128	Disabled	Disabled	
3	100/1000T	Auto	128	Disabled	Disabled	
4	100/1000T	Auto	96	Disabled	Disabled	
5	100/1000T	20000	128	Designated	Forwarding	009c02-d53980
6	100/1000T	Auto	128	Disabled	Disabled	
7	100/1000T	Auto	128	Disabled	Disabled	
8	100/1000T	Auto	128	Disabled	Disabled	

9	100/1000T	20000	160	Designated	Forwarding	009c02-d53980
10	100/1000T	Auto	128	Disabled	Disabled	
11	100/1000T	20000	128	Designated	Forwarding	009c02-d53980
12	100/1000T	Auto	128	Disabled	Disabled	
13	100/1000T	20000	128	Designated	Forwarding	009c02-d53980
14	100/1000T	Auto	128	Disabled	Disabled	
15	100/1000T	20000	128	Designated	Forwarding	009c02-d53980
16	100/1000T	Auto	128	Disabled	Disabled	
17	100/1000T	Auto	128	Disabled	Disabled	
18	100/1000T	Auto	128	Disabled	Disabled	
25		Auto	128	Disabled	Disabled	
26		Auto	128	Disabled	Disabled	
Trk1		Auto	64	Disabled	Disabled	
Trk2		Auto	64	Disabled	Disabled	
Trk3		Auto	64	Disabled	Disabled	

ArubaOS-Switch# show spanning-tree instance 1

MST Instance Information

Instance ID : 1
Mapped VLANs : 220
Switch Priority : 12288

Topology Change Count : 62
Time Since Last Change : 9 mins

Regional Root MAC Address : 002389-d5a059
Regional Root Priority : 8192
Regional Root Path Cost : 20000
Regional Root Port : 11
Remaining Hops : 19

Root Inconsistent Ports :
Loop Inconsistent Ports :

Port	Type	Cost	Priority	Role	State	Designated Bridge
1	100/1000T	20000	128	Designated	Forwarding	009c02-d53980
2	100/1000T	Auto	128	Disabled	Disabled	
3	100/1000T	Auto	128	Disabled	Disabled	
4	100/1000T	Auto	128	Disabled	Disabled	
5	100/1000T	20000	128	Designated	Forwarding	009c02-d53980
6	100/1000T	Auto	128	Disabled	Disabled	
7	100/1000T	Auto	128	Disabled	Disabled	
8	100/1000T	Auto	128	Disabled	Disabled	
9	100/1000T	20000	160	Designated	Forwarding	009c02-d53980
10	100/1000T	Auto	128	Disabled	Disabled	
11	100/1000T	20000	128	Root	Forwarding	002389-d5a059
12	100/1000T	Auto	128	Disabled	Disabled	
13	100/1000T	20000	128	Designated	Forwarding	009c02-d53980
14	100/1000T	Auto	128	Disabled	Disabled	
15	100/1000T	20000	128	Designated	Forwarding	009c02-d53980
16	100/1000T	Auto	128	Disabled	Disabled	
17	100/1000T	Auto	128	Disabled	Disabled	
18	100/1000T	Auto	128	Disabled	Disabled	
25		Auto	128	Disabled	Disabled	
26		Auto	128	Disabled	Disabled	
Trk1		Auto	64	Disabled	Disabled	
Trk2		Auto	64	Disabled	Disabled	
Trk3		Auto	64	Disabled	Disabled	

Cisco

```
Cisco(config)#spanning-tree ?
backbonefast  Enable BackboneFast Feature
etherchannel   Spanning tree etherchannel specific configuration
extend        Spanning Tree 802.1t extensions
logging       Enable Spanning tree logging
loopguard     Spanning tree loopguard options
mode          Spanning tree operating mode
mst           Multiple spanning tree configuration
pathcost      Spanning tree pathcost options
portfast      Spanning tree portfast options
transmit      STP transmit parameters
uplinkfast    Enable UplinkFast Feature
vlan          VLAN Switch Spanning Tree
```

```
Cisco(config)#spanning-tree mode ?
mst           Multiple spanning tree mode
pvst          Per-Vlan spanning tree mode
rapid-pvst    Per-Vlan rapid spanning tree mode
```

```
Cisco(config)#spanning-tree mode mst
```

```
Cisco(config)#spanning-tree mst configuration
```

```
Cisco(config-mst)#?
abort         Exit region configuration mode, aborting changes
exit          Exit region configuration mode, applying changes
instance      Map vlans to an MST instance
name          Set configuration name
no            Negate a command or set its defaults
private-vlan  Set private-vlan synchronization
revision      Set configuration revision number
show          Display region configurations
```

```
Cisco(config-mst)#name ArubaOS-Switch-Cisco
```

```
Cisco(config-mst)#revision 1
```

```
Cisco(config-mst)# instance 1 vlan 220
```

```
Cisco(config-mst)# instance 2 vlan 100
```

```
Cisco(config-mst)# instance 3 vlan 240
```

```
Cisco(config)#spanning-tree mst 0 priority 20480
(note - increments of 4096, default setting is 32768)
```

```
Cisco(config)#spanning-tree mst 1 priority 16384
(note - increments of 4096, default setting is 32768)
```

```
Cisco(config)#spanning-tree mst 2 priority 12288
(note - increments of 4096, default setting is 32768)
```

```
Cisco(config)#spanning-tree mst 3 priority 8192
(note - increments of 4096, default setting is 32768)
```

```
Cisco(config)#interface g1/0/9
```

```
Cisco(config-if)#spanning-tree ?
bpdufilter    Don't send or receive BPDUs on this interface
bpduguard     Don't accept BPDUs on this interface
```

```

cost          Change an interface's spanning tree port path cost
guard         Change an interface's spanning tree guard mode
link-type     Specify a link type for spanning tree protocol use
mst           Multiple spanning tree
port-priority Change an interface's spanning tree port priority
portfast      Enable an interface to move directly to forwarding on link up
stack-port    Enable stack port
vlan          VLAN Switch Spanning Tree

```

```
Cisco(config-if)#spanning-tree portfast
```

```
Cisco(config-if)#spanning-tree cost 10000
```

```
Cisco(config-if)#spanning-tree port-priority 160
(note - increments of 16, default setting is 128)
```

```
Cisco(config-if)#spanning-tree mst 1 cost 10000
```

```
Cisco(config-if)#spanning-tree mst 1 port-priority 160
(note - increments of 16, default setting is 128)
```

```
Cisco#show spanning-tree ?
```

```

active          Report on active interfaces only
backbonefast    Show spanning tree backbonefast status
blockedports    Show blocked ports
bridge          Status and configuration of this bridge
detail          Detailed information
inconsistentports Show inconsistent ports
interface       Spanning Tree interface status and configuration
mst             Multiple spanning trees
pathcost        Show Spanning pathcost options
root            Status and configuration of the root bridge
summary         Summary of port states
uplinkfast      Show spanning tree uplinkfast status
vlan            VLAN Switch Spanning Trees
|              Output modifiers
<cr>

```

```
Cisco#show spanning-tree
```

```
MST0
```

```

Spanning tree enabled protocol mstp
Root ID    Priority    8192
           Address    009c.02d5.3980
           Cost        0
           Port        6 (GigabitEthernet1/0/6)
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

Bridge ID  Priority    20480 (priority 20480 sys-id-ext 0)
           Address    0022.91ab.4380
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

```

Interface	Role	Sts	Cost	Prio.Nbr	Type
-----	---	---	-----	-----	-----
Gi1/0/1	Desg	FWD	20000	128.1	P2p
Gi1/0/6	Root	FWD	20000	128.6	P2p
Gi1/0/9	Desg	FWD	10000	160.9	P2p Edge

```
MST1
```

```

Spanning tree enabled protocol mstp
Root ID    Priority    8193
           Address    0023.89d5.a059

```

```

Cost          40000
Port          6 (GigabitEthernet1/0/6)
Hello Time    2 sec  Max Age 20 sec  Forward Delay 15 sec

Bridge ID     Priority    16385 (priority 16384 sys-id-ext 1)
Address       0022.91ab.4380
Hello Time    2 sec  Max Age 20 sec  Forward Delay 15 sec

Interface      Role Sts Cost      Prio.Nbr Type
-----
Gi1/0/6        Root FWD 20000     128.6    P2p

MST2
Spanning tree enabled protocol mstp
Root ID       Priority    8194
Address       cc3e.5f73.bacb
Cost          40000
Port          6 (GigabitEthernet1/0/6)
Hello Time    2 sec  Max Age 20 sec  Forward Delay 15 sec

Bridge ID     Priority    12290 (priority 12288 sys-id-ext 2)
Address       0022.91ab.4380
Hello Time    2 sec  Max Age 20 sec  Forward Delay 15 sec

Interface      Role Sts Cost      Prio.Nbr Type
-----
Gi1/0/6        Root FWD 20000     128.6    P2p
Gi1/0/9        Desg FWD 10000    160.9    P2p Edge

MST3
Spanning tree enabled protocol mstp
Root ID       Priority    8195
Address       0022.91ab.4380
This bridge is the root
Hello Time    2 sec  Max Age 20 sec  Forward Delay 15 sec

Bridge ID     Priority    8195 (priority 8192 sys-id-ext 3)
Address       0022.91ab.4380
Hello Time    2 sec  Max Age 20 sec  Forward Delay 15 sec

Interface      Role Sts Cost      Prio.Nbr Type
-----
Gi1/0/6        Desg FWD 20000     128.6    P2p

Cisco#show spanning-tree mst

##### MST0    vlans mapped: 1-99,101-219,221-239,241-4094
Bridge         address 0022.91ab.4380 priority 20480 (20480 sysid 0)
Root           address 009c.02d5.3980 priority 8192 (8192 sysid 0)
                port Gi1/0/6 path cost 0
Regional Root address 009c.02d5.3980 priority 8192 (8192 sysid 0)
                internal cost 20000 rem hops 19
Operational    hello time 2 , forward delay 15, max age 20, txholdcount 6
Configured     hello time 2 , forward delay 15, max age 20, max hops 20

Interface      Role Sts Cost      Prio.Nbr Type
-----
Gi1/0/1        Desg FWD 20000     128.1    P2p
Gi1/0/6        Root FWD 20000     128.6    P2p
Gi1/0/9        Desg FWD 10000    160.9    P2p Edge

##### MST1    vlans mapped: 220

```

```

Bridge      address 0022.91ab.4380 priority 16385 (16384 sysid 1)
Root        address 0023.89d5.a059 priority 8193  (8192 sysid 1)
            port    Gil/0/6      cost    40000      rem hops 18

