

# Campus 3-Tier with Routed Access – iBGP

**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.**

<https://www.eve-ng.net/index.php/documentation/howtos/howto-add-aruba-cx-switch/>

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### Lab Objective

This is the first of a series of IPv4 labs for 3-tier campus networks. In this lab, you will configure iBGP routed access and DHCP server to test client reachability across the network.

## Lab Network Layout

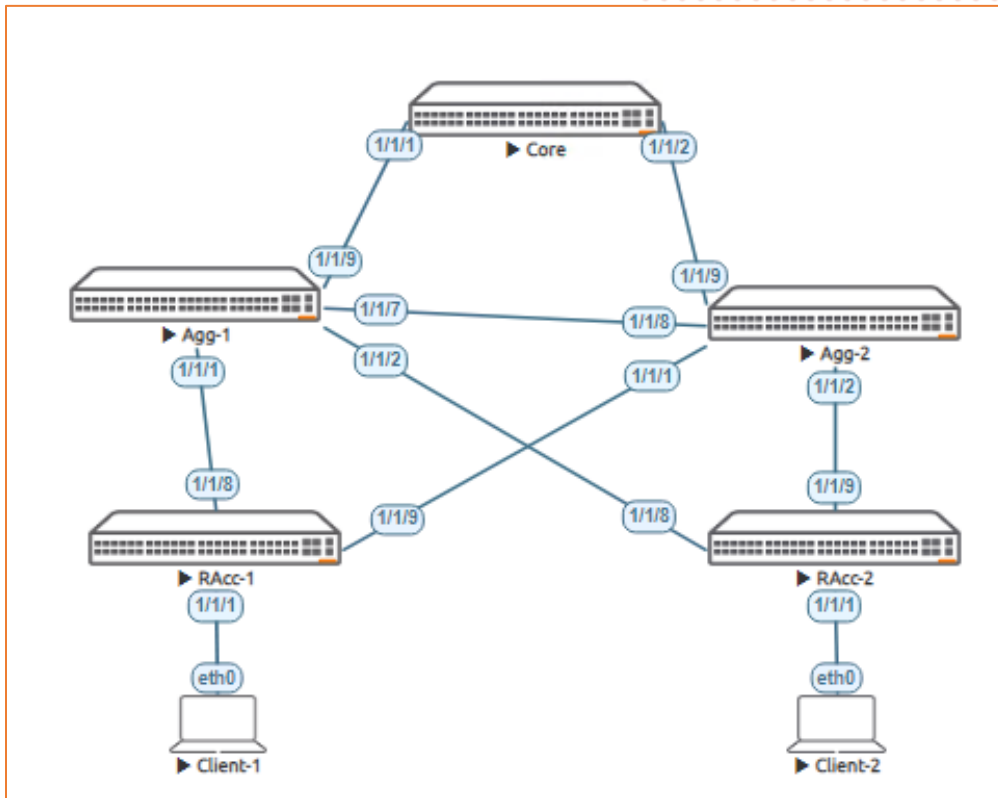


Figure 1. Lab topology and addresses

Table 1. IPv4 Addresses

Device	Interface	IPv6 address	Subnet Mask
Core	Loopback 0	10.0.0.1	/30
	1/1/1	10.0.1.1	/30
	1/1/2	10.0.2.1	/30
Agg-1	Loopback 0	10.0.0.2	/32
	1/1/9	10.0.1.2	/30
	1/1/8	10.0.3.1	/30
	1/1/2	10.0.4.1	/30
	1/1/1	10.0.5.1	/30
Agg-2	Loopback 0	10.0.0.3	/32
	1/1/9	10.0.2.2	/30
	1/1/8	10.0.3.2	/30
	1/1/2	10.0.6.1	/30
	1/1/1	10.0.7.1	/30
RAcc-1	Loopback 0	10.0.0.4	/32
	1/1/8	10.0.5.2	/30
	1/1/9	10.0.7.2	/30
	VLAN 11	10.0.11.1	/24
RAcc-2	Loopback 0	10.0.0.5	/32
	1/1/8	10.0.4.2	/30
	1/1/9	10.0.6.2	/30
	VLAN 12	10.0.12.1	/24
IPv4 Client 1 & 2	DHCP		

Recommended AOS-CX Switch Simulator Version: 10:07:0010

Login to each switch with username: admin and no password. You will be prompted to assign a new password.

