



AOS-CX Switch Introduction and Interoperability with AOS-S Switches

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Jan, 2024

Agenda Details

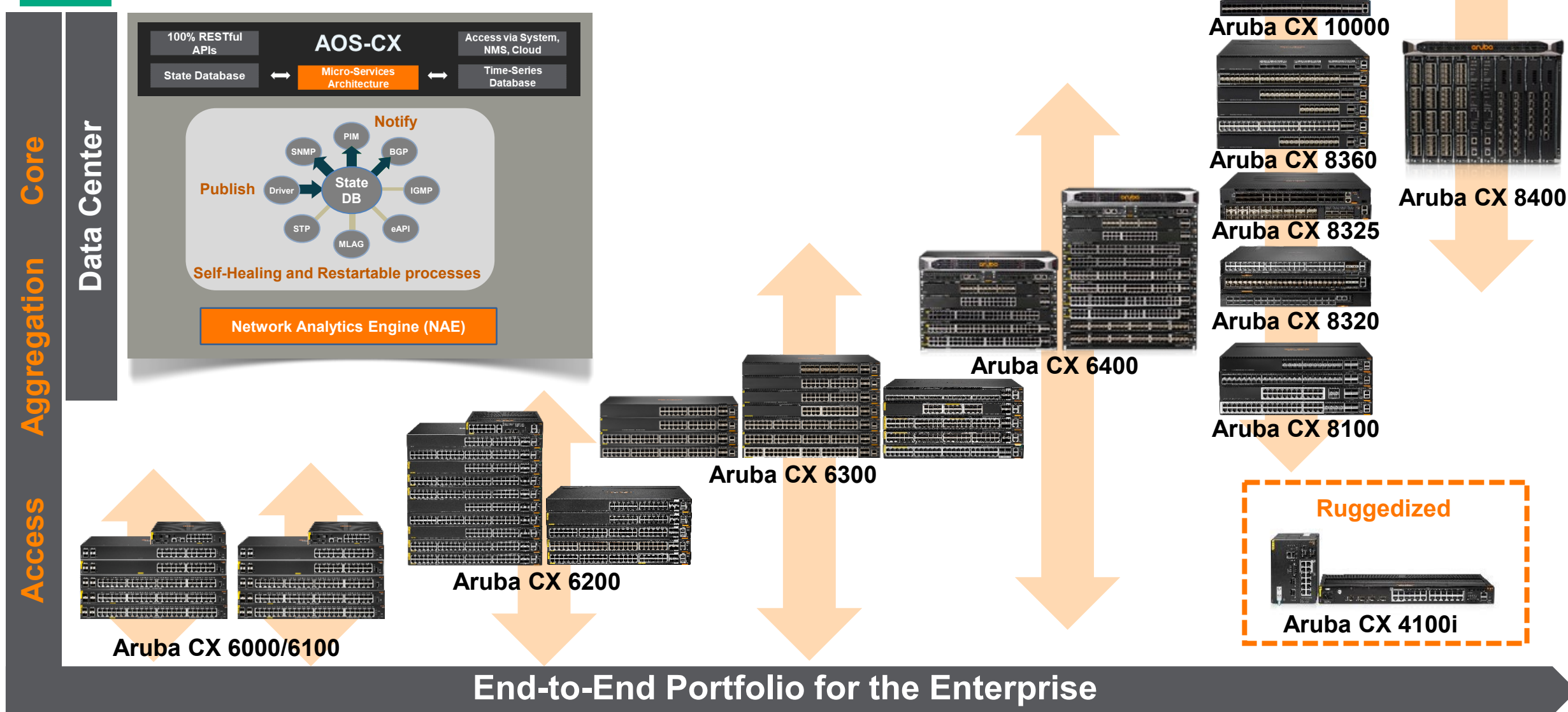
- AOS-CX Overview
- CLI philosophy and configuration defaults
- Layer-2 configurations
 - Ethernet interface ranges
and how to reset an interface to its default values
 - VLANs
 - VLAN Interoperability
 - VLAN ranges
 - Link-Aggregation
 - Link Aggregation Interoperability
- Layer-3 configurations
 - Layer-3 VLAN-Interface
 - L3 VLAN interface ranges
 - Layer-3 Interface
- Additional Resources





AOS-CX Overview

Aruba CX Switching Portfolio



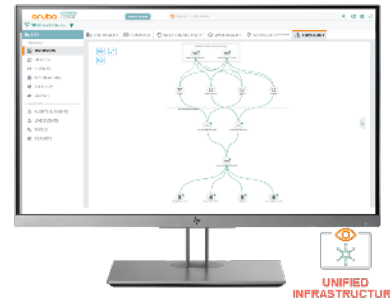
Aruba CX Switching

Next-gen switching designed for the network operator

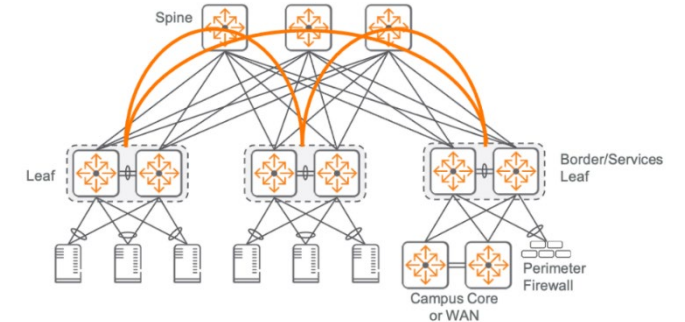
**Simplicity from access to data center
with AOS-CX**



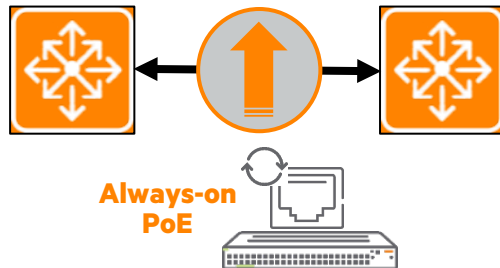
**Unified mgmt and intelligent
configs with Aruba Central**



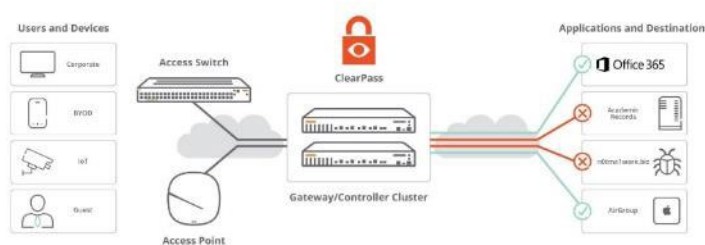
**Campus and DC Fabrics with
BGP-EVPN VXLAN with GBP**