```

```

Interface      Role Sts Cost      Prio.Nbr Type
-----

```

```

Gil/0/6        Root FWD 20000    128.6    P2p

```

```

##### MST2    vlans mapped: 100

```

```

Bridge      address 0022.91ab.4380 priority 12290 (12288 sysid 2)
Root        address cc3e.5f73.bacb priority 8194  (8192 sysid 2)
            port    Gil/0/6      cost    40000      rem hops 18

```

```

Interface      Role Sts Cost      Prio.Nbr Type
-----

```

```

Gil/0/6        Root FWD 20000    128.6    P2p
Gil/0/9        Desg FWD 10000    160.9    P2p Edge

```

```

##### MST3    vlans mapped: 240

```

```

Bridge      address 0022.91ab.4380 priority 8195  (8192 sysid 3)
Root        this switch for MST3

```

```

Interface      Role Sts Cost      Prio.Nbr Type
-----

```

```

Gil/0/6        Desg FWD 20000    128.6    P2p

```

```

Cisco#show spanning-tree mst configuration

```

```

Name          [ArubaOS-Switch-Cisco]
Revision 1     Instances configured 4

```

```

Instance      Vlans mapped
-----

```

```

0             1-99,101-219,221-239,241-4094
1             220
2             100
3             240
-----

```

```

Cisco#show spanning-tree mst 0

```

```

##### MST0    vlans mapped: 1-99,101-219,221-239,241-4094

```

```

Bridge      address 0022.91ab.4380 priority 20480 (20480 sysid 0)
Root        address 009c.02d5.3980 priority 8192  (8192 sysid 0)
            port    Gil/0/6      path cost 0
Regional Root address 009c.02d5.3980 priority 8192  (8192 sysid 0)
            internal cost 20000      rem hops 19

```

```

Operational hello time 2 , forward delay 15, max age 20, txholdcount 6
Configured  hello time 2 , forward delay 15, max age 20, max hops 20

```

```

Interface      Role Sts Cost      Prio.Nbr Type
-----

```

```

Gil/0/1        Desg FWD 20000    128.1    P2p
Gil/0/6        Root FWD 20000    128.6    P2p
Gil/0/9        Desg FWD 10000    160.9    P2p Edge

```

```

Cisco#show spanning-tree mst 1

```

```

##### MST1    vlans mapped: 220

```

Bridge	address	0022.91ab.4380	priority	16385	(16384 sysid 1)
Root	address	0023.89d5.a059	priority	8193	(8192 sysid 1)
	port	Gil/0/6	cost	40000	rem hops 18

Interface	Role	Sts	Cost	Prio.Nbr	Type
-----	-----	-----	-----	-----	-----
Gil/0/6	Root	FWD	20000	128.6	P2p


```
Cisco#show spanning-tree mst 3
```

```
##### MST3      vlans mapped:    240
Bridge          address 0022.91ab.4380  priority      8195    (8192 sysid 3)
Root            this switch for MST3
```


Interface	Role	Sts	Cost	Prio.Nbr	Type
-----	-----	-----	-----	-----	-----
Gil/0/6	Desg	FWD	20000	128.6	P2p

Chapter 11 VRRP

This chapter compares the commands used to configure Virtual Router Redundancy Protocol (VRRP). Cisco supports VRRP and Hot Standby Router Protocol (HSRP), HSRP is not compatible with VRRP.

In many networks, edge devices are often configured to send packets to a statically configured default router. If this router becomes unavailable, the devices that use it as their first-hop router become isolated from the network. VRRP, which is based on RFC 5798, uses dynamic failover to ensure the availability of an end node's default router. This is done by assigning the IP address used as the default route to a "virtual router," or VR.

On a given VLAN, a VR includes two or more member routers that you configure with a virtual IP address that is the default gateway's IP address. The VR includes an owner router assigned to forward traffic designated for the virtual router (If the owner is forwarding traffic for the VR, it is the master router for that VR) and one or more prioritized backup routers (If a backup is forwarding traffic for the VR, it has replaced the owner as the master router for that VR.)

VRRP CLI Comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
router vrrp disable router vrrp enable	router vrrp ipv4 enable	
interface vlan 2	vlan 220	interface vlan 100
vlan 2 interface vlan 2 vrrp 2 address-family ipv4 address 10.1.100.1	vrrp vrid 220 virtual-ip-address 10.1.220.1	vrrp 100 ip 10.1.100.1
priority 2	priority 254	vrrp 100 priority 100

vrrp 2 address-family ipv4 no shutdown	enable	
do show vrrp detail	show vrrp	show vrrp
		show vrrp brief
do show vrrp statistics	show vrrp vlan 220	show vrrp interface vlan 100

VRRP CLI Configurable options

ArubaOS-CX-Switch

```
ArubaOS-CX-Switch(config)# router
  bgp          BGP specific commands
  graceful-restart  Configure graceful restart for routing process
  ospf         Configure OSPF or enter the OSPF configuration context
  ospfv3       Configure OSPFv3 or enter the OSPFv3 configuration context.
  pim         Configure PIM, or enter PIM configuration context
  vrrp        VRRP information
```

```
ArubaOS-CX-Switch(config)# router vrrp
  disable  Disable VRRP
  enable   Enable VRRP
```

```
ArubaOS-CX-Switch(config)# router vrrp disable
<cr>
```

```
ArubaOS-CX-Switch(config)# router vrrp disable
```

```
ArubaOS-CX-Switch(config)# router vrrp enable
<cr>
```

```
ArubaOS-CX-Switch(config)# router vrrp enable
```

```
ArubaOS-CX-Switch(config)# vlan 1-4094
```

```
ArubaOS-CX-Switch(config)# vlan 2
```

```
ArubaOS-CX-Switch(config-vlan-2)#
  end          End current mode and change to enable mode.
  exit        Exit current mode and change to previous mode
  ip          IP information
  list        Print command list
  name        VLAN ASCII String
  no          Negate a command or set its defaults
  shutdown    Disable the VLAN
```

```
ArubaOS-CX-Switch(config-vlan-2)# exit
```

```
ArubaOS-CX-Switch(config)# interface vlan 2
<cr>
```

```
ArubaOS-CX-Switch(config)# interface vlan 2
```

```
ArubaOS-CX-Switch(config-if-vlan)# vrrp
  <1-255>  VRRP virtual router ID between 1-255
```

```
ArubaOS-CX-Switch(config-if-vlan)# vrrp 2
  address-family  IP address family
```

```
ArubaOS-CX-Switch(config-if-vlan)# vrrp 2 address-family
  ipv4  Address family IPv4
```

```

ipv6    Address family IPv6

ArubaOS-CX-Switch(config-if-vlan)# vrrp 2 address-family ipv
  ipv4    Address family IPv4
  ipv6    Address family IPv6

ArubaOS-CX-Switch(config-if-vlan)# vrrp 2 address-family ipv4
<cr>

ArubaOS-CX-Switch(config-if-vlan)# vrrp 2 address-family ipv4

ArubaOS-CX-Switch(config-if-vrrp)#
  address    VRRP virtual router address
  end        End current mode and change to enable mode
  exit       Exit current mode and change to previous mode
  list       Print command list
  no         Negate a command or set its defaults
  preempt    VRRP virtual router preempt mode (default is enabled)
  priority   VRRP virtual router priority
  shutdown   Disable VRRP virtual router
  timers     VRRP timers
  track      Track information (supported for non-owner virtual router)
  version    VRRP virtual router version (default 2 for IPv4)

ArubaOS-CX-Switch(config-if-vrrp)# address
  A.B.C.D    IP information
  A:B::C:D   IPv6 information

ArubaOS-CX-Switch(config-if-vrrp)# address 10.0.0.2
  primary    Primary address
  secondary  Secondary address
ArubaOS-CX-Switch(config-if-vrrp)# address 10.0.0.2
  primary    Primary address
  secondary  Secondary address

ArubaOS-CX-Switch(config-if-vrrp)# address 10.0.0.2 primary
<cr>

ArubaOS-CX-Switch(config-if-vrrp)# address 10.0.0.2 primary
Specified address or subnet not found on the interface.

ArubaOS-CX-Switch(config-if-vrrp)# priority
<1-254>    Specify VRRP virtual router priority

ArubaOS-CX-Switch(config-if-vrrp)# priority 2
<cr>

ArubaOS-CX-Switch(config-if-vrrp)# priority 2

ArubaOS-CX-Switch(config-if-vrrp)# no shutdown
Primary IP address is not configured on this interface vlan2

ArubaOS-CX-Switch(config-if-vrrp)# do show vrrp
<1-255>    VRRP virtual router ID between 1-255
  brief     Brief information
  detail    Detail information
  interface Interface information
  ipv4      Address family IPv4
  ipv6      Address family IPv6
  statistics Statistics information
<cr>

ArubaOS-CX-Switch(config-if-vrrp)# do show vrrp detail

```



```

VRRP is enabled

Interface vlan2 - VRRPv2 Statistics
  Invalid group ID packet received : 0
  Invalid version packet received : 0
  Invalid checksum packet received : 0

Interface vlan2 - VRRPv3 Statistics
  Invalid group ID packet received : 0
  Invalid version packet received : 0
  Invalid checksum packet received : 0

Interface vlan2 - Group 2 - Address-Family IPv4
  State is None
  State duration
  Virtual IP address is no address
  Advertisement interval is 1000 msec
  Version is 2
  Preemption is enabled
    min delay is 0 sec
  Priority is 2
  Master Router is unknown
  Master Advertisement interval is 1000 msec
  Master Down interval is 3992 msec
  VRRPv3 Advertisements: sent 0(error 0) - rcvd 0
  VRRPv2 Advertisements: sent 0(error 0) - rcvd 0
  Group Discarded Packets: 0
    IP address owner conflicts: 0
    IP address configuration mismatch: 0
    Advert interval errors: 0
    Adverts received in Init state: 0
    Invalid group other reason:0
  Group State transition:
    Init to master:0
    Init to backup:0
    Backup to master:0
    Master to backup:0
    Master to init:0
    Backup to init:0

ArubaOS-CX-Switch(config-if-vrrp)# do show vrrp
<1-255>      VRRP virtual router ID between 1-255
brief        Brief information
detail       Detail information
interface    Interface information
ipv4         Address family IPv4
ipv6         Address family IPv6
statistics   Statistics information
<cr>

ArubaOS-CX-Switch(config-if-vrrp)# do show vrrp statistics

VRRP is enabled

Interface vlan2 - VRRPv2 Statistics
  Invalid group ID packet received : 0
  Invalid version packet received : 0
  Invalid checksum packet received : 0

Interface vlan2 - VRRPv3 Statistics
  Invalid group ID packet received : 0
  Invalid version packet received : 0

