LAB GUIDE



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Deploying OSPFv2 Features

!!IMPORTANT!!

THIS GUIDE ASSUMES THAT THE AOS-CX OVA HAS BEEN INSTALLED AND WORKS IN GNS3 OR EVE-NG. PLEASE REFER TO GNS3/EVE-NG INITIAL SETUP LABS IF REQUIRED.

AT THIS TIME, EVE-NG DOES NOT SUPPORT EXPORTING/IMPORTING AOS-CX STARTUP-CONFIG. THE LAB USER SHOULD COPY/PASTE THE AOS-CX NODE CONFIGURATION FROM THE LAB GUIDE AS DESCRIBED IN THE LAB GUIDE IF REQUIRED.

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Lab Objective

The OSPF (Open Shortest Path Protocol) is one of the most popular routing protocols for IP Networks. It uses a link state routing (LSR) algorithm which is performed by every switch router mode in the network.

This lab should be considered as a basic OSPFv2 lab as an introduction to the configuration and operation of OSPF on Aruba CX switches.

This workshop introduces OSPF features relating to the use of virtual links and options for using encrypted password between ospf neighbors for authentication. Other configurations involve the use of the 'passive interface ' command and the 'default-information originate' command.

The list of features presented in this lab is a very small snapshot of the ospf features available within the CX software and a comprehensive view of all OSPF features available can be found in the documentation guides from the aruba support portal :

AOS-CX 10.07 IP Routing Guide 8400 AOS-CX 10.07 IP Routing Guide 8400 (HTML) AOS-CX 10.07 IP Routing Guide 6300,6400,8320,8325,8360 Series AOS-CX 10.07 IP Routing Guide 6300,6400,8320,8325,8360 Series (HTML)

At the end of the lab tasks, familiarity should be obtained on how to deploy the key features of virtual links and authentication commands, the default originate command and familiarity with additional ospf 'show and status' commands.

Lab Overview

This Lab is based on CX simulator release 10.07.

The lab comprises of configuring multiple areas within a single autonomous system. A virtual link is required to connect 'Area2 'to the backbone as Area 2 is directly connected to Area 1. On completion of the area link configuration, routing exchanges between ospf neighbors are propagated to and from area 2.

The second part of the lab comprises of encrypted authentication between ospf neighbors using configurations with a key-chain' and directly on the interface of each switch. The passive interface ' command and the 'default-information originate' command.

are introduced as separate task

Finally, series of useful 'show' commands are presented as a final task.



Figure 1 OSPF Area and IP addressing



	0 0 0 0 0 0 0 0 0 1 0			• • • • • • • • •	Lab Guide Deploying OSPFv2 Features
Lab Tasks					
Task 1 Lab Set-up					
For this lab refer to Figure 1 for topology and IP addres	ss details.				• •
• Start all the devices, including host and client					• • • • •
Open each switch console and log in with user "ac	lmin" and no pass	word		• • • • •	• • • • · ·
• Change all hostnames as shown in the topology: hostname	· • • • • • • • • • • • • • • • • • • •				0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
• On all devices, bring up required ports: int 1/1/1-1/1/3	· · · · · · · · · · · · · · · · · · ·		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 Validate LLDP neighbors appear as expected on e should be paighbor. 	each switch				0 0
Show flup herghbor					0 0
		•			0 0
Task 2–Configure loopback 0 in	nterfaces o	on Sw	vitch /	∖- Ε	0 0
Configure loopback addressing on loopback 0 on each	switch				0 0
Loopback0 ip addressing					^ 0

Switch A ip address 192.168.2.1 Switch B ip address 192.168.2.2 Switch C ip address 192.168.2.3 Switch D ip address 192.168.2.4 Switch E ip address 192.168.2.5

Example Switch B

SwitchB# conf t

SwitchB(config)# interface loopback 0
SwitchB(config-loopback-if)# ip address 192.168.2.2/32

End of Task2

Task 3 - Configure OSPF for Switches A, B, C, D & E

The following tasks will be completed in task3 to configure OSPF on switches A, B, C, D & E

On each switch A, B,C

- Configure a OSPF routing process with appropriate areas and assign a router-id which will be 'loopback0'
- · Configure appropriate switch interfaces with OSPF enabled and ensure connectivity is established
- Ensure neighbor adjacencies are formed between each switch rtr
- Review inter-area and intra-area routes in the ospf routing table
- Review the OSPF Cost of specific routes (Switch A)



	Lab Guide
	Deploying OSPEv2 Features
Configure Switches A to E with their appropriate	e configurations. OSPF routing area configurations are presented with their full
notation but can be abbreviated; as in area 0.6	0.0.0 to area 0 and area 0.0.0.1 to area 1
Christel and O	• • • • • • • • • • • • • • • • • • •
SWITCHA area U	
nouton conf 1	
router ospr 1	`
router-10 192.168.2.1	
area 0.0.0	
interface 1/1/1	
ip address 192.168.4.0/31	
F	
in osof 1 area 0 0 0 0	
ip ospf network point-to-point	
	· · · · · · · · · · · · · · · · · · ·
interface 1/1/2	

ip address 192.168.4.2/31

ip ospf 1 area 0.0.0.0

ip ospf network point-to-point

interface loopback 0

ip ospf 1 area 0.0.0.0

SwitchB area 0

router ospf 1

router-id 192.168.2.2 area 0.0.0.0

interface 1/1/1

ip address 192.168.4.1/31

ip ospf 1 area 0.0.0.0
ip ospf network point-to-point

interface 1/1/2

ip address 192.168.4.4/31

ip ospf 1 area 0.0.0.0

ip ospf network point-to-point

interface loopback 0

ip ospf 1 area 0.0.0.0

	Lab Guide Deploying OSPFv2 Features
SwitchC Area0 & Area 1 - ABR	
router ospf 1	
router-id 192.168.2.3	
area 0.0.0.0	
interface 1/1/1	0 0
ip address 192.168.4.3/31	• • • • • • • • • • • • • • • • • • •
ip ospf 1 area 0.0.0.0	
ip ospf network point-to-point	
interface 1/1/2	
ip address 192.168.4.5/31	
ip ospf 1 area 0.0.0.0	
ip ospf network point-to-point	
interface 1/1/3	
ip address 192.168.4.10/31	

ip ospf 1 area 0.0.0.1

ip ospf network point-to-point

interface loopback 0
 ip ospf 1 area 0.0.0.0

SwitchD Area 1

```
router ospf 1
```

router-id 192.168.2.4 area 0.0.0.1

interface 1/1/1

```
ip address 192.168.4.11/31
```

ip ospf 1 area 0.0.0.1

ip ospf network point-to-point

```
interface 1/1/2
```

```
ip address 192.168.4.12/31
```

ip ospf 1 area 0.0.0.1



Task 3.2 display OSPF routes

Note relating to OSPF areas

OSPF rules state that each non-backbone area cannot learn routes from another non-backbone area (if not forming a direct adjacency neighbor).

Area 2 from Switch E connects directly to Switch D in area 2. Switch D & E exchange routing information (for area 2) as a neighbor adjacency has been formed.

On switch D, show the ip ospf route table with the 'sh ip ospf route' command

192.168.2.5/32 (i) area: 0.0.0.2 via 192.168.4.13 interface 1/1/2, cost 100 distance 110

Switch E will only have ospf routes learnt that are resident within area 2 which will be the directly connected transit subnet between switch D & C of 192.168.4.12/31

Host route 192.168.2.5/32 from loopback 0 on switch E is present on Switch D but the route will not be present on Switches A, B, & C as the ospf area topology breaks the ospf topology rules.

To enable our routes to propagate throughout our network including to and from Switch E in Area2, a virtual link 'tunnel' will be configured between Switch D and Switch C. This will be covered in the next section.

Lab Guide Deploying OSPFv2 Features

Task4 - Creating a Virtual Ospf Link

In this task, a virtual link will be configured traversing area 1 between Switch C and Switch D. This will allow area 2 to virtually connect to area 0 and exchange routing information, even though area 2 does not have a direct connectivity to area 0 through Switch D.

- Virtual links are only valid traversing a full ospf area (stub areas cannot be used.) In this example, a virtual link between Switch C & Switch D will be created across 'area 1'.
- Router-id's must be used for each virtual ink connection.
- A virtual link cannot be created across area 0 (backbone area)

Task 4.1 Virtual links between Switch D and Switch C across area 1

On Switch C, create a virtual link to Switch D ospf router-d 192.168.2.4

SwitchC(config)# router ospf 1
SwitchC(config-ospf-1)# area 0.0.0.1 virtual-link 192.168.2.4

On Switch D, create a virtual link to Switch C ospf router-id 192.168.2.3

```
SwitchD(config)# router ospf 1
SwitchD(config-ospf-1)# area 0.0.0.1 virtual-link 192.168.2.3
```

On Switches A, B & C run the following command to confirm that Switch D host route is now advertised throughout the network.

sh ip ospf route 192.168.2.5/32

On switch E, display the ip ospf routes. Switch E should now have a routing table reflecting all routes learnt between areas.

```
SwitchE# sh ip ospf route
Codes: i - Intra-area route, I - Inter-area route
      E1 - External type-1, E2 - External type-2
OSPF Process ID 1 VRF default, Routing Table
 Total Number of Routes : 8
192.168.2.1/32
                  (I)
    via 192.168.4.12 interface 1/1/1, cost 100 distance 110
192.168.2.2/32
                  (I)
    via 192.168.4.12 interface 1/1/1, cost 300 distance 110
192.168.2.3/32
                  (I)
    via 192.168.4.12 interface 1/1/1, cost 200 distance 110
192.168.4.0/31
                  (I)
    via 192.168.4.12 interface 1/1/1, cost 400 distance 110
192.168.4.2/31
                  (I)
```