**High Availability with
Aruba VSX or VSF
Live Upgrades**



**IoT and User Security
Aruba Dynamic Segmentation**



**Data center class performance with
Gen7 ASIC**



AOS-CX Operating System

Built on cloud-native principles

Modularity

Faster innovation
with independent processes

Programmability

Simplified
operations
through automation

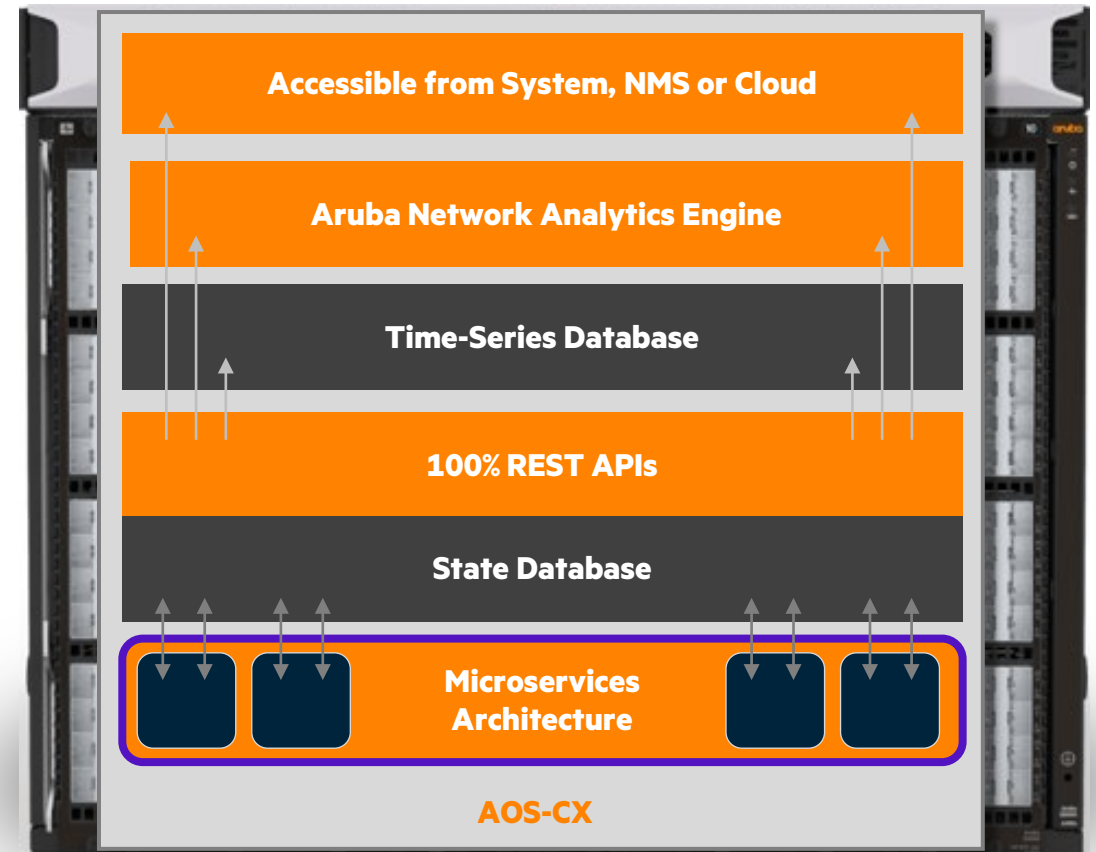
Resiliency

Stable and reliable
microservices
design

Elasticity

One operating model from
edge access
to data center

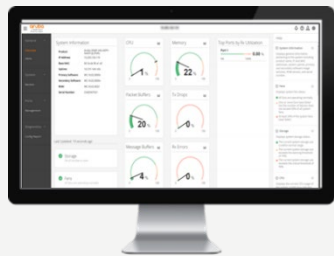
Gartner



Simplify Operations with a Unified Infrastructure

Unique switch architecture provides management choice

Web GUI



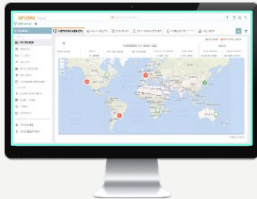
Web interface for
single switch network
management

CLI

NetEdit

for AOS-CX

COP (Central on-prem)



On-prem
wired + wireless access
network management

Fabric Composer



Software-defined orchestration solution for
enterprise data center networks

Central



**Cloud-based wired + wireless + SD-
WAN**
network management



CLI Configuration



CLI philosophy and configuration defaults



AOS-CX CLI Philosophy

- Intuitive
 - Simple
 - Short
 - Consistent
-
- Commands are generally based on industry standard
 - Port-based configuration vs. VLAN-based
 - Port-based configuration vs. feature-based
 - The “no” form of a command accept all parameters, even if they are unnecessary in the “no” form
 - Enable/Disable commands for specific features



Industry standard-based CLI

Configuration Example

Link-Aggregation:

```
interface lag 100
  no shutdown
  description VSX-link
  no routing
  vlan trunk native 1
  vlan trunk allowed 1,10,20,30,40,201
  lacp mode active
interface 1/1/2
  no shutdown
  description vsx-link1
  lag 100
interface 1/1/3
  no shutdown
  description vsx-link2
  lag 100
```

VRF Configuration global:

```
vrf guest
```

OSPF Configuration global:

```
router ospf 1
  router-id 99.99.99.2
  passive-interface default
  area 0.0.0.0
```

Layer-3 Interface Configuration:

```
interface vlan201
  vrf attach guest
  ip address 10.0.201.2/24
  ip ospf 1 area 0.0.0.0
  no ip ospf passive
```

CX Access Switch Defaults

- Default configuration of an CX Access switch (6xxx)
 - Ports/interfaces are:
 - L2 or Bridging by default
 - Members of vlan-1 in access mode by default
 - Admin "up" by default (no shutdown)
 - "interface vlan 1" or SVI for vlan-1 is created by default
 - DHCPv4 is enabled on interface vlan-1 by default
 - ZTP is enabled on interface vlan-1 by default
 - HTTP service, REST in read/write mode and WebGUI are enabled by default on "mgmt" and "default" VRF
 - SSH server is enabled in "mgmt" and "default" VRF
 - Spanning-Tree is enabled by default





Layer-2 configurations





Ethernet interface ranges and how to reset an interface to its default values



Configuring a range of Physical interfaces

- Range contexts can be created by specifying the interface range using the below CLI in global configuration context.
 - ‘interface <RANGE>’
- Range can be specified using a hyphen (-) and / or a comma separated list.
Switch(config)# interface 1/1/1,1/1/7-1/1/8
Switch(config-if-<1/1/1,1/1/7-1/1/8>)#
- On successfully configuring a range of interfaces, the range shall appear on the context prompt



How to reset an interface to its default values?

```
default interface <INTERFACE-ID>
```

Description

Sets an interface (or a range of interfaces) to factory default values.