```

```
Invalid checksum packet received : 0
```

```
VRRP Statistics for interface vlan2 - Group 2 - Address-Family IPv4
```

```
State is INIT (Interface Down)
```

```
State duration
```

```
VRRPv3 Advertisements: sent 0(error 0) - rcvd 0
```

```
VRRPv2 Advertisements: sent 0(error 0) - rcvd 0
```

```
Group Discarded Packets: 0
```

```
IP address owner conflicts: 0
```

```
IP address configuration mismatch: 0
```

```
Advert interval errors: 0
```

```
Adverts received in Init state: 0
```

```
Invalid group other reason:0
```

```
Group State transition:
```

```
Init to master:0
```

```
Init to backup:0
```

```
Backup to master:0
```

```
Master to backup:0
```

```
Master to init:0
```

```
Backup to init:0
```

```
ArubaOS-CX-Switch(config)# track 1
```

```
ArubaOS-CX-Switch(config)# track by 1
```

```
ArubaOS-CX-Switch(config)# interface 1/1/1
```

```
ArubaOS-CX-Switch(config-if)# track by 1
```

```
ArubaOS-CX-Switch(config-if-vrrp)# version
```

```
version VRRP virtual router version (default 2 for IPv4)
```

```
ArubaOS-CX-Switch(config-if-vrrp)# version
```

```
<2-3> Specify VRRP virtual router version
```

```
ArubaOS-CX-Switch(config-if-vrrp)# version 3
```

```
ArubaOS-CX-Switch(config-if-vrrp)# timers advertise
```

```
<100-40950> Specify timer value in milliseconds
```

```
ArubaOS-CX-Switch(config-if-vrrp)# timers advertise 2000
```

```
<cr>
```

ArubaOS-Switch

```
ArubaOS-Switch(config)# router vrrp
```

```
ArubaOS-Switch(vrrp)# ?
```

```
ipv4          Configure VRRP for IPv4 virtual routers.
```

```
ipv6          Configure VRRP for IPv6 virtual routers.
```

```
traps         Enable/disable sending SNMP traps for the following situations: o  
              'New Master' - Sent when the switch transitions to the 'Master'  
              state.
```

```
virtual-ip-ping If disabled, globally prevents a response to ping requests to the  
                virtual router IP addresses configured on all backup routers.
```

```
ArubaOS-Switch(vrrp)# ipv4 ?
```

```
disable       Disable VRRP globally.
```

```
enable        Enable VRRP globally.
```

```
ArubaOS-Switch(vrrp)# ipv4 enable
```

```

ArubaOS-Switch(vrrp)# vlan 220

ArubaOS-Switch(vlan-220)# vrrp vrid 220

ArubaOS-Switch(vlan-220-vrid-220)# virtual-ip-address 10.1.220.1

ArubaOS-Switch(vlan-220-vrid-220)# priority 254

ArubaOS-Switch(vlan-220-vrid-220)# enable

ArubaOS-Switch# show vrrp

VRRP Global Statistics Information

VRRP Enabled          : Yes
Invalid VRID Pkts Rx  : 0
Checksum Error Pkts Rx : 0
Bad Version Pkts Rx   : 0
Virtual Routers Respond To Ping Requests : No

VRRP Virtual Router Statistics Information

Vlan ID                : 220
Virtual Router ID       : 220
Protocol Version        : 2
State                   : Master
Up Time                 : 10 mins
Virtual MAC Address     : 00005e-0001dc
Master's IP Address     : 10.1.220.10
Associated IP Addr Count : 1      Near Failovers           : 0
Advertise Pkts Rx       : 13     Become Master         : 2
Zero Priority Rx         : 0      Zero Priority Tx       : 0
Bad Length Pkts         : 0      Bad Type Pkts         : 0
Mismatched Interval Pkts : 0     Mismatched Addr List Pkts : 0
Mismatched IP TTL Pkts  : 0      Mismatched Auth Type Pkts : 0

ArubaOS-Switch# show vrrp vlan 220

VRRP Virtual Router Statistics Information

Vlan ID                : 220
Virtual Router ID       : 220
Protocol Version        : 2
State                   : Master
Up Time                 : 12 mins
Virtual MAC Address     : 00005e-0001dc
Master's IP Address     : 10.1.220.10
Associated IP Addr Count : 1      Near Failovers           : 0
Advertise Pkts Rx       : 13     Become Master         : 2
Zero Priority Rx         : 0      Zero Priority Tx       : 0
Bad Length Pkts         : 0      Bad Type Pkts         : 0
Mismatched Interval Pkts : 0     Mismatched Addr List Pkts : 0
Mismatched IP TTL Pkts  : 0      Mismatched Auth Type Pkts : 0

```

Cisco

```

Cisco(config)#interface vlan 100

Cisco(config-if)#?
Interface configuration commands:

```

aaa	Authentication, Authorization and Accounting.
arp	Set arp type (arpa, probe, snap) or timeout or log options
bandwidth	Set bandwidth informational parameter
bgp-policy	Apply policy propagated by bgp community string
carrier-delay	Specify delay for interface transitions
cdp	CDP interface subcommands
cts	Configure Cisco Trusted Security
dampening	Enable event dampening
datalink	Interface Datalink commands
default	Set a command to its defaults
delay	Specify interface throughput delay
description	Interface specific description
eou	EAPoUDP Interface Configuration Commands
exit	Exit from interface configuration mode
flow-sampler	Attach flow sampler to the interface
help	Description of the interactive help system
history	Interface history histograms - 60 second, 60 minute and 72 hour
hold-queue	Set hold queue depth
ip	Interface Internet Protocol config commands
link	Configure Link
load-interval	Specify interval for load calculation for an interface
logging	Configure logging for interface
loopback	Configure internal loopback on an interface
macro	Command macro
max-reserved-bandwidth	Maximum Reservable Bandwidth on an Interface
mka	MACsec Key Agreement (MKA) interface configuration
neighbor	interface neighbor configuration mode commands
network-policy	Network Policy
nmosp	NMSP interface configuration
no	Negate a command or set its defaults
ntp	Configure NTP
private-vlan	Configure private VLAN SVI interface settings
rate-limit	Rate Limit
routing	Per-interface routing configuration
service-policy	Configure CPL Service Policy
shutdown	Shutdown the selected interface
snmp	Modify SNMP interface parameters
source	Get config from another source
spanning-tree	Spanning Tree Subsystem
standby	HSRP interface configuration commands
timeout	Define timeout values for this interface
topology	Configure routing topology on the interface
traffic-shape	Enable Traffic Shaping on an Interface or Sub-Interface
vrrp	VRRP Interface configuration commands
vtp	Enable VTP on this interface

Cisco(config-if)#vrrp ?
 <1-255> Group number

Cisco(config-if)#vrrp 100 ?
 authentication Authentication string
 description Group specific description
 ip Enable Virtual Router Redundancy Protocol (VRRP) for IP
 preempt Enable preemption of lower priority Master
 priority Priority of this VRRP group
 timers Set the VRRP timers
 track Event Tracking

Cisco(config-if)#vrrp 100 ip ?

```

A.B.C.D VRRP group IP address

Cisco(config-if)#vrrp 100 ip 10.1.100.1 ?
    secondary Specify an additional VRRP address for this group
    <cr>

Cisco(config-if)#vrrp 100 ip 10.1.100.1

Cisco(config-if)#vrrp 100 priority ?
    <1-254> Priority level

Cisco(config-if)#vrrp 100 priority 100 ?
    <cr>

Cisco(config-if)#vrrp 100 priority 100

Cisco#show vrrp ?
    all Include groups in disabled state
    brief Brief output
    interface VRRP interface status and configuration
    | Output modifiers
    <cr>

Cisco#show vrrp
Vlan100 - Group 100
    State is Backup
    Virtual IP address is 10.1.100.1
    Virtual MAC address is 0000.5e00.0164
    Advertisement interval is 1.000 sec
    Preemption enabled
    Priority is 101
    Master Router is 10.1.100.5, priority is 254
    Master Advertisement interval is 1.000 sec
    Master Down interval is 3.605 sec (expires in 3.043 sec)

Cisco#show vrrp brief
Interface      Grp Pri Time  Own Pre State  Master addr  Group addr
Vl100          100 101 3605      Y Backup  10.1.100.5   10.1.100.1

Cisco#show vrrp interface vlan 100

Vlan100 - Group 100
    State is Backup
    Virtual IP address is 10.1.100.1
    Virtual MAC address is 0000.5e00.0164
    Advertisement interval is 1.000 sec
    Preemption enabled
    Priority is 101
    Master Router is 10.1.100.5, priority is 254
    Master Advertisement interval is 1.000 sec
    Master Down interval is 3.605 sec (expires in 2.909 sec)

```

Chapter 12 ACLs

This chapter compares the commands for configuring access control lists (ACLs).

An ACL is a list of one or more access control entries (ACEs) specifying the criteria the switch uses to either permit (forward) or deny (drop) the IP packets traversing the switch's interfaces.

This chapter covers ACL basics, creating ACLs, applying ACLs for routing/Layer 3 operations, applying ACLs for VLAN/Layer 2 operations, and applying ACLs for port/interface controls.

When using these commands, keep in mind:

- On ArubaOS-Switch and Cisco, ACLs include an Implicit Deny as the last ACE. If traffic does not match an ACL rule, it is denied (or dropped).

Access Control Lists ('ACLs') allow a network administrator to define sets of rules based on network traffic addressing or other header content, and to use these rules to restrict, alter or log the passage of traffic through the switch. Choosing the rule criteria is called Classification, and one such rule set, or list, is called an Access Control List.

There are 3 classes of ACL - MAC, IPv4 and IPv6 - which are each focused on relevant frame/packet characteristics. ACLs can be configured to match on almost any frame or packet header field and then take an appropriate action.

Network traffic passing through a switch can be blocked, permitted, counted, or reprioritized based on many different frame/packet characteristics including, but not limited to:

- Frame ingress VLAN ID
- Source and/or destination Ethernet MAC, IPv4 or IPv6 address
- Layer 2 (EtherType) and Layer 3 (IP) protocol
- Layer 4 application port(s)

Different ACLs of the same type can be used in opposite directions. If an ACL of a particular type is applied in a direction that is already in use, the current ACL will be replaced by the new ACL. An ACL contains one or more 'Access Control Entries' ('ACE') which are listed according to priority by sequence number. A single ACE matches on one or more characteristics of the particular traffic type and has a configured action to either discard or allow the packet to continue through the switch. This occurs by, beginning with the ACE with the lowest sequence number, comparing the incoming or outgoing frame to its particular match characteristics and if there is a match, the ACE's action - either permit or deny - is taken. If there is no match, the match characteristics of the next ACE in sequence is compared to the relevant frame/packet details and if there's a match the specified action is taken.