				• • • •		• • • • •	•			Lab C	Guide		
				• • • •	• • • • • • • • • • • •	• • • • •	•	Deploy	vina OSI	PFv2 Fe	atures		
) • •					,					
				••••			•						
via 192.168.4.12	inter†	ace 1/1/1	l, cost 300 distanc	e 110	• • • • • • • • • • •	• • • • •	•						
192.168.4.4/31 (I)													
via 192.168.4.12	interf	ace 1/1/1	L, cost 300 distand	e 110			• •						
192.168.4.10/31 (I)			9.0	• • • •	• • • • • • • • • • •	• • • • •	• • •						
via 192.168.4.12	interf	ace 1/1/1	L, cost 200 distanc	e 110	• • • • • • • • • • • •	••••	•••						
192.168.4.12/31 (i)	area:	0.0.0.2	•										
directly attached	l to in	terface 1	1/1/1, cost 100 dis	tance	110 • • • • • • • • •			• •					
-				• • • •	• • • • • • • • • • • •	••••	• • •	• •					
								•••					
From Switch E, ping loo	opback	0 addres	ses of Switch A & B	, 192.16	58.2.1 & 192.168.2	.2 respe	ctively	, to en	sure co	nnectiv	rity		
across the osof area				• • •			• • •						
					•••••	••••	•••	••••					
				•						•			
On Switch A or Switch E	s, run ti	ne tollowi	ng command:-		• • • • • • • • • • • •	••••	• • • •						
SwitchA# sh in osnf ho	order-r	outers											
VRE : default	i dei i	outers	Process · 1				• • •				• • • •	 • • •	• •
Internal Pouting Table			11000033 1 1										
incentar Roucing Table												 	• •
												 	• •
					• • • • •	••••	• • •				••••	•••	• •
Codes: 1 - Intra-area	route,	1 - Inte	er-area route										
		_			• •							 	• •
Router-ID	Cost	Туре	Area	SPF	Nexthop							 	• •
Interface						••••	•••	• • • •					::
i 192.168.2.3	100	ABR	0.0.0.0	26	192.168.4.3								
1/1/2						•						 	• •
i <mark>192.168.2.4</mark>	200	ABR	<mark>0.0.0.0</mark>	26	192.168.4.3		•••				• • • •	 •••	• •
1/1/2							•						
													• •

Switch C & Switch D are operating as Area Border routers. Area 0 is extended to switch D, router-id 192.168.2.4, to support the connectivity of Area 2 to the backbone Area 0.

End of lab task 4



Task 5 Authentication

OSPF Neighbors can authenticate with each other using an encrypted password. From software release CX 10.07, additional cryptography support is provided in addition to the existing MD5 algorithm. In CX release 10.07, cryptography support is provided for the following authentication/Digests:-

Authentication/Digest Lengths

- MD5 = 16 bytes
- SHA-1 = 20 bytes
- SHA-256 = 32 bytes
- SHA-384 = 48 bytes
- SHA-512 = 64 bytes

When it comes to speed and less security, MD5 maybe the best fit.

If security is the most important factor, select a hash algorithm from the SHA suite, example SHA-256, SHA-384, SHA-512'. SHA-256 seems like a good balance between speed and security.

In the authentication examples, the sha-256 crypto algorithm is used. If using a CX simulator release prior to 10.7, only the MD5 authentication crypto method is available.

Task 5.1 OSPF Authentication – Interface

In this task, will configure authentication between all ospf neighbors and including the virtual link 'tunnel' between Switch C and Switch D.

Network Type

: Point-to-point

Switch A – Switch B Authentication

On either Switch A or Switch B, use the 'sho ip ospf interface 1/1/1' command.

Example output below from Switch A.

```
SwitchA# sh ip ospf interface 1/1/1
```

Status

Codes: DR - Designated router BDR - Backup Designated router

Interface 1/1/1 is up, line protocol is up

: up

VRF	: default	Process	: 1
IP Address	: 192.168.4.0/31	Area	: 0.0.0.0

		0 0	Lab Guide
			Deploying OSPEV2 realures
Hello Interval	: 10 sec	Dead Interval : 40 sec	
Transit Delay	: 1 sec	Retransmit Interval : 5 sec	
Authentication	: No	Link Speed : 1000Mbps	• •
Cost Configured	: NA	Cost Calculated : 100	0 0 0 0 0 0 0 0 0 0 0
State/Type	: Point-to-point	Router Priority : n/a	
DR	: No	BDR : No	
Link LSAs	: 0	Checksum Sum : 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
BFD	: Disabled	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Enter the followin	g configuration on Switch A		0 0
SwitchA(config	;)# interface 1/1/1		0 0
SwitchA(config	-if)# ip ospf authentication h	mac-sha-256	
SwitchA(config	g-if)# ip ospf sha-key 1 sha p]	aintext aruba	0 0
		٠	0 0
Note: at this point	t the ospf neighbor adjacency will be	'down' between Switch A and Switch B.	· · · · · · · · · · · · · · · · · · ·
SwitchA# sh ip	ospf neighbors		
VRF : default	Proce	ess : 1	
Total Number o	f Neighbors : 1		
Neighbor ID	Priority State	Nbr Address Interface	
192.168.2.3	n/a FULL	192.168.4.3 1/1/2	
Repeat the conf	iguration on Switch B		
And then run the	'sh ip ospf neighbor' & 'sh ip	ospf interface 1/1/1' commands.	
SwitchA# sh ip c	ospf neighbors		
VRF : default	Process :	1	
		==	
Total Number of	Neighbors : 2		
Neighbor ID	Priority State Nbr	Address Interface	