Parameter	Description
<INTERFACE-ID>	Specifies the ID of a single interface or range of interfaces. Format: member/slot/port or member/slot/port-member/slot/port to specify a range.

Examples

On the 6400 Switch Series, interface identification differs.

Resetting an interface:

```
switch(config)#default interface 1/1/1
```

Resetting an range of interfaces:

```
switch(config)#default interface 1/1/1-1/1/10
```



VLANs

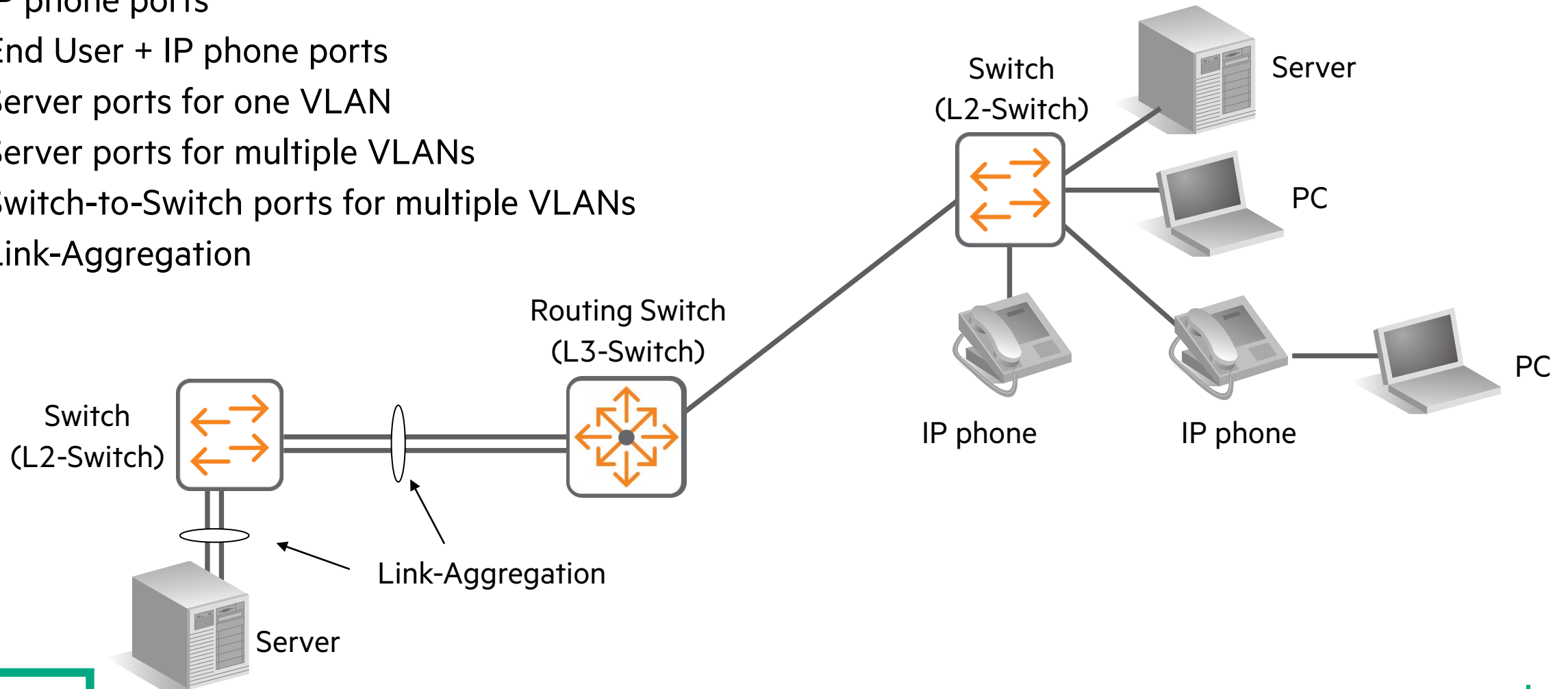


VLAN Interoperability



Switch Port Roles

- End User ports (PCs, Printer,...)
- IP phone ports
- End User + IP phone ports
- Server ports for one VLAN
- Server ports for multiple VLANs
- Switch-to-Switch ports for multiple VLANs
- Link-Aggregation



Terminology Differences

Switch Port Role	AOS-S Switch	AOS-CX Switch
End nodes: PCs, printers, and so on	Untagged port	Access port
PC + IP Phone	Untagged in data VLAN; tagged in voice VLAN	Trunk port with tagged voice VLAN
Switch-to-switch with multiple VLANs	Tagged port	Trunk port
Link aggregation	Trunk port	Link Aggregation