ACL CLI Comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
access-list ip My_ip_ACL 10 permit udp any 172.16.1.0/24 20 permit tcp 172.16.2.0/16 gt 1023 any 30 permit tcp 172.26.1.0/24 any syn ack dscp 10 25 permit icmp 172.16.2.0/16 any 40 deny any any any count 20 comment Permit all TCP ephemeral ports access-list ip My_ip_ACL resequence 1 1 20 comment Permit all TCP ephemeral ports 25 permit icmp 10.0.0.1/24 10.0.0.2 25 permit icmp 10.0.0.1/24 10.0.0.2 dscp AF32 vla 2	ip access-list standard <1-99> permit 10.0.100.111/32 ! ip access-list standard <std_acl> permit 10.0.100.111/32 deny 10.1.100.0/24 ! ArubaOS-Sw(eth-1)# ip access-group 100 in ArubaOS-Sw(eth-1)# ip access-group 100 out ArubaOS-Sw(eth-1)# ipv6 access-group test in ArubaOS-Sw(eth-1)# ipv6 access-group test out	ip access-list standard 1 permit 10.0.100.111 0.0.0.0 ! ip access-list extended std_acl permit 10.0.100.111 0.0.0.0 deny ip 10.1.100.0 0.0.0.255 10.0.100.111 0.0.0.0 permit ip any any object-group network object-group-name host {host-address host-name} interface <L3Interface> ip access-group <ACL> in interface <L3Interface> ip access-group <ACL> out
show access-list	show access-list	show ip access-lists

ACL CLI Configurable options

ArubaOS-CX-Switch
ArubaOS-CX-Switch(config)# access-list ip my_list ArubaOS-CX-Switch(config-acl-ip)# 10 comment Set a text comment for a new or existing ACL entry deny Deny packets matching this ACE permit Permit packets matching this ACE ArubaOS-CX-Switch(config-acl-ip)# 10 permit <0-255> Specify numeric protocol value ah Authenticated header any Any internet protocol number esp Encapsulation security payload gre Generic routing encapsulation icmp Internet control message protocol igmp Internet group management protocol ospf Open Shortest Path First (version 2) pim Protocol independent multicast sctp Stream control transmission protocol tcp Transmission control protocol udp User datagram protocol ArubaOS-CX-Switch(config-acl-ip)# 10 permit udp A.B.C.D Specify source IP host address A.B.C.D/M Specify source IP network address with prefix length A.B.C.D/W.X.Y.Z Specify source IP network address with network mask any Any source IP address

```

ArubaOS-CX-Switch(config-acl-ip)# 10 permit udp any
A.B.C.D          Specify destination IP host address
A.B.C.D/M        Specify destination IP network address with prefix length
A.B.C.D/W.X.Y.Z  Specify destination IP network address with network mask
any              Any destination IP address
eq               Layer 4 source port equal to
gt               Layer 4 source port greater than
lt               Layer 4 source port less than
range            Layer 4 source port range

```

```

ArubaOS-CX-Switch(config-acl-ip)# 10 permit udp any 172.16.1.0/24
count            Count packets matching this entry
dscp             Specify a Differentiated Services Code Point value.
ecn              Specify an Explicit Congestion Notification value.
eq               Layer 4 destination port equal to
fragment         Specify a fragment packet.
gt               Layer 4 destination port greater than
ip-precedence    Specify an IP Precedence value.
log              Log packets matching this entry (will also enable 'count')
lt               Layer 4 destination port less than
range            Layer 4 destination port range
tos              Specify a Type of Service value.
ttl              Specify a time-to-live value.
vlan             Specify VLAN tag to match on.
<cr>

```

```

ArubaOS-CX-Switch(config-acl-ip)# 10 permit udp any 172.16.1.0/24

```

```

ArubaOS-CX-Switch(config-acl-ip)# do show access-list
commands        Format output as CLI commands
configuration    Display user-specified configuration
hitcounts        Hit counts (statistics)
interface        Specify interface
ip               Internet Protocol v4 (IPv4)
ipv6             Internet Protocol v6 (IPv6)
log-timer        Display ACL log timer length (frequency)
mac              Ethernet MAC Protocol
<cr>

```

```

ArubaOS-CX-Switch(config-acl-ip)# do show access-list
Type      Name
Sequence  Comment
          Action          L3 Protocol
          Source IP Address Source L4 Port(s)
          Destination IP Address Destination L4 Port(s)
          Additional Parameters
-----
IPv4      my_list
          10 permit          udp
          any
          172.16.1.0/255.255.255.0

```

```

ArubaOS-CX-Switch(config-acl-ip)# 20 comment
TEXT      Comment text

```

```

ArubaOS-CX-Switch(config-acl-ip)# 20 comment Permit all TCP ephemeral ports

```

```

ArubaOS-CX-Switch(config-acl-ip)# 25 permit
<0-255>    Specify numeric protocol value
ah          Authenticated header
any         Any internet protocol number
esp         Encapsulation security payload

```



```

gre      Generic routing encapsulation
icmp     Internet control message protocol
igmp     Internet group management protocol
ospf     Open Shortest Path First (version 2)
pim      Protocol independent multicast
sctp     Stream control transmission protocol
tcp      Transmission control protocol
udp      User datagram protocol

ArubaOS-CX-Switch(config-acl-ip)# 25
comment  Set a text comment for a new or existing ACL entry
deny     Deny packets matching this ACE
permit   Permit packets matching this ACE

ArubaOS-CX-Switch(config-acl-ip)# 25 permit
<0-255>  Specify numeric protocol value
ah       Authenticated header
any      Any internet protocol number
esp      Encapsulation security payload
gre      Generic routing encapsulation
icmp     Internet control message protocol
igmp     Internet group management protocol
ospf     Open Shortest Path First (version 2)
pim      Protocol independent multicast
sctp     Stream control transmission protocol
tcp      Transmission control protocol
udp      User datagram protocol

ArubaOS-CX-Switch(config-acl-ip)# 25 permit icmp
A.B.C.D  Specify source IP host address
A.B.C.D/M Specify source IP network address with prefix length
A.B.C.D/W.X.Y.Z Specify source IP network address with network mask
any      Any source IP address

ArubaOS-CX-Switch(config-acl-ip)# 25 permit icmp 10.0.0.1/24
A.B.C.D  Specify destination IP host address
A.B.C.D/M Specify destination IP network address with prefix length
A.B.C.D/W.X.Y.Z Specify destination IP network address with network mask
any      Any destination IP address

ArubaOS-CX-Switch(config-acl-ip)# 25 permit icmp 10.0.0.1/24 10.0.0.2
count    Count packets matching this entry
dscp     Specify a Differentiated Services Code Point value.
ecn      Specify an Explicit Congestion Notification value.
fragment Specify a fragment packet.
ip-precedence Specify an IP Precedence value.
log      Log packets matching this entry (will also enable 'count')
tos      Specify a Type of Service value.
ttl      Specify a time-to-live value.
vlan     Specify VLAN tag to match on.
<cr>

ArubaOS-CX-Switch(config-acl-ip)# 25 permit icmp 10.0.0.1/24 10.0.0.2

ArubaOS-CX-Switch(config-acl-ip)# 25 permit icmp 10.0.0.1/24 10.0.0.2 dscp
<0-63>  A valid DSCP codepoint.
AF11    DSCP 10 (Assured Forwarding class 1, low drop probability)
AF12    DSCP 12 (Assured Forwarding class 1, medium drop probability)
AF13    DSCP 14 (Assured Forwarding class 1, high drop probability)
AF21    DSCP 18 (Assured Forwarding class 2, low drop probability)
AF22    DSCP 20 (Assured Forwarding class 2, medium drop probability)
AF23    DSCP 22 (Assured Forwarding class 2, high drop probability)
AF31    DSCP 26 (Assured Forwarding class 3, low drop probability)

```

AF32	DSCP 28	(Assured Forwarding class 3, medium drop probability)
AF33	DSCP 30	(Assured Forwarding class 3, high drop probability)
AF41	DSCP 34	(Assured Forwarding class 4, low drop probability)
AF42	DSCP 36	(Assured Forwarding class 4, medium drop probability)
AF43	DSCP 38	(Assured Forwarding class 4, high drop probability)
CS0	DSCP 0	(Class Selector 0: Default)
CS1	DSCP 8	(Class Selector 1: Scavenger)
CS2	DSCP 16	(Class Selector 2: OAM)
CS3	DSCP 24	(Class Selector 3: Signaling)
CS4	DSCP 32	(Class Selector 4: Realtime)
CS5	DSCP 40	(Class Selector 5: Broadcast video)
CS6	DSCP 48	(Class Selector 6: Network control)
CS7	DSCP 56	(Class Selector 7)
EF	DSCP 46	(Expedited Forwarding)

```
ArubaOS-CX-Switch(config-acl-ip)# 25 permit icmp 10.0.0.1/24 10.0.0.2 dscp AF32
count          Count packets matching this entry
ecn            Specify an Explicit Congestion Notification value.
fragment       Specify a fragment packet.
ip-precedence  Specify an IP Precedence value.
log            Log packets matching this entry (will also enable 'count')
tos            Specify a Type of Service value.
ttl            Specify a time-to-live value.
vlan           Specify VLAN tag to match on.
<cr>
```

```
ArubaOS-CX-Switch(config-acl-ip)# 25 permit icmp 10.0.0.1/24 10.0.0.2 dscp AF32
```

```
ArubaOS-CX-Switch(config-acl-ip)# 25 permit icmp 10.0.0.1/24 10.0.0.2 dscp AF32 vlan
VLAN-ID 802.1q VLAN ID.
```

```
ArubaOS-CX-Switch(config-acl-ip)# 25 permit icmp 10.0.0.1/24 10.0.0.2 dscp AF32 vlan 2
count          Count packets matching this entry
ecn            Specify an Explicit Congestion Notification value.
fragment       Specify a fragment packet.
ip-precedence  Specify an IP Precedence value.
log            Log packets matching this entry (will also enable 'count')
tos            Specify a Type of Service value.
ttl            Specify a time-to-live value.
<cr>
```

```
ArubaOS-CX-Switch(config-acl-ip)# 25 permit icmp 10.0.0.1/24 10.0.0.2 dscp AF32 vlan 2
```

