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

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Published: November 2018
Rev: 4

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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 four switch operating systems: ArubaOS-CX, ArubaOS switch (now the Aruba OS), HPE Comware version 7, and Cisco IOS.

In this guide, we refer to 8400 as ArubaOS-CX, HPE ProVision as ArubaOS-Switch, HPE Comware as Comware7 and Cisco IOS is referenced as Cisco.

The ArubaOS-CX operating system runs on the 8400 and 8320 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 HPE Comware7 operating system runs on HPE FF 12900, HPE 12500, HPE 10500, HPE FF 7900, HPE 5930, HPE 5920, HPE 5940 HPE 5900, HPE FF 5700, and HPE 5130 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
- HPE 5900AF-48G-4XG-2QSFP+ switch running Comware 7.1.045, Release 2416
- 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.

Comware Differences

If you are familiar with either the ArubaOS-Switch CLI or the Cisco IOS CLI, you will notice that the Comware CLI is organized slightly differently. Comware was designed for Internet service providers (ISPs). Many features and functions—such as security and Quality of Service (QoS)—are multi-tiered to support the different needs of multiple entities accessing the same switch.

Navigation Differences Among CLIs

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

- With ArubaOS-CX-Switch, 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 Comware or 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-Switch, Comware 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*. In Comware the term is *bridge aggregation*, while in Cisco it is *EtherChannel/Port-Channel*.

Comware supports hybrid port-type, which supports 0 or more untagged VLANs + 0 or more tagged VLANs, this is useful in access layer switches to implement Protocol-based, IP-Subnet-based, MAC-based VLANs

Interface use	ArubaOS-CX-Switch	ArubaOS-Switch	Comware	Cisco
Non-802.1Q interfaces (such as used for computers or printers)	`access`	`untagged`	`access`	`access`
802.1Q interfaces (such as used for switch-to-switch, switch-to-server, and switch-to-VoIP phones)	`trunk`	`tagged`	`trunk` (Note: some display views will denote tagged)	`trunk`
Aggregated interfaces	`lag`	`trunk`	`bridge aggregation`	`Etherchannel/ Port-Channel`
Hybrid port	`N/A`	`hybrid (default)`	`port hybrid`	`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	Comware	Cisco

U = User Exec / User View	ArubaOS-CX-Switch>	ArubaOS-Switch>	<Comware>	Cisco>
P = Privileged Exec	ArubaOS-CX-Switch#	ArubaOS-Switch#		Cisco#
C = Configuration S = System View	ArubaOS-CX-Switch(config)#	ArubaOS-Switch(config)#	[Comware]	Cisco(config)#

Comparing Frequently Used Commands

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

	ArubaOS-CX-Switch		ArubaOS-Switch		Comware		Cisco
Configuration commands							
C	hostname	C	hostname	S	sysname	C	hostname
C	logging	C	logging	S	info-center	C	logging
C	Not supported	C	router rip	S	rip	C	router rip
C	access-list	C	access-list	S	acl	C	access-list
User Exec / Privileged Exec Commands							
U	enable	U	enable	U	system-view	U	enable
P	configure	P	configure	U	system-view (configuration mode is same as being at System View)	U	configure terminal
U/P	Show images	U/P/C	show flash	U	dir	U/P	show flash
U/P	show version	U/P/C	show version	U/S	display version	U/P	show version
P	show run	P/C	show run	U/S	display current-configuration	P	show run
U/P	show vlan	P/C	show vlan	U/S	display saved-configuration	P	show vlan
P	show history	U/P/C	show history	U/S	display history	U/P	show history
U/P	show events	U/P/C	show logging	U/S	display info-center	U/P	show logging
U/P	show ip route	U/P/C	show ip route	U/S	display ip routing-table	U/P	show ip route
U/P	show ip interface brief	U/P/C	show ip	U/S	display ip interface brief	U/P	show ip interface brief
U/P	show interface brief	U/P/C	show interface brief	U/S	display interface brief	U/P	show interfaces status
P	erase startup-config	P/C	erase startup-config	U	reset saved	P	erase start
U/P	show checkpoint <checkpoint-name>	P/C	show config <filename>	U	more <filename>	P	more flash:/<filename>
P	boot system	P/C	reload	U	reboot	P	reload
P	write memory	P/C	write memory	U/S	save	P	write memory

U/P	show tech	P	show tech	U/S	display diagnostic-information	U/P	show tech-support
U/P	show	U/P/C	show	U/S	display	U/P	show
U/P/C	no	U/P/C	no	U/S	undo	P	no
P/C	end	C	end	S	return	C	end
U/P/C	exit	U/P/C	exit	U/S	quit	U/P/C	exit
P	erase	P/C	erase	U/S	delete	P	erase
P	copy	P/C	copy	U	copy/tftp	P	copy
P	Traceroute6	P/C	Traceroute6	S	ospf	P	Traceroute6
P	traceroute	P/C	traceroute	S	ip route-static	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	Comware 7	Cisco
ArubaOS-CX-Switch> enable	ArubaOS-Switch> enable	<Comware> system-view System View: return to User View with Ctrl+Z.	Cisco> enable
ArubaOS-CX-Switch#	ArubaOS-Switch#	[Comware]	Cisco#

Management Access Configurable options

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

```
ArubaOS-Switch#
```

Comware 7

```
<Comware> system-view
System View: return to User View with Ctrl+Z.

[Comware]
```

Cisco

```
Cisco> enable

Cisco#
```

Configuration Access CLI comparision

ArubaOS-CX-Switch	ArubaOS-Switch	Comware 7	Cisco
`ArubaOS-CX-Switch# configure`	`ArubaOS-Switch# configure`	No specific command, see note below	`Cisco# configure terminal Enter configuration commands, one per line. End with CNTL/Z.`
`ArubaOS-CX-Switch(config)#`	`ArubaOS-Switch(config)#`	`[Comware]`	`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)#
```

Comware

Comware does not have a specific configuration mode, when at "System View" context, configuration commands are entered directly at that prompt.

When you are configuring interfaces, protocols, and so on, the prompt will change to indicate that sub-level.

```
<Comware> system-view

[Comware]
```

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	Comware7	Cisco
Configuration commands			
`session-timeout 0`	`console inactivity-timer`	`user-interface aux 0`	`line console 0`
		`idle-timeout`	`exec-timeout`
		`user-interface vty 0`	`line vty 0`
		`idle-timeout`	`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.

Comware

```
[Comware]user-interface aux 0

[Comware-ui-aux0]idle-timeout ?
  INTEGER<0-35791>  Specify the idle timeout in minutes for login user.
                    (10 is the default configuration setting)

[Comware-ui-aux0]idle-timeout 20 ?
  INTEGER<0-59>  Specify the idle timeout in seconds for login user.
  <cr>
                    (0 is the default configuration setting)

[Comware-ui-aux0]idle-timeout 20 10

[Comware-ui-aux0]
```

[also]

```
[Comware]user-interface vty 0

[Comware-ui-vty0]idle-timeout 20 10
```

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	Comware 7	Cisco
boot system	reload	reboot	reload
boot system '?' *Displays further sub-options to boot the system*	reload	reboot slot <>	
		scheduler reboot	
show boot-history show boot-history all		display scheduler	show reload
	show reload		
		undo scheduler reboot	

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
```

Comware 7

```
<Comware7>reboot ?
  force  Forcibly reboot without checking
  slot   Specify the slot number
  <cr>

<Comware7>reboot
```

-or-

```
<Comware7>reboot force ?
  <cr>

<Comware7>reboot force

<Comware7>reboot slot ?
  <1>  Slot number

<Comware7>reboot slot 1 ?
  force    Forcibly reboot without checking
  subslot  Specify the subslot number
  <cr>

<Comware7>reboot slot 1
```

[for timed reboot]

```
<Comware7>scheduler reboot ?
  at     Specify the execution time
  delay  Specify the delay time

<Comware7>scheduler reboot at ?
  TIME  Execution time (HH:MM)

<Comware7>scheduler reboot at 23:00 ?
  DATE  Execution date (MM/DD/YYYY or YYYY/MM/DD)
  <cr>

<Comware7>scheduler reboot at 23:00 03/09/2015 ?
  <cr>

<Comware7>scheduler reboot at 23:00 03/09/2015
Reboot system at 23:00:00 03/09/2015(in 7 hours and 51 minutes). Confirm?[Y/N]:y
<Comware7>%Mar  9 15:08:34:699 2015 Comware7 SCH/5/SCH_REBOOT_SCHEDULED: aux0 set schedule
reboot parameters at 15:08:30 03/09/2015, and system will reboot at 23:00:00 03/09/2015.

<Comware7>
```

-or-

```
<Comware7>scheduler reboot delay ?
  STRING<1-6>  Interval (HH:MM or MM)

<Comware7>scheduler reboot delay 07:45 ?
  <cr>

<Comware7>scheduler reboot delay 07:45
Reboot system at 22:56:01 03/09/2015(in 7 hours and 45 minutes). Confirm?[Y/N]:y
```

```
<Comware7>%Mar  9 15:11:04:975 2015 Comware7 SCH/5/SCH_REBOOT_SCHEDULED: aux0 set schedule
reboot parameters at 15:11:01 03/09/2015, and system will reboot at 22:56:01 03/09/2015.


<Comware7>display scheduler reboot
System will reboot at 23:00:00 03/09/2015(in 7 hours and 47 minutes).


<Comware7>undo schedule reboot
<Comware7>%Mar  9 15:09:23:490 2015 Comware7 SCH/5/SCH_REBOOT_CANCEL: aux0 cancelled reboot
parameters at 15:09:23 03/09/2015.
```

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	Comware 7	Cisco
User Exec / Privileged Exec Commands			
	dir	dir usba0:/	dir usb
usb usb mount			
copy usb:/<filename> primary	copy usb flash <filename> primary		copy run usbflash0:test.cfg
show usb	show usb-port	display device usb	

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)
```

Comware 7

```
<Comware7>display device usb ?
  >        Redirect it to a file
  >>       Redirect it to a file in append mode
  slot     Specify the slot number
  verbose  Display detailed information
  |        Matching output
  <cr>

<Comware7>display device usb
slot 1:
      Device Name :   usba
      State       : Normal

<Comware7>dir usba0:/
Directory of usba0:
   0 -rw-     7309312 Mar 23 2015 15:04:02   5900_5920-cmw710-boot-r2311p05.bin
```

```
   1 -rw-    10986496 Mar 23 2015 15:08:32   5900_5920-cmw710-boot-r2416.bin
   2 -rw-    54262784 Mar 23 2015 15:07:08   5900_5920-cmw710-system-r2311p05.bin
   3 -rw-    66350080 Mar 23 2015 15:13:04   5900_5920-cmw710-system-r2416.bin
   4 -rw-        5429 Mar 23 2015 14:43:04   test.cfg

984816 KB total (699456 KB free)
```

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	Comware 7	Cisco
User Exec / Privileged Exec Commands			
show system *Or abbreviations also works like:* sh sys	show system information show modules	display device manuinfo display device verbose	show inventory show version
show environment fan	show system fans	display fan	show env fan
show system resource-utilization	show system power-supply	display power	show env power
show environment led	show system temperature	display environment	show env temperature
show system error-counter-monitor			
show environment power-supply	Show running-config v3-specific	display current-configuration	

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
```

Comware 7

```
<Comware>display device ?
  chassis   Specify the chassis number
  manuinfo  Manufacture information
  slot      Specify the slot number
  verbose   Display detail information
  |         Matching output
  <cr>

<Comware>display device manuinfo ?
  slot  Specify the slot number
  |     Matching output
  <cr>

<Comware>display device manuinfo
Slot 1:
DEVICE_NAME          : S5500-28C-PWR-EI
DEVICE_SERIAL_NUMBER : xxxxxxxxxxxx
MAC_ADDRESS          : 0023-89D5-A059
MANUFACTURING_DATE   : 2010-02-16
VENDOR_NAME          : H3C


<Comware>display device verbose ?
  |     Matching output
  <cr>


<Comware>display device verbose
 Slot 1
```

```
SubSNo PortNum PCBVer FPGAVer CPLDVer BootRomVer AddrLM Type       State
0      28      REV.C  NULL    002     710        IVL    MAIN       Normal

slot 1 info:
Up Time     : 0 weeks, 0 days, 1 hours, 22 minutes
Brd Type    : HP A5500-24G-PoE+ EI Switch with 2 Interface Slots
Brd Status  : Master
Sft Ver     : Release 2221P07
Patch Ver   : None
PCB Ver     : REV.C
BootRom Ver : 721
CPLD Ver    : 002


<Comware>display fan ?
  slot  Display slot ID
  |     Matching output
  <cr>

<Comware>display fan
 Slot 1
      FAN    1
      State    : Normal


<Comware>display power ?
  slot  Display slot ID
  |     Matching output
  <cr>

<Comware>display power
 Slot 1
      Power    1
      State    : Normal
      Type     : AC


<Comware>display environment ?
  slot  Specify the slot number
  |     Matching output
  <cr>

<Comware>display environment
Slot 1
System temperature information (degree centigrade):
---------------------------------------------------------------------------
Sensor     Temperature  LowerLimit  WarningLimit  AlarmLimit ShutdownLimit
hotspot 1  33           -5          55            NA          NA
```

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      xxxxxxxxxx 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	Comware 7	Cisco
User Exec / Privileged Exec Commands			
show user information	show telnet	display users	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	Comware 7	Cisco
User Exec / Privileged Exec Commands			
show tech	show tech	display diagnostic-information	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>
```

Comware7

```
<Comware7>display diagnostic-information ?
  STRING           [drive][path][file name]
  flash:           Device name
  hardware         Hardware information for diagnosis
  infrastructure   Infrastructure information for diagnosis
  l2               L2 information for diagnosis
  l3               L3 information for diagnosis
  service          Service information for diagnosis
  slot1#flash:     Device name
  slot1#usba0:     Device name
  usba0:           Device name
  <cr>



<Comware7>display diagnostic-information
Save or display diagnostic information (Y=save, N=display)? [Y/N]:
```

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	Comware 7	Cisco
Configuration commands			
banner motd # Enter TEXT message. End with the character'#'	banner motd # Enter TEXT message. End with the character'#'	header motd Please input banner content, and quit 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!
#
```

Comware

```
[Comware]header motd #
Please input banner content, and quit 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	Comware	Cisco
Configuration commands			
ip source-interface tftp interface 1/1/1 ip source-interface tftp 10.0.0.1	ip source-interface	tftp client source interface Vlan-interface 1	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	info-center loghost source Vlan-interface 1	logging source-interface vlan 1
	ip source-interface radius 10.0.111.21	radius nas-ip 10.0.111.31	ip radius source-interface vlan 1
	ip source-interface tacacs 10.0.111.21	hwtacacs nas-ip 10.0.111.31	ip tacacs source-interface vlan 1
		ftp client source interface Vlan-interface 1	ip ftp source-interface vlan 1
		ntp source-interface Vlan-interface 100	
		telnet client source interface Vlan-interface 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
```

Comware7

```
[Comware7]ntp source Vlan-interface 1
```

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	Comware 7	Cisco
		`[Comware7]super password role network-admin simple password`	`enable password 0 <password>`
		[Comware7]super password role network-admin hash <hashtext password>	enable secret 0 <password>

`user word group administrators password`		`[Comware7]local-user manager`
		
		`[Comware7-luser-manage-manager]password simple password`
		
		`[Comware7-luser-manage-manager]authorization-attribute user-role network-admin`
		
		[Comware7-luser-manage-manager]service-type terminal	

`user user-name password`	`password manager user-name <name> plaintext <password>`	`[Comware7]local-user <name>`
		
		`[Comware7-luser-manage-operator]password simple <password>`
		
		`[Comware7-luser-manage-operator]authorization-attribute user-role network-operator`
		
		[Comware7-luser-manage-operator]service-type terminal	

user user-name password	password operator user-name <name> plaintext <password>	[Comware7]user-interface aux 0 [Comware7-line-aux0]authentication-mode password [Comware7-line-aux0]set authentication password simple 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.