VLAN Configuration Comparison

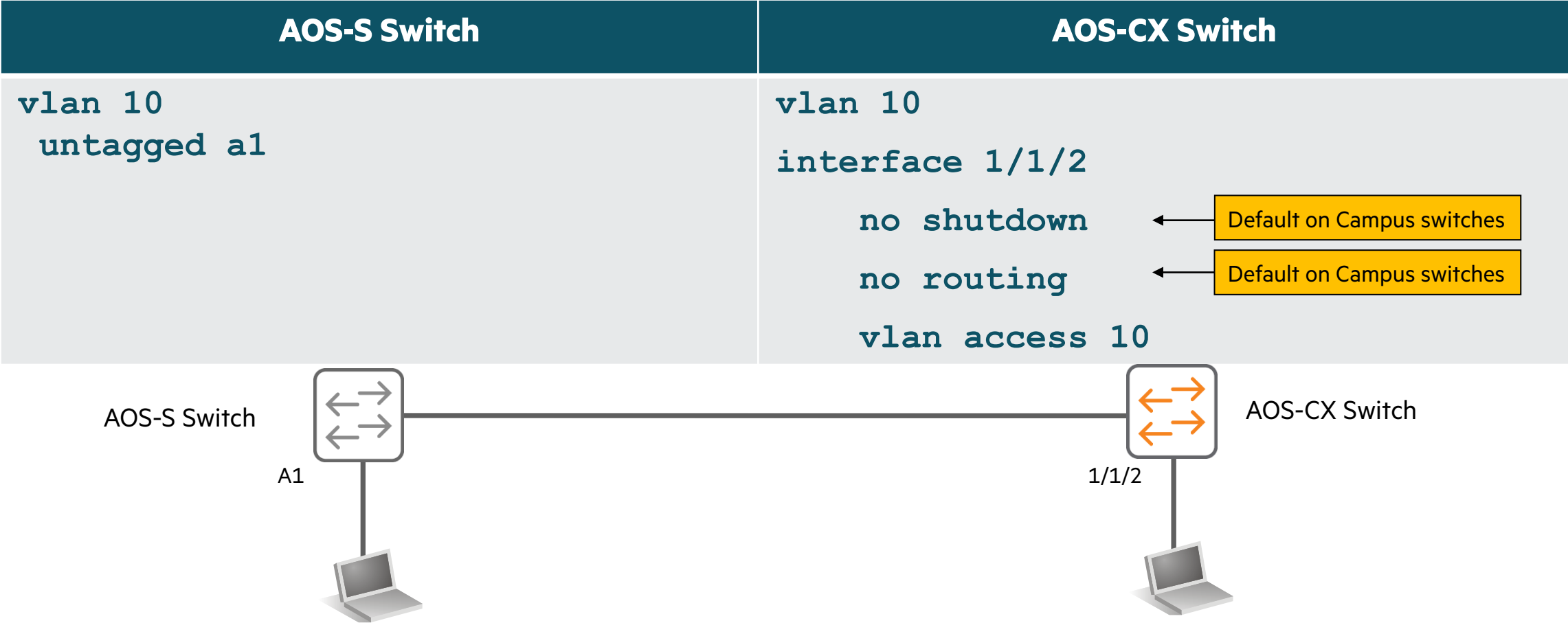
Switch-to-Switch connection

AOS-S Switch	AOS-CX Switch
<pre>vlan 1 untagged a1 vlan 2 tagged a1 vlan 3 tagged a1</pre> <div>← Default</div>	<pre>vlan 1-3 interface 1/1/2 no shutdown no routing vlan trunk native 1 vlan trunk allowed 1-3</pre> <div>← Default on Campus switches</div> <div>← Default on Campus switches</div>



VLAN Configuration Comparison

Switch-to-End Node connection



Useful show commands

VLAN

Description	AOS-S Switch	AOS-CX Switch
Port status	show interface brief	show interface brief
Port counters / utilization	show interface <port>	show interface <port>
What VLAN are configured?	show vlan	show vlan
Specific information about a single VLAN.	show vlan <vlan-id>	show vlan id <vlan-id>
Which untagged VLAN does a port belong to?	show vlan ports <port> detail	show vlan port <port>, show interface <port>
Which VLANs are configured on a port?	show vlan ports <port> detail	show vlan port <port>, show interface <port>
Which ports exist with more than one VLAN	show interface status	show interface brief





VLAN ranges



Configuring a range of L2 VLANs

- Range context for VLANs can be created by specifying the VLAN range using the below CLI in global configuration context.
 - 'vlan <RANGE>'
- Range can be specified using a hyphen (-) and / or a comma separated list.
Switch(config)# vlan 11,12-20
Switch(config-vlan-<11,12-20>)#
- The range can be specified in any order. User is taken to a context with the range displayed on the prompt.
Switch(config)# vlan 10,9,8
Switch(config-vlan-<10,9,8>)#



Link Aggregation





Link Aggregation Interoperability



Static Aggregated Ports

AOS-S Switch	AOS-CX Switch
<pre>trunk a1-a2 trk30 trunk</pre>	<pre>interface lag 30 no shutdown no routing interface 1/1/1 no shutdown lag 30 interface 1/1/2 no shutdown lag 30</pre> <div>Default on Campus switches</div> <div>Default on Campus switches</div> <div>Here we do not use dynamic aggregation protocols like LACP</div>



Dynamic Aggregated Ports using LACP

IEEE 802.1AX (former 802.3ad)

AOS-S Switch	AOS-CX Switch
<pre>trunk a1-a2 trk30 lacp</pre>	<pre>interface lag 30 no shutdown no routing lacp mode active interface 1/1/1 no shutdown lag 30 interface 1/1/2 no shutdown lag 30</pre> <div><div>Default on Campus switches</div><div>Default on Campus switches</div><div>enable LACP</div></div>



Useful show commands

Link Aggregation

Description	AOS-S Switch	AOS-CX Switch
What ports belong to the aggregation?	show trunk	show lacp interfaces
Which aggregation does a port belong to?	show trunk <port>	show lacp interfaces <port>
What load-balancing algorithm is used for egress traffic?	show trunks load-balance interface ...	show lacp aggregates
Specific LACP information.	show lacp ...	show lacp ...





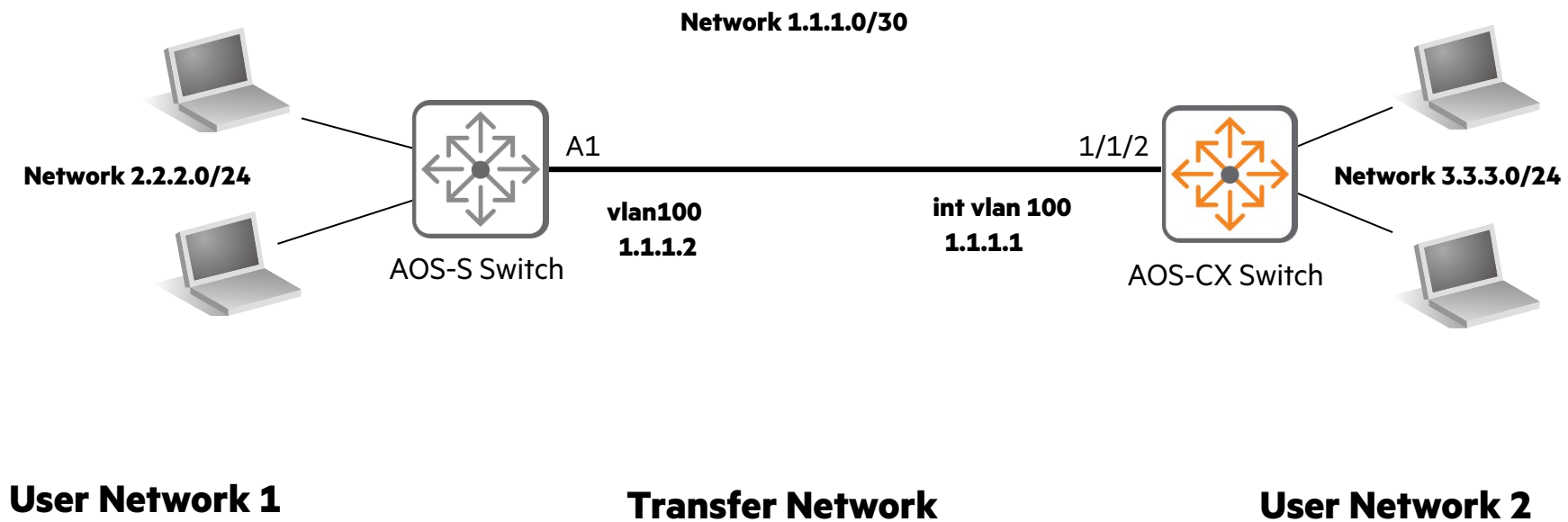
Layer-3 configurations



Layer-3 VLAN-Interface



Layer-3 Interfaces (VLAN-based)