## Lab Task 1 – Initialize the Switches and Configure IPv4 Addresses and OSPF

### Core Switch

```

configure
 session-timeout 0
 hostname Core
 router ospf 1
  area 0.0.0.0
 interface loopback 0
  ip address 10.0.0.1/32
  
```

```
ip ospf 1 area 0.0.0.0
interface 1/1/1
no shutdown
ip address 10.0.1.1/30
ip ospf 1 area 0.0.0.0
ip ospf network point-to-point
interface 1/1/2
no shutdown
ip address 10.0.2.1/30
ip ospf 1 area 0.0.0.0
ip ospf network point-to-point
write memory
```

### Agg-1 Switch

```
configure
session-timeout 0
hostname Agg-1
router ospf 1
area 0.0.0.0
interface loopback 0
ip address 10.0.0.2/32
ip ospf 1 area 0.0.0.0
interface 1/1/9
no shutdown
ip address 10.0.1.2/30
ip ospf 1 area 0.0.0.0
ip ospf network point-to-point
interface 1/1/8
no shutdown
ip address 10.0.3.1/30
ip ospf 1 area 0.0.0.0
ip ospf network point-to-point
interface 1/1/2
no shutdown
ip address 10.0.4.1/30
ip ospf 1 area 0.0.0.0
ip ospf network point-to-point
interface 1/1/1
no shutdown
ip address 10.0.5.1/30
ip ospf 1 area 0.0.0.0
ip ospf network point-to-point
write memory
```

### Agg-2 Switch

```
configure
session-timeout 0
hostname Agg-2
router ospf 1
area 0.0.0.0
interface loopback 0
ip address 10.0.0.3/32
ip ospf 1 area 0.0.0.0
interface 1/1/9
no shutdown
ip address 10.0.2.2/30
ip ospf 1 area 0.0.0.0
ip ospf network point-to-point
interface 1/1/8
no shutdown
ip address 10.0.3.2/30
ip ospf 1 area 0.0.0.0
ip ospf network point-to-point
interface 1/1/2
no shutdown
```

```
ip address 10.0.6.1/30
ip ospf 1 area 0.0.0.0
ip ospf network point-to-point
interface 1/1/1
no shutdown
ip address 10.0.7.1/30
ip ospf 1 area 0.0.0.0
ip ospf network point-to-point
write memory
```

### RAcc-1 Switch

```
configure
session-timeout 0
hostname RAcc-1
router ospf 1
area 0.0.0.0
interface loopback 0
ip address 10.0.0.4/32
ip ospf 1 area 0.0.0.0
interface 1/1/8
no shutdown
ip address 10.0.5.2/30
ip ospf 1 area 0.0.0.0
ip ospf network point-to-point
interface 1/1/9
no shutdown
ip address 10.0.7.2/30
ip ospf 1 area 0.0.0.0
ip ospf network point-to-point
vlan 11
interface vlan 11
ip address 10.0.11.1/24
ip ospf 1 area 0.0.0.0
interface 1/1/1
no shutdown
no routing
vlan access 11
write memory
```

### RAcc-2 Switch

```
configure
session-timeout 0
hostname RAcc-2
router ospf 1
area 0.0.0.0
interface loopback 0
ip address 10.0.0.5/32
ip ospf 1 area 0.0.0.0
interface 1/1/8
no shutdown
ip address 10.0.4.2/30
ip ospf 1 area 0.0.0.0
ip ospf network point-to-point
interface 1/1/9
no shutdown
ip address 10.0.6.2/30
ip ospf 1 area 0.0.0.0
ip ospf network point-to-point
vlan 12
interface vlan 12
ip address 10.0.12.1/24
ip ospf 1 area 0.0.0.0
interface 1/1/1
no shutdown
no routing
```

```
vlan access 12
write memory
```