Comware7

```
[Comware7]super ?
  authentication-mode  Specify the authentication mode for user role switching
  default              Default target user role
  password             Set the password used to switch to a user role

[Comware7]super password ?
  hash    Specify a hashtext password
  role    Specify the user role
  simple  Specify a plaintext password
  <cr>

[Comware7]super password role ?
  STRING<1-63>      User role name
  network-admin
  network-operator
  level-0
  level-1
  level-2
  level-3
  level-4
  level-5
  level-6
  level-7
  level-8
  level-9
  level-10
  level-11
  level-12
  level-13
  level-14
  level-15
  security-audit

[Comware7]super password role network-admin ?
  hash    Specify a hashtext password
  simple  Specify a plaintext password
  <cr>

[Comware7]super password role network-admin simple ?
  STRING<1-63>  Plaintext password string

[Comware7]super password role network-admin simple password ?
  <cr>

[Comware7]super password role network-admin simple password

[Comware7]super password role network-admin hash ?
  STRING<1-110>  Hashtext password string

[Comware7]super password role network-admin hash password ?
  <cr>

[Comware7]super password role network-admin hash password
```

```
[Comware7]local-user ?
   STRING<1-55>  Local user name, which cannot contain the domain name

[Comware7]local-user manager ?
  <cr>

[Comware7]local-user manager
New local user added.

[Comware7-luser-manage-manager]?
Local-user protocol view commands:
  access-limit             Specify the maximum concurrent access number for the
                           local user
  authorization-attribute  Specify authorization attributes of local user
  bind-attribute           Specify binding attributes of local user
  cfd                      Connectivity Fault Detection (CFD) module
  diagnostic-logfile       Diagnostic log file configuration
  display                  Display current system information
  group                    Specify user group of local user
  logfile                  Log file configuration
  monitor                  System monitor
  password                 Specify password of local user
  password-control         Password control feature
  ping                     Ping function
  quit                     Exit from current command view
  return                   Exit to User View
  save                     Save current configuration
  security-logfile         Security log file configuration
  service-type             Specify a service type for the local user
  state                    Specify state of local user
  tracert                  Tracert function
  undo                     Cancel current setting

[Comware7-luser-manage-manager]password ?
  hash    Specify a hashtext password
  simple  Specify a plaintext password
  <cr>

[Comware7-luser-manage-manager]password simple ?
  STRING<1-63>  Plaintext password string

[Comware7-luser-manage-manager]password simple password ?
  <cr>

[Comware7-luser-manage-manager]password simple password

[Comware7-luser-manage-manager]authorization-attribute ?
  acl              Specify ACL of local user
  callback-number  Specify PPP callback number of local user
  idle-cut         Specify idle cut function for local user
  user-profile     Specify user profile of local user
  user-role        Specify user role of the local user
  vlan             Specify VLAN ID of local user
  work-directory   Specify work directory of local user

[Comware7-luser-manage-manager]authorization-attribute user-role ?
  STRING<1-63>      User role name
  network-admin
  network-operator
  level-0
  level-1
```

```
  level-2
  level-3
  level-4
  level-5
  level-6
  level-7
  level-8
  level-9
  level-10
  level-11
  level-12
  level-13
  level-14
  level-15
  security-audit

[Comware7-luser-manage-manager]authorization-attribute user-role network-admin ?

  acl              Specify ACL of local user
  callback-number  Specify PPP callback number of local user
  idle-cut         Specify idle cut function for local user
  user-profile     Specify user profile of local user
  vlan             Specify VLAN ID of local user
  work-directory   Specify work directory of local user
  <cr>

[Comware7-luser-manage-manager]authorization-attribute user-role network-admin

[Comware7-luser-manage-manager]service-type ?
  ftp       FTP service
  http      HTTP service type
  https     HTTPS service type
  pad       X.25 PAD service
  ssh       Secure Shell service
  telnet    Telnet service
  terminal  Terminal access service

[Comware7-luser-manage-manager]service-type terminal ?
  http    HTTP service type
  https   HTTPS service type
  pad     X.25 PAD service
  ssh     Secure Shell service
  telnet  Telnet service
  <cr>

[Comware7-luser-manage-manager]service-type terminal


[Comware7-luser-manage-manager]password ?
  hash    Specify a hashtext password
  simple  Specify a plaintext password
  <cr>

[Comware7-luser-manage-manager]password hash ?
  STRING<1-110>  Hashtext password string

[Comware7-luser-manage-manager]password hash password ?
  <cr>

[Comware7-luser-manage-manager]password hash password
```

[the next command sets the use of uid/pw for login via console, even though the scheme is defined for AAA, it works with local uid/pw configuration]

```
[Comware7]user-interface aux 0

[Comware7-line-aux0]?
Line view commands:
  activation-key       Specify a character to begin a terminal session
  authentication-mode  Login authentication mode
  auto-execute         Automatic execution configuration
  cfd                  Connectivity Fault Detection (CFD) module
  command              Command authorization and accounting
  databits             Set the databits of line
  diagnostic-logfile   Diagnostic log file configuration
  display              Display current system information
  escape-key           Escape key sequence configuration
  flow-control         Set a flow control mode
  history-command      History command buffer configuration
  idle-timeout         User connection idle timeout
  logfile              Log file configuration
  monitor              System monitor
  parity               Set the parity check method
  ping                 Ping function
  protocol             Set the protocols to be supported by the line
  quit                 Exit from current command view
  return               Exit to User View
  save                 Save current configuration
  screen-length        Specify the number of lines to be displayed on a screen
  security-logfile     Security log file configuration
  set                  Specify line parameters
  shell                Enable terminal user service
  speed                Line transmission speed
  stopbits             Specify the stop bit of line
  terminal             Specify terminal attribute
  tracert              Tracert function
  undo                 Cancel current setting
  user-role            Specify user role configuration information


[Comware7-line-aux0]authentication-mode ?
  none      Login without authentication
  password  Password authentication
  scheme    Authentication use AAA

[Comware7-line-aux0]authentication-mode scheme ?
  <cr>

[Comware7-line-aux0]authentication-mode scheme
```

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

```
[Comware7]user-interface aux 0

[Comware7-line-aux0]authentication-mode password ?
  <cr>

[Comware7-line-aux0]authentication-mode password

[Comware7-line-aux0]set ?
  authentication  Specify the authentication parameters for line
```

```
[Comware7-line-aux0]set authentication ?
  password  Specify the password of line

[Comware7-line-aux0]set authentication password ?
  hash    Specify a hashtext password
  simple  Specify a plaintext password

[Comware7-line-aux0]set authentication password simple ?
  STRING<1-16>  Plaintext password string

[Comware7-line-aux0]set authentication password simple password  ?
  <cr>

[Comware7-line-aux0]set authentication password simple password
```

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	Comware 7	Cisco
See details below	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).

Comware 7

Requires direct access to the switch (with console cable).

If password recovery capability is enabled (which is the default setting), a console user can access the device configuration without authentication and reconfigure the console login password and user privilege level passwords.

If password recovery capability is disabled, a console user must restore the factory-default configuration before configuring new passwords. Restoring the factory-default configuration deletes the next-startup configuration files.

Availability of related BootROM options varies with different versions of Comware.

```
Press Ctrl-B to enter Boot Menu... 1
BootRom password: Not required. Please press Enter to continue.

Password recovery capability is disabled.

   BOOT  MENU
```

```
1. Download application file to flash
2. Select application file to boot
3. Display all files in flash
4. Delete file from flash
5. Restore to factory default configuration
6. Enter bootrom upgrade menu
7. Skip current configuration file
8. Reserved
9. Set switch startup mode
0. Reboot
Ctrl+F: Format File System
Ctrl+D: Enter Debugging Mode
Ctrl+T: Enter Board Test Environment

Enter your choice(0-9):
```

Select 7 in order for switch to load its default configuration file, then select 0 to Reboot the switch.

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	Comware7	Cisco
			Cisco(config)#aaa new-model
ArubaOS-CX-Switch(config)# aaa authorization commands default group	ArubaOS-Switch(config)# aaa authorization commands local	[Comware7]role name network-admin2	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	[Comware7-role-network-admin2]rule 1 permit command display interface brief	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	[Comware7-role-network-admin2]rule 2 permit command display ip interface brief	Cisco(config-view)#commands exec include show ip interface brief
	ArubaOS-Switch# show authorization group network-admin2	[Comware7]local-user test1 class manage [Comware7-luser-manage-test1]password simple password	(no specific show commands)
		[Comware7-luser-manage-test1]service-type telnet	
		[Comware7-luser-manage-test1]authorization-attribute user-role network-admin2	
		[Comware7]display role name network-admin2 [Comware7]display local-user user-name test1 class manage	

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
```

Comware 7

```
[Comware7]role ?
  default-role   Specify the default user role configuration
  feature-group  Specify a feature group
  name           Specify a name for the user role

 [Comware7]role name ?
  STRING<1-63>  User role name
```

```
[Comware7]role name network-admin2 ?
  <cr>

[Comware7]role name network-admin2
[Comware7-role-network-admin2]%Jun 25 21:48:33:154 2016 Comware7 RBAC/6/INFO: Anonymous user
created role network-admin2 successfully.

[Comware7-role-network-admin2]?
Role view commands:
  cfd                 Connectivity Fault Detection (CFD) module
  description         Describe the user role
  diagnostic-logfile  Diagnostic log file configuration
  display             Display current system information
  interface           Specify the privilege of processing interface
  ip                  Specify IP configuration
  logfile             Log file configuration
  monitor             System monitor
  ping                Ping function
  quit                Exit from current command view
  return              Exit to User View
  rule                Specify a privilege control rule for the user role
  save                Save current configuration
  security-logfile    Security log file configuration
  tracert             Tracert function
  undo                Cancel current setting
  vlan                Specify the privilege of processing VLAN
  vpn-instance        Specify the privilege of processing VPN instance

[Comware7-role-network-admin2]rule ?
  INTEGER<1-256>  Rule number

[Comware7-role-network-admin2]rule 1 ?
  deny    Deny access to the matched commands
  permit  Permit access to the matched commands

[Comware7-role-network-admin2]rule 1 permit ?
  command  Specify a command matching string
  execute  Specify the execute (X) type commands
  read     Specify the read (R) type commands
  write    Specify the write (W) type commands

[Comware7-role-network-admin2]rule 1 permit command ?
  TEXT<1-128>  Command matching string. It may comprise multiple segments
               separated by semicolons. Each segment represents one or more
               commands and can contain multiple wildcards (*). The commands of
               the next segment, if any, must be subcommands of the previous
               segment.

[Comware7-role-network-admin2]rule 1 permit command display interface brief ?
  TEXT<1-104>  Command matching string. It may comprise multiple segments
               separated by semicolons. Each segment represents one or more
               commands and can contain multiple wildcards (*). The commands of
               the next segment, if any, must be subcommands of the previous
               segment.
  <cr>

[Comware7-role-network-admin2]rule 1 permit command display interface brief

[Comware7-role-network-admin2]rule 2 permit command display ip interface brief

Comware7]local-user ?
  STRING<1-55>  Local user name, which cannot contain the domain name
```

```
[Comware7]local-user test1 ?
  class  Specify a class for the local user
  <cr>

[Comware7]local-user test1 class ?
  manage   Device management user
  network  Network access user

[Comware7]local-user test1 class manage ?
  <cr>

[Comware7]local-user test1 class manage
New local user added.