Layer-3 Interfaces (VLAN-based)

AOS-S Switch	AOS-CX Switch
<p>Layer-3 VLAN configuration:</p> <pre>vlan 100 untagged a1 ip address 1.1.1.2 255.255.255.252</pre>	<p>Layer-3 VLAN configuration:</p> <pre>vlan 100 interface 1/1/2 no shutdown no routing vlan access 100 interface vlan 100 no shutdown ip address 1.1.1.1/30</pre> <div><div>Default on Campus switches</div><div>Default on Campus switches</div></div>
<p>Enabled layer-2 protocols by default:</p> <ul style="list-style-type: none">- HP stacking (on most switches)- LLDP	<p>Enabled layer-2 protocols by default:</p> <ul style="list-style-type: none">- LLDP- Spanning-Tree
<p>Layer-2 protocols need to be disabled per port if globally enabled:</p> <p>Spanning-tree:</p> <pre>(config)# spanning-tree a1 bpdu-filter</pre>	<p>Layer-2 protocol to be disabled per port:</p> <p>Spanning-tree:</p> <pre>interface 1/1/2 spanning-tree bpdu-filter</pre>

A separate VLAN for the transfer layer-3 network is required



L3 VLAN interface ranges

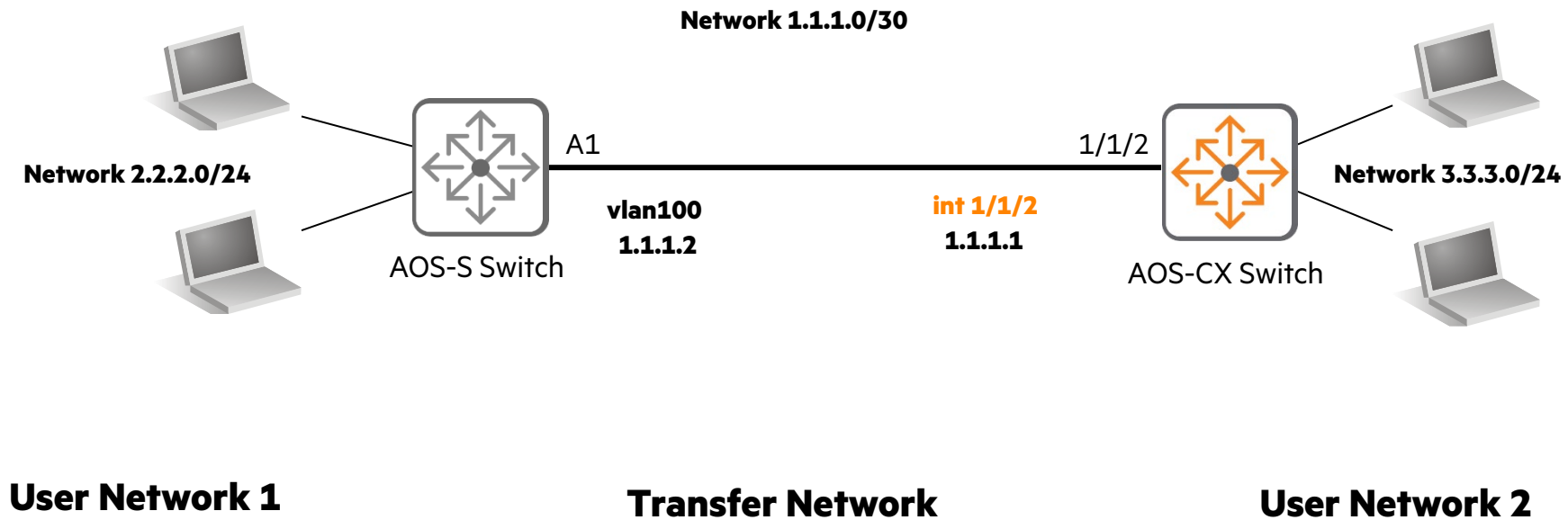


Configuring a range of L3 VLANs (Interface VLAN)

- Range contexts can be created by specifying the interface VLAN range using the below CLI in global configuration context.
 - ‘interface vlan <RANGE>’
- Range can be specified using a hyphen (-) and / or a comma separated list.
Switch(config)# interface vlan 1-3,5-6
Switch(config-if-vlan-<1-3,5-6>)#
- Any Interface VLAN can only be created if corresponding VLAN is already configured. If one or more interface vlans does not have corresponding VLAN(s) configured, they shall not be configured, and user will not be taken to the range context.



Layer-3 Interfaces (interface-based)





Layer-3 VLAN-Interface



Layer-3 Interfaces (interface-based)

AOS-S Switch

Layer-3 VLAN configuration:

```
vlan 100
  untagged a1
  ip address 1.1.1.2 255.255.255.252
```

No direct IP address configuration on interface possible. VLAN-based approach is needed on AOS-S

Enabled layer-2 protocols by default:

- HP stacking (on most switches)
- LLDP

Layer-2 protocols need to be disabled per port if globally enabled:

Spanning-tree:

```
(config)# spanning-tree a1 bpu-filter
```

AOS-CX Switch

Layer-3 interface configuration:

```
interface 1/1/2
  no shutdown
  routing
  ip address 1.1.1.1 255.255.255.252
```

Default on Campus switches

Default on DC switches

Enabled layer-2 protocols by default on L3 interface:

- LLDP



Useful show commands

IP addressing

Description	AOS-S Switch	AOS-CX Switch
What IP addresses are configured?	show ip	show ip interfaces brief
Details of IP interfaces	show run vlan <id>	show ip interface <port/vlan>
What IP-MTU is used	show jumbos	show ip interface <port/vlan>
What does the routing table look like?	show ip route ...	show ip route ...