Test connectivity between switches by pinging loop back and interface addresses from each switch. Also check that the desired OSPF neighbors appear.

```
Agg-2# ping 10.0.0.4
```

```
PING 10.0.0.4 (10.0.0.4) 100(128) bytes of data.
108 bytes from 10.0.0.4: icmp_seq=1 ttl=64 time=2.61 ms
108 bytes from 10.0.0.4: icmp_seq=2 ttl=64 time=2.99 ms
108 bytes from 10.0.0.4: icmp_seq=3 ttl=64 time=3.21 ms
108 bytes from 10.0.0.4: icmp_seq=4 ttl=64 time=2.12 ms
108 bytes from 10.0.0.4: icmp_seq=5 ttl=64 time=1.86 ms
```

```
--- 10.0.0.4 ping statistics ---
```

```
5 packets transmitted, 5 received, 0% packet loss, time 4005ms
rtt min/avg/max/mdev = 1.861/2.558/3.208/0.506 ms
```

```
Agg-2(config)# show ip ospf neighbors
```

```
VRF : default Process : 1
=====
```

```
Total Number of Neighbors : 4
```

Neighbor ID	Priority	State	Nbr Address	Interface
10.0.0.4	n/a	FULL	10.0.7.2	1/1/1
10.0.0.5	n/a	FULL	10.0.6.2	1/1/2
10.0.0.2	n/a	FULL	10.0.3.1	1/1/8
10.0.0.1	n/a	FULL	10.0.2.1	1/1/9

Also check the routing table of each switch to ensure the appropriate routes are being learned at each switch.

```
Agg-2(config)# show ip route
```

```
Displaying ipv4 routes selected for forwarding
```

```
Origin Codes: C - connected, S - static, L - local
R - RIP, B - BGP, O - OSPF
Type Codes: E - External BGP, I - Internal BGP, V - VPN, EV - EVPN
IA - OSPF internal area, E1 - OSPF external type 1
E2 - OSPF external type 2
```

```
VRF: default
```

Prefix e/ Age	NextHop	Interface	VRF(egress)	Origin/ Type	Distanc Metric
0.0.0.0/0 00h:00m:59s	10.0.3.1	1/1/8	-	B/I	[200/0]
	10.0.2.1	1/1/9	-		[200/0]

```

00h:00m:59s
10.0.0.1/32      10.0.2.1      1/1/9      -      O      [110/10]
0] 01h:02m:23s
10.0.0.2/32      10.0.3.1      1/1/8      -      O      [110/10]
0] 00h:00m:59s
10.0.0.3/32      -      loopback0  -      L      [0/0]
-
10.0.0.4/32      10
...

```

## Lab Task 2 – Configure BGP

### Core Switch

```

configure
router bgp 65001
  bgp router-id 10.0.0.1
  neighbor 10.0.0.2 remote-as 65001
  neighbor 10.0.0.2 update-source loopback 0
  neighbor 10.0.0.3 remote-as 65001
  neighbor 10.0.0.3 update-source loopback 0
  address-family ipv4 unicast
    neighbor 10.0.0.2 activate
    neighbor 10.0.0.2 default-originate
    neighbor 10.0.0.3 activate
    neighbor 10.0.0.3 default-originate
  exit-address-family
write memory

```

### Agg-1 Switch

```

configure
router bgp 65001
  bgp router-id 10.0.0.2
  neighbor 10.0.0.1 remote-as 65001
  neighbor 10.0.0.1 update-source loopback 0
  neighbor 10.0.0.3 remote-as 65001
  neighbor 10.0.0.3 update-source loopback 0
  address-family ipv4 unicast
    neighbor 10.0.0.1 activate
    neighbor 10.0.0.1 default-originate
    neighbor 10.0.0.3 activate
    neighbor 10.0.0.3 default-originate
  exit-address-family
write memory