[Comware7-luser-manage-test1]?
Local-user protocol view commands:
  access-limit             Specify the maximum concurrent access number for the
                           local user
  authorization-attribute  Specify authorization attributes of local user
  bind-attribute           Specify binding attributes of local user
  cfd                      Connectivity Fault Detection (CFD) module
  diagnostic-logfile       Diagnostic log file configuration
  display                  Display current system information
  group                    Specify user group of local user
  ip                       Specify IP configuration
  logfile                  Log file configuration
  monitor                  System monitor
  password                 Specify password of local user
  password-control         Password control feature
  ping                     Ping function
  quit                     Exit from current command view
  return                   Exit to User View
  save                     Save current configuration
  security-logfile         Security log file configuration
  service-type             Specify a service type for the local user
  state                    Specify state of local user
  tracert                  Tracert function
  undo                     Cancel current setting

[Comware7-luser-manage-test1]password ?
  hash    Specify a hashtext password
  simple  Specify a plaintext password
  <cr>

[Comware7-luser-manage-test1]password simple ?
  STRING<1-63>  Plaintext password string

[Comware7-luser-manage-test1]password simple password ?
  <cr>

[Comware7-luser-manage-test1]password simple password

[Comware7-luser-manage-test1]service-type ?
  ftp       FTP service
  http      HTTP service type
  https     HTTPS service type
  pad       X.25 PAD service
  ssh       Secure Shell service
  telnet    Telnet service
  terminal  Terminal access service

[Comware7-luser-manage-test1]service-type telnet ?
```

```
  http      HTTP service type
  https     HTTPS service type
  pad       X.25 PAD service
  ssh       Secure Shell service
  terminal  Terminal access service
  <cr>

[Comware7-luser-manage-test1]service-type telnet

[Comware7-luser-manage-test1]authorization-attribute ?
  acl              Specify ACL of local user
  callback-number  Specify PPP callback number of local user
  idle-cut         Specify idle cut function for local user
  user-profile     Specify user profile of local user
  user-role        Specify user role of the local user
  vlan             Specify VLAN ID of local user
  work-directory   Specify work directory of local user

[Comware7-luser-manage-test1]authorization-attribute user-role ?
  STRING<1-63>      User role name
  network-admin
  network-operator
  level-0
  level-1
  level-2
  level-3
  level-4
  level-5
  level-6
  level-7
  level-8
  level-9
  level-10
  level-11
  level-12
  level-13
  level-14
  level-15
  security-audit
  network-admin2

[Comware7-luser-manage-test1]authorization-attribute user-role network-admin2 ?
  acl              Specify ACL of local user
  callback-number  Specify PPP callback number of local user
  idle-cut         Specify idle cut function for local user
  user-profile     Specify user profile of local user
  vlan             Specify VLAN ID of local user
  work-directory   Specify work directory of local user
  <cr>

[Comware7-luser-manage-test1]authorization-attribute user-role network-admin2

[Comware7-luser-manage-test1]undo authorization-attribute user-role network-operator



[Comware7]display role ?
  >              Redirect it to a file
  >>             Redirect it to a file in append mode
  feature        Specify a feature
  feature-group  Specify a feature group
  name           Specify a name for the user role
  |              Matching output
```

```
  <cr>

[Comware7]display role name ?
  STRING<1-63>      User role name
  network-admin
  network-operator
  level-0
  level-1
  level-2
  level-3
  level-4
  level-5
  level-6
  level-7
  level-8
  level-9
  level-10
  level-11
  level-12
  level-13
  level-14
  level-15
  security-audit
  network-admin2

[Comware7]display role name network-admin2 ?
  >     Redirect it to a file
  >>    Redirect it to a file in append mode
  |     Matching output
  <cr>

[Comware7]display role name network-admin2
Role: network-admin2
  Description:
  VLAN policy: permit (default)
  Interface policy: permit (default)
  VPN instance policy: permit (default)
  ----------------------------------------------------------------------
  Rule    Perm   Type  Scope         Entity
  ----------------------------------------------------------------------
  1       permit       command       display interface brief
  2       permit       command       display ip interface brief
  R:Read W:Write X:Execute

[Comware7]display local-user ?
  >             Redirect it to a file
  >>            Redirect it to a file in append mode
  class         Specify a class for the local user
  idle-cut      Display local users with idle cut function
  service-type  Display local users of specified service type
  state         Display local users in state of active or block
  user-name     Display local users using specified user name
  vlan          Display local users in specified VLAN
  |             Matching output
  <cr>

[Comware7]display local-user user-name ?
  STRING<1-55>  User name

[Comware7]display local-user user-name test1 ?
  class  Specify a class for the local user

[Comware7]display local-user user-name test1 class ?
```

```
  manage   Device management user
  network  Network access user

[Comware7]display local-user user-name test1 class manage ?
  >     Redirect it to a file
  >>    Redirect it to a file in append mode
  |     Matching output
  <cr>

[Comware7]display local-user user-name test1 class manage
Total 1 local users matched.

Device management user test1:
 State:                    Active
 Service type:             Telnet
 User group:               system
 Bind attributes:
 Authorization attributes:
  Work directory:          flash:
  User role list:          network-admin2
```

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	Comware7	Cisco
Configuration commands			
ntp server 10.0.100.251	ntp server 10.0.100.251 ntp unicast ntp enable	ntp-service unicast-server 10.0.100.251	ntp server 10.0.100.251
clock timezone us/central	clock timezone us central	ntp-service enable	clock timezone US-Cent -6
	clock summer-time	clock timezone US-Central minus 06:00:00	
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 <>
User Exec / Privileged Exec Commands			
show ntp associations	show ntp association	display ntp-service sessions	show ntp associations
show ntp status	show ntp status		show ntp status
show clock	show time	display clock	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
```

Comware 7

```
[Comware7]ntp-service ?
  authentication         Configure NTP authentication
  authentication-keyid   Specify an authentication key ID
  dscp                   Set the Differentiated Services Codepoint (DSCP) value
  enable                 Enable NTP service
  ipv6                   IPv6 protocol
  max-dynamic-sessions   Specify the maximum number of dynamic NTP sessions
  peer                   Permit full access
  query                  Permit control query
  refclock-master        Configure the local clock as a master clock
  reliable               Specify a trusted key
  server                 Permit server access and query
  source                 Specify a source interface
  synchronization        Permit server access only
  unicast-peer           Specify a NTP peer
  unicast-server         Specify a NTP server

[Comware7]ntp-service unicast-server ?
  STRING<1-253>  Host name of the NTP server
  X.X.X.X        IP address of the NTP server

[Comware7]ntp-service unicast-server 10.0.100.251 ?
  authentication-keyid  Specify an authentication key ID
  priority              Specify the NTP peer as the first choice under the same
                        condition
  source                Specify a source interface
  version               Specify NTP version
  vpn-instance          Specify a VPN instance
  <cr>

[Comware7]ntp-service unicast-server 10.0.100.251

[Comware7]ntp-service enable ?
  <cr>

[Comware7]ntp-service enable


[Comware7]display ntp-service ?
  sessions  NTP connection
```

```
  status    NTP status and configuration information
  trace     Trace the time synchronization information

[Comware7]display ntp-service sessions
      source          reference       stra reach poll  now offset  delay disper
**************************************************************************
[12345]10.0.100.251    216.218.192.202    2   255   64   18 3.1524 2.6092 4.0741
Notes: 1 source(master), 2 source(peer), 3 selected, 4 candidate, 5 configured.
 Total sessions: 1

[Comware7]display ntp-service status
 Clock status: synchronized
 Clock stratum: 3
 System peer: 10.0.100.251
 Local mode: client
 Reference clock ID: 10.0.100.251
 Leap indicator: 00
 Clock jitter: 0.000153 s
 Stability: 0.000 pps
 Clock precision: 2^-17
 Root delay: 94.17725 ms
 Root dispersion: 11.99341 ms
 Reference time: d8be1d3e.190e4251  Thu, Mar 26 2015  0:53:02.097


[Comware7]clock ?
  protocol     Specify a time protocol
  summer-time  Configure daylight saving time
  timezone     Configure time zone

[Comware7]clock timezone ?
  STRING<1-32>  Name of time zone

[Comware7]clock timezone US-Central ?
  add    Add time zone offset
  minus  Minus time zone offset

[Comware7]clock timezone US-Central minus ?
  TIME  Time zone offset (hh:mm:ss)

[Comware7]clock timezone US-Central minus 06:00:00 ?
  <cr>

[Comware7]clock timezone US-Central minus 06:00:00

[Comware7]clock summer-time ?
  STRING<1-32>  Name of the daylight saving time

[Comware7]clock summer-time US-Central ?
  TIME  Time to start (HH:MM:SS)

[Comware7]clock summer-time US-Central 02:00:00 ?
  STRING<1-32>  Date to start (MM/DD)
  January       Start from January
  February      Start from February
  March         Start from March
  April         Start from April
  May           Start from May
  June          Start from June
  July          Start from July
  August        Start from August
  September     Start from September
  October       Start from October
```

```
  November      Start from November
  December      Start from December

[Comware7]clock summer-time US-Central 02:00:00 03/08 ?
  TIME  Time to end (hh:mm:ss)

[Comware7]clock summer-time US-Central 02:00:00 03/08 02:00:00 ?
  STRING<1-32>  Date to end (MM/DD)

[Comware7]clock summer-time US-Central 02:00:00 03/08 02:00:00 11/01 ?
  TIME  Time offset (hh:mm:ss)

[Comware7]clock summer-time US-Central 02:00:00 03/08 02:00:00 11/01 01:00:00 ?
  <cr>

[Comware7]clock summer-time US-Central 02:00:00 03/08 02:00:00 11/01 01:00:00

[Comware7]clock protocol ?
  none  Manually set the system time at the CLI
  ntp   Use the Network Time Protocol (NTP)
  ptp   Use the Precision Time Protocol (PTP)

[Comware7]clock protocol ntp ?
  <cr>

[Comware7]clock protocol ntp

[Comware7]display clock
01:08:21 US-Central Thu 03/26/2015
Time Zone : US-Central minus 06:00:00
Summer Time : US-Central 02:00:00 03/08 02:00:00 11/01 01:00:00
```

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	Comware7	Cisco
Configuration commands			
hostname ArubaOS-CX-Switch		public-key local create rsa	hostname Cisco
ip dns domain-name HPE-Aruba		ssh server enable	ip domain-name test
ssh host-key ed25519	crypto key generate ssh	user-interface vty 0 63 authentication-mode scheme protocol inbound ssh	crypto key generate
ssh known-host remove all		local-user <name> password simple password service-type ssh authorization-attribute user-role network-admin	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	display public-key local rsa public	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/A3FLjVJio9cSs4aIGZh6EV7c
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==
```

Comware7

```
[Comware7]public-key ?
  local  Local key pairs
  peer   Configure peer's public key

[Comware7]public-key local ?
  create   Create a local key pair
  destroy  Destroy local key pairs
  export   Print or export the public key

[Comware7]public-key local create ?
  dsa    DSA key pair
  ecdsa  ECDSA key pair
  rsa    RSA key pairs

[Comware7]public-key local create rsa ?
  name  Specify the name of the key pair
  <cr>

[Comware7]public-key local create rsa
The range of public key modulus is (512 ~ 2048).
If the key modulus is greater than 512, it will take a few minutes.
Press CTRL+C to abort.
Input the modulus length [default = 1024]:
Generating Keys...


[Comware7]user-interface vty 0 63

[Comware7-line-vty0-63]authentication-mode ?
  none      Login without authentication
  password  Password authentication
  scheme    Authentication use AAA

[Comware7-line-vty0-63]authentication-mode scheme ?
  <cr>

[Comware7-line-vty0-63]authentication-mode scheme

[Comware7-line-vty0-63]protocol ?
  inbound  Incoming protocols

[Comware7-line-vty0-63]protocol inbound ?
  all     All protocols
  ssh     SSH protocol
  telnet  Telnet protocol

[Comware7-line-vty0-63]protocol inbound ssh ?
```

```
  <cr>

[Comware7-line-vty0-63]protocol inbound ssh


[Comware7]local-user <name>

[Comware7-luser-manage-ssh-manager]password simple password

[Comware7-luser-manage-ssh-manager]service-type ?
  ftp       FTP service
  http      HTTP service type
  https     HTTPS service type
  pad       X.25 PAD service
  ssh       Secure Shell service
  telnet    Telnet service
  terminal  Terminal access service

[Comware7-luser-manage-ssh-manager]service-type ssh ?
  http      HTTP service type
  https     HTTPS service type
  pad       X.25 PAD service
  telnet    Telnet service
  terminal  Terminal access service
  <cr>

[Comware7-luser-manage-ssh-manager]service-type ssh
```

NOTE: by configuring 'protocol inbound ssh' on the vty interfaces, if telnet access was previously enabled, it is now functionally disabled, however still remove the 'telnet server enable' command, as done later in a few steps.

```
[Comware7-luser-manage-ssh-manager]authorization-attribute ?
  acl              Specify ACL of local user
  callback-number  Specify PPP callback number of local user
  idle-cut         Specify idle cut function for local user
  user-profile     Specify user profile of local user
  user-role        Specify user role of the local user
  vlan             Specify VLAN ID of local user
  work-directory   Specify work directory of local user

[Comware7-luser-manage-ssh-manager]authorization-attribute user-role ?
  STRING<1-63>      User role name
  network-admin
  network-operator
  level-0
  level-1
  level-2
  level-3
  level-4
  level-5
  level-6
  level-7
  level-8
  level-9
  level-10
  level-11
  level-12
  level-13
  level-14
  level-15
  security-audit
```

```
[Comware7-luser-manage-ssh-manager]authorization-attribute user-role network-admin ?
  acl              Specify ACL of local user
  callback-number  Specify PPP callback number of local user
  idle-cut         Specify idle cut function for local user
  user-profile     Specify user profile of local user
  vlan             Specify VLAN ID of local user
  work-directory   Specify work directory of local user
  <cr>

[Comware7-luser-manage-ssh-manager]authorization-attribute user-role network-admin

[Comware7]undo telnet server enable


[Comware7]ssh ?
  client  SSH client configuration
  server  Specify the server attribute
  user    SSH user

[Comware7]ssh server ?
  acl                     Specify an ACL used to control the SSH clients' access
  authentication-retries  Specify authentication retry times
  authentication-timeout  Specify authentication timeout
  compatible-ssh1x        Enable compatible ssh1x
  dscp                    Set the Differentiated Services Codepoint (DSCP) value
  enable                  Enable Stelnet Server
  ipv6                    IPv6 information
  rekey-interval          Specify the SSH server key rekey-interval

[Comware7]ssh server enable ?
  <cr>

[Comware7]ssh server enable


[Comware7]display ssh server ?
  session  Server session
  status   Server state

[Comware7]display ssh server status
 Stelnet server: Enable
 SSH version : 1.99
 SSH authentication-timeout : 60 second(s)
 SSH server key generating interval : 0 hour(s)
 SSH authentication retries : 3 time(s)
 SFTP server: Disable
 SFTP Server Idle-Timeout: 10 minute(s)
 NETCONF server: Disable
 SCP server: Disable


[Comware7]display ssh server session
 UserPid   SessID Ver   Encrypt    State          Retries  Serv     Username
 583       0      2.0   aes256-cbc Established    0        Stelnet  ssh-manager


[Comware7]display public-key local rsa public

=============================================
Key name: hostkey(default)
Key type: RSA
Time when key pair created: 17:51:54 2015/03/26
Key code:
```

```
   30819F300D06092A864886F70D010101050003818D0030818902818100BF00CF5B0FC7B9DA
   6AB174B8F791617F737BD82DE62BA6E08F93067AEAC21AC025307DAF5C2C2934B95AD686C6
   9D6281E76387E938743A29033123456789054FEFC0BE17FDCBA9E470BE1DCB1FF6D8E5B10E
   A3BC17337C52A34297C849B3EF15D08FE49A239A3574516F5EF2C97234B588071A0E89CC7F
   786818BBD277CA84FF0203010001

==========================================
Key name: serverkey(default)
Key type: RSA
Time when key pair created: 17:51:54 2015/03/26
Key code:

   307C300D06092A864886F70D0101010500036B003068026100C9A1E046BBEF0B7CAE47A07C
   DF278BA5B7C0BADC12462EEB1234567890541FFD2935C27F8220AA7AE0DBB1600091E104CA
   F8577E0EAE794EC8BB8E094CEBA16277583A06EF175EC91FE6E0045EFC806B551402940EC9
   4074F97B9588FF45FDFF0203010001
```

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	Comware 7	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.	For Comware7, HTTP is not enabled by default, requires: configure local uid/pw with 'service-type web' and enable http support	HTTP server is enabled by default, but must configure http authentication type. Must have all the device web files for full functionality.
Configuration commands			
`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/display commands			
`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.

Comware7

HTTP is not enabled by default.