ArubaOS-Switch

Standard ACL

```
ArubaOS-Switch(config)# ip access-list standard 1
```

```
ArubaOS-Switch(config-std-nacl)# permit 10.0.100.111 0.0.0.0
```

```
ArubaOS-Switch(config)# ip access-list standard std_acl
```

```
ArubaOS-Switch(config-std-nacl)# permit 10.0.100.111/32
```

```
ArubaOS-Switch(config-std-nacl)# vlan 220
```

```
ArubaOS-Switch(vlan-220)# ip access-group ?
```

```
ASCII-STR      Enter an ASCII string for the 'access-group'
command/parameter.
```

```
ArubaOS-Switch(vlan-220)# ip access-group 1 ?
in                Match inbound packets
out               Match outbound packets
connection-rate-filter Manage packet rates
vlan              VLAN acl
```

```
ArubaOS-Switch(vlan-220)# ip access-group 1 in
```

```
ArubaOS-Switch(config)# vlan 100
```

```
ArubaOS-Switch(vlan-100)# ip access-group std_acl in
```

Extended ACL

```
ArubaOS-Switch(config)# ip access-list extended 100
```

```
ArubaOS-Switch(config-ext-nacl)# deny ip 10.1.220.0 0.0.0.255 10.0.100.111 0.0.0.0
```

```
ArubaOS-Switch(config-ext-nacl)# permit ip any any
```

```
ArubaOS-Switch(config)# ip access-list extended ext_acl
```

```
ArubaOS-Switch(config-ext-nacl)# deny ip 10.1.100.0/24 10.0.100.111/32
```

```
ArubaOS-Switch(config-ext-nacl)# permit ip any any
```

```
ArubaOS-Switch(config)# vlan 220
```

```
ArubaOS-Switch(vlan-220)# ip access-group 100 in
```

```
ArubaOS-Switch(vlan-220)# vlan 100
```

```
ArubaOS-Switch(vlan-100)# ip access-group ext_acl in
```

Cisco

Standard ACL

```
Cisco(config)#ip access-list standard 1
```

```
Cisco(config-std-nacl)#permit 10.0.100.111 0.0.0.0
```

```
Cisco(config)#ip access-list standard std_acl
```

```
Cisco(config-std-nacl)#permit 10.0.100.111 0.0.0.0
```

```
Cisco(config)#interface vlan 220
```

```
Cisco(config-if)#ip access-group ?
<1-199>          IP access list (standard or extended)
<1300-2699>      IP expanded access list (standard or extended)
WORD             Access-list name
```

```
Cisco(config-if)#ip access-group 1 ?
```

```
in    inbound packets
out   outbound packets

Cisco(config-if)#ip access-group 1 in

Cisco(config)#interface vl 100

Cisco(config-if)#ip access-group std_acl in
```

Extended ACL

```
Cisco(config)#ip access-list extended 100
Cisco(config-ext-nacl)#deny ip 10.1.220.0 0.0.0.255 10.0.100.111 0.0.0.0
Cisco(config-ext-nacl)#permit ip any any

Cisco(config)#ip access-list extended ext_acl
Cisco(config-ext-nacl)#deny ip 10.1.100.0 255.255.255.0 10.0.100.111 255.255.255.255
Cisco(config-ext-nacl)#permit ip any any

Cisco(config-ext-nacl)#interface vlan 220
Cisco(config-if)#ip access-group 100 in
Cisco(config-if)#interface vlan 100
Cisco(config-if)#ip access-group ext_acl in
```

Chapter 13 BGP

This chapter compares the commands used to enable and configure Border Gateway Protocol.

BGP, based on RFC 4271, is a routing protocol that enables BGP-speaking devices to exchange reachability information about independent networks called Autonomous Systems (ASs). These networks present themselves to other ASs as independent entities that have a single, coherent routing plan. BGP is the most commonly used protocol between Internet service providers (ISPs).

The characteristics of BGP are as follows:

- BGP focuses on the control of route propagation and the selection of optimal routes, rather than on route discovery and calculation, which makes BGP an exterior gateway protocol, different from interior gateway protocols such as Open Shortest Path First (OSPF) and Routing Information Protocol (RIP).
- BGP uses TCP to enhance reliability.
- BGP supports Classless Inter-Domain Routing (CIDR).

- BGP reduces bandwidth consumption by advertising only incremental updates, and is therefore used to advertise a large amount of routing information on the Internet.
- BGP eliminates routing loops completely by adding AS path information to BGP routes.
- BGP provides abundant policies to implement flexible route filtering and selection.
- BGP is scalable.

A router advertising BGP messages is called a BGP speaker. It establishes peer relationships with other BGP speakers to exchange routing information. When a BGP speaker receives a new route or a route better than the current one from another AS, it will advertise the route to all the other BGP peers in the local AS.

BGP can be configured to run on a router in the following two modes:

- iBGP (internal BGP)
- eBGP (external BGP)

When a BGP speaker peers with another BGP speaker that resides in the same AS, the session is referred to as an iBGP session; and, when a BGP speaker peers with a BGP speaker that resides in another AS, the session is referred to as an eBGP session.

BGP CLI Comparison

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
Configuration commands		
router bgp 64502	router bgp 64502	router bgp 64504
bgp router-id 10.0.0.2	bgp router-id 10.0.0.2	bgp router-id 10.0.0.4
neighbor 10.0.101.31 remote-as 64503	neighbor 10.0.101.31 remote-as 64503	neighbor 10.0.101.21 remote-as 64502
neighbor 10.0.101.41 remote-as 64504	neighbor 10.0.101.41 remote-as 64504	
neighbor 10.0.101.51 remote-as 64505	neighbor 10.0.101.51 remote-as 64505	
redistribute connected	redistribute connected	redistribute connected
redistribute static	redistribute static	
enable	enable	
network 10.0.221.0/24	network 10.0.221.0/24	network 10.0.241.0 mask 255.255.255.0
Show/display commands		
show bgp ipv4 unicast summary	Show ip bgp summary	show ip bgp summary

BGP CLI Configurable options

ArubaOS-CX-Switch	
ArubaOS-CX-Switch(config)# router	
bgp	BGP specific commands
graceful-restart	Configure graceful restart for routing process
ospf	Configure OSPF or enter the OSPF configuration context
ospfv3	Configure OSPFv3 or enter the OSPFv3 configuration context.
pim	Configure PIM, or enter PIM configuration context
vrrp	VRRP information

```

ArubaOS-CX-Switch(config)# router bgp
    <1-65535> The autonomous system (AS) number of the BGP process.

ArubaOS-CX-Switch(config)# router bgp 65534
    vrf    VRF Instance
    <cr>

ArubaOS-CX-Switch(config)# router bgp 65534

ArubaOS-CX-Switch(config-router)#
    aggregate-address  To create an aggregate entry
    bgp                BGP specific commands
    disable            Disable BGP instance
    distance            Configure the administrative distances for BGP routes
    enable              Enable the BGP instance on the VRF
    end                End current mode and change to enable mode
    exit               Exit current mode and change to previous mode
    list               Print command list
    maximum-paths       Forward packets over multiple paths
    neighbor            Specify neighbor router
    network             Specify a network to announce via BGP
    no                  Negate a command or set its defaults
    redistribute        Redistribute information from another routing protocol
    timers              Adjust routing timers

ArubaOS-CX-Switch(config-router)# bgp
    always-compare-med  Compare MED attribute for BGP best-path selection across neighbors
in different AS
    bestpath            Change the default best-path selection
    cluster-id          Configure Route-Reflector Cluster-id
    default             Configure BGP defaults
    deterministic-med   Pick the best-MED path among paths advertised from the neighboring
AS
    graceful-restart    Configure graceful-restart capability parameters
    log-neighbor-changes Log BGP neighbors session state changes
    maxas-limit         Maximum AS numbers allowed in routes learned from peers
    router-id           Override configured router identifier

ArubaOS-CX-Switch(config-router)# bgp router-id
    A.B.C.D Configure the BGP router identifier for the VRF

ArubaOS-CX-Switch(config-router)# bgp router-id 10.0.0.1
    <cr>

ArubaOS-CX-Switch(config-router)# bgp router-id 10.0.0.1

ArubaOS-CX-Switch(config-router)# neighbor
    A.B.C.D Neighbor address
    WORD    Peer Group name

ArubaOS-CX-Switch(config-router)# neighbor 10.0.0.20
    advertisement-interval Minimum interval between sending BGP routing updates
    allowas-in              Accept as-path with my AS present in it
    default-originate       Originate default route to this neighbor
    description             Neighbor specific description
    ebgp-multihop           Allow EBGp neighbors not on directly connected networks
    local-as                Configure the local AS number for the EBGp neighbor
    maximum-prefix          Number of routes allowed to be learnt from the specified neighbor.
    next-hop-self           Configure own IP as nexthop for all routes advertised to the
neighbor
    passive                 Do not initiate BGP session for this neighbor
    password                Set a password
    peer-group              Member of the peer-group

```

port	Neighbor's BGP port
remote-as	Configure the AS of the neighbor
remove-private-AS	Remove private AS number from outbound updates
route-map	Route-map filter to apply for the neighbor
route-reflector-client	Configure a neighbor as Route Reflector client
send-community	Send Community attribute to this neighbor
shutdown	Administratively shut down this neighbor
soft-reconfiguration	Per neighbor soft reconfiguration
timers	BGP per neighbor timers
update-source	Source of routing updates
weight	Set default weight for routes from this neighbor

```
ArubaOS-CX-Switch(config-router)# neighbor 10.0.0.20 remo
  remote-as      Configure the AS of the neighbor
  remove-private-AS Remove private AS number from outbound updates
```

```
ArubaOS-CX-Switch(config-router)# neighbor 10.0.0.20 remote-as
<1-65535> AS number
```

```
ArubaOS-CX-Switch(config-router)# neighbor 10.0.0.20 remote-as 6543
<cr>
```

```
ArubaOS-CX-Switch(config-router)# neighbor 10.0.0.20 remote-as 6543
```

```
ArubaOS-CX-Switch(config-router)# redistribute
  connected  Redistribute directly attached networks
  ospf       Redistribute OSPFv2 routes
  static     Redistribute static routes
```

```
ArubaOS-CX-Switch(config-router)# redistribute connected
  route-map  Apply route-map policy for redistribution
<cr>
```

```
ArubaOS-CX-Switch(config-router)# redistribute connected
```

```
ArubaOS-CX-Switch(config-router)# redistribute static
```

```
ArubaOS-CX-Switch(config-router)# enable
```

```
ArubaOS-CX-Switch(config-router)# network
  A.B.C.D/M  Configure the IP network to import into BGP
```

```
ArubaOS-CX-Switch(config-router)# network 10.0.0.4/24
  route-map  A route-map policy to apply on the network
<cr>
```

```
ArubaOS-CX-Switch(config-router)# network 10.0.221.0/24
  route-map  A route-map policy to apply on the network
<cr>
```

```
ArubaOS-CX-Switch(config-router)# network 10.0.221.0/24
```

```
ArubaOS-CX-Switch(config-router)# do show ip bgp
  A.B.C.D/M  IP prefix <network>/<length>, e.g., 35.0.0.0/8
  all-vrfs   All VRFs
  community  Display routes that belong to specified BGP communities
  neighbor   Detailed information on TCP and specific BGP neighbor connection
  neighbors  Detailed information on TCP and all BGP neighbor connections
  paths      Path information
  peer-group Peer group information
  summary    Summary of BGP neighbor status
  vrf        VRF Instance
<cr>
```

```
ArubaOS-CX-Switch(config-router)# do show ip bgp
Status codes: s suppressed, d damped, h history, * valid, > best, = multipath,
               i internal, e external S Stale, R Removed
Origin codes: i - IGP, e - EGP, ? - incomplete
```

```
VRF : default
Local router-id 10.0.0.1
```