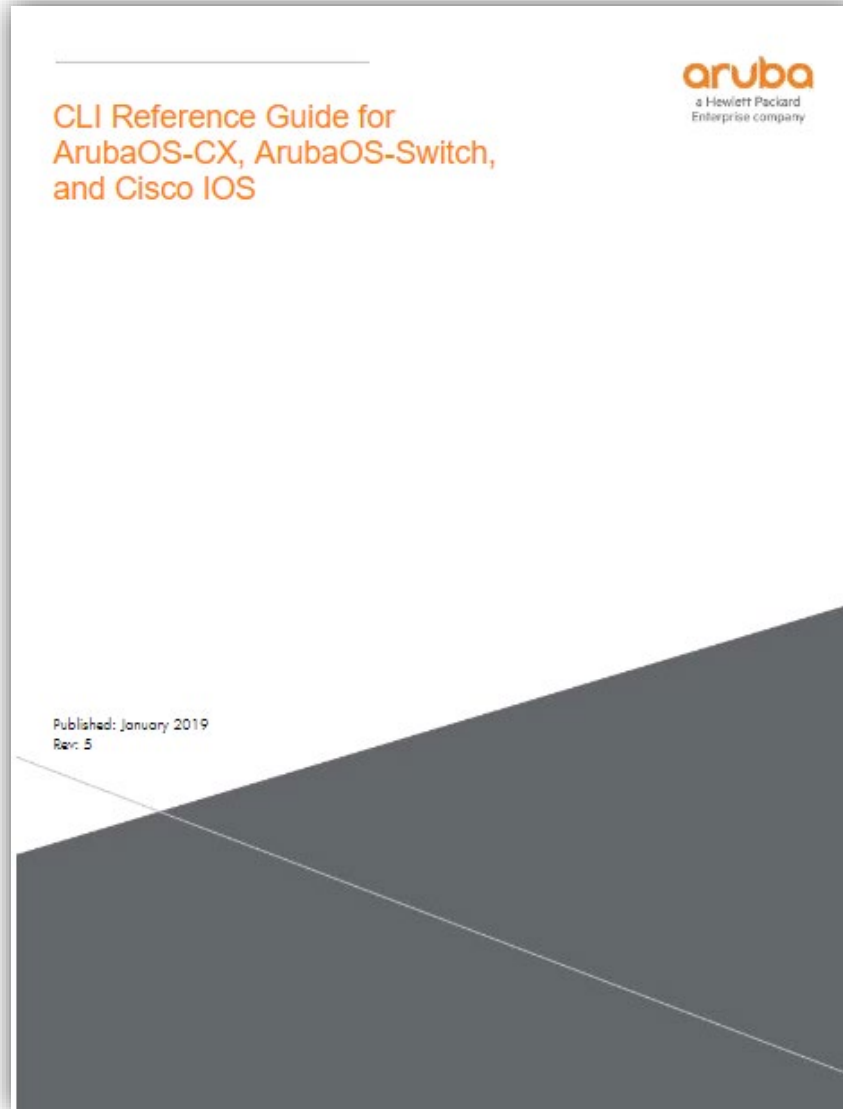


Additional Resources

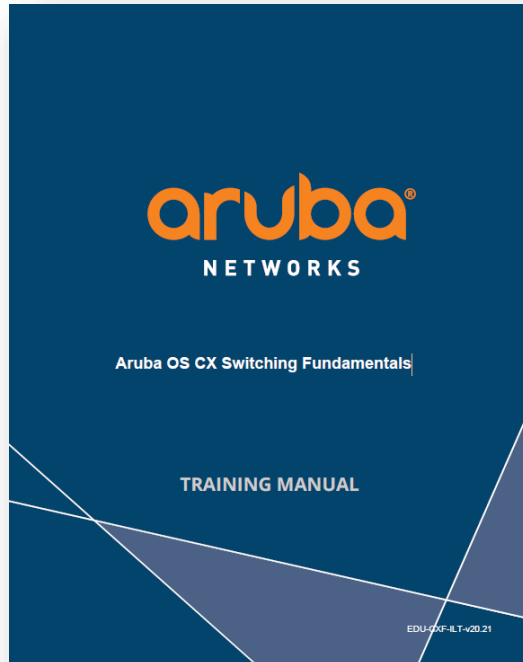


AOS-S / AOS-CX Switch Interoperability

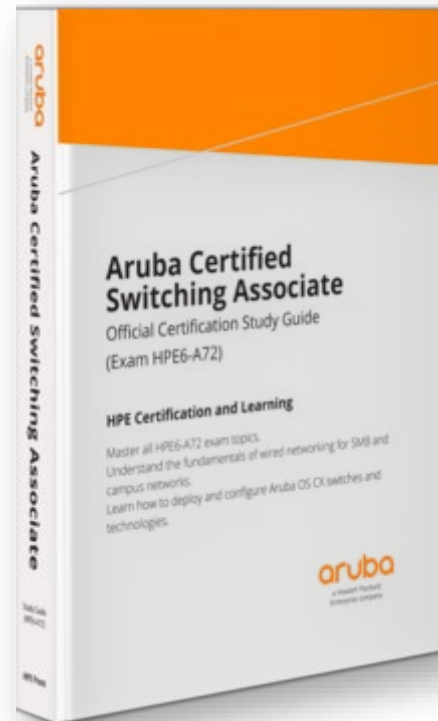
Documents



Official Switching Fundamentals Trainings & Books

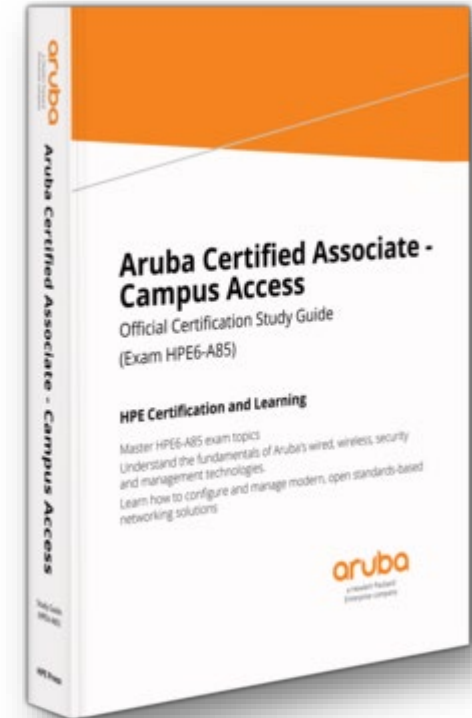


- Aruba OS-CX Switching Fundamentals, Rev. 20.21
- Aruba OS-CX Switching Fundamentals eLearning + Self-directed lab
- (4-Hour) Self-Directed Lab - Aruba OS-CX Switching Fundamentals (ACSA)



Aruba Certified Switching Associate Official Certification Study Guide (HPE6-A72)

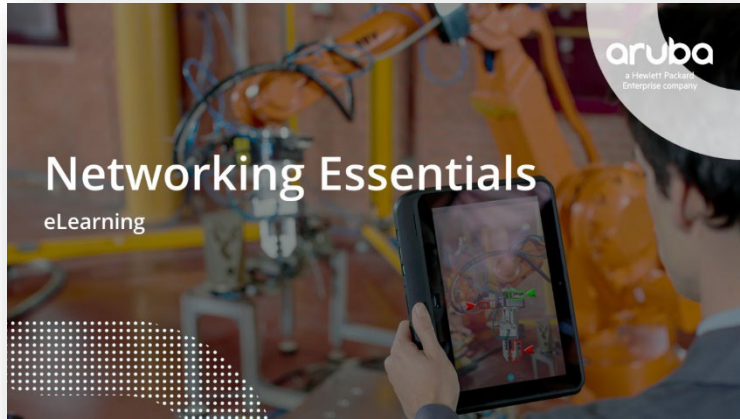
- Hardcover
- eBook
- Kindle Edition



Aruba Certified Associate - Campus Access (HPE6-A85)