```
[Comware7]local-user manager

[Comware7-luser-manage-manager]password simple password
```

```
[Comware7-luser-manage-manager]authorization-attribute user-role network-admin

[Comware7-luser-manage-manager]service-type http

[Comware7]ip ?
  as-path            Specify an AS path
  community-list     Specify a community list entry
  extcommunity-list  Specify an extended community-list entry
  fast-forwarding    IP fast-forwarding information
  host               Add a static host name-to-IPv4 address mapping
  http               Hypertext Transfer Protocol (HTTP) module
  https              Hypertext Transfer Protocol Secure (HTTPS) module
  icmp               Specify ICMP configuration information
  load-sharing       IP forwarding load-sharing
  local              Apply a policy to locally generated packets
  prefix-list        Specify an IPv4 prefix list
  redirects          Send ICMP Redirect packets
  route-static       Establish a static route
  rpf-route-static   Specify static multicast route
  source             Source binding function
  ttl-expires        Send ICMP Time Exceeded packets
  unreachables       Send ICMP Destination Unreachable packets
  urpf               Unicast reverse path forward function
  vpn-instance       Specify a VPN instance

[Comware7]ip http ?
  acl     Specify a basic IPv4 ACL to filter hosts that use HTTP service
  enable  Enable HTTP server
  port    Specify an HTTP server port number

[Comware7]ip http enable ?
  <cr>


[Comware7]display web ?
  menu   Web menu information
  users  Web users

[Comware7]display web users ?
  >     Redirect it to a file
  >>    Redirect it to a file in append mode
  |     Matching output
  <cr>

[Comware7]display web users
UserID          Name            Type   Language JobCount LoginTime LastOperation
900b01302b0010f manager         HTTP   English     0     15:39:39  15:49:02
```

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	Comware 7	Cisco
(Enabled by default, both globally and per port)	(Enabled by default, both globally and per port)	(Generally enabled by default, both globally and per port. See notes for additional information)	(Not enabled by default)
Configuration commands			
`lldp` `lldp reinit 10`	`lldp run`	`lldp global enable`	`lldp run`

`lldp < holdtime-multiplier | management-ipv4-address | management-ipv6-address | reinit | select-tlv | timer | txdelay >`	`lldp admin-status oobm [txonly | rxonly | tx_rx | disable]`	`[Comware7]lldp global enable`
		`[Comware7]interface g1/0/1`
		
		`[Comware7-GigabitEthernet1/0/1]lldp enable`
			`lldp < holdtime | reinit | run | timer | tlv-select >`
			
			`lldp tlv-select < 4-wire-power-management |mac-phy-cfg |management-address |port-description |port-vlan |power-management |system-capabilities |system-description |system-name >`

User Exec / Privileged Exec Commands			

`show lldp neighbor-info`
 	
`show lldp neighbor-info 1/1/1`
	`show lldp info remote-device`
	
	`show lldp info remote-device 1`
		`[Comware7]display lldp neighbor-information list`
		
		`show lldp neighbor-information interface GE1/0/1`
		
		`[Comware7]display lldp neighbor-information interface g1/0/1 verbose`
			`show lldp neighbors`
			
			`show lldp neighbors g1/0/1 detail`

show lldp statistics	show lldp stats	show lldp statistics	show lldp traffic show lldp errors
show lldp tlv		Show lldp tlv-config	
show lldp configuration	show lldp config	Show lldp status	
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
```

Comware7

By default:
• If the switch starts up with empty configuration, LLDP is disabled globally (initial setting).
• If the switch starts up with the default configuration file (also included via the .ipe file), LLDP is enabled globally (factory default).

(Based on above information, generally enabled by default, both globally and per port)

(if needed)

```
[Comware7]lldp ?
  compliance       Enable compliance with another link layer discovery protocol
  fast-count       The fast-start times of transmitting frames
  global           Specify global
  hold-multiplier  Hold multiplicator for TTL
  max-credit       Specify LLDP maximum transmit credit
  mode             Specify LLDP bridge mode
  timer            Timer of LLDP

[Comware7]lldp global ?
  enable  Enable capability

[Comware7]lldp global enable ?
  <cr>

[Comware7]lldp global enable

[Comware7]interface g1/0/1

[Comware7-GigabitEthernet1/0/1]lldp enable


[Comware7]display lldp ?
  local-information     Display local information
  neighbor-information  Display neighbor information
  statistics            Display statistics information
  status                Display LLDP status and configuration
  tlv-config            Display TLV configuration

[Comware7]display lldp neighbor-information ?
  >          Redirect it to a file
  >>         Redirect it to a file in append mode
  agent      Specify LLDP agent
  interface  Specify interface
  list       Neighbor list
  verbose    Verbose message
  |          Matching output
  <cr>

[Comware7]display lldp neighbor-information list
Chassis ID : * -- -- Nearest nontpmr bridge neighbor
             # -- -- Nearest customer bridge neighbor
             Default -- -- Nearest bridge neighbor
System Name          Local Interface Chassis ID      Port ID
```

```
2520G-1              GE1/0/1         c091-3483-8d80  13


[Comware7]display lldp neighbor-information interface g1/0/1 ?
  >        Redirect it to a file
  >>       Redirect it to a file in append mode
  agent    Specify LLDP agent
  verbose  Verbose message
  |        Matching output
  <cr>

[Comware7]display lldp neighbor-information interface g1/0/1
LLDP neighbor-information of port 1[GigabitEthernet1/0/1]:
LLDP agent nearest-bridge:
 LLDP neighbor index : 1
 ChassisID/subtype   : c091-3483-8d80/MAC address
 PortID/subtype      : 13/Locally assigned
 Capabilities        : Bridge

[Comware7]display lldp neighbor-information interface g1/0/1 verbose
LLDP neighbor-information of port 1[GigabitEthernet1/0/1]:
LLDP agent nearest-bridge:
 LLDP neighbor index : 1
 Update time         : 0 days, 0 hours, 1 minutes, 57 seconds
 Chassis type        : MAC address
 Chassis ID          : c091-3483-8d80
 Port ID type        : Locally assigned
 Port ID             : 13
 Time to live        : 120
 Port description    : 13
 System name         : 2520G-1
 System description  : ProCurve J9299A Switch 2520G-24-PoE, revision J.14.54, RO
                       M J.14.05 (/sw/code/build/walle(J_t4b))
 System capabilities supported : Bridge
 System capabilities enabled   : Bridge
 Management address type           : IPv4
 Management address                : 10.0.111.2
 Management address interface type : IfIndex
 Management address interface ID   : Unknown
 Management address OID            : 0
 Auto-negotiation supported : Yes
 Auto-negotiation enabled   : Yes
 OperMau                    : Speed(1000)/Duplex(Full)
```

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	Comware 7	Cisco
Configuration commands			

interface mgmt. ip static 10.0.0.1/24	Oobm ip address 10.199.111.21/24	interface M-GigabitEthernet 0/0/0 ip address 10.199.111.51 255.255.255.0	interface fastEthernet 0 ip address 10.199.111.41 255.255.255.0
ssh server vrf mgmt	ip ssh listen oobm	telnet client source interface <>	ip ssh source-interface <>
https-server vrf mgmt	web-management listen oobm	ssh client source interface <>	
		ntp source <>	
Show/display commands			
ping <target-ip> vrf mgmt	ping <taget-ip> source oobm	Ping -i <source-ip> <target-ip>	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
```

Comware7

```
[Comware7]interface M-GigabitEthernet 0/0/0

[Comware7-M-GigabitEthernet0/0/0]?
M-gigabitethernet interface view commands:
  arp                 ARP module
  bandwidth           Specify the expected bandwidth
  bfd                 BFD module
  cfd                 Connectivity Fault Detection (CFD) module
  ddns                Dynamic Domain Name System (DDNS) module
  default             Restore the default settings
  description         Describe the interface
  dhcp                Dynamic Host Configuration Protocol (DHCP) commands
  diagnostic-logfile  Diagnostic log file configuration
  display             Display current system information
  duplex              Status of duplex
  ip                  Specify IP configuration
  ipsec               IP Security (IPsec) module
  ipv6                Specify IPv6 configuration
  isis                Configure interface parameters for IS-IS
  link-delay          Set the physical state change suppression
  lldp                Link Layer Discovery Protocol(802.1ab)
  logfile             Log file configuration
  mad                 Multi-active detection
  monitor             System monitor
  mtu                 Specify Maximum Transmission Unit(MTU) of the interface
  ospf                OSPF interface commands
  ospfv3              OSPFv3 interface commands
  packet-filter       Packet filter settings
  ping                Ping function
  quit                Exit from current command view
  return              Exit to User View
  rip                 Configure interface parameters for RIP
  ripng               Configure interface parameters for RIPng
  save                Save current configuration
  security-logfile    Security log file configuration
  shutdown            Shut down the interface
  speed               Specify speed of current port
  tracert             Tracert function
  undo                Cancel current setting


[Comware7-M-GigabitEthernet0/0/0]ip ?
  address           Set the IP address of an interface
  binding           Bind the interface with a VPN instance
  forwarding-table  IP forwarding table
  irdp              Enable the ICMP Router Discovery Protocol

[Comware7-M-GigabitEthernet0/0/0]ip address ?
  X.X.X.X      IP address
  bootp-alloc  Obtain an IP address through BOOTP
  dhcp-alloc   Obtain an IP address through DHCP

[Comware7-M-GigabitEthernet0/0/0]ip address 10.199.111.51 255.255.255.0 ?
```

```
  irf-member  Specify an IP address for an IRF member device
  sub         Indicate a subordinate address
  <cr>

[Comware7-M-GigabitEthernet0/0/0]ip address 10.199.111.51 255.255.255.0


[Comware7]telnet ?
  client  Specify telnet client attribute
  server  Telnet server configuration

[Comware7]telnet client ?
  source  Specify a source

[Comware7]telnet client source ?
  interface  Specify a source interface
  ip         Specify a source IP address

[Comware7]telnet client source interface ?
  M-GigabitEthernet  MGE interface
  Vlan-interface     VLAN interface

[Comware7]telnet client source interface M-GigabitEthernet 0/0/0 ?
  <cr>

[Comware7]telnet client source interface M-GigabitEthernet 0/0/0


[Comware7]ssh ?
  client  SSH client configuration
  server  Specify the server attribute
  user    SSH user

[Comware7]ssh client ?
  ipv6    Specify IPv6 protocol
  source  Specify a source address or interface for the SSH client

[Comware7]ssh client source ?
  interface  Specify a source interface
  ip         Specify a source IPv4 address

[Comware7]ssh client source interface ?
  M-GigabitEthernet  MGE interface
  Vlan-interface     VLAN interface

[Comware7]ssh client source interface m
[Comware7]ssh client source interface M-GigabitEthernet 0/0/0 ?
  <cr>

[Comware7]ssh client source interface M-GigabitEthernet 0/0/0


[Comware7]ntp ?
  authentication        Configure NTP authentication
  authentication-keyid  Specify an authentication key ID
  dscp                  Set the Differentiated Services Codepoint (DSCP) value
  enable                Enable NTP service
  ipv6                  IPv6 protocol
  max-dynamic-sessions  Specify the maximum number of dynamic NTP sessions
  peer                  Permit full access
  query                 Permit control query
  refclock-master       Configure the local clock as a master clock
  reliable              Specify a trusted key
```

```
  server                Permit server access and query
  source                Specify a source interface
  synchronization       Permit server access only
  unicast-peer          Specify a NTP peer
  unicast-server        Specify a NTP server

[Comware7]ntp source ?
  M-GigabitEthernet  MGE interface
  Vlan-interface     VLAN interface

[Comware7]ntp source M-GigabitEthernet 0/0/0 ?
  <cr>

[Comware7]ntp source M-GigabitEthernet 0/0/0


[Comware7]ping ?
  -a              Specify the source IP address
  -c              Specify the number of echo requests
  -f              Specify packets not to be fragmented
  -h              Specify the TTL value
  -i              Specify an outgoing interface
  -m              Specify the interval for sending echo requests
  -n              Numeric output only. No attempt will be made to lookup host
                  addresses for symbolic names
  -p              No more than 8 "pad" hexadecimal characters to fill out the
                  sent packet. For example, -p f2 will fill the sent packet with
                  000000f2 repeatedly
  -q              Display only summary
  -r              Record route. Include the RECORD_ROUTE option in the
                  ECHO_REQUEST packets and display the route
  -s              Specify the payload length
  -t              Specify the wait time for each reply
  -tos            Specify the TOS value
  -v              Display the received ICMP packets other than ECHO-RESPONSE
                  packets
  -vpn-instance   Specify a VPN instance
  STRING<1-253>   IP address or hostname of remote system
  ip              IP information
  ipv6            IPv6 information
  mpls            MPLS ping
  trill           TRansparent Interconnection of Lots of Links (TRILL) module

[Comware7]ping -i ?
  M-GigabitEthernet  MGE interface
  Vlan-interface     VLAN interface

[Comware7]ping -i M-GigabitEthernet 0/0/0 ?
  -a              Specify the source IP address
  -c              Specify the number of echo requests
  -f              Specify packets not to be fragmented
  -h              Specify the TTL value
  -m              Specify the interval for sending echo requests
  -n              Numeric output only. No attempt will be made to lookup host
                  addresses for symbolic names
  -p              No more than 8 "pad" hexadecimal characters to fill out the
                  sent packet. For example, -p f2 will fill the sent packet with
                  000000f2 repeatedly
  -q              Display only summary
  -r              Record route. Include the RECORD_ROUTE option in the
                  ECHO_REQUEST packets and display the route
  -s              Specify the payload length
  -t              Specify the wait time for each reply
```

```
  -tos           Specify the TOS value
  -v             Display the received ICMP packets other than ECHO-RESPONSE
                 packets
  -vpn-instance  Specify a VPN instance
  STRING<1-253>  IP address or hostname of remote system

[Comware7]ping -i M-GigabitEthernet 0/0/0 10.199.111.41 ?
  <cr>

[Comware7]ping -i M-GigabitEthernet 0/0/0 10.199.111.41
Ping 10.199.111.41 (10.199.111.41): 56 data bytes, press CTRL_C to break
56 bytes from 10.199.111.41: icmp_seq=0 ttl=255 time=3.488 ms
56 bytes from 10.199.111.41: icmp_seq=1 ttl=255 time=3.065 ms
56 bytes from 10.199.111.41: icmp_seq=2 ttl=255 time=1.773 ms
56 bytes from 10.199.111.41: icmp_seq=3 ttl=255 time=90.936 ms
56 bytes from 10.199.111.41: icmp_seq=4 ttl=255 time=21.390 ms

--- Ping statistics for 10.199.111.41 ---
5 packet(s) transmitted, 5 packet(s) received, 0.0% packet loss
round-trip min/avg/max/std-dev = 1.773/24.130/90.936/34.177 ms
[Comware7]%Jun 10 14:42:08:954 2016 Comware7 PING/6/PING_STATIS_INFO: Ping statistics for
10.199.111.41: 5 packet(s) transmitted, 5 packet(s) received, 0.0% packet loss, round-trip
min/avg/max/std-dev = 1.773/24.130/90.936/34.177 ms.