Na FUL 192.168.4.1 1/1/1 192.168.2.2 n/a FUL 192.168.4.3 1/1/2 192.168.2.3 n/a FUL 192.168.4.3 1/1/2 SwitchA# sh ip ospf interface 1/1/1 SwitchA# sh ip ospf interface 1/1/1 1/1/2 Codes: DR - Designated router BDR - Backup Designated router Interface 1/1/1 is up, line protocol is up					• •	• • •	• • •	• •	•••							L	.ab	Gui	de				
192.168.2.2 n/a FUL 192.168.4.1 1/1/2 192.168.2.3 n/a FUL 192.168.4.3 1/1/2 SwitchA# sh ip opt interface 1/1/1 Codes: DR - Designated router BDR - Backup Designated router Interface 1/1/1 is up, line protocol is up 					•••	•••	•••	•••				De	plo	ying	9 OS	SPF\	/2 Fe	eatu	res				
192.168.2.2 n/a FUL 192.168.4.1 1/1/1 192.168.2.3 n/a FUL 192.168.4.3 1/1/2 SwitchA# sh ip opp interface 1/1/1 switchA# sh ip opp interface 1/1/1 1/1/2 Codes: DR - Designated router BDR - Backup Designated router Interface 1/1/1 is up, line protocol is up					• •	• • •	• •	• •	• • •	•													
192.168.2.2 n/a FULL 192.168.4.1 1/1/1 192.168.2.3 n/a FULL 192.168.4.3 1/1/2 SwitchA# sh ip ospf interface 1/1/1 Image: State interface 1/1/1 Image: State interface 1/1/1 Image: State interface 1/1/1 Codes: DR - Designated router BDR - Backup Designated router Image: State interface int	102 160 2 2	- 1 -	5111.1		•••	•••	•••	•••	•••														
192.168.2.3 n/a FUL 192.168.4.3 1/1/2 SwitchA# sh ip ospf interface 1/1/1 Codes: DR - Designated router BDR - Backup Designated router Interface 1/1/1 is up, line protocol is up 	192.168.2.2	n/a	FULL	192.168.4.1 1/1/1	•	•••	•••	••	•••														
192.168.2.3 n/a FUL 192.168.4.3 1/1/2 SwitchA# sh ip opf interface 1/1/1 SwitchA# sh ip opf interface 1/1/1 Image: SwitchA# sh ip opt outer Image: SwitchA# sh ip opt outer Codes: DR - Designated router BDR - Backup Designated router Image: SwitchA# sh ip opt outer Image: SwitchA# sh ip opt outer Interface 1/1/1 is up, line protocol is up							• • •	•••															
192.168.2.3 n/a FUL 192.168.4.3 1/1/2 SwitchA# sh ip optimerface 1/1/1 Codes: DR - Designated router BDR - Backup Designated router Interface 1/1/1 is up, line protocol is up					••	•••	•••	••	•••		•												
SwitchA# sh ip ospf interface 1/1/1 Codes: DR - Designated router BDR - Backup Designated router Interface 1/1/1 is up, line protocol is up 	192.168.2.3	n/a	FULL	192.168.4.3 1/1/2		• • •	• • •	•••	• • •														
SwitchA# sh ip ospf interface 1/1/1 Codes: DR - Designated router BDR - Backup Designated router Interface 1/1/1 is up, line protocol is up 					•••	•••	•••	•••	•••														
Codes: DR - Designated router BDR - Backup Designated router Interface 1/1/1 is up, line protocol is up	SwitchA# sh ip d	ospf int	erface 1/1/1		• •	• •	• • •	• •	• • •	•	•	•											
Codes: DK - Designated router BDK - Backup Designated router Interface 1/1/1 is up, line protocol is up					•••	•••	•••	•••	•••				•										
Interface 1/1/1 is up, line protocol is up	Codes: DR - Desi	Ignated	router BDR - Bac	kup Designated router	• •	• •	• • •	• •	• • •	•	•	•	• •										
Interface 1/1/1 is up, line protocol is up					•••	•••	•••	••	•••				•••	•									
Interface 1/1/1 is up, line protocol is up					• •	• •	• • •	• •		• • •	•	•	• •	• •	• •								
VRF : default Process : 1 IP Address : 192.168.4.0/31 Area : 0.0.0 Status : up Network Type : Point-to-point Hello Interval : 10 sec Dead Interval : 40 sec Transit Delay : 1 sec Retransmit Interval : 5 sec Authentication : SHA-256 Link Speed : 1000Mbps Cost Configured : NA Cost Calculated : 100 State/Type : Point-to-point : n/a	Interface 1/1/1	is up,	line protocol is	up	•••	•••	•••	•••	•••				•••	•••	•••	••••							
VRF : default Process : 1 IP Address : 192.168.4.0/31 Area : 0.0.0 Status : up Network Type : Point-to-point Hello Interval : 10 sec Dead Interval : 40 sec Transit Delay : 1 sec Retransmit Interval : 5 sec Authentication : SHA-256 Link Speed : 1000Mbps Cost Configured : NA Cost Calculated : 100 State/Type : Point-to-point Router Priority : n/a				\ • • • • • •	• •	• •	• • •	• •		• • •	•	•	• •	• •	• •	• •	• •						
VRF: defaultProcess: 1IP Address: 192.168.4.0/31Area: 0.0.0.0Status: upNetwork Type: Point-to-pointHello Interval: 10 secDead Interval: 40 secTransit Delay: 1 secRetransmit Interval: 5 secAuthentication: SHA-256Link Speed: 1000MbpsCost Configured: NaCost Calculated: 100State/Type: Point-to-pointRouter Priority: n/a					•••	•••	•••	•••	•••				•••	::	•••	•••	•••	•••					
VRF: defaultProcess: 1IP Address: 192.168.4.0/31Area: 0.0.0.0Status: upNetwork Type: Point-to-pointHello Interval: 10 secDead Interval: Point-to-pointTransit Delay: 1 secRetransmit Interval: 5 secAuthentication: SHA-256Link Speed: 100Cost Configured: NACost Calculated: 100State/Type: Point-to-point: n/a					• •	• •	• •	• •	• • •	• • •	•	•	• •	• •	• •	• •	• •	• •	• • •	• • •			
VRF: defaultProcess: 1IP Address: 192.168.4.0/31Area: 0.6.0.0Status: upNetwork Type: Point-to-pointHello Interval: 10 secDead Interval: 40 secTransit Delay: 1 secRetransmit Interval: 5 secAuthentication: SHA-256Link Speed: 1000MbpsCost Configured: NACost Calculated: 100State/Type: Point-to-pointRouter Priority: n/a				• • •	•••	•••	•••	•••	•••				•••	•••	•••	•••	•••	•••	•••		•••	•••	
IP Address: 192.168.4.0/31Area: 0.0.0.0Status: upNetwork Type: Point-to-pointHello Interval: 10 secDead Interval: 40 secTransit Delay: 1 secRetransmit Interval: 5 secAuthentication: SHA-256Link Speed: 1000MbpsCost Configured: NACost Calculated: 100State/Type: Point-to-pointRouter Priority: n/a		• dofau	1+	Process	•	• • •	• • •	• •	• • •	• • •	•	•	• •	• •	• •	• •	• •	• •	• • •	• • •	• •	• •	•
IP Address : 192.168.4.0/31 Area : 0.0.0.0 Status : up Network Type : Point-to-point Hello Interval : 10 sec Dead Interval : 40 sec Transit Delay : 1 sec Retransmit Interval : 5 sec Authentication : SHA-256 Link Speed : 1000Mbps Cost Configured : NA Cost Calculated : 100 State/Type : Point-to-point Router Priority : n/a	VIXI	. uerau	10	FIOCESS	•••		•••	•••	•••				•••	•••	•••	•••	•••	•••	•••	· • •	•••	•••	
Status : up Network Type : Point-to-point Hello Interval : 10 sec Dead Interval : 40 sec Transit Delay : 1 sec Retransmit Interval : 5 sec Authentication : SHA-256 Link Speed : 100Mbps Cost Configured : NA Cost Calculated : 100 State/Type : Point-to-point Router Priority : n/a	IP Address	: 192.1	68.4.0/31	Area	:	0.0	.0.	0	•••	•	•	•	• •	• •	• •	• •	• •	• •	• • •	• • •	• •	• •	•
Status : up Network Type : Point-to-point Hello Interval : 10 sec Dead Interval : 40 sec Transit Delay : 1 sec Retransmit Interval : 5 sec Authentication : SHA-256 Link Speed : 100Mbps Cost Configured : NA Cost Calculated : 100 State/Type : Point-to-point Router Priority : n/a							•••	•••	•••				•••			•••	•••	•••	•••		•••	•••	
Status : up Network Type : Point-to-point Hello Interval : 10 sec Dead Interval : 40 sec Transit Delay : 1 sec Retransmit Interval : 5 sec Authentication : SHA-256 Link Speed : 100Mbps Cost Configured : NA Cost Calculated : 100 State/Type : Point-to-point Router Priority : n/a							• • •	• •	• • •	•	•	•	• •	• •	• •	• •	••	• •	•••	• •	• •	• •	•
Status: upNetwork Type: Point-to-point.Hello Interval: 10 secDead Interval: 40 secTransit Delay: 1 secRetransmit Interval: 5 secAuthentication: SHA-256Link Speed: 1000MbpsCost Configured: NACost Calculated: 100State/Type: Point-to-pointRouter Priority: n/a													•••	•••	•••	•••	•••	•••	•••		•••	•••	
Hello Interval : 10 sec Dead Interval : 40 sec Transit Delay : 1 sec Retransmit Interval : 5 sec Authentication : SHA-256 Link Speed : 1000Mbps Cost Configured : NA Cost Calculated : 100 State/Type : Point-to-point Router Priority : n/a	Status	: up		Network Type	:	Poi	nt-	to-	poir	nt		•	••	•••	••	••	•••	••	• • •	• • •	••	•••	•
Hello Interval : 10 sec Dead Interval : 40 sec Transit Delay : 1 sec Retransmit Interval : 5 sec Authentication : SHA-256 Link Speed : 100Mbps Cost Configured : NA Cost Calculated : 100 State/Type : Point-to-point Router Priority : n/a											•	•	•••	•••	•••	•••	• •	•••	• • •	• •	•••	•••	•
Hello Interval: 10 secDead Interval: 40 secTransit Delay: 1 secRetransmit Interval: 5 secAuthentication: SHA-256Link Speed: 100MbpsCost Configured: NACost Calculated: 100State/Type: Point-to-pointRouter Priority: n/a													•••	::	•••	•••	::	•••	•••		•••	•••	•
Transit Delay: 1secRetransmit Interval: 5secAuthentication: SHA-256Link Speed: 1000MbpsCost Configured: NACost Calculated: 100State/Type: Point-to-pointRouter Priority: n/a	Hello Interval	: 10 s	ec	Dead Interval	:	40	se	с				•	• •	• •	• •	• •	• •	• •	• • •		• •	• •	•
Transit Delay: 1secRetransmit Interval: 5secAuthentication: SHA-256Link Speed: 1000MbpsCost Configured: NACost Calculated: 100State/Type: Point-to-pointRouter Priority: n/a													•	•	•••	•••	•••	•••	•••		•••	::	
Authentication : SHA-256Link Speed: 1000MbpsCost Configured : NACost Calculated: 100State/Type: Point-to-pointRouter Priority: n/a	Transit Delay	:1 s	ec	Retransmit Interval	. :	5	se	с								• •	• •	• •	• • •	• •	• •	• •	•
Authentication : SHA-256 Link Speed : 1000Mbps Cost Configured : NA Cost Calculated : 100 State/Type : Point-to-point Router Priority : n/a																	•••	•••	•••		•••	•••	
Cost Configured : NA Cost Calculated : 100 State/Type : Point-to-point Router Priority : n/a	Authentication	: SHA-2	<mark>56</mark>	Link Speed	:	100	ØMb	ps												-	• •	• •	•
State/Type : Point-to-point Router Priority : n/a	Cost Configured	: NA		Cost Calculated	:	100)																
	State/Type	: Point	-to-point	Router Priority	:	n/a	I																
DR : No BDR : No	DR	: No		BDR	:	No																	
Link LSAs : 0 Checksum Sum : 0	Link LSAs	: 0		Checksum Sum	:	0																	
BFD : Disabled	BFD	: Disab	led																				

Task 5.2 Authentication between Switch B & Switch C using the keychain

Using the keychain option is a more flexible way to manage key string passwords whereby a key string password can be changed in a central location on the switch.

Enter the following configuration on **Switch B** SwitchB(config)# keychain sha256 SwitchB(config-keychain)# key 1 SwitchB(config-keychain-key)# key-string plaintext aruba SwitchB(config-keychain-key)# cryptographic-algorithm hmac-sha-256 SwitchB(config-keychain-key)# exit SwitchB(config-keychain)# interface 1/1/2 SwitchB(config-if)# ip ospf authentication keychain

							Lab Guide Deploying OSPFv2 Features
SwitchB(config-i	f)# ip ospf k	eychain sha256					
Repeat the con	figuration o	on Switch C with in	terface 1/1/2				
And then run the	eʻsh ip osµ	of neighbor'&'s	sh ip ospf inte	rface x/x,	/x' co	ommands o	n either Switch B or Switch C.
			0 0 0 0 7 0 0 0 0 0 0		• • • • • • • • • •		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SwitchC# sh ip	ospf neight	oors	• • •		• • • •		
VRF : default		Proc	ess : 1				
Total Number of	Neighbors	: 3		• • • • • • • • • • • • • • • • • • •	••••		· · · · · · · · · · · · · · · · · · ·
Neighbor ID	Priority	State	Nbr Address	Interfa	ce	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
192.168.2.1	n/a	FULL	192.168.4.2	1/1/1			
192.168.2.2	n/a	FULL	192.168.4.4	1/1/2			
192.168.2.4	n/a	FULL	192.168.4.11	1/1/3			
Switchu# Sh ip	ignated not	ace 1/1/2	Decignated neutro				
Coues. DK - Des	ignated Pot	iter bok - backup	Designated Poure	:1-			
Interface 1/1/2	! is up, lir	ne protocol is up					
VRF	: default		Process	:	: 1		
IP Address	: 192.168.	4.5/31	Area		: 0.0	.0.0	
Status	: up		Network Ty	vpe	: Poi	nt-to-point	:
Hello Interval	: 10 sec		Dead Inter	val	: 40	sec	
Transit Delay	:1 sec		Retransmit	: Interval	: 5	sec	
Authentication	: Keychair	<mark>sha256</mark>	Link Speed	1 :	: 100	0Mbps	
Cost Configured	I:NA		Cost Calcu	lated	: 100		
State/Type	: Point-to	o-point	Router Pri	ority	: n/a		
DR	: No		BDR		: No		
Link LSAs	: 0		Checksum S	Sum	: 0		
BFD	: Disabled	1					

	Lab Guide Deploying OSPFv2 Features
Task 5.3 Authentication between Switch interface authentication commands	C and Switch A using Keychain and
The keychain configuration can be used at one end of the link and the other end of the link to form an ospf neighbor adjacency using encry	he interface authentication commands can be used at the /pted password authentication.
In this example, Switch C will use the keychain configuration and Sv	witch A will use authentication configuration on the interface.
Enter the following configuration on Switch A	
SwitchA(config)# interface 1/1/2	
SwitchA(config-if)# ip ospf authentication hmac-sha-256	5
SwitchA(config-if)# ip ospf sha-key 1 sha plaintext aru	ıba
Enter the following configuration on Switch C	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SwitchC(config)# interface 1/1/1	
SwitchC(config-if)# ip ospf authentication keychain	
SwitchC(config-if)# ip ospf keychain sha256	

And then run the 'sh ip ospf neighbor' & 'sh ip ospf interface x/x/x' commands on either Switch A or Switch C.