Network	Nexthop	Metric	LocPrf	Weight	Path
Total number of entries 0					

```
ArubaOS-CX-Switch(config-router)# do show ip bgp neighbor
A.B.C.D Neighbor to display information about
```

```
ArubaOS-CX-Switch(config-router)# do show ip bgp summary
VRF : default
```

```
BGP Summary
Local AS           : 65534           BGP router identifier : 10.0.0.1
Peers              : 1               Log Neighbor Changes  : No
Hold Time          : 180             Keep Alive             : 60
```

Neighbor	Remote-AS	MsgRcvd	MsgSent	Up/Down	Time	State	AdminStatus
10.0.0.20	6543	0	0	00h:00m:00s	Idle	Up	

```
ArubaOS-CX-Switch(config-router)# do show ip bgp community
AA:NN             Community number in aa:nn format
internet          Advertise the prefix to all BGP neighbors.
local-as          Do not advertise the prefix outside of the sub-AS
no-advertise      Do not advertise the prefix to any BGP neighbors.
no-export          Do not advertise the prefix to any eBGP neighbors.
vrf               VRF Instance
<cr>
```

```
ArubaOS-CX-Switch(config-router)# do show ip bgp community
Status codes: s suppressed, d damped, h history, * valid, > best, = multipath,
               i internal, e external S Stale, R Removed
VRF : default
Local router-id 10.0.0.1
```

Network	Next Hop	Community
Total number of entries 0		

ArubaOS-Switch

```
ArubaOS-Switch(config)# router bgp ?
<1-65535>          The autonomous system number for the BGP routing process on this
                    router

ArubaOS-Switch(config)# router bgp 64502 ?
bgp                Configure various BGP parameters.
disable            Disable BGP on the router.
distance           Configure the administrative distances for BGP routes.
enable             Enable BGP on the router.
neighbor           Add/Modify/delete entries of the BGP peer table.
network            Advertise a network to the BGP neighbors if the network exists in
                    the routing table.
redistribute        Advertises routes from the specified protocol to the BGP
                    neighbors.
timers             Configure global keepalive and hold-time values for BGP.
<cr>
```

```
ArubaOS-Switch(config)# router bgp 64502
```



```

ArubaOS-Switch(bgp) # bgp
allowas-in          Specify the number of times the local AS may appear in an AS-path.
always-compare-med  Compare MEDs for routes from neighbors in different ASs.
bestpath            Configure various BGP best-path options.
client-to-client-r... Enable or Disable client-to-client route reflection.
cluster-id          Specify the cluster ID to be used when the BGP router is used as a
                    route-reflector.
default-metric       Specify a BGP MED to be set on routes when they are advertised to
                    peers.
graceful-restart     Configure BGP graceful restart timers.
log-neighbor-changes Enable or disable BGP event logging.
maximum-prefix       Specify the maximum number of routes that BGP will add to its
                    routing table.
open-on-accept       Configure BGP to send an Open message immediately when the TCP
                    connection has been established for configured peers.
router-id            Configure a BGP router-id to be used during neighbor session
                    establishment and in BGP best-path selection.

ArubaOS-Switch(bgp) # bgp router-id ?
IP-ADDR             A 32-bit integer in ipv4-address format to be used as the BGP
                    router-id

ArubaOS-Switch(bgp) # bgp router-id 10.0.0.2

ArubaOS-Switch(bgp) # ?
bgp                 Configure various BGP parameters.
disable             Disable BGP on the router.
distance            Configure the administrative distances for BGP routes.
enable              Enable BGP on the router.
neighbor            Add/Modify/delete entries of the BGP peer table.
network             Advertise a network to the BGP neighbors if the network exists in
                    the routing table.
redistribute         Advertises routes from the specified protocol to the BGP
                    neighbors.
timers              Configure global keepalive and hold-time values for BGP.

ArubaOS-Switch(bgp) # neighbor 10.0.101.31 ?
allowas-in          Specify the number of times the local AS # may appear in an
                    AS-path.
as-override         Replace all occurrences of the peer AS number with the router's
                    own AS number before advertising the route.
description          Configure description for this BGP peer or peer-group.
dynamic             Enable or disable advertisement of dynamic capability to the peer.
ebgp-multihop       Enable or disable multi-hop peering with the specified EBGp peer,
                    and optionally indicate the maximum number of hops (TTL).
graceful-restart     Enable or Disable the advertisement of graceful-restart
                    capability.
ignore-leading-as    Allow any received routes that do not have their own AS appended
                    to the as-path.
local-as            Configure the local AS # used for peering with this peer .
maximum-prefix       Specify the maximum number of routes BGP will accept from the
                    specified peer.
next-hop-self        Force BGP to use the router's outbound interface address as the
                    next hop for the route updates to the peer.
out-delay           Specify the delay-time before advertising the route updates to the
                    peer.
passive             If enabled, do not initiate a peering connection to the peer.
password            Use MD5 authentication for the peer and set the password to be
                    used. If in enhanced secure-mode, you will be prompted for the
                    password.
remote-as           Add an entry to the neighbor table, specifying the AS # of the BGP
                    peer.

```

remove-private-as	Specify whether the private AS # should be removed from the as-path attribute of updates to the EBGp peer.
route-map	Specify a route-map to be applied for filtering routes received from or sent to the peer.
route-reflector-cl...	Act as a route reflector for the peer.
route-refresh	Enable or disable the advertisement of route-refresh capability in the Open message sent to the peer.
send-community	Enable or disable sending the community attribute in route updates to the peer.
shutdown	Shutdown the BGP peering session without removing the associated peer configuration.
timers	Configure the keepalive and hold-time values for the peer.
ttl-security	Configure the TTL security for this peer.
update-source	Specify the source address to accept TCP connections from the peer.
use-med	Enable or disable the comparison of MED attribute for the same route received from two different autonomous systems.
weight	Specify the weight for all routes received from the specified peer.

```
ArubaOS-Switch(bgp)# neighbor 10.0.101.31 remote-as 64503 ?
<cr>
```

```
ArubaOS-Switch(bgp)# neighbor 10.0.101.31 remote-as 64503
```

```
ArubaOS-Switch(bgp)# neighbor 10.0.101.41 remote-as 64504
```

```
ArubaOS-Switch(bgp)# neighbor 10.0.101.51 remote-as 64505
```

```
ArubaOS-Switch(bgp)# redistribute connected
```

```
ArubaOS-Switch(bgp)# redistribute static
```

```
ArubaOS-Switch(bgp)# enable
```

```
ArubaOS-Switch(bgp)# network 10.0.221.0/24
```

```
ArubaOS-Switch# show ip bgp ?
```

as-path	Shows list of unique as-paths learnt by this router.
community	Show routes belonging to the specified communities.
general	Show a global configuration details.
IP-ADDR/MASK-LENGTH	Show routes matching this network ipv4 address.
neighbor	Show information about the state of BGP peering session<ip-addr> - Show information only for this peer.
redistribute	Show protocols being redistributed into BGP.
regex	Show BGP routes whose as-path information matches the supplied regular expression.
route	Displays as-path or community information of the BGP routes.
summary	Show a summary of BGP peer state information.
<cr>	

```
ArubaOS-Switch# show ip bgp summary
```

```
Peer Information
```

Remote Address	Remote-AS	Local-AS	State	Admin Status
10.0.101.31	64503	64502	Established	Start
10.0.101.41	64504	64502	Established	Start
10.0.101.51	64505	64502	Established	Start

Cisco

Cisco(config)#router bgp ?
 <1-4294967295> Autonomous system number
 <1.0-XX.YY> Autonomous system number

Cisco(config)#router bgp 64504 ?
 <cr>

Cisco(config)#router bgp 64504

Cisco(config-router)#bgp ?
 aggregate-timer Configure Aggregation Timer
 always-compare-med Allow comparing MED from different neighbors
 asnotation Change the default asplain notation
 bestpath Change the default bestpath selection
 client-to-client Configure client to client route reflection
 cluster-id Configure Route-Reflector Cluster-id (peers may reset)
 confederation AS confederation parameters
 dampening Enable route-flap dampening
 default Configure BGP defaults
 deterministic-med Pick the best-MED path among paths advertised from the neighboring AS
 dmzlink-bw Use DMZ Link Bandwidth as weight for BGP multipaths
 enforce-first-as Enforce the first AS for EBGP routes(default)
 fast-external-fallover Immediately reset session if a link to a directly connected external peer goes down
 graceful-restart Graceful restart capability parameters
 inject-map Routemap which specifies prefixes to inject
 log-neighbor-changes Log neighbor up/down and reset reason
 maxas-limit Allow AS-PATH attribute from any neighbor imposing a limit on number of ASes
 nexthop Nexthop tracking commands
 nopeerup-delay Set how long BGP will wait for the first peer to come up before beginning the update delay or graceful restart timers (in seconds)
 redistribute-internal Allow redistribution of iBGP into IGP (dangerous)
 regex Select regular expression engine
 route-map route-map control commands
 router-id Override configured router identifier (peers will reset)
 scan-time Configure background scanner interval
 slow-peer Configure slow-peer
 soft-reconfig-backup Use soft-reconfiguration inbound only when route-refresh is not negotiated
 suppress-inactive Suppress routes that are not in the routing table
 transport global enable/disable transport session parameters
 update-delay Set the max initial delay for sending update
 upgrade-cli Upgrade to hierarchical AFI mode

Cisco(config-router)#bgp router-id ?
 A.B.C.D Manually configured router identifier
 vrf vrf-specific router id configuration

