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

aruba
a Hewlett Packard Enterprise company

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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 relod
- USB
- System and environment
- Remote management sessions (viewing and terminating)
- Tech support output
- Motd
- Source interface for management communications

Management Access CLI comparision

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 comparision

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 comparision

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

```
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)#
```

Note: session-timeout works for ssh sessions as well.

ArubaOS-Switch

```
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)#
```

Note: console inactivity-timer works for telnet and ssh sessions as well.

Cisco

```
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)#
```

[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 '?'` *Displays further sub-options to boot the system*	`reload`	
`show boot-history` `show boot-history all`		`show reload`
	`show reload`	

Reload & Timed Reload Configurable options

ArubaOS-CX-Switch

```
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>
```

```
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 comparision

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 comparision Configurable options

ArubaOS-CX-Switch

```
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
```

ArubaOS-Switch

```
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)
```

Cisco

```
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
```

```
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 comparision

ArubaOS-CX-Switch	ArubaOS-Switch	Cisco
show system *Or abbreviations also works like:* 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

```
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
```

```
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-rdntmgmtd               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-mgmtd                 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
vtysh                     0                 0                 14
jbd2/sda2-8               0                 0                 0
pmd                       0                 0                 36
dbus-daemon               0                 0                 14
aaautilspamcfg            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
arpmgrd                   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
                                                                          Power
Name    Type                Description                                   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      : xxxxxxxxxx

  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:   xxxxxxxxxx


  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: xxxxxxxxxxx

NAME: "Switch 1 - Power Supply 0", DESCR: "FRU Power Supply"
PID: C3K-PWR-265WAC    , VID: V01Q , SN: xxxxxxxxxxx

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 FDO1231V0US
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       : xxxxxxxxxxx
Model revision number           : F0
Motherboard revision number     : A0
Model number                    : WS-C3750E-24TD-S
Daughterboard assembly number   : 800-28590-01
Daughterboard serial number     : xxxxxxxxxxx
System serial number            : xxxxxxxxxxx
Top Assembly Part Number        : 800-27546-03
Top Assembly Revision Number    : A0
Version ID                      : V02
CLEI Code Number                : xxxxxxxxxxx
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 comparision

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

Remote Management Sessions—Viewing CLI Configurable options

ArubaOS-CX-Switch

```
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
```

ArubaOS-Switch

```
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       :
```

Cisco

```
Cisco#show users ?
  all   Include information about inactive ports
  wide  use wide format
  |     Output modifiers
  <cr>

Cisco#show users
    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

  Interface    User               Mode         Idle     Peer Address
```

```
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                                     00:00:00
   4 vty 3                                     00:00:00
   5 vty 4                                     00:00:00
   6 vty 5                                     00:00:00
   7 vty 6                                     00:00:00
   8 vty 7                                     00:00:00
   9 vty 8                                     00:00:00
  10 vty 9                                     00:00:00
  11 vty 10                                    00:00:00
  12 vty 11                                    00:00:00
  13 vty 12                                    00:00:00
  14 vty 13                                    00:00:00
  15 vty 14                                    00:00:00
  16 vty 15                                    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 comparision

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

```
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!
#
```

ArubaOS-Switch

```
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!
#
```

Cisco

```
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!
#
```

Source Interface for Management Communications CLI comparision

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.
 sntp                   The SNTP 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.                   [protocols as seen in above]
 loopback               Specify a loopback interface.
 vlan                   Specify a VLAN interface.


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.
 sntp                   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 comparision

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>	usernam <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 paasword-encryption

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

ArubaOS-CX-Switch

```
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
GR4mhTNFpTqQ8DYoMfYUvtg==
```

ArubaOS-Switch

```
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.
```

```
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 comparision

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

```
switch login: admin
Password: <forgot-password>
One Time Token for password reset (valid for 30 mins) :
AAEAAQABAAEAgI79uC8K+JJKJvxSu+U3JH7iLw8SqqaN/UdKYZeZw0WdXxKnhUQVamggmN5ZqJCLfXUnXAGvOES4eyBX5
p/FwcoYvBFF2dIJ5g5FeYOC862NTL95wmEX01e5V4VqhSVtxeMYOeuanzlmzSfkBZa0FWXVOwYHou3ptfj1JjPLjbz3

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 comparision

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.