SwitchC# sh ip ospf neighbors

VRF	:	de	efa	aul	lt												Pr	0	ce	es	s	:	1	
						==	==	:=:	 ==	 ==	==	 ==	 ==	 ==	-=	==	 	=	==		==	==	-=:	=

Total Number of Neighbors : 3

Neighbor ID	Priority	State	Nbr Address	Interface
192.168.2.1	n/a	FULL	192.168.4.2	1/1/1
192.168.2.2	n/a	FULL	192.168.4.4	1/1/2
192.168.2.4	n/a	FULL	192.168.4.11	1/1/3

SwitchC# sh ip ospf interface 1/1/2

Codes: DR - Designated router BDR - Backup Designated router

			٠	•	• •	• •	•	•	•	•								La	ab	Gu	ide	•				
		· · · · · · · · · · · · · · ·			•••							C)ep	loy	ring	0	SP	Fv:	2 F	eat	ure	3				
		· · · · · · · · · · · · · · · · · · ·	•	•	• •	• •	•	•	•	•																
		••••••	•	•	• •	• •	•	•	•	•																
Interface 1/1/2	is up, line protocol is up			•	•••	•				•																
1	10 ap; 11.e proceed1 10 ap																									
			•	•	• •	• •		•	•	• •																
			٠	•	• •	• •	•	•	•	• •	•															
		• • • • • • • • • • •	•	•	• •	• •	•	•	•	• •	•															
VRF	: default	Process	:	1																						
			•	•	• •	• •	•	•	•	• •	•	• •	•													
IP Address	: 192.168.4.5/31	Area	•	0.	.0.	0.0	0	•	•	• •	•	• •	•	6												
	· · · · · · · · · · · · · · · · · · ·		•	•						•	•	•		•												
																è ,										
Chatura			•		• •			•		•	•	• •	•	• •	•	•	• •									
Status	: up	Network Type	۲	PC	5 10	ιτ-7	το	-po	in	C, (•	• •	•	• •	•	•	• •	•								
			•		•••	•				•		•		•		•	••	•	•••							
			1			11														11						
																			• •				• •			
Hello Interval	: 10 sec	Dead Interval ••••	•	40	9 •	se	c 🔹	•	•	• •	•	• •	•	• •	•	•	• •	•	• •	• •	•		• •	• •	• •	
		• • •	٠	•	• •	• •	•	•	•	• •	•	• •	•	•	•	•	• •	•	• •	• •	•		• •	• •	• •	•
Transit Delav	: 1 sec	Retransmit Interval	-	5		sed	c .												•••				•••			
Authontication	· Kovchain sha256	Link Spood	•	10	200	Mh	nc	•	•	• •	•	• •	•	•		•		•	• •	• •	•		• •	• •	• •	•
AUTHEITTICATION	. Reychain Shazoo	LINK Speed	•	Te	000	וטויוע	ps	• •	•	• •	•	• •	•	• •	•	• •	• •	•	• •	• •	•		• •	• •	• •	•
					•••	•				•	•	•		•		•	•	•	•••	•	•		•••	• •	•	•
Cost Configured	: NA	Cost Calculated	:	16	90																					
State/Type	: Point-to-point	Router Priority	:	n/	/a			•	•	• •	•	• •	•	• •	•	•	• •	•	• •	• •	•		• •	• •	• •	
									•	• •	•	• •	•	• •	•	•	• •	•	• •	• •	•		• •	• •	• •	•
DR	: No	BDR	:	No	С				•	• •	•	•	•	•	•	•	•	•	•••	• •	•	•	• •	• •	• •	•
link ISAc	• 0	Checksum Sum		a																						
LINK LOAG	. 0		·	0										• •	•	•	• •	•	• •	• •	•		• •	• •	• •	•
DED	Disabled														•	•	• •	•	• •	• •	•	•	• •	• •	• •	•
DFU	. DISADIEU																•		•••				•••	•••		

Task 5.4 Authentication with virtual-link configuration

Authentication is also available over the virtual link(s) either using the key chain configuration method or providing the authentication configuration directly within the virtual link configuration as if configuring a physical interface.

In this example, the authentication configuration is configured directly within the virtual link configuration on both Switch C and Switch D.

: 1

: No

: 40

Run the following command on either Switch D or Switch to confirm the current authentication status of the virtual-link

SwitchD# sh ip ospf virtual-links

Virtual link to router 192.168.2.3 is up -----

VRF	: default	Process	: 1
Transit Area	: 0.0.0.1	Authentication	: N
Hello Interval	: 10	Dead Interval	: 4
Transit Delay	: 1	Retransmit Interval	: 5
Number of Link LSAs	: 0	Checksum Sum	: 0

Enter the following configuration on Switch D

	5 0 0 5 0 0 7 0 0 1 0 0	0 0	• • • • • •	• •		• •		Depl	oying	OSF	La PFv2	b Gι Feat	uide ures				
SwitchD(config)# rou	ter ospf 1	0 0	•••	•••		•••	•										
SwitchD(config-ospf-	1)# area 0.0.0.1 virtual-link 192.	168.2.3	•••	•		•••	•										
SwitchD(config-route	<pre>^-vlink)# authentication hmac-sha-</pre>	256	•••	•••	•••	•••	•••										
SwitchD(config-route	∽-vlink)# sha-key 1 sha plaintext	aruba	• • • • • • • •			• • • • • •											
Repeat the configuration	on on Switch C	, 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	•••	•••		•••	•••		• • (• • •								
SwitchC(config)# rou	ter ospf 1	· • • • • • • • • • • • • • • • • • • •	•••	•••		•••					•						
SwitchC(config-ospf-	1)# area 0.0.0.1 virtual-link 192.	168.2.4	•••	•••	•••	•••	•••	• • •	•••	•••	•••	• • •					
SwitchC(config-route	<pre>r-vlink)# authentication hmac-sha-</pre>	256	•••	•••		•••								•••	•••	•••	•
SwitchC(config-route	∩-vlink)# sha-key 1 sha plaintext	aruba	• • • • • •			• • • • • • • •										• • • • • •	
On Switch C & D, run	he following command to confirm the	new authentication sta	atus	s of	the	virt	ual li	nk		•••		•••		• • •	•••	•••	•
SwitchC# sh ip ospf	virtual-links			•	•••	•••	• • •			•••		• • •		• • •	•••	•••	•
Virtual link to routo	er 192.168.2.4 is up					•••										 • •<	
VRF	: default	Process	:	1									• •	• • •	•••	•••	•
Transit Area	: 0.0.0.1	Authentication	:	sh	<mark>a256</mark>	5											
Hello Interval	: 10	Dead Interval	:	40													
Transit Delay	: 1	Retransmit Interval	:	5													
Number of Link LSAs	: 0	Checksum Sum	:	0													

Number of State Changes : 10

The following attributes are required when configuring authentication to ensure a successful neighbor adjacency. This applies to the commands if applied directly under an interface or using the keychain or in a combination at either end of the link.

- 1. The authenticating algorithm must match at either end of the link, as in 'hmac-sha-256' for example.
- 2. The key number must match at either end of the link, as in 'sha-key **1**' under interface or 'key **1**' if using the key chain.
- 3. The authentication password match at either end of the link , as in 'ip opsf sha-key 1 sha plaintext aruba' under interface or 'key-string plaintext aruba' if using the key chain for example.

End of Task 5

Task 6 Passive interface	Lab Guide Deploying OSPFv2 Features
Passive interface	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
The use of the passive interface for OSPF tells the inter to deploy a passive ospf interface, either in the ospf glob	face to disable route processing for that interface. There are two methods bal context:-
Global OSPF context example	
SwitchA(config)# router ospf 1	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
<pre>SwitchA(config-ospf-1)# passive interface default</pre>	
And disabled on a per interface as a desired:-	
SwitchA(config)# interface 1/1/2	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
<pre>SwitchA(config-if)# no ip ospf passive</pre>	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
The option to use the default global setting (no passive interfaces as 'passive' as desired . This is the method the	re interface default) and the interface command to set specific nat will be used in task 6.1

Task 6.1 Passive Interface

The passive interface can be enabled on a per interface as desired.