<Comware7>tftp ?
  STRING<1-253>  IP address or hostname of the TFTP Server
  ipv6           IPv6 TFTP Client

<Comware7>tftp 10.199.111.200 ?
  get   Download a file from the TFTP server
  put   Upload a local file to the TFTP server
  sget  Download a file from the TFTP server securely

<Comware7>tftp 10.199.111.200 get ?
  STRING<1-255>  Source filename

<Comware7>tftp 10.199.111.200 get 5900_5920-CMW710-R2422P01.ipe ?
  STRING<1-255>  Destination filename
  dscp           Set the Differentiated Services Codepoint (DSCP) value
  source         Specify the source address for outgoing TFTP packets
  vpn-instance   Specify a VPN instance
  <cr>

<Comware7>tftp 10.199.111.200 get 5900_5920-CMW710-R2422P01.ipe source ?
  interface  Use the primary address of an interface
  ip         Use a local IP address

<Comware7>tftp 10.199.111.200 get 5900_5920-CMW710-R2422P01.ipe source interface ?
  M-GigabitEthernet  MGE interface
  Vlan-interface     VLAN interface

<Comware7>tftp 10.199.111.200 get 5900_5920-CMW710-R2422P01.ipe source interface
 M-GigabitEthernet 0/0/0 ?
  dscp  Set the Differentiated Services Codepoint (DSCP) value
  <cr>

<Comware7>tftp 10.199.111.200 get 5900_5920-CMW710-R2422P01.ipe source interface
 M-GigabitEthernet 0/0/0


<Comware7>display lldp ?
  local-information     Display local information
```

```
  neighbor-information  Display neighbor information
  statistics            Display statistics information
  status                Display LLDP status and configuration
  tlv-config            Display TLV configuration

<Comware7>display lldp neighbor-information ?
  >          Redirect it to a file
  >>         Redirect it to a file in append mode
  agent      Specify LLDP agent
  interface  Specify interface
  list       Neighbor list
  verbose    Verbose message
  |          Matching output
  <cr>

<Comware7>display lldp neighbor-information interface ?
  FortyGigE            FortyGigE interface
  GigabitEthernet      GigabitEthernet interface
  M-GigabitEthernet    MGE interface
  Ten-GigabitEthernet  Ten-GigabitEthernet interface

<Comware7>display lldp neighbor-information interface M-GigabitEthernet 0/0/0 ?
  >        Redirect it to a file
  >>       Redirect it to a file in append mode
  agent    Specify LLDP agent
  verbose  Verbose message
  |        Matching output
  <cr>

<Comware7>display lldp neighbor-information interface M-GigabitEthernet 0/0/0
LLDP neighbor-information of port 26446[M-GigabitEthernet0/0/0]:
LLDP agent nearest-bridge:
 LLDP neighbor index : 1
 ChassisID/subtype   : 0025-61d7-c560/MAC address
 PortID/subtype      : 6/Locally assigned
 Capabilities        : Bridge
```

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	Comware 7	Cisco
Configuration commands			
interface 1/1/1	Interface 1/1	interface g1/0/1	interface g1/0/1
interface loopback <number>			interface loopback <number>
[configuring a SVI interface:] interface vlan 1		duplex auto	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	description link-to-core
shutdown no shutdown	disable enable	shutdown undo shutdown	shutdown no shutdown
ip address 10.93.20.10/24			ip address 10.93.20.10 255.255.255.0
		speed auto	speed auto
Show/display commands			
show interfaces brief	show interfaces brief	display interface brief	show interfaces status
show interfaces 1/1/1	show interfaces brief 1/1	display interface g1/0/1 brief	show interfaces g1/0/1 status
show interface 1/1/1	show interfaces 1/1	display interface g1/0/1	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
```

Comware7

```
<Comware7>display interface ?
  >                     Redirect it to a file
  >>                    Redirect it to a file in append mode
  FortyGigE             FortyGigE interface
  GigabitEthernet       GigabitEthernet interface
  InLoopBack            InLoopBack interface
  M-GigabitEthernet     MGE interface
  NULL                  NULL interface
  Register-Tunnel       Register Tunnel interface
  Ten-GigabitEthernet   Ten-GigabitEthernet interface
  Vlan-interface        VLAN interface
  brief                 Brief information of status and configuration for
                        interface(s)
  range                 Display range information
  |                     Matching output
  <cr>
```

```
<Comware7>display interface brief ?
  >            Redirect it to a file
  >>           Redirect it to a file in append mode
  description  Display the complete description information
  down         Display all down ports brief information
  |            Matching output
  <cr>

<Comware7>display interface brief
Brief information on interfaces in route mode:
Link: ADM - administratively down; Stby - standby
Protocol: (s) - spoofing
Interface            Link Protocol Primary IP      Description
InLoop0              UP   UP(s)    --
M-GE0/0/0            DOWN DOWN     --
NULL0                UP   UP(s)    --
REG0                 UP   --       --
Vlan1                UP   UP       10.0.111.51

Brief information on interfaces in bridge mode:
Link: ADM - administratively down; Stby - standby
Speed: (a) - auto
Duplex: (a)/A - auto; H - half; F - full
Type: A - access; T - trunk; H - hybrid
Interface            Link Speed   Duplex Type PVID Description
FGE1/0/53            DOWN auto    A      A    1
FGE1/0/54            DOWN auto    A      A    1
GE1/0/1              UP   1G(a)   F(a)   A    1
GE1/0/2              DOWN auto    A      A    1
GE1/0/3              DOWN auto    A      A    1
GE1/0/4              DOWN auto    A      A    1
GE1/0/5              DOWN auto    A      A    1
GE1/0/6              DOWN auto    A      A    1
GE1/0/7              DOWN auto    A      A    1
GE1/0/8              DOWN auto    A      A    1
GE1/0/9              DOWN auto    A      A    1
GE1/0/10             DOWN auto    A      A    1
GE1/0/11             DOWN auto    A      A    1
GE1/0/12             DOWN auto    A      A    1
GE1/0/13             DOWN auto    A      A    1
GE1/0/14             DOWN auto    A      A    1
GE1/0/15             DOWN auto    A      A    1
GE1/0/16             DOWN auto    A      A    1
GE1/0/17             DOWN auto    A      A    1
GE1/0/18             DOWN auto    A      A    1
GE1/0/19             DOWN auto    A      A    1
GE1/0/20             DOWN auto    A      A    1
GE1/0/21             DOWN auto    A      A    1
GE1/0/22             DOWN auto    A      A    1
GE1/0/23             DOWN auto    A      A    1
GE1/0/24             DOWN auto    A      A    1
GE1/0/25             DOWN auto    A      A    1
GE1/0/26             DOWN auto    A      A    1
GE1/0/27             DOWN auto    A      A    1
GE1/0/28             DOWN auto    A      A    1
GE1/0/29             DOWN auto    A      A    1
GE1/0/30             DOWN auto    A      A    1
GE1/0/31             DOWN auto    A      A    1
GE1/0/32             DOWN auto    A      A    1
GE1/0/33             DOWN auto    A      A    1
GE1/0/34             DOWN auto    A      A    1
GE1/0/35             DOWN auto    A      A    1
```

```
GE1/0/36              DOWN auto    A      A    1
GE1/0/37              DOWN auto    A      A    1
GE1/0/38              DOWN auto    A      A    1
GE1/0/39              DOWN auto    A      A    1
GE1/0/40              DOWN auto    A      A    1
GE1/0/41              DOWN auto    A      A    1
GE1/0/42              DOWN auto    A      A    1
GE1/0/43              DOWN auto    A      A    1
GE1/0/44              DOWN auto    A      A    1
GE1/0/45              DOWN auto    A      A    1
GE1/0/46              DOWN auto    A      A    1
GE1/0/47              DOWN auto    A      A    1
GE1/0/48              DOWN auto    A      A    1
XGE1/0/49             ADM  auto    A      A    1
XGE1/0/50             ADM  auto    A      A    1
XGE1/0/51             DOWN auto    A      A    1
XGE1/0/52             DOWN auto    A      A    1


<Comware7>display interface g1/0/1 ?
  >      Redirect it to a file
  >>     Redirect it to a file in append mode
  brief  Brief information of status and configuration for interface(s)
  |      Matching output
  <cr>

<Comware7>display interface g1/0/1 brief
Brief information on interfaces in bridge mode:
Link: ADM - administratively down; Stby - standby
Speed: (a) - auto
Duplex: (a)/A - auto; H - half; F - full
Type: A - access; T - trunk; H - hybrid
Interface             Link Speed   Duplex Type PVID Description
GE1/0/1               UP   1G(a)   F(a)   A    1


<Comware7>display interface g1/0/1
GigabitEthernet1/0/1
Current state: UP
Line protocol state: UP
IP packet frame type: Ethernet II, hardware address: cc3e-5f73-baf4
Description: GigabitEthernet1/0/1 Interface
Bandwidth: 1000000 kbps
Loopback is not set
Media type is twisted pair
Port hardware type is 1000_BASE_T
1000Mbps-speed mode, full-duplex mode
Link speed type is autonegotiation, link duplex type is autonegotiation
Flow-control is not enabled
Maximum frame length: 10000
Allow jumbo frames to pass
Broadcast max-ratio: 100%
Multicast max-ratio: 100%
Unicast max-ratio: 100%
PVID: 1
MDI type: automdix
Port link-type: Access
 Tagged VLANs:   None
 Untagged VLANs: 1
Port priority: 0
Last clearing of counters: Never
 Peak input rate: 90 bytes/sec, at 2015-04-07 00:31:58
 Peak output rate: 33 bytes/sec, at 2015-04-07 00:22:05
```

```
 Last 300 second input: 0 packets/sec 83 bytes/sec 0%
 Last 300 second output: 0 packets/sec 19 bytes/sec 0%
 Input (total):  1728 packets, 215498 bytes
         146 unicasts, 37 broadcasts, 1545 multicasts, 0 pauses
 Input (normal):  1728 packets, - bytes
         146 unicasts, 37 broadcasts, 1545 multicasts, 0 pauses
 Input:  0 input errors, 0 runts, 0 giants, 0 throttles
         0 CRC, 0 frame, - overruns, 0 aborts
         - ignored, - parity errors
 Output (total): 253 packets, 50800 bytes
         152 unicasts, 10 broadcasts, 91 multicasts, 0 pauses
 Output (normal): 253 packets, - bytes
         152 unicasts, 10 broadcasts, 91 multicasts, 0 pauses
 Output: 0 output errors, - underruns, - buffer failures
         0 aborts, 0 deferred, 0 collisions, 0 late collisions
         0 lost carrier, - no carrierr


[Comware7]interface ?
  Bridge-Aggregation   Bridge-Aggregation interface
  FortyGigE            FortyGigE interface
  GigabitEthernet      GigabitEthernet interface
  LoopBack             LoopBack interface
  M-GigabitEthernet    MGE interface
  NULL                 NULL interface
  Route-Aggregation    Route-Aggregation interface
  Ten-GigabitEthernet  Ten-GigabitEthernet interface
  Tunnel               Tunnel interface
  Vlan-interface       VLAN interface
  range                Configure an interface range

[Comware7]interface g1/0/1

[Comware7-GigabitEthernet1/0/1]?
Gigabitethernet_l2 interface view commands:
  apply                   Apply a PoE profile
  arp                     ARP module
  bandwidth               Specify the expected bandwidth
  bpdu-drop               Specify BPDU drop function
  broadcast-suppression   Broadcast storm suppression function
  cdp                     Non standard IEEE discovery protocol
  cfd                     Connectivity Fault Detection (CFD) module
  dcbx                    Data Center Bridge Capability Exchange Protocol
  default                 Restore the default settings
  description             Describe the interface
  dhcp                    DHCP module
  diagnostic-logfile      Diagnostic log file configuration
  display                 Display current system information
  dldp                    DLDP module
  dot1x                   802.1X module
  duplex                  Status of duplex
  eee                     Energy efficient ethernet
  enable                  Enable functions
  evb                     Edge Virtual Bridging (EVB) module
  flex10                  Configure Flex10
  flow-control            Enable flow control function
  flow-interval           Set the interface statistics interval
  igmp-snooping           IGMP snooping module
  ip                      Specify IP configuration
  ipv6                    Specify IPv6 configuration
  jumboframe              Specify jumbo frame forwarding
  l2vpn                   Layer 2 Virtual Private Network (L2VPN) module
  lacp                    Configure LACP protocol
```

```
  link-aggregation       Specify link aggregation group configuration
                         information
  link-delay             Set the physical state change suppression
  lldp                   Link Layer Discovery Protocol(802.1ab)
  logfile                Log file configuration
  loopback               Specify loopback of current port
  loopback-detection     Loopback detection module
  mac-address            Configure MAC address
  mac-authentication     MAC authentication module
  mac-forced-forwarding  Specify MAC-forced forwarding configuration information
  mac-vlan               MAC VLAN configuration
  mdix-mode              Specify mdix type
  mirroring-group        Specify mirroring group
  mld-snooping           MLD snooping module
  monitor                System monitor
  mrp                    Multiple registration protocol
  multicast-suppression  Multicast storm suppression function
  mvrp                   Multiple VLAN registration protocol
  oam                    OAM module
  packet-filter          Packet filter settings
  pbb                    Provider Backbone Bridge (PBB) module
  ping                   Ping function
  poe                    Power over Ethernet
  port                   Set port attributes
  port-isolate           Port isolation configuration
  port-security          Port security module
  priority-flow-control  Priority-based flow control (PFC) configuration
  ptp                    Precision Time Protocol (PTP) module
  qcn                    Quantized Congestion Notification (QCN) module
  qinq                   802.1QinQ function
  qos                    Quality of Service (QoS) module
  quit                   Exit from current command view
  return                 Exit to User View
  rmon                   RMON module
  save                   Save current configuration
  security-logfile       Security log file configuration
  service-instance       Configure a service instance
  sflow                  sFlow function
  shutdown               Shut down the interface
  smart-link             Smart Link module
  spbm                   SPBM configuration
  speed                  Specify speed of current port
  storm-constrain        Port storm control
  stp                    Spanning Tree Protocol (STP) module
  tracert                Tracert function
  trill                  TRansparent Interconnection of Lots of Links (TRILL)
                         module
  undo                   Cancel current setting
  unicast-suppression    Unicast storm suppression function
  virtual-cable-test     Test cable connection for an interface
  vlan                   Set VLAN precedence
  voice-vlan             Voice VLAN configuration

[Comware7-GigabitEthernet1/0/1]description ?
  TEXT  Interface description, 1 to 255 characters

[Comware-GigabitEthernet1/0/1]description link-to-core


[Comware7-GigabitEthernet1/0/1]duplex ?
  auto  Enable port's duplex negotiation automatically
  full  Full-duplex
  half  Half-duplex
```

```
[Comware7-GigabitEthernet1/0/1]duplex auto


[Comware7-GigabitEthernet1/0/1]speed ?
  10    Specify speed as 10 Mbps
  100   Specify speed as 100 Mbps
  1000  Specify speed as 1000 Mbps
  auto  Enable port's speed negotiation automatically

[Comware7-GigabitEthernet1/0/1]speed auto


[Comware7-GigabitEthernet1/0/1]shutdown


[Comware7-GigabitEthernet1/0/1]undo shutdown
```