Cisco(config-router)#bgp router-id 10.0.0.4 ?
 <cr>

```
Cisco(config-router)#bgp router-id 10.0.0.4
```

```
Cisco(config-router)##?
```

```
Router configuration commands:
```

address-family	Enter Address Family command mode
aggregate-address	Configure BGP aggregate entries
auto-summary	Enable automatic network number summarization
bgp	BGP specific commands
default	Set a command to its defaults
default-information	Control distribution of default information
default-metric	Set metric of redistributed routes
distance	Define an administrative distance
distribute-list	Filter networks in routing updates
exit	Exit from routing protocol configuration mode
help	Description of the interactive help system
maximum-paths	Forward packets over multiple paths
neighbor	Specify a neighbor router
network	Specify a network to announce via BGP
no	Negate a command or set its defaults
redistribute	Redistribute information from another routing protocol
scope	Enter scope command mode
synchronization	Perform IGP synchronization
table-map	Map external entry attributes into routing table
template	Enter template command mode
timers	Adjust routing timers

```
Cisco(config-router)#neighbor ?
```

A.B.C.D	Neighbor address
WORD	Neighbor tag
X:X:X:X::X	Neighbor IPv6 address

```
Cisco(config-router)#neighbor 10.0.101.21 ?
```

activate	Enable the Address Family for this Neighbor
advertise-map	specify route-map for conditional advertisement
advertisement-interval	Minimum interval between sending BGP routing updates
allowas-in	Accept as-path with my AS present in it
capability	Advertise capability to the peer
default-originate	Originate default route to this neighbor
description	Neighbor specific description
disable-connected-check	one-hop away EBGp peer using loopback address
distribute-list	Filter updates to/from this neighbor
dmzlink-bw	Propagate the DMZ link bandwidth
ebgp-multihop	Allow EBGp neighbors not on directly connected networks
fall-over	session fall on peer route lost
filter-list	Establish BGP filters
ha-mode	high availability mode
inherit	Inherit a template
local-as	Specify a local-as number
maximum-prefix	Maximum number of prefixes accepted from this peer
next-hop-self	Disable the next hop calculation for this neighbor
next-hop-unchanged	Propagate next hop unchanged for iBGP paths to this neighbor
password	Set a password
peer-group	Member of the peer-group
prefix-list	Filter updates to/from this neighbor
remote-as	Specify a BGP neighbor
remove-private-as	Remove private AS number from outbound updates
route-map	Apply route map to neighbor
route-reflector-client	Configure a neighbor as Route Reflector client
send-community	Send Community attribute to this neighbor

shutdown	Administratively shut down this neighbor
slow-peer	Configure slow-peer
soft-reconfiguration	Per neighbor soft reconfiguration
soo	Site-of-Origin extended community
timers	BGP per neighbor timers
translate-update	Translate Update to MBGP format
transport	Transport options
ttl-security	BGP ttl security check
unsuppress-map	Route-map to selectively unsuppress suppressed routes
update-source	Source of routing updates
version	Set the BGP version to match a neighbor
weight	Set default weight for routes from this neighbor

```
Cisco(config-router)#neighbor 10.0.101.21 remote-as ?
<1-4294967295> AS of remote neighbor
<1.0-XX.YY> AS of remote neighbor
```

```
Cisco(config-router)#neighbor 10.0.101.21 remote-as 64502 ?
shutdown Administratively shut down this neighbor
<cr>
```

```
Cisco(config-router)#neighbor 10.0.101.21 remote-as 64502
```

```
Cisco(config-router)#redistribute connected
```

```
Cisco(config-router)#network 10.0.241.0 ?
backdoor Specify a BGP backdoor route
mask Network mask
nlri Specify nlri type for network
route-map Route-map to modify the attributes
<cr>
```

```
Cisco(config-router)#network 10.0.241.0 mask ?
A.B.C.D Network mask
```

```
Cisco(config-router)#network 10.0.241.0 mask 255.255.255.0
```

```
Cisco#show ip bgp ?
A.B.C.D Network in the BGP routing table to display
A.B.C.D/nn IP prefix <network>/<length>, e.g., 35.0.0.0/8
all All address families
cidr-only Display only routes with non-natural netmasks
community Display routes matching the communities
community-list Display routes matching the community-list
dampening Display detailed information about dampening
extcommunity-list Display routes matching the extcommunity-list
filter-list Display routes conforming to the filter-list
import Display route topology import / export activity
inconsistent-as Display only routes with inconsistent origin ASs
injected-paths Display all injected paths
ipv4 Address family
ipv6 Address family
l2vpn Address family
labels Display Labels for IPv4 NLRI specific information
neighbors Detailed information on TCP and BGP neighbor connections
nexthops Nexthop address table
nsap Address family
oer-paths Display all oer controlled paths
paths Path information
peer-group Display information on peer-groups
pending-prefixes Display prefixes pending deletion
prefix-list Display routes matching the prefix-list
quote-regexp Display routes matching the AS path "regular expression"
```

regex	Display routes matching the AS path regular expression
replication	Display replication status of update-group(s)
rib-failure	Display bgp routes that failed to install in the routing table (RIB)
route-map	Display routes matching the route-map
summary	Summary of BGP neighbor status
template	Display peer-policy/peer-session templates
topology	Routing topology instance
update-group	Display information on update-groups
update-sources	Update source interface table
version	Display prefixes with matching version numbers
vpn4	Address family
vpn6	Address family
	Output modifiers

```

Cisco#show ip bgp summary
BGP router identifier 10.0.0.4, local AS number 64504
BGP table version is 5, main routing table version 5
4 network entries using 544 bytes of memory
4 path entries using 208 bytes of memory
4/4 BGP path/bestpath attribute entries using 496 bytes of memory
3 BGP AS-PATH entries using 72 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 1320 total bytes of memory
BGP activity 4/0 prefixes, 4/0 paths, scan interval 60 secs

Neighbor      V      AS MsgRcvd MsgSent  TblVer  InQ  OutQ  Up/Down  State/PfxRcd
10.0.101.21    4      64502      8       8        5    0    0 00:03:23      3

```

Chapter 14 OSPF

This chapter compares the commands you use to enable and configure Open Shortest Path First (OSPF).

OSPF is a link-state routing protocol you can apply to routers grouped into OSPF areas identified by the routing configuration on each router. The protocol uses Link-State Advertisements (LSAs) transmitted by each router to update neighboring routers regarding that router's interfaces and the routes available through those interfaces.

Each router in an area also maintains a link-state database (LSDB) that describes the area topology. The routers used to connect areas to each other flood summary link LSAs and external link LSAs to neighboring OSPF areas to update them regarding available routes. In this way, each OSPF router determines the shortest path between itself and a desired destination router in the same OSPF domain (AS [Autonomous System]).

The OSPFv2 configurations in this chapter start with single area, then configuring multiple areas, after which adding stub and totally stubby components, and then the show/display OSPF commands. Each section builds upon the next adding additional OSPF capabilities.

OSPF CLI Comparison

ArubaOS-CX-Switch

ArubaOS-Switch

Cisco

router ospf 2 enable	router ospf enable	router ospf 1
router-id 10.0.0.41		router-id 10.0.0.41
area 0	area 0	
area 10.1.220.0	vlan 220 ip ospf area 0	network 10.1.220.0 0.0.0.255 area 0
router ospf 2 redistribute connected	router ospf redistribute connected	router ospf 1 redistribute connected
show ip ospf		Show ip ospf
Show ip route ospf	Show ip route	Show ip route ospf
Show ip ospf neighbour		Show ip ospf neighbour

OSPF CLI Configurable options

ArubaOS-CX-Switch

```

ArubaOS-CX-Switch(config)# router
  bgp          BGP specific commands
  graceful-restart  Configure graceful restart for routing process
  ospf         Configure OSPF or enter the OSPF configuration context
  ospfv3       Configure OSPFv3 or enter the OSPFv3 configuration context.
  pim          Configure PIM, or enter PIM configuration context
  vrrp         VRRP information

ArubaOS-CX-Switch(config)# router ospf
  ospf         Configure OSPF or enter the OSPF configuration context
  ospfv3       Configure OSPFv3 or enter the OSPFv3 configuration context.

ArubaOS-CX-Switch(config)# router ospf
  <1-63>       Specify the OSPF Process ID

ArubaOS-CX-Switch(config)# router ospf 2
  vrf          VRF Instance.
  <cr>

ArubaOS-CX-Switch(config)# router ospf 2

ArubaOS-CX-Switch(config-ospf-2)#
  area          Configure OSPF area parameters
  default-metric  Configure metric of redistributed routes.
  disable       Disable OSPF process
  distance       Configure OSPF administrative distance
  enable        Enable OSPF process
  end           End current mode and change to enable mode
  exit          Exit current mode and change to previous mode
  graceful-restart  Configure graceful-restart for OSPF
  list          Print command list
  max-metric     Configure stub router advertisement
  maximum-paths  Configure maximum number of ECMP routes that OSPF can support
  no            Negate a command or set its defaults
  passive-interface  Configure the interfaces to suppress OSPF routing updates
  redistribute   Redistribute routes from another routing protocol
  rfc1583-compatibility  Compatible with RFC 1583. Turned off by default.
  router-id      Configure OSPF router identifier
  trap-enable    Enable OSPF SNMP Traps. Default is disabled.

ArubaOS-CX-Switch(config-ospf-2)# enable

ArubaOS-CX-Switch(config-ospf-2)# area
  <0-4294967295> Set area id in decimal format