On Switch A display ospf neighbors

SwitchA# sh ip ospf neighbors

VRF : default Process : 1

Total Number of Neighbors : 2

Neighbor ID	Priority	State	Nbr Address	Interface
192.168.2.2	n/a	FULL	192.168.4.1	1/1/1
192.168.2.3	n/a	FULL	192.168.4.3	1/1/2

On Switch A enter the no ip ospf passive command under interface 1/1/1 SwitchA(config)# interface 1/1/1

	Lab Guide Deploying OSPFv2 Features
SwitchA(config-if)# ip ospf passive	
Repeat the sh ip ospf neighbor command on Switc	ch A.
Switch A will no longer have an ospf neighbor on interfathat interface.	ace 1/1/1 to neighbor 192.168.2.2. All routing processes will be disable on
Remove the ip ospf passive command on interface 1/1/	/1
SwitchA(config)# interface 1/1/1	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SwitchA(config-if)# no ip ospf passive	
The neighbor adjacency will be formed for neighbor 19	2.168.2.2 on interface 1/1/1
	End of Task 6



TASK 7 Default-information originate

The default-information originate configures ospf to advertis	e the defau	lt rou	te (0.0.	0.0/	0) 1	to its	s ne	eigh	bor	's. 1	her	e a	re t	wo					
options:-			• • •	• •		•	• • •	•	• •		•									
				•••																
default-information originate				• •		•	• •	•				•								
		•••		• • •	•••	•		•												
SwitchA# conf t	• • • •			•••		•		•				• • •		•						
	N • • •			• • •	• • •	•	• • •	•	• • •	• • •	• • •	• • •	• • •		•					
SwitchA(config)# router ospf 1	• • •			• •	•••	•	•••	•	• • •	• • •	• • •	• •	• • •	• • •	•					
Cuitaba/ang Cia ang City da Cault in Commetian anisinata																				
SwitchA(config-ospf-i)# default-information originate																				
This option will advertise the default route $(0, 0, 0, 0, 0)$ if presi	ent in the ro	uter		•••	•••	•	•••	•			•	•	•		•	•••		•••	•••	• • •
		utor																		
												• •							• •	
						• •													• •	
default-information originate always						• •	• • •	• •	• • •	• • •	• • •	• •	• • •		• •	• • •	• • •		• •	• • •
					• •	• •	• • •	•	• • •	• • •	• • •	• •	• • •			• • •	• • •	• • •	• •	• • •
						•	•••	•				• •	• • •		•	• • •	• • •	• • •	• •	• • •
SwitchA# cont t																			•••	• • •
SwitchA(config)# router ospf 1																				
Suitch/(config conf 1)# default information eniginate	-1																			
SwitchA(config-ospi-i)# derauit-information offginate	aiways										• • •	• •	• • •		• •		• • •		• •	
												•	• •		• •	• • •	• • •	• • •	• •	• • •
This option will advertise the default route (0.0.0.0/0) regard	less if the ro	oute i	s p	rese	ent i	n th	ne ro	oute	er					• • •	• •	• • •	• • •	• • •	• •	• • •
																• • •	• • •	• • •	• •	• • •

Task 7.1 'default-Information originate always' command

In this task, the default originate always configuration will be configured on Switch A. The route table will be observed to see how the default route propagates through out the network.

On Switch A, configure the default-information originate always command under the ospf 1 context.

SwitchA# conf t

SwitchA(config)# router ospf 1

SwitchA(config-ospf-1)# default-information originate always

On the remaining switches B,C,D & E, run the sh ip ospf route command

Extract from Switch B & C route table

Switch B

```
0.0.0/0 (E2)
```

via 192.168.4.0 interface 1/1/1, cost 25 distance 110

Switch C

0.0.0/0 (E2)

via 192.168.4.2 interface 1/1/1, cost 25 distance 110

All switches will now receive the default route of 0.0.0.0/0 generated by Switch A.

	Lab Guide
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) • •	
Task 7.2 'default-information origina	ate' command
On Switch A, replace the default-information origina	te always config and add the default-information originate
command	
	• • • • • • • • • • • • • • • • • • • •
SuitchA(config)# nouton conf 1	\
SwitchA(config)# Pouler Ospr 1	\circ
SwitchA(config-ospf-1)# no default-information origina	ate always
<pre>SwitchA(config-ospf-1)# default-information originate</pre>	
	· · · · · · · · · · · · · · · · · · ·
On the remaining switches ${\sf B}, {\sf C}, {\sf D}$ & ${\sf E},$ run the sh ${\rm \ ip \ ospf}$	route command
All remaining switches no longer have the default route of 0	0.0.0.0/0 in the routing table as Switch A does not have the default
route in the route table.	
The next step is to add a default route to the routing table to	o get Switch A to re-advertise the default route . There is not an
appropriate interface to use for default routes as it is an isol	lated lab, so the interface on Switch B 192.168.4.1 is selected to

illustrate the default route re-advertisement On Switch A , enter the following command

SwitchA(config)# ip route 0.0.0.0/0 192.168.4.1

This is identifying interface 192.168.4.1 (on Switch B) as the default route from Switch A for all unknown ip routes. Switch A will re-advertise the default static route into ospd.

On the remaining switches, run the ship ospf route command and note the default advertisement and the interface that it is being advertised from.

Switch B

0.0.0.0/0

via 192.168.4.0 interface 1/1/1, cost 1 distance 110

Switch C

SwitchA(config)# ip route 0.0.0.0/0 192.168.4.1

(E2)

Switch D

0.0.0/0 (E2)

via 192.168.4.10 interface 1/1/1, cost 1 distance 110

Switch E

Lab Guide Deploying OSPFv2 Features 0.0.0.0/0 (E2) via 192.168.4.12 interface 1/1/1, cost 1 distance 110 End of Task 7 TASK 8 —show commands

In this section there is a summary of some of the more common ospf commands that can be used. There are multiple options on some commands, which can be highlighted using the '?' as in:-

SwitchC# sh ip ospf ?

[<1-63>]	Specify the OSPF Process ID						• •	• •	• • •	• •	• •	• •	• •	• •	• •	• •	• •	•
		• •	•••	• • •	• • •	• • •	• •	• •	• • •	•••	• •	• •	• •	• •	• •	• •	• •	•
all-vrfs	All VRES				•••		•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	•••	
border-routers	Display USPF border router information																	
							• •	• •				• •	• •	• •	• •	• •	• •	•
interface	Display OSPF interface information					• •	• •	• •		• •		• •	• •	• •	• •	• •	• •	•
							• •	• •	• • •	• •	• •	• •	• •	• •	• •	• •	• •	•
lcdb	Dicplay OSDE link state database information							• •	• • •	••	•••	• •	• •	• •	• •	• •	• •	•
ISUD	Dispidy USPF link state uatabase information								•••	•••	•••	• •	•••	•••	•••	•••	•••	
neighbors	Display OSPF neighbor information																	
routes	Display OSPE routing table																	
	Display OCDE statistics																	
statistics	Display USPF Statistics																	
virtual-links	Display OSPF virtual links information																	

vrf VRF Instance.

<cr>

A snapshot of the key command cli string is provided as examples.

sh ip ospf border-routers

Displays the OSPF routing table entries for Area Border Router (ABR) and Autonomous System Border Router (ASBR).

Swito VRF : Inter	chA# sh ip ospf bc default rnal Routing Table					
Codes	s: i - Intra-area	route,	I - In	ter-area route		
	Router-ID Interface	Cost	Туре	Area	SPF	Nexthop
i	192.168.2.3	100	ABR	0.0.0.0	83	192.168.4.3
i	1/1/2 192.168.2.4 1/1/2	200	ABR	0.0.0.0	83	192.168.4.3

sh ip ospf

Displays general OSPF, area, state, and configuration information.

SwitchC# sh ip ospf	
VRF : default	Process : 1

				Lab Guide
				Deploying OSPFv2 Features
RouterID :	192.168.2.3	0SPFv2	: Enabled	
BFD :	Disabled	SPF Start Interval	: 200 ms	• •
SPF Hold Interval :	1000 ms	SPF Max Wait Interv	al : 5000 ms	
LSA Start Time :	5000 ms	LSA Hold Time	: 0 ms	
LSA Max Wait lime :	0 ms	LSA Arrival	: 1000 ms	
EXTERNAL LSAS :	0	Reference Bandwidth	: 0 : 100000 Mbps	• • • • •
Area Border	4 true	AS Border	· false	
GR Status :	Enabled	GR Interval	: 120	
GR State :	inactive	GR Exit Status	: none	
GR Helper :	Disabled	GR Strict LSA Check	: Disabled	
GR Ignore Lost I/F :	Disabled		· • • • • • • • • • • • • • • • • • • •	· · · · · · · · · · · · · · · · · · ·
Summary address:				0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Area Total	Active		· · · · · · · · · · · · · · · · · · ·	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 Nonmol 2	 2		· · · · · · · · · · · · · · · · · · ·	• •
Stub 0	2		• • • • • • • • • • • • •	• • • • • • • • • • • • • • • • • • • •
NSSA 0	0			• • • • • • • • • • • • • • • • • • •
	·		• • • • • • • • • •	
Area : 0.0.0.0			· · · · · · · · · · · · · · · · · · ·	• •
			• • • • • •	
Area Type	: Normal	Status	: Active	
Total Interfaces	: 3	Active Interfaces	: 3	
Passive Interfaces	: 0	Loopback Interfaces	: 1	• •
SPF Calculation Coun	t : 96			• • • • • • • • • • • • • • • • • • • •
Area ranges : Number of ISAs	٠q	Checksum Sum	· 279017	` 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Area • 0.0.0.1			. 275047	
Area Type	: Normal	Status	: Active	* • • • • • • • • • • • • • • • • • • •
Total Interfaces	: 1	Active Interfaces	: 1	
Passive Interfaces	: 0	Loopback Interfaces	: 0	
SPF Calculation Coun	t : 96			
Area ranges :				
Number of LSAs	: 9	Checksum Sum	: 279047	
Area : 0.0.0.1				
Area Tyne	• Normal	Status	· Active	
Total Interfaces	• 1	Active Interfaces	• 1	
Passive Interfaces	: 0	Loopback Interfaces	: 0	
SPF Calculation Coun	t : 96			
Area ranges :				
ip-prefix 10.10.	10.200/32, inter	-area, advertise		
ip-prefix 10.10.	20.200/32, inter	-area, advertise		
Number of LSAs	: 19	Checksum Sum	: 571478	
sh ip ospf interfa	ce x/x/x			
SwitchC# sh ip ospf Codes: DR - Designat	interface 1/1/1 ed router BDR -	Backup Designated router	,	
Interface 1/1/1 is u	p, line protocol	is up		
VRF : de IP Address : 19	fault 2.168.4.3/31	Process Area	: 1 : 0.0.0.0	

Status: upHello Interval: 10 secTransit Delay: 1 secAuthentication: Keychain sha256Cost Configured: NAState/Type: Point-to-pointDR: NoLink LSAs: 0BFD: Disabled

sh ip ospf routes

Displays OSPF routing table information.