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	Comware 7	Cisco
Configuration commands			

`interface lag 1`	`Trunk 1/20,1/24 trk1 lacp`	`interface Bridge-Aggregation 1`
		` description LACP-link-to-ArubaOS-Switch`
		` link-aggregation mode dynamic`
			`interface port-channel 1`
			`switchport mode trunk`
			`encapsulation dot1q`
			`switchport mode access`

`interface lag 1`
` vlan trunk allowed all`
	`vlan 220 tagged trk1`	`interface Bridge-Aggregation 1`
		` port link-type trunk`
		` port trunk permit vlan 220`
			`interface <>`
			` switchport mode trunk`
			` switchport trunk allowed vlan <>`

`interface lag 1`
` vlan access 1`
			`interface <>`
			` switchport mode access`
			` switchport access vlan <>`

`?`		`Interface g1/0/23` ` port link-aggregation group 1`	`Interface gi1/0/1` ` channel-group 1 mode active`

Show/display commands			
show lacp configuration	show trunks show lacp	display link-aggregation summary	show lacp 1 internal
	show lacp peer	display link-aggregation verbose	
show lacp interfaces	show lacp peer show lacp counters	display link-aggregation member-port	show interfaces etherchannel
show lacp aggregates	show vlans 220 show vlans ports trk1 detail	display vlan 220	show vlan name test

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-Comware5-1          100/1000T | Trk1   LACP
  20     | trk1-link-to-Comware5-1          100/1000T | Trk1   LACP
  21     | trk2-link-to-Comware7-1          100/1000T | Trk2   LACP
  22     | trk2-link-to-Comware7-1          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
```

Comware 7

```
[Comware]interface Bridge-Aggregation 1

[Comware-Bridge-Aggregation1]description LACP-link-to-ArubaOS-Switch

[Comware-Bridge-Aggregation1]link-aggregation mode dynamic

[Comware]interface g1/0/23

[Comware-GigabitEthernet1/0/23]port link-aggregation group 1

[Comware-GigabitEthernet1/0/23]interface g1/0/24

[Comware-GigabitEthernet1/0/24]port link-aggregation group 1

[Comware]interface Bridge-Aggregation 1

[Comware-Bridge-Aggregation1]port link-type trunk

[Comware-Bridge-Aggregation1]port trunk permit vlan 220


[Comware]display link-aggregation summary
Aggregation Interface Type:
BAGG -- Bridge-Aggregation, RAGG -- Route-Aggregation
Aggregation Mode: S -- Static, D -- Dynamic
Loadsharing Type: Shar -- Loadsharing, NonS -- Non-Loadsharing
Actor System ID: 0x8000, 0023-89d5-a059

AGG         AGG       Partner ID               Select Unselect   Share
Interface   Mode                               Ports  Ports      Type
--------------------------------------------------------------------------------
BAGG1       D         0x3980, 009c-02d5-3980   2      0          Shar


[Comware]display link-aggregation verbose
Loadsharing Type: Shar -- Loadsharing, NonS -- Non-Loadsharing
Port Status: S -- Selected, U -- Unselected
Flags:  A -- LACP_Activity, B -- LACP_Timeout, C -- Aggregation,
        D -- Synchronization, E -- Collecting, F -- Distributing,
        G -- Defaulted, H -- Expired

Aggregation Interface: Bridge-Aggregation1
```

```
Aggregation Mode: Dynamic
Loadsharing Type: Shar
System ID: 0x8000, 0023-89d5-a059
Local:
  Port             Status  Priority Oper-Key  Flag
--------------------------------------------------------------------------------
  GE1/0/23         S       32768    1         {ACDEF}
  GE1/0/24         S       32768    1         {ACDEF}
Remote:
  Actor            Partner Priority Oper-Key  SystemID               Flag
--------------------------------------------------------------------------------
  GE1/0/23         19      0        562       0x3980, 009c-02d5-3980 {ACDEF}
  GE1/0/24         20      0        562       0x3980, 009c-02d5-3980 {ACDEF}


[Comware]display link-aggregation member-port
Flags: A -- LACP_Activity, B -- LACP_Timeout, C -- Aggregation,
       D -- Synchronization, E -- Collecting, F -- Distributing,
       G -- Defaulted, H -- Expired

GigabitEthernet1/0/23:
Aggregation Interface: Bridge-Aggregation1
Local:
    Port Number: 23
    Port Priority: 32768
    Oper-Key: 1
    Flag: {ACDEF}
Remote:
    System ID: 0x3980, 009c-02d5-3980
    Port Number: 19
    Port Priority: 0
    Oper-Key: 562
    Flag: {ACDEF}
Received LACP Packets: 12 packet(s)
Illegal: 0 packet(s)
Sent LACP Packets: 12 packet(s)

GigabitEthernet1/0/24:
Aggregation Interface: Bridge-Aggregation1
Local:
    Port Number: 24
    Port Priority: 32768
    Oper-Key: 1
    Flag: {ACDEF}
Remote:
    System ID: 0x3980, 009c-02d5-3980
    Port Number: 20
    Port Priority: 0
    Oper-Key: 562
    Flag: {ACDEF}
Received LACP Packets: 11 packet(s)
Illegal: 0 packet(s)
Sent LACP Packets: 11 packet(s)
```

```
[Comware]display vlan 220
VLAN ID: 220
 VLAN Type: static
 Route Interface: configured
 IPv4 address: 10.1.220.3
 IPv4 subnet mask: 255.255.255.0
 Description: VLAN 0220
 Name: test
 Tagged   Ports:
    Bridge-Aggregation1
    GigabitEthernet1/0/6     GigabitEthernet1/0/23    GigabitEthernet1/0/24
 Untagged Ports:
    GigabitEthernet1/0/4     GigabitEthernet1/0/5
```

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	Comware 7	Cisco
Configuration commands			
spanning-tree	spanning-tree	stp region-configuration	spanning-tree mode mst
		region-name ArubaOS-Switch-Comware-Cisco	spanning-tree mst configuration
spanning-tree mode mstp	spanning-tree config-name ArubaOS-Switch-Comware-Cisco	revision-level 1	name ArubaOS-Switch-Comware-Cisco
spanning-tree config-name MST0 spanning-tree config-revision 40	spanning-tree config-revision 1	instance 1 vlan 220	revision 1
spanning-tree instance 1 vlan 1	spanning-tree instance 1 vlan 220	instance 2 vlan 100	instance 1 vlan 220
spanning-tree instance 2 vlan 100	spanning-tree instance 2 vlan 100	instance 3 vlan 240	instance 2 vlan 100
spanning-tree instance 3 vlan 240	spanning-tree instance 3 vlan 240	active region-configuration	instance 3 vlan 240

spanning-tree priority 1	spanning-tree priority 2	stp priority 16384	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 g1/0/9 stp edged-port stp cost 10000 stp port priority 160 stp instance 1 cost 10000 stp instance 1 port priority 160	Interface gi1/0/1 spanning-tree < cost | guard | link-type | mst | port-prority | port-fast >
Show/display commands			
show spanning-tree	show spanning-tree	display stp	show spanning-tree
		display stp brief	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-Comware-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-Comware-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
```