```

```

A.B.C.D          Set area id in IPv4 address notation

ArubaOS-CX-Switch(config-ospf-2)# area 0
  default-metric  Configure cost for the default route used for a stub or NSSA area
  nssa            Configure OSPF area as NSSA
  range          Summarize routes matching address/mask on border routers only
  stub           Configure OSPF area as stub
  virtual-link    Configure a virtual link
  <cr>

ArubaOS-CX-Switch(config-ospf-2)# area 0

ArubaOS-CX-Switch(config-ospf-2)# router-id
  A.B.C.D        Set router identifier

ArubaOS-CX-Switch(config-ospf-2)# router-id 10.0.0.1
  <cr>

ArubaOS-CX-Switch(config-ospf-2)# router-id 10.0.0.1

ArubaOS-CX-Switch(config-ospf-2)# redistribute
  bgp            Border Gateway Protocol (BGP)
  connected      Connected routes (directly attached subnet or host)
  static         Statically configured routes

ArubaOS-CX-Switch(config-ospf-2)# redistribute connected
  <cr>

ArubaOS-CX-Switch(config-ospf-2)# redistribute connected

ArubaOS-CX-Switch(config-ospf-2)# area
  <0-4294967295> Set area id in decimal format
  A.B.C.D        Set area id in IPv4 address notation

ArubaOS-CX-Switch(config-ospf-2)# area 10.0.0.3
  default-metric  Configure cost for the default route used for a stub or NSSA area
  nssa            Configure OSPF area as NSSA
  range          Summarize routes matching address/mask on border routers only
  stub           Configure OSPF area as stub
  virtual-link    Configure a virtual link
  <cr>

ArubaOS-CX-Switch(config-ospf-2)# area 10.0.0.3 range
  A.B.C.D/M      Area range prefix/mask

ArubaOS-CX-Switch(config-ospf-2)# area 10.0.0.3 range 10.0.0.5/24
  type          LSDB type that this address aggregate applies to

ArubaOS-CX-Switch(config-ospf-2)# area 10.0.0.3 range 10.0.0.5/24 type
  inter-area     Specify LSDB type as inter-area
  nssa           Specify LSDB type as NSSA external

ArubaOS-CX-Switch(config-ospf-2)# area 10.0.0.3 range 10.0.0.5/24 type nssa
  no-advertise   Specify the address range status as DoNotAdvertise
  <cr>

ArubaOS-CX-Switch(config-ospf-2)# area 10.0.0.3 range 10.0.0.5/24 type nssa
OSPF Area is not enabled.

ArubaOS-CX-Switch(config-ospf-2)# do show ip
  aspath-list     List AS path lists
  bgp             BGP specific commands
  community-list  List community-list

```


dns	Display DNS client configuration
ecmp	ECMP Configuration
errors	Errors
forward-protocol	Forward-protocol
helper-address	Show the helper-address for DHCP relay configuration
igmp	Display IGMP configurations and status
interface	Interface information
irdp	Configure ICMP Router Discovery Protocol
mroute	Show Mroute information
ospf	OSPF information
pim	pim configurations
prefix-list	Build a prefix list
route	Routing Table
source-interface	Specify source-interface utility

```
ArubaOS-CX-Switch(config-ospf-2)# do show ip ospf
[<1-63>]      Specify the OSPF Process ID
all-vrfs       All VRFs.
border-routers Display OSPF border router information
interface      Display OSPF interface information
lsdb           Display OSPF link state database information
neighbors      Display OSPF neighbor information
routes         Display OSPF routing table
statistics     Display OSPF statistics
virtual-links  Display OSPF virtual links information
vrf            VRF Instance.
<cr>
```

```
ArubaOS-CX-Switch(config-ospf-2)# do show ip ospf
Routing Process 2 with ID : 10.0.0.1 VRF default
-----
```

```
Graceful-restart is configured
Restart Interval: 120, State: inactive
Last Graceful Restart Exit Status: none
Maximum Paths to Destination: 4
Number of external LSAs 0, checksum sum 0
Number of areas is 1, 1 normal, 0 stub, 0 NSSA
Number of active areas is 0, 0 normal, 0 stub, 0 NSSA
Area (0.0.0.0) (Inactive)
  Interfaces in this Area: 0 Active Interfaces: 0
  Passive Interfaces: 0 Loopback Interfaces: 0
  SPF calculation has run 2 times
  Area ranges:
  Number of LSAs: 1, checksum sum 39090
```

```
ArubaOS-CX-Switch(config-ospf-2)# do show ip ospf all-vrfs
Routing Process 2 with ID : 10.0.0.1 VRF default
-----
```

```
Graceful-restart is configured
Restart Interval: 120, State: inactive
Last Graceful Restart Exit Status: none
Maximum Paths to Destination: 4
Number of external LSAs 0, checksum sum 0
Number of areas is 1, 1 normal, 0 stub, 0 NSSA
Number of active areas is 0, 0 normal, 0 stub, 0 NSSA
Area (0.0.0.0) (Inactive)
  Interfaces in this Area: 0 Active Interfaces: 0
  Passive Interfaces: 0 Loopback Interfaces: 0
  SPF calculation has run 2 times
  Area ranges:
  Number of LSAs: 1, checksum sum 39090
```

```
ArubaOS-CX-Switch(config-ospf-2)# do show ip ospf statistics
OSPF Process ID 2 VRF default, Statistics (cleared 0h6m40s ago)
```

```
-----
Unknown Interface Drops          : 0
Unknown Virtual Interface Drops  : 0
Bad Instance ID Drops            : 0
Bad IP Header Length Drops       : 0
Wrong OSPF Version Drops         : 0
Bad Source IP Drops              : 0
Resource Failure Drops           : 0
Bad Header Length Drops          : 0
Total Drops                      : 0
```

ArubaOS-Switch

```
ArubaOS-Switch(config)# ip router-id 10.0.0.21
```

```
ArubaOS-Switch(config)# router ospf
```

```
ArubaOS-Switch(ospf)# enable
```

```
ArubaOS-Switch(ospf)# area backbone
```

-or-

```
ArubaOS-Switch(ospf)# area 0.0.0.0
```

-or-

```
ArubaOS-Switch(ospf)# area 0
```

```
ArubaOS-Switch(ospf)# vlan 220
```

```
ArubaOS-Switch(vlan-220)# ip ospf area backbone
```

-or-

```
ArubaOS-Switch(vlan-220)# ip ospf area 0.0.0.0
```

-or-

```
ArubaOS-Switch(vlan-220)# ip ospf area 0
```

```
ArubaOS-Switch(vlan-220)# router ospf
```

(also as compound statements)

```
ArubaOS-Switch(config)# vlan 220 ip ospf area backbone
```

-or-

```
ArubaOS-Switch(config)# vlan 220 ip ospf area 0
```

-or-

```
ArubaOS-Switch(config)# vlan 220 ip ospf area 0.0.0.0
```

```
ArubaOS-Switch(ospf)# redistribute ?
```

connected

static

rip

bgp

```
ArubaOS-Switch(ospf)# redistribute connected

Cisco
Cisco(config)#router ospf 1

Cisco(config-router)#router-id 10.0.0.41

Cisco(config-router)#network 10.1.220.0 0.0.0.255 area 0

-or-

Cisco(config-router)#network 10.1.220.0 0.0.0.255 area 0.0.0.0

Cisco(config-router)#redistribute ?

  bgp                Border Gateway Protocol (BGP)
  connected          Connected
  eigrp              Enhanced Interior Gateway Routing Protocol (EIGRP)
  isis               ISO IS-IS
  iso-igrp           IGRP for OSI networks
  maximum-prefix     Maximum number of prefixes redistributed to protocol
  metric             Metric for redistributed routes
  metric-type        OSPF/IS-IS exterior metric type for redistributed routes
  mobile             Mobile routes
  nssa-only          Limit redistributed routes to NSSA areas
  odr                On Demand stub Routes
  ospf               Open Shortest Path First (OSPF)
  rip                Routing Information Protocol (RIP)
  route-map          Route map reference
  static             Static routes
  subnets           Consider subnets for redistribution into OSPF
  tag                Set tag for routes redistributed into OSPF\

  <cr>

Cisco(config-router)#redistribute connected
```

Appendix A CLI Commands in ArubaOS-Switch Software

This appendix shows display commands added to ArubaOS-Switch software.

Included are related ArubaOS-CX-Switchsoftware commands. Refer to the latest release notes for your switch product to determine which commands are supported.

HPE Networking has added CLI commands into the ArubaOS-CXSwitch software in a phased manner over several releases to help network management staff learn to use the ArubaOS-Switch software CLI with a minimum of effort.

ArubaOS-CX-Switchwas used for this section.

Fundamental Commands

ArubaOS-Switch commands
copy startup-config tftp <ip-address> <file name>
clock set <HH:MM:SS> <MM/DD/YYYY>
clock summer-time
clock timezone
aaa accounting commands
aaa authorization commands radius
No equivalent ArubaOS-Switch software command
No equivalent ArubaOS-Switch software command
copy
erase startup-config
flow-control
console inactivity-timer
exit
boot
erase startup
copy tftp startup-config
end
write memory
reload at
reload after
terminal length
set authentication password
console baud-rate
startup-default config <config file name>
hostname
configure
telnet
telnet-server
console terminal
no
Sys-debug ip fib blackhole
Sys-debug ipv6 fib blackhole
Sys-debug destination logging
Sys-debug destination buffer
Ipv6 route <network/subnetmask> blackhole logging
Ip route <network/subnetmask> blackhole logging
Access-list logtimer <5-300>
Sys-debug acl
Sys-debug destination buffer
Sys-debug destination logging
vsf sequence-reboot {primary secondary}

vsf domain 20
vsf lldp-mad ipv4 10.1.1.1 v2c public
vsf member 4 link 1 name NAME-STR
vsf member 4 link 1 all start-disabled
vsf member 4 link 1 all
vsf member 4 link 1
vsf member 4 priority 255
vsf member 4 remove reboot
vsf member 4 remove
vsf member 4 shutdown
vsf member 4 type <jnum> mac-address <mac-ad>
vsf member 4 type <jnum>
vsf port-speed 1g
vsf port-speed 10g
vsf vlan-mad 707

Display Commands

ArubaOS-CX-Switch commands
show vrrp (ipv4 ipv6 brief detail) (<1-255>)
show vrrp
show vrrp (ipv4 ipv6 brief detail)
show vrrp (<1-255>)
show vrrp (brief detail) (ipv4 ipv6) (<1-255>)
show vrrp (brief detail) (ipv4 ipv6)
show vrrp interface IFNAME
show vrrp interface IFNAME (<1-255>)
show vrrp statistics
show vrrp statistics interface IFNAME
show vrrp statistics interface IFNAME (<1-255>)
show track

show running-config vrrp
show vlan summary
show vlan
show vlan <1-4094>
show vlan port IFNAME
show dhcp-relay
show ip helper-address {interface (IFNAME A.B)}
show dhcp-relay bootp-gateway {interface (IFNAME A.B)}
show ip forward-protocol udp {interface (IFNAME A.B)}
clear udld statistics {interface IFNAME}
show udld
show udld interface IFNAME
show running-config interface tunnel
show interface tunnel {brief}
show environment temperature
show environment temperature detail
top cpu
top memory
show system resource-utilization
show system resource-utilization daemon WORD
show system resource-utilization module SLOT-NUMBER
show system
show environment
show clock
show tech
show tech local-file
show ipv6 ospfv3 neighbors A.B.C.D interface IFNAME detail all-vrfs
show ipv6 ospfv3 neighbors A.B.C.D interface IFNAME detail {vrf WORD}
show ipv6 ospfv3 [<1-63>] neighbors A.B.C.D all-vrfs

```
show ipv6 ospfv3 [<1-63>] neighbors A.B.C.D {vrf WORD}
```

```
show ipv6 ospfv3 [<1-63>] neighbors A.B.C.D detail all-vrfs
```