SwitchC# sh ip ospf routes Codes: i - Intra-area route, I - Inter-area route E1 - External type-1, E2 - External type-2

OSPF Process ID 1 VRF default, Routing Table

Total Number of Routes : 10

192.168.2.1/32 (i) area: 0.0.0.0
via 192.168.4.2 interface 1/1/1, cost 100 distance 110
192.168.2.1/32 (i) area: 0.0.0.0
via 192.168.4.11 interface 1/1/3, cost 100 distance 110
192.168.2.2/32 (i) area: 0.0.0.0
via 192.168.4.4 interface 1/1/2, cost 100 distance 110
192.168.2.5/32 (I)
via 192.168.4.11 interface 1/1/3, cost 200 distance 110
192.168.4.0/31 (i) area: 0.0.0.0
via 192.168.4.2 interface 1/1/1, cost 200 distance 110
192.168.4.0/31 (i) area: 0.0.0.0
via 192.168.4.4 interface 1/1/2, cost 200 distance 110
192.168.4.2/31 (i) area: 0.0.0.0
directly attached to interface 1/1/1, cost 100 distance 110
192.168.4.4/31 (i) area: 0.0.0.0
MORE, next page: Space, next line: Enter, quit: q

sh ip ospf statistics

SwitchC# sh ip ospf statistics OSPF Process ID 1 VRF default, Statistics (cleared 3 days 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 : 0 Bad Source IP Drops Resource Failure Drops : 0 Bad Header Length Drops : 0 Total Drops : 0

sh ip ospf virtual-links

SwitchC# sh ip ospf virtual-links Virtual link to router 192.168.2.4 is up

VRF : default Transit Area : 0.0.0.1 Hello Interval : 10 Transit Delay : 1 Number of Link LSAs : 0 Number of State Changes : 10

Process	: 1
Authentication	: sha256
Dead Interval	: 40
Retransmit Interval	: 5
Checksum Sum	: 0

Network Type:Point-to-pointDead Interval:40secRetransmit Interval:5sec

Link Speed : 1000Mbps Cost Calculated : 100 Router Priority : n/a

Checksum Sum : 0

sh ip ospf ne SwitchC# sh ip VRF : default	e ighbors ospf neight	oors	Process : 1							Deplo	oying	OSP	Lab Fv2 F	Gui Featu	de res			
Total Number o	f Neighbors	: 3				•••												
Neighbor ID	Priority	State	Nbr Address	Interfa	ce	•••	• • •	• • •	•••	• •								
192.168.2.1	n/a	FULL	192.168.4.2	1/1/1		•••												
192.168.2.2	n/a	FULL	192.168.4.4	1/1/2		•••	•••	•••				• . • • .						
192.168.2.4	n/a	FULL	192.168.4.11	1/1/3		•••	•••	•••				•••	•					
						•••		• • •	•••				• • •		•••	• -		
			End of Tas	k 8 and Lab								0 0 0 0					 • •<	0 0 0 0 0 0



	Lab Guide Deploying OSPFv2 Features
Appendix – Complete Configurat	ions
	· 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Switch A	
SwitchA# sh runn	
Current configuration:	
I	
Version ArubaOS-CX Virtual.10.07.0004	
!export-password: default	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
hostname SwitchA	
user admin group administrators password cipherte	xt AQBapUIjq5yzV2PXlvinBNH3jHolHScphhas
TIqFhY98FUJiYgAAAPSjj/wY2BG5dUHQLQ4BA/40bY5dAJgSz	MudwESxaqHTfW7NK17bl1HRW2PrjBNNkpWRax5P
0RtODX5Uj6lZZy6SJBypBXn2uGsKIItI9no7wgzDp5+PMHBZR	1z68Y7FUZMU
led locator on	
ntp server pool.ntp.org minpoll 4 maxpoll 4 iburs	t
ntp enable	
!	
ssh server vrf mgmt	
vlan 1	
interface mgmt	
no shutdown	
ip dhcp	
interface 1/1/1	
no shutdown	
ip address 192.168.4.0/31	
ip ospf 1 area 0.0.0.0	
ip ospf network point-to-point	
ip ospf authentication hmac-sha-256	
ip ospf sha-key 1 sha ciphertext AQBapUbZyuMy	DkoDN0zeQb18qY0p5vpa77xnpPQEngEkpWjWBQA
AAIouj70C	
interface 1/1/2	
no shutdown	
ip address 192.168.4.2/31	
ip ospf 1 area 0.0.0.0	
ip ospf network point-to-point	