Comware7

```
[Comware7]stp ?
  bpdu-protection       Specify BPDU protection function
  bridge-diameter       Specify bridge diameter
  global                Specify global parameter
  instance              Specify the spanning tree instance list
  max-hops              Specify max hops
  mode                  Specify state machine mode
  pathcost-standard     Specify port path cost standard
  port-log              Specify port status logging
  priority              Specify bridge priority
  region-configuration  Enter MSTP region view
  root                  Specify root switch
  tc-protection         Specify TC protection function
  tc-snooping           Specify TC snooping
  timer                 Specify timer configuration
  timer-factor          Specify aged out time factor
  vlan                  Specify the VLAN list

[Comware7]stp region-configuration

[Comware7-mst-region]?
Mst-region view commands:
  active              Active region configuration
  cfd                 Connectivity Fault Detection (CFD) module
  check               Check the reg-configuration under-construction
  diagnostic-logfile  Diagnostic log file configuration
  display             Display current system information
  instance            Specify the spanning tree instance list
  logfile             Log file configuration
  monitor             System monitor
  ping                Ping function
  quit                Exit from current command view
  region-name         Specify region name
  return              Exit to User View
  revision-level      Specify revision level
  save                Save current configuration
  security-logfile    Security log file configuration
  tracert             Tracert function
  undo                Cancel current setting
  vlan-mapping        VLAN mapping

[Comware7-mst-region]region-name ArubaOS-Switch-Comware-Cisco

[Comware7-mst-region]revision-level 1

[Comware7-mst-region]instance 1 vlan 220

[Comware7-mst-region]instance 2 vlan 100

[Comware7-mst-region]instance 3 vlan 240
```

```
[Comware7-mst-region]active region-configuration

[Comware7]stp priority 16384
   (note - increments of 4096, default setting is 32768)

[Comware7]stp instance 1 priority 20480
   (note – in steps of 4096, default setting is 32768)

[Comware7]stp instance 2 priority 8192
   (note – in steps of 4096, default setting is 32768)

[Comware7]stp instance 3 priority 12288
   (note – in steps of 4096, default setting is 32768)

[Comware7]interface g1/0/9

[Comware7-GigabitEthernet1/0/9]stp ?
  compliance              Specify MST BPDU Format
  config-digest-snooping  Specify configuration digest snooping
  cost                    Specify port path cost
  edged-port              Specify edge port
  enable                  Enable STP
  instance                Specify the spanning tree instance list
  loop-protection         Specify loop protection
  mcheck                  Specify mcheck
  no-agreement-check      Specify port ignore agreement information
  point-to-point          Specify point to point link
  port                    Specify port parameter
  role-restriction        Forbid the port to be a root port
  root-protection         Specify root protection
  tc-restriction          Restrict propagation of TC message
  transmit-limit          Specify transmission limit count
  vlan                    Specify the VLAN list

[Comware7-GigabitEthernet1/0/9]stp edged-port

[Comware7-GigabitEthernet1/0/9]stp cost 10000

[Comware7-GigabitEthernet1/0/9]stp port priority 160
   (note – in steps of 16, default setting is 128)

[Comware7-GigabitEthernet1/0/9]stp instance 1 cost 10000

[Comware7-GigabitEthernet1/0/9]stp instance 1 port priority 160
   (note – in steps of 16, default setting is 128)


[Comware7]display stp ?
  >                     Redirect it to a file
  >>                    Redirect it to a file in append mode
  abnormal-port         Display abnormal ports
  bpdu-statistics       BPDU statistics
  brief                 Brief information
  down-port             Port information of protocol down
  history               History of port roles
  instance              Specify the spanning tree instance list
  interface             Specify interface
  region-configuration  Region configuration
  root                  Display status and configuration of the root bridge
  slot                  Specify the slot number
  tc                    Port TC count
  vlan                  Specify the VLAN list
  |                     Matching output
```

```
  <cr>

[Comware7]display stp
-------[CIST Global Info][Mode MSTP]-------
 Bridge ID           : 16384.cc3e-5f73-bacb
 Bridge times        : Hello 2s MaxAge 20s FwdDelay 15s MaxHops 20
 Root ID/ERPC        : 8192.009c-02d5-3980, 0
 RegRoot ID/IRPC     : 8192.009c-02d5-3980, 20
 RootPort ID         : 128.6
 BPDU-Protection     : Disabled
 Bridge Config-
 Digest-Snooping     : Disabled
 TC or TCN received  : 68
 Time since last TC  : 0 days 0h:29m:41s
...
----[Port6(GigabitEthernet1/0/6)][FORWARDING]----
 Port protocol       : Enabled
 Port role           : Root Port
 Port ID             : 128.6
 Port cost(Legacy)   : Config=auto, Active=20
 Desg.bridge/port    : 8192.009c-02d5-3980, 128.13
 Port edged          : Config=disabled, Active=disabled
 Point-to-Point      : Config=auto, Active=true
 Transmit limit      : 10 packets/hello-time
 TC-Restriction      : Disabled
 Role-Restriction    : Disabled
 Protection type     : Config=none, Active=none
 MST BPDU format     : Config=auto, Active=802.1s
 Port Config-
 Digest-Snooping     : Disabled
 Rapid transition    : True
 Num of VLANs mapped : 1
 Port times          : Hello 2s MaxAge 20s FwdDelay 15s MsgAge 0s RemHops 20
 BPDU sent           : 2745
          TCN: 0, Config: 0, RST: 3, MST: 2742
 BPDU received       : 5273
          TCN: 0, Config: 0, RST: 1426, MST: 3847
...
----[Port9(GigabitEthernet1/0/9)][FORWARDING]----
 Port protocol       : Enabled
 Port role           : Designated Port
 Port ID             : 160.9
 Port cost(Legacy)   : Config=10000, Active=10000
 Desg.bridge/port    : 16384.cc3e-5f73-bacb, 160.9
 Port edged          : Config=enabled, Active=enabled
 Point-to-Point      : Config=auto, Active=true
 Transmit limit      : 10 packets/hello-time
 TC-Restriction      : Disabled
 Role-Restriction    : Disabled
 Protection type     : Config=none, Active=none
 MST BPDU format     : Config=auto, Active=802.1s
 Port Config-
 Digest-Snooping     : Disabled
 Rapid transition    : True
 Num of VLANs mapped : 0
 Port times          : Hello 2s MaxAge 20s FwdDelay 15s MsgAge 0s RemHops 19
 BPDU sent           : 5604
          TCN: 0, Config: 0, RST: 876, MST: 4728
 BPDU received       : 0
          TCN: 0, Config: 0, RST: 0, MST: 0
...
-------[MSTI 1 Global Info]-------
 Bridge ID           : 20480.cc3e-5f73-bacb
```

```
 RegRoot ID/IRPC     : 8192.0023-89d5-a059, 20020
 RootPort ID         : 128.6
 Master bridge       : 8192.009c-02d5-3980
 Cost to master      : 20
 TC received         : 0

----[Port6(GigabitEthernet1/0/6)][FORWARDING]----
 Port protocol       : Enabled
 Port role           : Root Port
 Port ID             : 128.6
 Port cost(Legacy)   : Config=auto, Active=20
 Desg.bridge/port    : 12288.009c-02d5-3980, 128.13
 Protection type     : Config=none, Active=none
 Rapid transition    : True
 Num of VLANs mapped : 1
 Port times          : RemHops 19

-------[MSTI 2 Global Info]-------
 Bridge ID           : 8192.cc3e-5f73-bacb
 RegRoot ID/IRPC     : 8192.cc3e-5f73-bacb, 0
 RootPort ID         : 0.0
 Master bridge       : 8192.009c-02d5-3980
 Cost to master      : 20
 TC received         : 0

----[Port6(GigabitEthernet1/0/6)][FORWARDING]----
 Port protocol       : Enabled
 Port role           : Designated Port
 Port ID             : 128.6
 Port cost(Legacy)   : Config=auto, Active=20
 Desg.bridge/port    : 8192.cc3e-5f73-bacb, 128.6
 Protection type     : Config=none, Active=none
 Rapid transition    : True
 Num of VLANs mapped : 1
 Port times          : RemHops 20

----[Port9(GigabitEthernet1/0/9)][FORWARDING]----
 Port protocol       : Enabled
 Port role           : Designated Port
 Port ID             : 128.9
 Port cost(Legacy)   : Config=auto, Active=200
 Desg.bridge/port    : 8192.cc3e-5f73-bacb, 128.9
 Protection type     : Config=none, Active=none
 Rapid transition    : True
 Num of VLANs mapped : 1
 Port times          : RemHops 20

-------[MSTI 3 Global Info]-------
 Bridge ID           : 12288.cc3e-5f73-bacb
 RegRoot ID/IRPC     : 8192.0022-91ab-4380, 20020
 RootPort ID         : 128.6
 Master bridge       : 8192.009c-02d5-3980
 Cost to master      : 20
 TC received         : 0

----[Port6(GigabitEthernet1/0/6)][FORWARDING]----
 Port protocol       : Enabled
 Port role           : Root Port
 Port ID             : 128.6
 Port cost(Legacy)   : Config=auto, Active=20
 Desg.bridge/port    : 20480.009c-02d5-3980, 128.13
 Protection type     : Config=none, Active=none
 Rapid transition    : True
```

```
 Num of VLANs mapped : 1
 Port times          : RemHops 19


[Comware7]display stp brief
MST ID   Port                                    Role  STP State   Protection
 0        GigabitEthernet1/0/1                    DESI  FORWARDING  NONE
 0        GigabitEthernet1/0/6                    ROOT  FORWARDING  NONE
 0        GigabitEthernet1/0/9                    DESI  FORWARDING  NONE
 1        GigabitEthernet1/0/6                    ROOT  FORWARDING  NONE
 2        GigabitEthernet1/0/6                    DESI  FORWARDING  NONE
 2        GigabitEthernet1/0/9                    DESI  FORWARDING  NONE
 3        GigabitEthernet1/0/6                    ROOT  FORWARDING  NONE


[Comware7]display stp region-configuration
Oper Configuration
   Format selector      : 0
   Region name          : ArubaOS-Switch-Comware-Cisco
   Revision level       : 1
   Configuration digest : 0xcee7f8d6e076e3201f92550cb1d2cb92

   Instance  VLANs Mapped
   0         1 to 99, 101 to 219, 221 to 239, 241 to 4094
   1         220
   2         100
   3         240


[Comware7]display stp instance 0
-------[CIST Global Info][Mode MSTP]-------
 Bridge ID           : 16384.cc3e-5f73-bacb
 Bridge times        : Hello 2s MaxAge 20s FwdDelay 15s MaxHops 20
 Root ID/ERPC        : 8192.009c-02d5-3980, 0
 RegRoot ID/IRPC     : 8192.009c-02d5-3980, 20
 RootPort ID         : 128.6
 BPDU-Protection     : Disabled
 Bridge Config-
 Digest-Snooping     : Disabled
 TC or TCN received  : 68
 Time since last TC  : 0 days 0h:34m:59s
...
----[Port6(GigabitEthernet1/0/6)][FORWARDING]----
 Port protocol       : Enabled
 Port role           : Root Port
 Port ID             : 128.6
 Port cost(Legacy)   : Config=auto, Active=20
 Desg.bridge/port    : 8192.009c-02d5-3980, 128.13
 Port edged          : Config=disabled, Active=disabled
 Point-to-Point      : Config=auto, Active=true
 Transmit limit      : 10 packets/hello-time
 TC-Restriction      : Disabled
 Role-Restriction    : Disabled
 Protection type     : Config=none, Active=none
 MST BPDU format     : Config=auto, Active=802.1s
 Port Config-
 Digest-Snooping     : Disabled
 Rapid transition    : True
 Num of VLANs mapped : 1
 Port times          : Hello 2s MaxAge 20s FwdDelay 15s MsgAge 0s RemHops 20
 BPDU sent           : 2904
          TCN: 0, Config: 0, RST: 3, MST: 2901
 BPDU received       : 5431
```

```
          TCN: 0, Config: 0, RST: 1426, MST: 4005
...
----[Port9(GigabitEthernet1/0/9)][FORWARDING]----
 Port protocol       : Enabled
 Port role           : Designated Port
 Port ID             : 160.9
 Port cost(Legacy)   : Config=10000, Active=10000
 Desg.bridge/port    : 16384.cc3e-5f73-bacb, 160.9
 Port edged          : Config=enabled, Active=enabled
 Point-to-Point      : Config=auto, Active=true
 Transmit limit      : 10 packets/hello-time
 TC-Restriction      : Disabled
 Role-Restriction    : Disabled
 Protection type     : Config=none, Active=none
 MST BPDU format     : Config=auto, Active=802.1s
 Port Config-
 Digest-Snooping     : Disabled
 Rapid transition    : True
 Num of VLANs mapped : 0
 Port times          : Hello 2s MaxAge 20s FwdDelay 15s MsgAge 0s RemHops 19
 BPDU sent           : 5763
          TCN: 0, Config: 0, RST: 876, MST: 4887
 BPDU received       : 0
          TCN: 0, Config: 0, RST: 0, MST: 0
...


[Comware7]display stp instance 1
-------[MSTI 1 Global Info]-------
 Bridge ID           : 20480.cc3e-5f73-bacb
 RegRoot ID/IRPC     : 8192.0023-89d5-a059, 20020
 RootPort ID         : 128.6
 Master bridge       : 8192.009c-02d5-3980
 Cost to master      : 20
 TC received         : 0

----[Port6(GigabitEthernet1/0/6)][FORWARDING]----
 Port protocol       : Enabled
 Port role           : Root Port
 Port ID             : 128.6
 Port cost(Legacy)   : Config=auto, Active=20
 Desg.bridge/port    : 12288.009c-02d5-3980, 128.13
 Protection type     : Config=none, Active=none
 Rapid transition    : True
 Num of VLANs mapped : 1
 Port times          : RemHops 19


[Comware7]display stp instance 2
-------[MSTI 2 Global Info]-------
 Bridge ID           : 8192.cc3e-5f73-bacb
 RegRoot ID/IRPC     : 8192.cc3e-5f73-bacb, 0
 RootPort ID         : 0.0
 Master bridge       : 8192.009c-02d5-3980
 Cost to master      : 20
 TC received         : 0

----[Port6(GigabitEthernet1/0/6)][FORWARDING]----
 Port protocol       : Enabled
 Port role           : Designated Port
 Port ID             : 128.6
 Port cost(Legacy)   : Config=auto, Active=20
 Desg.bridge/port    : 8192.cc3e-5f73-bacb, 128.6
```

```
 Protection type     : Config=none, Active=none
 Rapid transition    : True
 Num of VLANs mapped : 1
 Port times          : RemHops 20

----[Port9(GigabitEthernet1/0/9)][FORWARDING]----
 Port protocol       : Enabled
 Port role           : Designated Port
 Port ID             : 128.9
 Port cost(Legacy)   : Config=auto, Active=200
 Desg.bridge/port    : 8192.cc3e-5f73-bacb, 128.9
 Protection type     : Config=none, Active=none
 Rapid transition    : True
 Num of VLANs mapped : 1
 Port times          : RemHops 20
```

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-Comware-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-Comware-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	Comware 7	Cisco
Configuration commands			
router vrrp disable router vrrp enable	router vrrp ipv4 enable	interface Vlan- interface 100	
interface vlan 2	vlan 220	vrrp vrid 100 virtual-ip 10.1.100.1	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 vrid 100 priority 254	vrrp 100 ip 10.1. 100.1
priority 2	priority 254	vrrp version 2	vrrp 100 priority 100
vrrp 2 address- family ipv4 no shutdown	enable		
Show/display commands			
do show vrrp detail	show vrrp	display vrrp verbose	show vrrp
		display vrrp	show vrrp brief
do show vrrp statistics	show vrrp vlan 220	display vrrp interface vlan 100 verbose	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
```

Comware7

```
[Comware7]interface Vlan-interface 100

[Comware7-Vlan-interface100]vrrp ?
  check-ttl  Enable TTL check on VRRP packets
  dot1q      Specify a VRRP control VLAN
  ipv6       Specify IPv6 Virtual Router
  version    Specify version of VRRP
  vrid       Specify the virtual router by its identifier

[Comware7-Vlan-interface100]vrrp vrid ?
  INTEGER<1-255>  Virtual router identifier

[Comware7-Vlan-interface100]vrrp vrid 100 ?
```

```
  authentication-mode  Configure authentication mode and authentication key
  preempt-mode         Enable preemption on the router
  priority             Configure the priority of the router
  shutdown             Shut down the virtual router
  source-interface     Specify the source interface for the VRRP group
  timer                Configure the value of the timer
  track                Associate a track entry with the VRRP group to control
                       master switchover in the VRRP group according to the
                       state change of the track entry
  virtual-ip           Assign an virtual IP address to the virtual router

[Comware7-Vlan-interface100]vrrp vrid 100 virtual-ip 10.1.100.1 ?
  <cr>

[Comware7-Vlan-interface100]vrrp vrid 100 virtual-ip 10.1.100.1


[Comware7-Vlan-interface100]vrrp vrid 100 priority ?
  INTEGER<1-254>  Priority value

[Comware7-Vlan-interface100]vrrp vrid 100 priority 254


[Comware7-Vlan-interface100]vrrp ?
  check-ttl  Enable TTL check on VRRP packets
  dot1q      Specify a VRRP control VLAN
  ipv6       Specify IPv6 Virtual Router
  version    Specify version of VRRP
  vrid       Specify the virtual router by its identifier

[Comware7-Vlan-interface100]vrrp version ?
  INTEGER<2-3>  Version of VRRP

[Comware7-Vlan-interface100]vrrp version 2


[Comware7]display vrrp ?
  >           Redirect it to a file
  >>          Redirect it to a file in append mode
  interface   Specify the interface
  ipv6        Specify IPv6 Virtual Router
  statistics  VRRP statistics
  verbose     Verbose information
  |           Matching output
  <cr>

[Comware7]display vrrp verbose
IPv4 Virtual Router Information:
 Running mode      : Standard
 Total number of virtual routers : 1
   Interface Vlan-interface100
     VRID           : 100                Adver Timer  : 100
     Admin Status   : Up                 State        : Master
     Config Pri     : 254                Running Pri  : 254
     Preempt Mode   : Yes                Delay Time   : 0
     Auth Type      : None
     Virtual IP     : 10.1.100.1
     Virtual MAC    : 0000-5e00-0164
     Master IP      : 10.1.100.5