- Hardcover
- eBook

Free Switching Fundamental Online Courses



Networking Essentials eLearning

- Communication
- Packet encapsulation
- Protocols
- VLANs or Virtual LANs
- Link-Aggregation
- Static and dynamic routing



Aruba Campus Access Essentials eLearning

- Networking fundamentals
- Types of networking devices
- Switching fundamentals and VLANs
- IP addressing and routing
- Aruba WLAN
- Aruba Central Management
- VSX switching virtualization
- Aruba Gateways
- Aruba WLAN tunneled and mixed mode
- Secure WLAN & 802.1X authentication
- Wired Port Access & Dynamic Segmentation
- VXLAN & Group-Based Policies



ArubaOS-CX virtual switches

AOS-CX Switch Feature Navigator and Documentation Portal

Aruba Switch Feature Navigator

Explore and Compare Switch features for each platforms and software releases

EXPLORE FEATURES

COMPARE RELEASES

Product Type

Platform

License Type

Fixed

CX 6100 CX 6200

Founda... Advan... Premi...

Hide Common Features

Scale Numbers

Note - The scale number values are Uni-Dimensional values; Scale values depicted below are from the latest SW release.

ACL

Client-telemetry

L2 features

L3 features

L3 features - security

L3 features - tunnels

Management

Management - security

Multicast

OSPFv2

OSPFv3

PoE

Policy

Port

Port Access Security

QoS

RIP/RIPng

Feature	CX 6100	CX 6200
Port Access Security		
Downloadable Gateway Role	X	10.06.0100
Downloadable Gateway Role per port	X	10.06.0100 32
Downloadable Gateway Role per system	X	10.06.0100 64
Downloadable User Roles per port	X	10.04.1000 32
Downloadable User Roles per system	X	10.04.1000 64
External Captive Portal URL Hashing for ClearPass	X	10.04.1000
Framed IP address in RADIUS requests	X	10.04.1000
High-Availability for 802.1X Supplicants	10.06.0001	10.04.1000
Local MAC Authentication - entries per MAC group	10.06.0001 64	10.05.0001 64
Local MAC Authentication - entries per system	10.06.0001 1024	10.05.0001 2048
Local MAC Authentication - number of MAC groups	10.06.0001 8	10.05.0001 32
Local User Roles per system	10.06.0001 32	10.04.1000 64

AOS-CX Switch Software Documentation Portal

About this portal...

4100i

AOS-CX software documentation for 4100 Switch series

6000

AOS-CX software documentation for 6000 Switch series

6100

AOS-CX software documentation for 6100 Switch series

6200

AOS-CX software documentation for 6200 Switch series

8100

AOS-CX software documentation for 8100 Switch series

8320

AOS-CX software documentation for 8320 Switch series

8325

AOS-CX software documentation for 8325 Switch series

8360

AOS-CX software documentation for 8360 Switch series

Additional Resources

Download the latest AOS-CX Software from the Aruba Support Portal.

[AOS-CX 10.12](#)
[AOS-CX 10.11](#)
[AOS-CX 10.10](#)

Data Center Networking

[Overview of Remote Direct Memory Access over Converged Ethernet](#)

Video Tutorials

View video tutorials and feature demos on the Aruba Airheads Broadcasting Channel

[Aruba AOS-CX Basics](#)
[AOS-CX Software Release Technical Update](#)

45

Aruba Documentation Portal und Validated Solution Guide (VSG)



Aruba Documentation Portal

About this portal...

Aruba Central

Aruba Central is a cloud-based networking solution with AI-powered insights, workflow automation, and edge-to-cloud security that empowers IT to

Aruba Central (on-premises)

Aruba Central (on-premises) is a variant of Aruba Central, a SAAS platform that offers you a single intelligent console to monitor, analyze, and

AOS-CX

AOS-CX is a modern, database-driven network switch operating system that delivers automation, distributed

ArubaOS

ArubaOS is the Operating System (OS) for all Aruba mobility controllers, virtual mobility controllers, mobility master, and controller managed wireless

Aruba ClearPass

Aruba ClearPass lets network administrators create and enforce network access security policies for devices, users, and applications in order to

AOS-S

The AOS-S Switch series is a mobile campus-access solution for enterprises, small- and medium-size businesses, and

Aruba Hardware

View Installation Guides, Startup Guides, and safety and regulatory information in all available languages for access points, switches, beacons

Airwave

Aruba AirWave is a versatile multi-vendor wired and wireless network management solution that simplifies day-to-day operations for large-scale

Aruba Fabric Composer

Aruba Fabric Composer is an intelligent, API-based, software-defined orchestration solution that simplifies

Aruba Instant

Aruba Instant is a simple, easy to deploy turn-key WLAN solution consisting of one or more APs. An Ethernet port with routable connectivity to the

HPE Aruba Networking Virtual Intranet Access (VIA)



The HPE Aruba Networking Virtual

Aruba User Experience Insight

Aruba User Experience Insight (UXI) is an innovative digital experience monitoring solution that provides AI-powered insights into end-user

Aruba NetEdit

Aruba NetEdit provides automation of search, edit, validation, deployment, and auditing for network configurations. Aruba NetEdit supports intelligent



Home

Edge Services Platform

Campus Design

Campus Deploy

Introduction

Campus Network Overview

Campus Wired Connectivity

Campus Wireless Connectivity

Campus Services

Campus Overlay

Summary

Campus Switch Reference Configuration

Validated Hardware and Software

What's New in This Version

Campus Migrate

Data Center Design

Data Center Deploy

SD-WAN & Branch Design

SD-WAN & Branch Deploy

ESP Policy Design

Companion Guides

Resources

Campus Deploy / Campus Network Overview

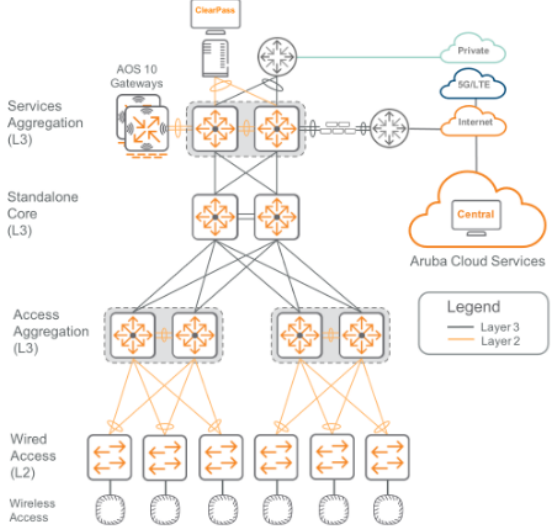
26-Oct-23

Deploying the Campus Network

The design referenced in this deployment guide is a large campus topology, described in the Aruba ESP Campus design guide. This topology implements a traditional 3-tier network using a routed core connected to an aggregation layer, which is then connected to the access layer. The access layer is deployed as Layer 2 only and default gateways are implemented at the aggregation layer. This design calls for a services aggregation block connected to the core to ensure efficient delivery of services to endpoints across the campus. All switches and gateways are configured with an IP address in the management VLAN.