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
```

```
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-dhcplist          Subscriber DHCP attribute list
  config-sensor-lldplist          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
iprbacl                         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
ipv6dhcpvs                      IPv6 DHCP Vendor-specific configuration mode
ipv6rbacl                       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 sourceguarde 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

```
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
```

```
  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, - outlyer, 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 ssh authentication-method`
	`show ip ssh`	`show ip ssh`
		`show ssh <0-97>`

`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
AAAAE2VjZHNhLXNoYTItbmlzdHAyNTYAAAAIbmlzdHAyNTYAAABBBLwI/ekxuJQxGvPviDCWsK2fp1c
fqJwdkzKFspuVOML85LI6zFBlJtOfJLG3K6nAY0h4OSVFm2iuBrPlqa8+KFY=


Key Type : ED25519
ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIAvOajmFM4bL/0mydg+a82EnpreKuho1Dj5Qj7fw/oZY


Key Type : RSA       Key Size : 2048
ssh-rsa
AAAAB3NzaC1yc2EAAAADAQABAAABAQC4TfLYwYz4t8C8UV4mk7lUbyzQs15mxhJnlpXdgv5T6fPkSr5pJtfFXZ1iSk8
/4AbjJ
928KXmfBRVCOJLCYn98fqGF1A7OWhRk6u15MewA4I63Doc1VxL/nGzkje5nT/26r96wLwI9l/A3FLjVJio9cSs4aIGZ
h6EV7c
llWYXvvkGQAIMDUmKyLhzLsX09Sr6lCZm1tRsES1KLjYk9bwdY7BgvzS0rv4Gj6s/FEZ03HOW6S+M5bAmb3IqV1nTKz
+hn8nK
3DwyZBM42tJyr+txRMgU9G2LDt66+lp/1sPaprQkYf7NU9bIyAOkrOwDKES+Tqw5aOHgTX00od1FSTsWv
```

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
Q38nMfTPvCCQZLTljhGGywHl0uGxzHbSFShRyIRyIrMpvQtX85GcLcZLhw==

-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
Q38nMfTPvCCQZLTljhGGywHl0uGxzHbSFShRyIRyIrMpvQtX85GcLcZLhw==
```

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 AAAAB3NzaC1yc2EAAAADAQABAAAAgQDEbwH5h57hZcqQbC07QmgIUC7icCexxBtx52vejCnp
ZAsaZzXMXahBSiGYs+GTZePb12345678905Zrk1BwpoZICOO5S8Fk7Gu0e9ilfRdETAstz01YmboasSJ
5rUp3sIasRHGMp3CZHQt520Dv22bDHoCBGEQ8+JF5IJ0kgYkhw==

Cisco#show ssh

Connection Version Mode Encryption  Hmac         State                 Username
0          2.0     IN   aes256-cbc  hmac-sha1    Session started       manager
0          2.0     OUT  aes256-cbc  hmac-sha1    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 acess methods.

Enable standard TCP port 80 access for unencrypted management access to the switch.
For encrypted management accesss 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 Comparision

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 Comparision

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
  nmsp                      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 authenticaton 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
  mroute-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 helps 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 Comparision

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 no shutdown	disable enable	shutdown 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  Mode   Type        Enabled Status  Reason                Speed
          VLAN                                                             (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 or 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

                         | Intrusion                              MDI  Flow Bcast
  Port         Type       | Alert     Enabled Status Mode         Mode Ctrl 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

                         | Intrusion                              MDI  Flow Bcast
  Port         Type      | Alert     Enabled Status Mode          Mode Ctrl 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
Te1/0/1                     notconnect   1            full    10G Not Present
Te1/0/2                     notconnect   1            full    10G Not Present
Fa0                         disabled     routed       auto   auto 10/100BaseTX


Cisco#show interfaces g1/0/1 ?
  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 g1/0/1 status

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


Cisco#show interfaces g1/0/1 status
```