[Comware7]display vrrp
IPv4 Virtual Router Information:
```

```
 Running mode      : Standard
 Total number of virtual routers : 1
 Interface          VRID  State        Running Adver   Auth     Virtual
                                       Pri     Timer   Type        IP
 -----------------------------------------------------------------------
 Vlan100            100   Master       254     100     None     10.1.100.1


[Comware7]display vrrp interface Vlan-interface 100 verbose
IPv4 Virtual Router Information:
 Running mode      : Standard
 Total number of virtual routers on interface Vlan-interface100 : 1
   Interface Vlan-interface100
     VRID            : 100                Adver Timer  : 100
     Admin Status    : Up                 State        : Master
     Config Pri      : 254                Running Pri  : 254
     Preempt Mode    : Yes                Delay Time   : 0
     Auth Type       : None
     Virtual IP      : 10.1.100.1
     Virtual MAC     : 0000-5e00-0164
     Master IP       : 10.1.100.5
```

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	Comware 7	Cisco
Configuration commands			
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	access-list number 2000 rule 1 permit source 10.0.100.111 0.0.0.0 rule 2 permit source 10.0.200.222 0 interface Vlan-interface 220 packet-filter 2000 inbound ! interface Vlan-interface 100 packet-filter 2001 inbound	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/display commands			
show access-list	show access-list	display acl all	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
```

Comware7

Basic ACL

```
[Comware7]acl number 2000

[Comware7-acl-basic-2000]rule permit source 10.0.100.111 0.0.0.0


[Comware7]acl number 2001 name ext_acl

[Comware7-acl-basic-2001-ext_acl]rule permit source 10.0.100.111 0
```

```
[Comware7]interface Vlan-interface 220

[Comware7-Vlan-interface220]packet-filter ?
  INTEGER<2000-2999>  Specify a basic ACL
  INTEGER<3000-3999>  Specify an advanced ACL
  INTEGER<4000-4999>  Specify an ethernet frame header ACL
  INTEGER<5000-5999>  Specify an ACL about user-defined frame or packet head
  filter              Specify the packet filter mode
  ipv6                IPv6 ACL
  name                Specify a named ACL

[Comware7-Vlan-interface220]packet-filter 2000 ?
  inbound   Filter incoming packets
  outbound  Filter outgoing packets

[Comware7-Vlan-interface220]packet-filter 2000 inbound ?
  hardware-count  Count rule matches performed by hardware
  <cr>

[Comware7-Vlan-interface220]packet-filter 2000 inbound


[Comware7]interface Vlan-interface 100

[Comware7-Vlan-interface100]packet-filter 2001 inbound
```

Advanced ACL

```
[Comware7]acl number 3000

[Comware7-acl-adv-3000]rule deny ip source 10.1.220.0 0.0.0.255 destination 10.1.100.111 0


[Comware7]acl number 3001 name ext_acl

[Comware7-acl-adv-3001-ext_acl]rule deny ip source 10.1.100.0 0.0.0.255 destination
10.0.100.111 0


[Comware7-acl-adv-3001-ext_acl]quit

[Comware7]interface Vlan-interface 220

[Comware7-Vlan-interface220]packet-filter 3000 inbound


[Comware7]interface Vlan-interface 100

[Comware7-Vlan-interface100]packet-filter 3001 inbound
```

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	Comware 7	Cisco
Configuration commands			
`router bgp 64502`	`router bgp 64502`	`bgp 64505`	`router bgp 64504`
`bgp router-id 10.0.0.2`	`bgp router-id 10.0.0.2`	`router-id 10.0.0.5`	`bgp router-id 10.0.0.4`

neighbor 10.0.101.31 remote-as 64503	neighbor 10.0.101.31 remote-as 64503	peer 10.0.101.21 as-number 64502	neighbor 10.0.101.21 remote-as 64502
neighbor 10.0.101.41 remote-as 64504	neighbor 10.0.101.41 remote-as 64504	address-family ipv4 unicast	
neighbor 10.0.101.51 remote-as 64505	neighbor 10.0.101.51 remote-as 64505	peer 10.0.101.21 enable	
redistribute connected	redistribute connected	import-route direct	redistribute connected
redistribute static	redistribute static	network 10.0.251.0 24	
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	display bgp peer ipv4	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
```

Comware7

```
[Comware7]bgp ?
  INTEGER<1-4294967295>  Autonomous system number

[Comware7]bgp 64503 ?
  <cr>

[Comware7]bgp 64503


[Comware7-bgp]?
Bgp protocol view commands:
  address-family            Specify an address family
  advertise-rib-active      Advertise the best route in IP routing table
  bgp                       BGP specific commands
  cfd                       Connectivity Fault Detection (CFD) module
  confederation             Configure AS confederation parameters
  diagnostic-logfile        Diagnostic log file configuration
  display                   Display current system information
```

```
  ebgp-interface-sensitive  Immediately reset session if a link connected peer
                            goes down
  graceful-restart          Configure Graceful Restart (GR) capability
  group                     Create a peer group
  ignore-first-as           Ignore the first AS number of eBGP route updates
  ip                        Specify Internet Protocol (IP) configuration
                            information
  log-peer-change           Log any session status and event change information
  logfile                   Log file configuration
  monitor                   System monitor
  non-stop-routing          Enable NSR
  peer                      Specify BGP peers
  ping                      Ping function
  primary-path-detect       Enable primary path detect function
  quit                      Exit from current command view
  return                    Exit to User View
  router-id                 Configure router ID
  save                      Save current configuration
  security-logfile          Security log file configuration
  timer                     Configure timers for BGP
  tracert                   Tracert function
  undo                      Cancel current setting
  vpn                       Set forwarding mode of MPLS L3VPN on egress PE


[Comware7-bgp]router-id 10.0.0.5


[Comware7-bgp]peer ?
  STRING<1-47>  Specify a peer group by its name
  X.X.X.X       IPv4 address
  X:X::X:X      IPv6 address

[Comware7-bgp]peer 10.0.101.21 ?
  INTEGER<0-32>          Specify a Mask length of IPv4 address
  as-number              AS number
  bfd                    Enable BFD for the peers
  capability-advertise   Advertise capability
  connect-interface      Set interface name to be used as session's output
                         interface
  description            Configure description information about the peers
  ebgp-max-hop           EBGP Multihop
  fake-as                Configure a fake AS number for the peers
  group                  Specify a peer-group
  ignore                 Disable session establishment with the peers
  ignore-originatorid    Ignore the originator ID attribute in received BGP
                         routes
  low-memory-exempt      Exempt the EBGP peers from low-memory shutdown
  password               Specify a password
  route-update-interval  Specify the interval for sending the same update to the
                         peers
  substitute-as          Replace the AS number in the AS_PATH attribute with the
                         local
  timer                  Configure timers for the peers
  ttl-security           Configure the Generalized TTL Security Mechanism (GTSM)

[Comware7-bgp]peer 10.0.101.21 as-number 64502 ?
  <cr>

[Comware7-bgp]peer 10.0.101.21 as-number 64502


[Comware7-bgp]address-family ?
```

```
  ipv4   Specify the IPv4 address family
  ipv6   Specify the IPv6 address family
  l2vpn  Specify the L2VPN address family
  vpnv4  Specify the VPNv4 address family
  vpnv6  Specify the VPNv6 address family

[Comware7-bgp]address-family ipv4 ?
  unicast  Specify the unicast address family
  <cr>

[Comware7-bgp]address-family ipv4 unicast ?
  <cr>

[Comware7-bgp]address-family ipv4 unicast

[Comware7-bgp-ipv4]?
Bgp-ipv4 protocol view commands:
  aggregate                 Create a summary route
  balance                   Configure BGP load balancing
  bestroute                 Change the default best route selection
  cfd                       Connectivity Fault Detection (CFD) module
  compare-different-as-med  Compare the MEDs of routes from different ASs
  dampening                 Enable route-flap dampening
  default                   Set default value for BGP
  default-route             Default route operation
  diagnostic-logfile        Diagnostic log file configuration
  display                   Display current system information
  fast-reroute              Configure fast reroute
  filter-policy             Filter networks in route updates
  import-route              Import routes from another routing protocol
  logfile                   Log file configuration
  monitor                   System monitor
  network                   Specify a network to advertise via BGP
  peer                      Specify BGP peers
  pic                       Enable Prefix Independent Convergence (PIC)
  ping                      Ping function
  preference                Configure the preference of BGP routes
  quit                      Exit from current command view
  reflect                   Configure route reflection
  reflector                 Configure the route reflector
  return                    Exit to User View
  save                      Save current configuration
  security-logfile          Security log file configuration
  summary                   Summarize subnet routes to classful network routes
  tracert                   Tracert function
  undo                      Cancel current setting

[Comware7-bgp-ipv4]peer 10.0.101.21 ?
  INTEGER<0-32>             Specify a Mask length of IPv4 address
  advertise-community       Send community attribute to the peers
  advertise-ext-community   Advertise extended community
  allow-as-loop             Configure permit of as-path loop
  as-path-acl               Specify an AS path ACL
  default-route-advertise   Advertise default route to the peers
  enable                    Enable the specified peers
  filter-policy             Filter networks in route updates
  keep-all-routes           Save original routing information from the peers
  label-route-capability    Send labeled route to the peers
  next-hop-local            Specify local address as the next hop of routes
                            advertised to the peers
  preferred-value           Assign a preferred value to routes received from the
                            peers
  prefix-list               Specify BGP route filtering policy based on a prefix
```

```
                            list
  public-as-only            Do not keep private AS numbers in BGP updates
  reflect-client            Configure the peers as route reflectors
  route-limit               Configure the maximum number of routes that can be
                            received from the peers
  route-policy              Specify a routing policy

[Comware7-bgp-ipv4]peer 10.0.101.21 enable ?
  <cr>

[Comware7-bgp-ipv4]peer 10.0.101.21 enable


[Comware7-bgp-ipv4]import-route direct


[Comware7-bgp-ipv4]network 10.0.251.0 24


[Comware7]display bgp ?
  dampening         BGP dampening information
  group             Display peer group information
  l2vpn             Specify the L2VPN address family
  network           Routing information advertised with the network command or
                    short-cut route information
  non-stop-routing  Display BGP NSR information
  paths             Path attribute information
  peer              Display peer information
  routing-table     Display BGP routes
  update-group      Display update group information

[Comware7]display bgp peer ?
  ipv4   Specify the IPv4 address family
  ipv6   Specify the IPv6 address family
  l2vpn  Specify the L2VPN address family
  vpnv4  Specify the VPNv4 address family
  vpnv6  Specify the VPNv6 address family

[Comware7]display bgp peer ipv4 ?
  >             Redirect it to a file
  >>            Redirect it to a file in append mode
  X.X.X.X       IPv4 address
  group-name    Specify a peer group by its name
  standby       Display information on the standby process
  unicast       Specify the unicast address family
  verbose       Detailed information
  vpn-instance  Specify a VPN instance
  |             Matching output
  <cr>

[Comware7]display bgp peer ipv4

 BGP local router ID: 10.0.0.5
 Local AS number: 64505
 Total number of peers: 1                 Peers in established state: 1

  * - Dynamically created peer
  Peer                    AS  MsgRcvd  MsgSent OutQ PrefRcv Up/Down  State

  10.0.101.21          64502       78       80    0       3 01:10:44 Established
```

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	Comware 7	Cisco
Configuration commands			
router ospf 2 enable	router ospf enable	ospf 1 router-id 10.0.0.31	router ospf 1
router-id 10.0.0.41			router-id 10.0.0.41
area 0	area 0	area 0	
area 10.1.220.0	vlan 220 ip ospf area 0	Network 10.1.220.0 0.0.0.255	network 10.1.220.0 0.0.0.255 area 0
router ospf 2 redistribute connected	router ospf redistribute connected	import-route direct	router ospf 1 redistribute connected
Show/display commands			
show ip ospf			Show ip ospf
Show ip route ospf	Show ip route	display ip route	Show ip route ospf
Show ip ospf neighbour		dis ospf peer	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
```

Comware 7

```
[Comware]ospf 1 router-id 10.0.0.31


[Comware-ospf-1]area 0
```

-or-

```
[Comware-ospf-1]area 0.0.0.0


[Comware-ospf-1-area-0.0.0.0]network 10.1.220.0 0.0.0.255


[Comware-ospf-1]import-route ?
  bgp     Border Gateway Protocol (BGP) routes
  direct  Direct routes
  isis    Intermediate System to Intermediate System (IS-IS) routes
  ospf    Open Shortest Path First (OSPF) routes
  rip     Routing Information Protocol (RIP) routes
  static  Static routes

[Comware-ospf-1]import-route direct
Comware]ospf 1


[Comware-ospf-1]area 1
```

-or-

```
[Comware-ospf-1]area 0.0.0.1


[Comware-ospf-1-area-0.0.0.1]network 10.1.100.0 0.0.0.255


[Comware-ospf-1-area-0.0.0.1]area 2
```

-or-

```
[Comware-ospf-1-area-0.0.0.1]area 0.0.0.2


[Comware-ospf-1-area-0.0.0.2]network 10.1.230.0 0.0.0.255

[Comware-ospf-1]area 2

[Comware-ospf-1-area-0.0.0.2]stub no-summary


[Comware]interface Vlan-interface 230

[Comware-Vlan-interface230]ospf cost 10
```

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	Comware commands in ArubaOS-Switch Software
copy startup-config tftp <ip-address> <file name>	backup startup-configuration to <ip-address> <file name>
clock set <HH:MM:SS> <MM/DD/YYYY>	clock datetime <HH:MM:SS> <MM/DD/YYYY>
clock summer-time	clock summer-time
clock timezone	clock timezone
aaa accounting commands	command accounting
aaa authorization commands radius	command authorization
No equivalent ArubaOS-Switch software command	command-alias enable
No equivalent ArubaOS-Switch software command	command-alias mapping
copy	copy
erase startup-config	delete <startup-config>
flow-control	flow-control
console inactivity-timer	idle-timeout
exit	quit
boot	reboot
erase startup	reset saved-configuration
copy tftp startup-config	restore startup-configuration
end	return
write memory	save
reload at	schedule reboot at
reload after	schedule reboot delay
terminal length	screen-length
set authentication password	set authentication password
console baud-rate	speed
startup-default config <config file name>	startup saved-configuration <config file name>
hostname	sysname
configure	system-view
telnet	telnet
telnet-server	telnet server enable
console terminal	terminal type
no	undo
[Below commands has no equivalent Comware command, as some of these features are specific to ArubaOS]	
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