The connections between the core and aggregation layers are Layer 3 and consist of point-to-point interfaces using the IP address range of 172.18.X.X. Shared services such as Active Directory, DHCP, DNS, and ClearPass are connected to the services aggregation layer which has address spaces in the 10.X.X.X range. The wireless network rides on top of the wired network using APs connected in the access switches and AOS 10 gateways dual-connected in the services aggregation switches. The physical layout of the network with switches, APs and gateways, as well as the Layer 2 and Layer 3 domains, are shown in the following diagram.

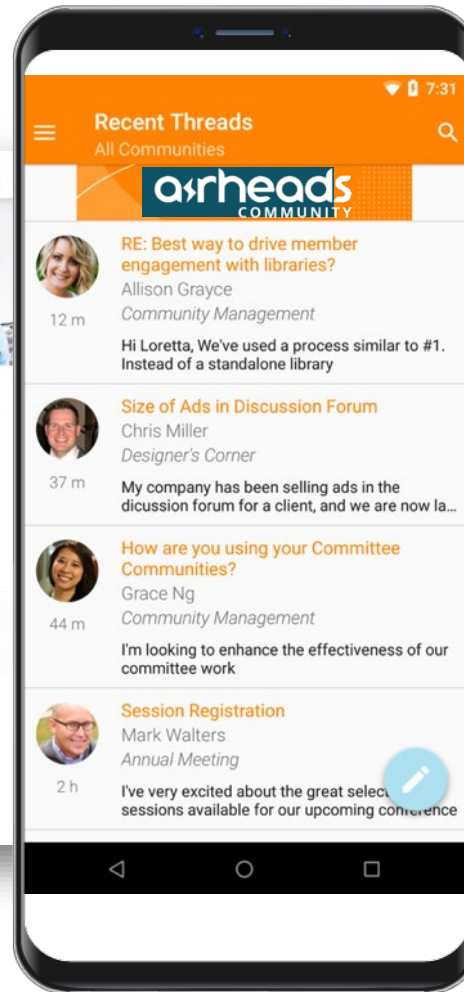
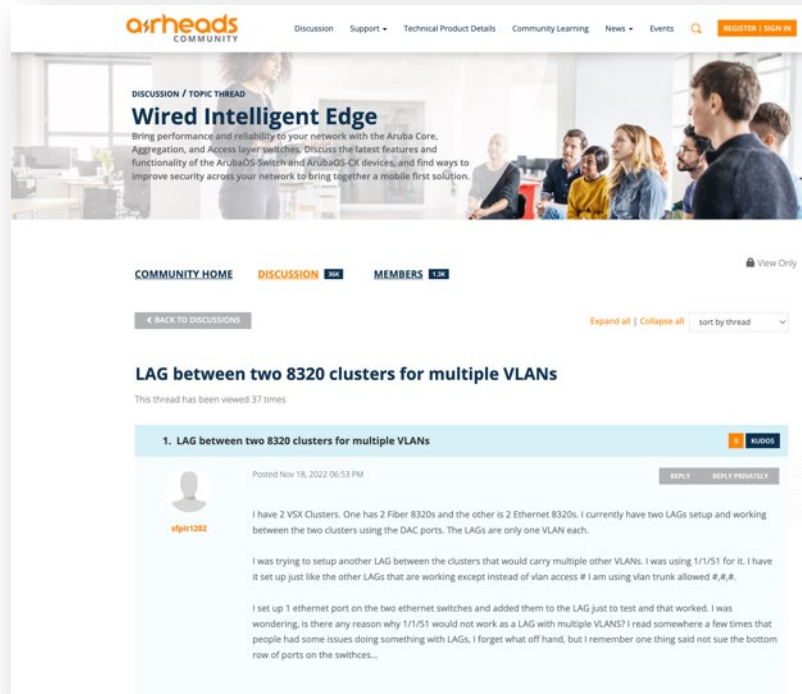
Campus Topology



Legend
— Layer 3
— Layer 2

VSG content for HPE Employees

Aruba Airheads Community




arheads
COMMUNITY

community.arubanetworks.com

Airheads Broadcasting Channel






Airheads Broadcasting


@AirheadsBroadcasting · 30.6K subscribers · 984 videos


This channel is created for all network engineers out there. We will upload short videos tha... >

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Created playlists

 Sort by




SD-WAN Feature:
About and configuring this Proxy

47 videos

SD-Wan Feature

[View full playlist](#)

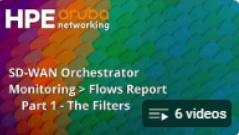


**STACKSTORM
AUTOMATION**

9 videos

Stackstorm Automation

[View full playlist](#)




**SD-WAN Orchestrator
Monitoring > Flows Report
Part 1 - The Filters**

6 videos

SD-WAN Deep Dive into the Orchestrator Monitoring Flows...

[View full playlist](#)

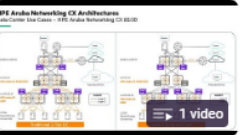


**AOS-CX 10.12
Release Update**

26 videos

AOS-CX 10.12 Software Release Update

[View full playlist](#)

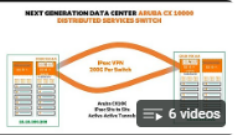


HPE Aruba Networking CX Architecture

1 video

HPE Aruba CX 8100

[View full playlist](#)




**NEXT GENERATION DATA CENTER ARUBA CX 8100
DISTIBUTED SERVICES SWITCH**

6 videos

HPE Aruba Networking TechFlash


[View full playlist](#)



**SD-WAN Troubleshooting
Tunnel Down Part 1: IPSEC UDP**

19 videos


SD-WAN How-To's



Cloud Auth

4 videos

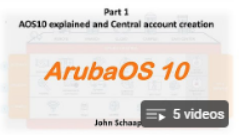
Aruba Cloud Auth Video Series



**Aruba RESTful
Automation
Series**

13 videos

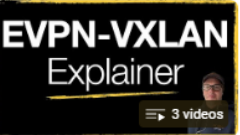
Aruba RESTful Automation



ArubaOS 10

5 videos


ArubaOS 10



**EVPN-VXLAN
Explainer**

3 videos

EVPN-VXLAN Explainer



**EVPN-VXLAN Config
From Scratch**

2 videos

EVPN-VXLAN Config From



CUSTOMER FIRST
CUSTOMER LAST

HPE **aruba**
networking