<pre>pepying OSPFiz Feaures i p ospf authentication hmac-sha-256 ip ospf ab-key 1 sha ciphertext AQBapubZyuHybko0002eQb18qY0pSypa77xmpPQEngEKpHjH000A AATouj70C interface 10/1/3 no shutdown interface 10ophack 8 ip address 192.168.2.1/32 ip ospf 1 area 8.0.8.0 ip route 8.0.8.0/8 192.168.4.1 i router ospf 1 router-id 192.168.2.1 default-information originate area 8.0.8.0 Switch B S</pre>		
<pre> p ospf authentication hmac-sha-256 p ospf sha-key 1 sha ciphertext AQ8apUbZyuWyDkODW02cQb180Y0p5vpa77xmpPCEngEkpWJW90A AXUUJ70C interface 1/1/3 no shutdom interface loopback 0 ip address 192.168.2.1/32 ip ospf 1 area 0.0.0 ip address 192.168.2.1/32 ip ospf 1 area 0.0.0 ip route 0.0.0.0/0 102.168.4.1 router ospf 1 router ospf 1 router -id 192.168.2.1 default-information originate area 0.0.0.0 Switch B Switch B</pre>		Deploying OSPFv2 Features
<pre>ip opp authentication hmac-sha-2.96 ip opp sha-key 1 sha ciphertext AQBapUbZyuMyOkoDM0zeQb18gY9p5vpa77xmpPQEngEkpHjM8QA AATouj70C interface loopback 0 ip address 192.168.2.1/32 ip opf 1 area 0.0.00 ip outer 0.0.0.0/0 192.168.4.1 i router 0.0.0.0/0 192.168.4.1 i router ospf 1 router 0.0.0.0/0 192.168.2.1/ default-information originate area 0.0.0.0 Switch B SwitchBW sh runn Current configuration: i Version ArubaOS-CX Virtual.10.07.0004 Iseport-password: default hostname SwitchB user admin group administrators password ciphertext AQBapUBDw0DuaTZ0QXmQ16nMCTgg+4923F hetRMnawijfYgAAP0EBAJbehQEANDHEPQD64JUvBnIdPpXIVhuY17n1bdaathHR2dDyGEMe/wQp+qt403ms ITeXZnUSZ7xgHCamukS1ISZ/ykQAdMmPR7ayUBBSquMuUEPMgKSxqb4MD Ied loator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyOkoDM0zeQb18qYpp5vpa77xnpPQEngEkpHjMBQAAIouj7 of</pre>		
<pre>ip ospf sha-key 1 sha ciphertext AQBapUbZyuMyDkoDNB2eQbtBaY9pSypa77xnpPQEngEkpMyBMQA AXGuiyToC interface 1/1/3 no shutdow interface 10opback 0 ip oute 0.8.8.0/0 192.168.2.1/32 ip ospf 1 area 0.8.0/0 192.168.4.1 router 0.8.8.0/0 192.168.4.1 router-id 192.168.2.1 default-information originate area 0.8.8.0 Switch B SwitchBf sh runn Current configuration: ! ! Version ArubaQS-CX Virtual.18.07.8004 !ksyot-password: default hostname SwitchB user admin group administrators password ciphertext AQBapUBDxADUaT20XmQEGNMCTgg++q921F he1BMAnawif*YQAAAP0EBADbehQEaM9HFp0064JUovMIndPpXIVHuY17n1bdeathHzdDyGEwc/wnQp+eyt40JmS ILeXZmUSZq7xgHRCamukS1ISZ/yNQAdMmR7ayUBBSqWmuEPeNgKSxqb4H0 led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN0zeQbIBqY0pSypa7xnpPQEngEkpWjMBQAAIouj7 oc</pre>	ip ospf authentication hmac-sha-256	
AAlouj70C interface 1/1/3 no shutdoon interface 1/0/2/AC ip obtek 0 ip address 192.168.2.1/32 ip ospf 1 area 0.0.0 ip route 0.0.0 /0 192.168.2.1 if router 0.0 /0 192.168.2.1 default-information originate area 0.0.0 /0 Switch B Switch B Switch B Switch B Switch Sh run Current configuration: I Version Aruba05-CX Virtual.10.07.0004 lexport-password: default hostnawe Switch B user admin group administrators password ciphertext AQBapdUBbu0DuaT2QQxmQI6mKTgg++q92JF hetBNAmaud; YVQAADA0EBA1behQEabDHFpODe41UovBnIEPpXiVLvY17tbdeathUH2dDy6EWe/wnQp+eyt40JmS TICXZDx27XgHRCamuxS15Z/YVQAAMERR7ayUBSQs4mUEPeNgKSxqb4MD led locator on Key-string ciphertext AQBapUbZyuMyOkoDN02eQbIBqtV0PSvpa7xnpPQEngEkpKjMBQAAAIouj7 OC	ip ospf sha-key 1 sha ciphertext AQBapUbZy	uMyDkoDN0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQA
<pre>interface 1/1/3 no shutdown interface loopback 0 jp address 192.168.2.1/32 jp ospf 1 area 0.0.0 jp route 0.0.0.0/0 192.168.4.1 router ospf 1 router.id 192.168.2.1/ default-information originate area 0.0.0.0 Switch B Switch B</pre>	AAIouj70C	
<pre>n o shutdown interface loopback 0 ip ddress 192.168.2.1/32 ip ospf 1 area 0.0.0 fp route 0.0.0.0/0 192.168.4.1 i router ospf 1 router ospf 1 router ospf 1 router.id 192.168.2.1 default-information originate area 0.0.0 Switch B SwitchB SwitchB SwitchB SwitchB Lurrent configuration: l Version Aruba05-CX Virtual.10.07.0004 Lexport-password: default hostname SwitchB user admin group administrators password ciphertext AQ8apdU8Dw0DuaT2QQxmQT6nMCTgg+cq92JF helRMnawidfYQAAAPEEAJbehQEAIVHFpOD064JUvNuT17n1bdeathUHZdDy6EWe/wnQp+eyt40JmS TlexZnUS:q7xgHRCamuks1ISZ/yWQAdMmPFayU88squkInuEPeNgKSxqb4ND Led locator on keychain sha256 key 1 key-string ciphertext AQ8apUbZyuMy0ko0N02cq0EJ8qY0pSvpa77xnpPQEngEkpMjMBQAAILouj7 OC</pre>	interface 1/1/3	
<pre>interface loopback 0 ip address 192.168.2.1/32 ip ospf 1 area 0.0.0 ip route 0.0.0/01 192.168.4.1 router ospf 1 router ospf 1 router-id 192.168.2.1 default-information originate area 0.0.0 Switch B SwitchB# sh runn Current configuration: ! Version Aruba0S-CX Virtual.18.07.0004 Lexport-password: default hostname SwitchB user admin group administrators password ciphertext AQ0apdU0B/wD0ua120QXmQ16nWCTgg++q921F hel8NAnawijfvgAAAP0EBA1behQEaM9HFpOOG4JUovBnIdPxXIVHuV17ntbdeathUHzddydEWe/wnQr+eyt403mS TLexZnVJSQ7xgHKCamukS1ISZ/yk0AdMmPR7ayU8BSqwMnuEPeNgKSxqb4MD Led locator on keychain sha256 key 1 key-string ciphertext AQ0apUbZyuMy0koDN02eQ018qY0Ppsya77xnpPQEngEkpHylWBQAAAIouj7 OC</pre>	no shutdown	
<pre>ip address 192.168.2.1/32 ip ospf 1 area 0.0.0 ip route 0.0.0/0 192.168.4.1 ! router ospf 1 router.id 192.168.2.1 default-information originate area 0.0.0 Switch B SwitchB# sh runn Current configuration: ! Version Aruba05-CX Virtual.10.07.0004 lexport-password: default hostname SwitchB user admin group administrators password ciphertext AQBapdU8DwDDuaT2QQXmQ16nMCTgg+tq92JF hetRNAnaw4jfVgAAAP0EBAJbehQEaN9HFpOD64JUovBnIdPpXiVHuV17n1bdeathUH2dDyEWe/wnQp+eyt40Jms IItaXZnUScq7ygHRCamuksIISZ/yWQAdwmPR7ayU8BSqwWnuEPeNgKSxqA4ND led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN0#2cQDIBqT0#5ypa77xnpPQEngEkpMjW8QAAAIouj7 oc</pre>	interface loopback 0	
<pre>ip ospf 1 area 0.0.0 ip route 0.0.0.0/0 192.168.4.1 ; router ospf 1 router ospf 1 router-id 192.168.2.1 default-information originate area 0.0.0.0 Switch B SwitchB SwitchB sh runn Current configuration: ; ! Version ArubaOS-CX Virtual.10.07.0004 Lexport-password: default hostname SwitchB user admin group administrators password ciphertext AQBapdUBDw0DuaT2QQXmQ16nKCTgg++q9z3F he1RNAnaw4jfYgAAAP0EBAJbehQEaM9HFp0D64JUovBn1dPpXiVHuv17n1bdeathUHZdDy6EWe/wmQp+eyt40JmS 11eXZnUSzQ7xgHRCamuKs1ISZ/yWQAdMmPR7ayUB8SqwMnuEPeNgK5xqb4ND led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN0zeQEbIBqY0pSvpa77xnpPQEngEkpWjWBQAAAIouj7 OC</pre>	ip address 192.168.2.1/32	
<pre>ip route 0.0.0/0 192.168.4.1 ! router ospf 1 router ospf 1 router.id 192.168.2.1 default-information originate area 0.0.0 Switch B SwitchB# sh runn Current configuration: ! Version Aruba0S-CX Virtual.10.07.0004 lexport-password: default hostname SwitchB user admin group administrators password ciphertext AQBapdUBDwDDuaT20QXmQI6nMCTgg+tq92JF heiRNAnaw4jfYgAAAP0EBAJbehQEaN9HFpDD64JUovBnIdPpXiVHuv17n1bdeathUH2dDy6EWe/wnQp+eyt40JmS IteXZnUSzQ7xgHRCamuKs1ISZ/yWQAdWmPR7ayUB8SqwWnuEPeNgKSxqb4ND led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN02eQbI8qY0p5vpa77xnpPQEngEkpWjWBQAAAIouj7 OC</pre>	ip ospf 1 area 0.0.0.0	
<pre>! router espf 1 router.id 192.168.2.1 default-information originate area 0.0.0.0 Switch B SwitchBs sh runn Current configuration: ! Version ArubaOS-CX Virtual.10.07.0004 lexport-password: default hostname SwitchB user admin group administrators password ciphertext AQBapdU8DwDDuaT2QQXmQI6nMCTgg++q92JF helRNAnawdjfYgAAAP0EBAJbehQEAJbehQEAJBuVEPNgXiVHuY17n1bdeathUHZdDyGEWe/wnQp+eyt40JmS IlexZnUS2Q7xgHRCamuKsIISZ/yWQAdWmPR7ayU88SqwWnuEPeNgK5xqb4ND led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN0azeQbI8qY@pSvpa77xnpPQEngEkpWjWBQAAAIouj7 oc</pre>	ip route 0.0.0.0/0 192.168.4.1	
router ospf 1 router-id 192.168.2.1 default-information originate area 0.0.0 Switch B SwitchB# sh runn Current configuration: ! Iversion ArubaOS-CX Virtual.10.07.0004 !export-password: default hostname SwitchB user admin group administrators password ciphertext AQBapdUBDwDDuaT2QQXmQI6nWCTgg++q92JF heiRNAnaw4jfYgAAAP0EBAJbehQEAN9HFpOD64JUovBnIdPpXiVHuV17n1bdeathUH2dDy6EWe/wnQp+eyt40JmS ILeXZnUSzQ7xgHRCamuks1ISZ/yWQAdWmPR7ayUB8SqwWnuEPeNgKSxqb4ND led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN0aZeQbIBqY0pSvpa77xnpPQEngEkpWjMBQAAAIouj7	!	
router-id 192.168.2.1 default-information originate area 0.0.0 Switch B Switch B Switch B Switch B Current configuration: ! Iversion Aruba05-CX Virtual.10.07.0004 !export-password: default hostname Switch8 user admin group administrators password ciphertext AQBapdU8DwDDuaT20QXmQI6nMCTgg++q92JF helRNAnaw4jfYgAAAP0EBAJbehQEaN9HFp0D64JUovBnIdPpXiVHuY17n1bdeathUHZdDy6EWe/wnQp+eyt40Jm5 IleXZnU52Q7xgHRCamuKslI5Z/yWQAdWmPR7ayU88SquWnuEPeNgK5xqb4ND led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuWyDkoDN0zeQbIBqY0p5vpa77xnpPQEngEkpWjWBQAAAIouj7	router ospf 1	
default-information originate area 0.0.0 Switch B Switch B Switch B Switch B Switch B Switch B Current configuration: ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! !	router-id 192.168.2.1	
area 0.0.0 Switch B SwitchB# sh runn Current configuration: ! !Version ArubaOS-CX Virtual.10.07.0004 !export-password: default hostname SwitchB user admin group administrators password ciphertext AQBapdUBDwDDuaT20QXmQI6nMCTgg++q9zJF helRNAnaw4jfYgAAAP0EBAJbehQEaN9HFpDD64JUovBnIdPpXiVHuY17n1bdeathUHZdDy6EWe/wnQp+eyt40JmS IIeXZnU5zQ7xgHRCamuKsIISZ/yWQAdWmPR7ayU88SqwWnuEPeNgK5xqb4ND led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQAAAIouj7	default-information originate	
Switch B SwitchB# sh runn Current configuration: ! !Version ArubaOS-CX Virtual.10.07.0004 !export-password: default hostname SwitchB user admin group administrators password ciphertext AQBapdUBDwDDuaT20QXmQI6nMCTgg++q92JF he1RNAnaw4jfYgAAAP0EBAJbehQEaN9HFp0D64JUovBnIdPpXiVHuY17n1bdeathUHZdDy6EWe/wnQp+eyt40JmS IIeXZnUSzQ7xgHRCamuKsIISZ/yWQAdWmPR7ayUB8SqwWnuEPeNgK5xqb4ND led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN0zeQbIBqY0p5vpa77xnpPQEngEkpWjWBQAAAIouj7	area 0.0.0.0	
Switch B SwitchB# sh runn Current configuration: ! !Version ArubaOS-CX Virtual.10.07.0004 !export-password: default hostname SwitchB user admin group administrators password ciphertext AQBapUUBDwDDuaT2QQXmQI6nMCTgg++q9zJF he1RNAnaw4jfYgAAAP0EBAJbehQEaN9HFpOD64JUovBnIdPpXiVHuY17n1bdeathUHZdDy6EWe/wnQp+eyt40JmS IIeZZnUSzQ7xgHRCamuKsIISZ/yWQAdWmPR7ayU88SqwWnuEPeNgK5xqb4ND led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQAAAIouj7		
SwitchB# sh runn Current configuration: ! !Version ArubaOS-CX Virtual.10.07.0004 !export-password: default hostname SwitchB user admin group administrators password ciphertext AQBapdU8DwDDuaT20QXmQI6nMCTgg++q9zJF he1RNAnaw4jfYgAAAP0EBAJbehQEaN9HFpOD64JUovBnIdPpXiVHuY17n1bdeathUHZdDy6EWe/wnQp+eyt40JmS IleXZnUSzQ7xgHRCamuKslISZ/yWQAdWmPR7ayU88SqwWnuEPeNgK5xqb4ND led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQAAAIouj7 OC	Switch B	
Current configuration: ! ! !Version ArubaOS-CX Virtual.10.07.0004 !export-password: default hostname SwitchB user admin group administrators password ciphertext AQBapdU8DwDDuaT20QXmQI6nMCTgg++q9zJF he1RNAnaw4jfYgAAAP0EBAJbehQEaN9HFp0D64JUovBnIdPpXiVHuY17n1bdeathUHZdDy6EWe/wnQp+eyt40JmS I1eXZnUSzQ7xgHRCamuKs1ISZ/yWQAdWmPR7ayU88SqwWnuEPeNgK5xqb4ND led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQAAAIouj7	SwitchB# sh runn	
<pre>! ! Version ArubaOS-CX Virtual.10.07.0004 !export-password: default hostname SwitchB user admin group administrators password ciphertext AQBapdU8DwDDuaT20QXmQI6nMCTgg++q9zJF helRNAnaw4jfYgAAAP0EBAJbehQEaN9HFp0D64JUovBnIdPpXiVHuY17n1bdeathUHZdDy6EWe/wnQp+eyt40JmS IleXZnUSzQ7xgHRCamuKsIISZ/yWQAdWmPR7ayU88SqwWnuEPeNgK5xqb4ND led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQAAAIouj7 OC</pre>	Current configuration:	
<pre>!Version ArubaOS-CX Virtual.10.07.0004 !export-password: default hostname SwitchB user admin group administrators password ciphertext AQBapdU8DwDDuaT2OQXmQI6nMCTgg++q9zJF helRNAnaw4jfYgAAAP0EBAJbehQEaN9HFpOD64JUovBnIdPpXiVHuY17n1bdeathUHZdDy6EWe/wnQp+eyt4OJmS IleXZnUSzQ7xgHRCamuKslISZ/yWQAdWmPR7ayU88SqwWnuEPeNgK5xqb4ND led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQAAAIouj7 OC</pre>	!	
<pre>!export-password: default hostname SwitchB user admin group administrators password ciphertext AQBapdU8DwDDuaT20QXmQI6nMCTgg++q9zJF helRNAnaw4jfYgAAAP0EBAJbehQEaN9HFp0D64JU0vBnIdPpXiVHuY17n1bdeathUHZdDy6EWe/wnQp+eyt40JmS I1eXZnUSzQ7xgHRCamuKs1ISZ/yWQAdWmPR7ayU88SqwWnuEPeNgK5xqb4ND led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQAAAIouj7 OC</pre>	Version ArubaOS-CX Virtual.10.07.0004	
<pre>hostname SwitchB user admin group administrators password ciphertext AQBapdU8DwDDuaT20QXmQI6nMCTgg++q9zJF he1RNAnaw4jfYgAAAP0EBAJbehQEaN9HFp0D64JUovBnIdPpXiVHuY17n1bdeathUHZdDy6EWe/wnQp+eyt40JmS I1eXZnUSzQ7xgHRCamuKs1ISZ/yWQAdWmPR7ayU88SqwWnuEPeNgK5xqb4ND led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQAAAIouj7 OC</pre>	!export-password: default	
user admin group administrators password ciphertext AQBapdU8DwDDuaT20QXmQI6nMCTgg++q9zJF he1RNAnaw4jfYgAAAP0EBAJbehQEaN9HFp0D64JUovBnIdPpXiVHuY17n1bdeathUHZdDy6EWe/wnQp+eyt40JmS I1eXZnUSzQ7xgHRCamuKs1ISZ/yWQAdWmPR7ayU88SqwWnuEPeNgK5xqb4ND led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQAAAIouj7 OC	hostname SwitchB	
he1RNAnaw4jfYgAAAP0EBAJbehQEaN9HFpOD64JUovBnIdPpXiVHuY17n1bdeathUHZdDy6EWe/wnQp+eyt4OJmS I1eXZnUSzQ7xgHRCamuKs1ISZ/yWQAdWmPR7ayU88SqwWnuEPeNgK5xqb4ND led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQAAAIouj7 OC	user admin group administrators password ciphe	rtext AQBapdU8DwDDuaT20QXmQI6nMCTgg++q9zJF
<pre>I1eXZnUSzQ7xgHRCamuKs1ISZ/yWQAdWmPR7ayU88SqwWnuEPeNgK5xqb4ND led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQAAAIouj7 OC</pre>	he1RNAnaw4jfYgAAAP0EBAJbehQEaN9HFpOD64JUovBnId	PpXiVHuY17n1bdeathUHZdDy6EWe/wnQp+eyt40JmS
<pre>led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQAAAIouj7 OC</pre>	I1eXZnUSzQ7xgHRCamuKs1ISZ/yWQAdWmPR7ayU88SqwWn	uEPeNgK5xqb4ND
<pre>keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQAAAIouj7 OC</pre>	led locator on	
<pre>key 1 key-string ciphertext AQBapUbZyuMyDkoDN0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQAAAIouj7 OC</pre>	keychain sha256	
key-string ciphertext AQBapUbZyuMyDkoDN0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQAAAIouj7	key 1	
oc	key-string ciphertext AQBapUbZyuMyDkoD	N0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQAAAIouj7
	ос	