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

Cisco#show interfaces g1/0/1

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
  nmsp                    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                     rollsing 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 (LACPDUs) 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 accidently be created and cause other issues/outages.

Link Aggregation Control Protocol (LACP) CLI comparision

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 gi1/0/1` `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            : l3-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                              Pri     Key  State
--------------------------------------------------------------------------------
```

```
Partner details of all interfaces:
--------------------------------------------------------------------------------
Intf    Aggr    Port    Port    State    System-id          System  Aggr
        Name    Id      Pri                                 Pri     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

          LACP      Trunk     Port                LACP      Admin   Oper
   Port   Enabled   Group     Status    Partner   Status    Key     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  Local                          Port      Oper    LACP     Tx
  Port   Trunk  System ID       Port   Priority  Key     Mode     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.


              LACP      LACP      Marker   Marker   Marker   Marker
  Port Trunk  PDUs Tx   PDUs Rx   Req. Tx  Req. Rx  Resp. Tx 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
                            LACP port     Admin     Oper    Port        Port
Port      Flags   State     Priority      Key       Key     Number      State
Fa1/0/22  SA      bndl      32768         0x1       0x1     0x18        0x3D
Fa1/0/23  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:
                            LACP port     Admin     Oper    Port        Port
Port      Flags   State     Priority      Key       Key     Number      State
Gi1/0/23  SA      bndl      32768         0x1       0x1     0x118       0x3D

Partner's information:

                  LACP port                         Admin  Oper   Port    Port
Port      Flags   Priority  Dev ID          Age     key    Key    Number  State
Gi1/0/23  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:
                            LACP port     Admin     Oper    Port        Port
Port      Flags   State     Priority      Key       Key     Number      State
Gi1/0/24  SA      bndl      32768         0x1       0x1     0x119       0x3D


Partner's information:

                  LACP port                         Admin  Oper   Port    Port
Port      Flags   Priority  Dev ID          Age     key    Key    Number  State
Gi1/0/24  SA      0         009c.02d5.3980  13s     0x0    0x234  0x18    0x3D

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

----
Port-channel1:Port-channel1   (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     Gi1/0/23 Active             0
  0     00     Gi1/0/24 Active             0


Time since last port bundled:    0d:00h:03m:09s    Gi1/0/24


Cisco#show vlan name test

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
220  test                             active    Gi1/0/4, Gi1/0/5


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 gi1/0/1 spanning-tree < cost | guard | link-type | mst | port-prority | 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 fowarding 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  :

                    |           Prio               | Designated    Hello
  Port   Type       | Cost      rity State         | Bridge        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 : 0xCEE7F8D6E076E3201F92550CB1D2CB92

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

  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  :

                                                                 Designated
  Port  Type      Cost      Priority Role       State         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  :

                                                                Designated
  Port  Type      Cost      Priority Role       State         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    Gi1/0/6         cost          40000     rem hops 18

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Gi1/0/6          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    Gi1/0/6         cost          40000     rem hops 18

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    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
---------------- ---- --- --------- -------- --------------------------------
Gi1/0/6          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    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


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    Gi1/0/6         cost          40000     rem hops 18


Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Gi1/0/6          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
---------------- ---- --- --------- -------- --------------------------------
Gi1/0/6          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 10.0.02
  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
  nmsp                        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.
 regexp                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 IGPs (dangerous)
  regexp                  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"
```

```
  regexp              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
  vpnv4               Address family
  vpnv6               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, afterwhich 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