```

### Agg-2 Switch

```

configure
router bgp 65001
  bgp router-id 10.0.0.3
  neighbor 10.0.0.1 remote-as 65001
  neighbor 10.0.0.1 update-source loopback 0
  neighbor 10.0.0.2 remote-as 65001
  neighbor 10.0.0.2 update-source loopback 0
  address-family ipv4 unicast
    neighbor 10.0.0.1 activate
    neighbor 10.0.0.1 default-originate
    neighbor 10.0.0.2 activate
    neighbor 10.0.0.2 default-originate
  exit-address-family
write memory

```

Verify BGP Neighbors at Core and Agg switches.

```

Agg-2(config)# show bgp ipv4 unicast
Status codes: s suppressed, d damped, h history, * valid, > best, = multipath,

```



i internal, e external S Stale, R Removed, a additional-paths  
Origin codes: i - IGP, e - EGP, ? - incomplete

VRF : default  
Local Router-ID 10.0.0.3

Network	Nexthop	Metric	LocPrf	Weight	Path
*>i 0.0.0.0/0	10.0.0.1	0	100	0	i
*=i 0.0.0.0/0	10.0.0.2	0	100	0	i

Total number of entries 2

### Verify BGP routes

Agg-2(config)# show ip route bgp

Displaying ipv4 routes selected for forwarding

Origin Codes: C - connected, S - static, L - local  
R - RIP, B - BGP, O - OSPF  
Type Codes: E - External BGP, I - Internal BGP, V - VPN, EV - EVPN  
IA - OSPF internal area, E1 - OSPF external type 1  
E2 - OSPF external type 2

VRF: default

Prefix e/ Age	Nexthop	Interface	VRF(egress)	Origin/ Type	Distanc Metric
0.0.0.0/0 00h:03m:06s	10.0.3.1	1/1/8	-	B/I	[200/0]
0.0.0.0/0 00h:03m:06s	10.0.2.1	1/1/9	-		[200/0]

Total Route Count : 1

## Lab Task 3 – Configure DHCP

### DHCP Server on RAcc1

```
configure
dhcp-server vrf default
pool vlan11
range 10.0.11.10 10.0.11.15
default-router 10.0.11.1
exit
enable
write memory
```

### DHCP Server on RAcc-2

```
configure
dhcp-server vrf default
pool vlan12
range 10.0.12.10 10.0.12.15
default-router 10.0.12.1
exit
enable
write memory
```

## Lab Task 4 – Validate

### Client-1



```
VPCS> ip dhcp
DORA IP 10.0.11.11/24 GW 10.0.11.1 - Note: DORA=DHCP Discover, Offer, Request, Accept

VPCS> ping 10.0.12.12

84 bytes from 10.0.12.12 icmp_seq=1 ttl=61 time=4.606 ms
84 bytes from 10.0.12.12 icmp_seq=2 ttl=61 time=3.387 ms
84 bytes from 10.0.12.12 icmp_seq=3 ttl=61 time=3.797 ms
84 bytes from 10.0.12.12 icmp_seq=4 ttl=61 time=4.048 ms
84 bytes from 10.0.12.12 icmp_seq=5 ttl=61 time=3.469 ms
```

## Client-2

```
VPCS> ip dhcp
DORA IP 10.0.12.12/24 GW 10.0.12.1

VPCS> ping 10.0.11.11

84 bytes from 10.0.11.11 icmp_seq=1 ttl=61 time=6.653 ms
84 bytes from 10.0.11.11 icmp_seq=2 ttl=61 time=5.548 ms
84 bytes from 10.0.11.11 icmp_seq=3 ttl=61 time=3.883 ms
84 bytes from 10.0.11.11 icmp_seq=4 ttl=61 time=4.377 ms
84 bytes from 10.0.11.11 icmp_seq=5 ttl=61 time=6.660 ms
```

## End of Lab



[www.arubanetworks.com](http://www.arubanetworks.com)

3333 Scott Blvd. Santa Clara, CA 95054  
1.844.472.2782 | T: 1.408.227.4500 | FAX: 1.408.227.4550 | [info@arubanetworks.com](mailto:info@arubanetworks.com)