cryptographic-algorithm hmac-sha-256

ntp server pool.ntp.org minpoll 4 maxpoll 4 iburst

ntp enable

!

! !

	Lab Guide Deploying OSPFv2 Features
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!	
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vlan 1	
interface mgmt	
no shutdown	
ip dhcp	
interface 1/1/1	
no chutdown	
no shutuown	
ip address 192.168.4.1/31	
ip ospf 1 area 0.0.0.0	
ip ospf network point-to-point	
ip ospf authentication hmac-sha-256	
ip ospf sha-key 1 sha ciphertext AQBapUbZy	uMyDkoDN0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQA
AAIouj70C	
interface 1/1/2	
no shutdown	
ip address 192.168.4.4/31	
ip ospf 1 area 0.0.0.0	
ip ospf network point-to-point	
ip ospf authentication keychain	
ip ospf keychain sha256	
interface 1/1/3	
no shutdown	
interface loopback 0	
ip address 192.168.2.2/32	
ip ospf 1 area 0.0.0.0	
router ospf 1	
router-id 192.168.2.2	
area 0.0.0.0	
Switch C	
hostname SwitchC	
user admin group administrators password ciphe	rtext

Lab Guide **Deploying OSPFv2 Features** AQBapfpGQNq62D++2BPOzWxgKegH8d6KK3SfliX0dRj8CecnYgAAAEiCQm3zivWzZ/l5ppG7kqWWa2aEMQK45iMxQfw4gg90g/qCgvb1+X7bv4Nvqakx N9elSnOolA/B0t++NiwhFjdu f03MqV5SKpVVXeIRXQ1Wb/HXk+2Jcd3Xz5f7uRwBXZdn led locator on keychain sha256 key 1 key-string ciphertext AQBapUbZyuMyDkoDN0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQAAAIouj70C cryptographic-algorithm hmac-sha-256 ntp server pool.ntp.org minpoll 4 maxpoll 4 iburst ntp enable ļ ssh server vrf mgmt vlan 1 interface mgmt no shutdown ip dhcp interface 1/1/1 no shutdown ip address 192.168.4.3/31 ip ospf 1 area 0.0.0.0 ip ospf network point-to-point ip ospf authentication keychain ip ospf keychain sha256 interface 1/1/2 no shutdown ip address 192.168.4.5/31 ip ospf 1 area 0.0.0.0 ip ospf network point-to-point ip ospf authentication keychain ip ospf keychain sha256 interface 1/1/3 no shutdown ip address 192.168.4.10/31 ip ospf 1 area 0.0.0.1 ip ospf network point-to-point interface loopback 0

```
Lab Guide
                                                                                    Deploying OSPFv2 Features
   ip address 192.168.2.3/32
   ip ospf 1 area 0.0.0.0
!
router ospf 1
   router-id 192.168.2.3
   area 0.0.0.0
   area 0.0.0.1
   area 0.0.0.1 virtual-link 192.168.2.4
       authentication hmac-sha-256
       sha-key 1 sha ciphertext AQBapUbZyuMyDkoDN0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQAAAIouj70C
       exit
SwitchD
Current configuration:
!
!Version ArubaOS-CX Virtual.10.07.0004
!export-password: default
hostname SwitchD
user admin group administrators password ciphertext AQBapZ+cA9wXpQyfL58emkn8n/UirFMRWZB8
4lBqh3SBXxFBk10u1Gd1pGhIAmp1n7zKQdFglLUHyEuPIcg/iHbQZ0vrnJeS
led locator on
keychain keychain
ntp server pool.ntp.org minpoll 4 maxpoll 4 iburst
ntp enable
ļ
ssh server vrf mgmt
vlan 1,100,200
interface mgmt
   no shutdown
   ip dhcp
interface 1/1/1
   no shutdown
   ip address 192.168.4.11/31
   ip ospf 1 area 0.0.0.1
   ip ospf network point-to-point
interface 1/1/2
```

	Lab Guide Deploying OSPFv2 Features
no shutdown	
ip address 192.168.4.12/31	
ip ospf 1 area 0.0.0.2	
ip ospf network point-to-point	
interface 1/1/3	
no shutdown	
interface loopback 0	
ip address 192.168.2.1/32	
ip ospf 1 area 0.0.0.1	
1	
router ospf 1	
router-id 192.168.2.4	
area 0.0.0.1	
area 0.0.0.1 virtual-link 192.168.2.3	
authentication hmac-sha-256	
sha-key 1 sha ciphertext AQBapUbZyuMyI	DkoDN0zeQbI8qY0p5vpa77xnpPQEngEkpWjWBQAAAIo
uj70C	~ • • • • • • • • • • • • • • • • • • •

```
exit
```

```
area 0.0.0.2
```

SwitchE

```
Current configuration:

!

!Version ArubaOS-CX Virtual.10.07.0004

!export-password: default

hostname SwitchE

user admin group administrators password ciphertext AQBapVww/GYlxzz+hMHOX/elpFyCgHj0aJaY

AYjOi8T9GtQfYgAAABf+91qnBPzkPjIJNfAbWIKALfeq9y1Z1EormgD+Ukt4faM2kCCmxryIPBPl5G1lF58Pwew8

ojGvsiIndmtHuQYRXL7Esy8g60DR3zGXUAdVb1hVx4jQrrlyeBLfkldchBmK

led locator on

ntp server pool.ntp.org minpoll 4 maxpoll 4 iburst

ntp enable

!

ssh server vrf mgmt

vlan 1

interface mgmt
```

	Lab Guide Deploying OSPFv2 Features
no shutdown	
ip dhcp interface 1/1/1	
no shutdown	
ip address 192.168.4.13/31	
ip ospf 1 area 0.0.0.2	
ip ospf network point-to-point	
interface 1/1/2	
no shutdown	
interface 1/1/3	
no shutdown	
interface loopback 0	
ip address 192.168.2.5/32	
ip ospf 1 area 0.0.0.2	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
!	
router ospf 1	
router-id 192.168.2.5	
area 0.0.0.2	

END OF DOCUMENT





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