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Revision History

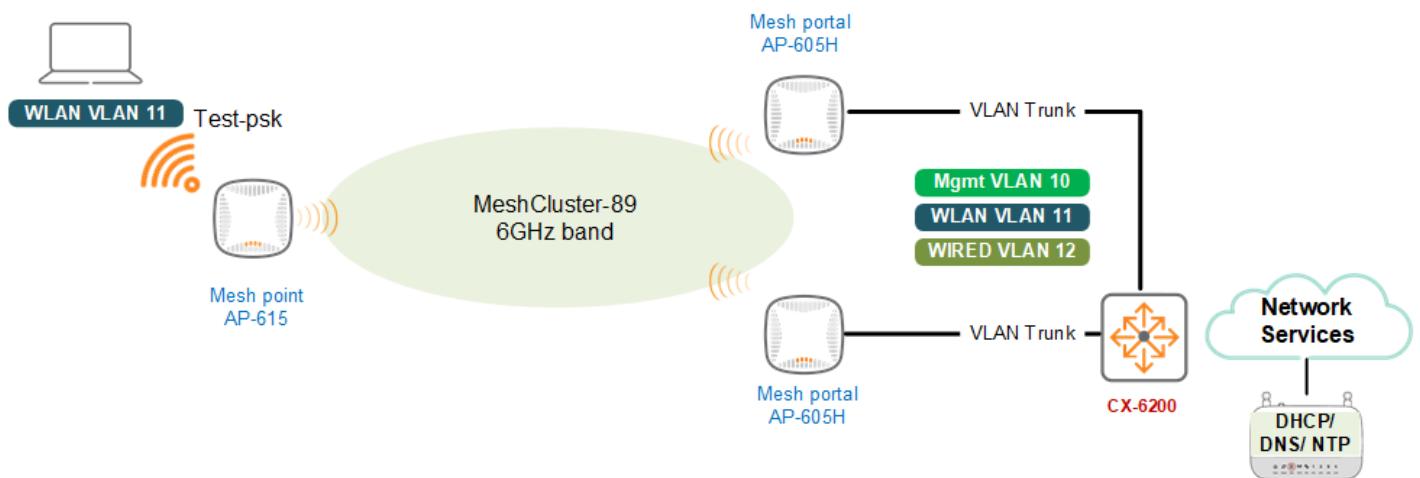
DATE	VERSION	EDITOR	CHANGES
29 Aug 2024	0.1	Ariya Parsamanesh	Initial creation
16 Sep 2024	0.2	Ariya Parsamanesh	Added CAS

1 Wi-Fi Mesh with AOS10 APs

Aruba APs running AOS10 firmware utilize Wi-Fi mesh technology to expand Wi-Fi coverage in both outdoor and indoor settings. To enable mesh functionality, APs need at least one valid uplink, which can be an Ethernet, 3G/4G, or Wi-Fi connection. Once an AP has a valid uplink, it operates as a Mesh Portal, while an AP without an Ethernet link (in our case) acts as a Mesh Point. Multiple Mesh Portal APs can be deployed to ensure redundancy within the mesh network.

Here is the lab set-up to demonstrate the following:

1. Dual band configuration for AP-605H and AP-615s to use 5GHz and 6GHz bands.
2. Mesh cluster using 6GHz band.
3. Wireless Client access over 6GHz mesh link
4. Using APIs to modify mesh configuration



1.1 Things you need

- Aruba AOS10 10.6.x.x or later (I am using 10.7.0.0)
- 3x APs (I am using AP-605H and AP-615)
- A Layer three switch and some Wi-Fi and wired clients

1.2 AOS10 Mesh Network

Wireless Mesh with AOS10 is very similar to Aruba Instant mesh functionality and is a very effective way to expand the wireless to areas that you may not have data cable drops. You can use it both for outdoor and indoor environments. Always check the local regulations for using 6GHz on Outdoor APs.

Generally, an AP with an active Ethernet link is a Mesh Portal and acts like a gateway between wireless mesh and the main wired LAN. The AP that connects to Mesh portal using its Wi-Fi radio is called Mesh Point. Then the mesh point provides wireless services to its clients like any other AP.

AOS10's wireless mesh functionality supports the default

- Hop count of 2

- Number of mesh points per mesh portal of 8

You can also choose Wi-Fi band for the mesh functionality. Here since we have Wi-Fi6E APs, we'll use 6GHz band for the mesh functionality.

Here we have 3x APs as shown below. At this stage all are connected to the LAN.

Customer: Ariva Publ...

Mesh-Lab

Manage Overview Devices Clients Guests

Access Points

Access Points: 3 Online: 2 Offline: 1 Radios: 6

Access Points (3)

Device Name	Status	IP Ad...	M...	Serial	Firmware Version
MeshPoint:09:0c	Online	10.10.10.32	AP-615	CNPVKZD1QQ	10.7.0.0_90579
Portal:5d:6b	Online	10.10.10.44	AP-605H	CNR5LHJ111	10.7.0.0_90579
Portal:5e:b5	Online	10.10.10.29	AP-605H	CNR5LHJ13Y	10.7.0.0_90579

1.3 Dual Band Configuration

Since I am using AP-605H and AP-615s that are both Wi-Fi6E and I want to use 6GHz for mesh backhaul, I need to enable 6GHz band for these APs. Remember that both these AP models have dual-radio, tri-band architecture. This means that you can choose the two radio bands to use. By default they use 2.4Ghz and 5GHz bands.

We need to change that to use 5Ghz and 6GHz bands. So While we are in the configuration mode, we'll select each APs and Edit them.

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Mesh-Lab

Manage Overview Devices Clients Guests

Access Points

WLANS Access Points Radios Interfaces Security Third Party Tunnel Services System IoT Configuration Audit

Access Points (3)

Name	Status	IP Addre...	WLANS	Radio Profile	Type
MeshPoint:09:0c	Online	10.10.10.32	All SSIDs selected	default	AP-615
Portal:5d:6b	Online	10.10.10.29	All SSIDs selected	default	AP-605H
Portal:5e:b5	Online	10.10.10.44	All SSIDs selected	default	AP-605H

Note that you can use the Central Automation Studio (CAS) <https://central.wifidownunder.com/> and edit all of them at the same time. So here we'll select each of the APs and edit them. Later on we'll use CAS as well.

Access Points

WLANS Access Points Radios Interfaces Security Third Party Tunnel Services System IoT Configuration Audit

Radio

Flexible Dual Band: 5 GHz and 6 GHz

Radio Profile: default

RADIO 0 **RADIO 1**

Enable Radio:

MODE: Access Access

Channel Assignment: Automatic Manual Automatic Manual

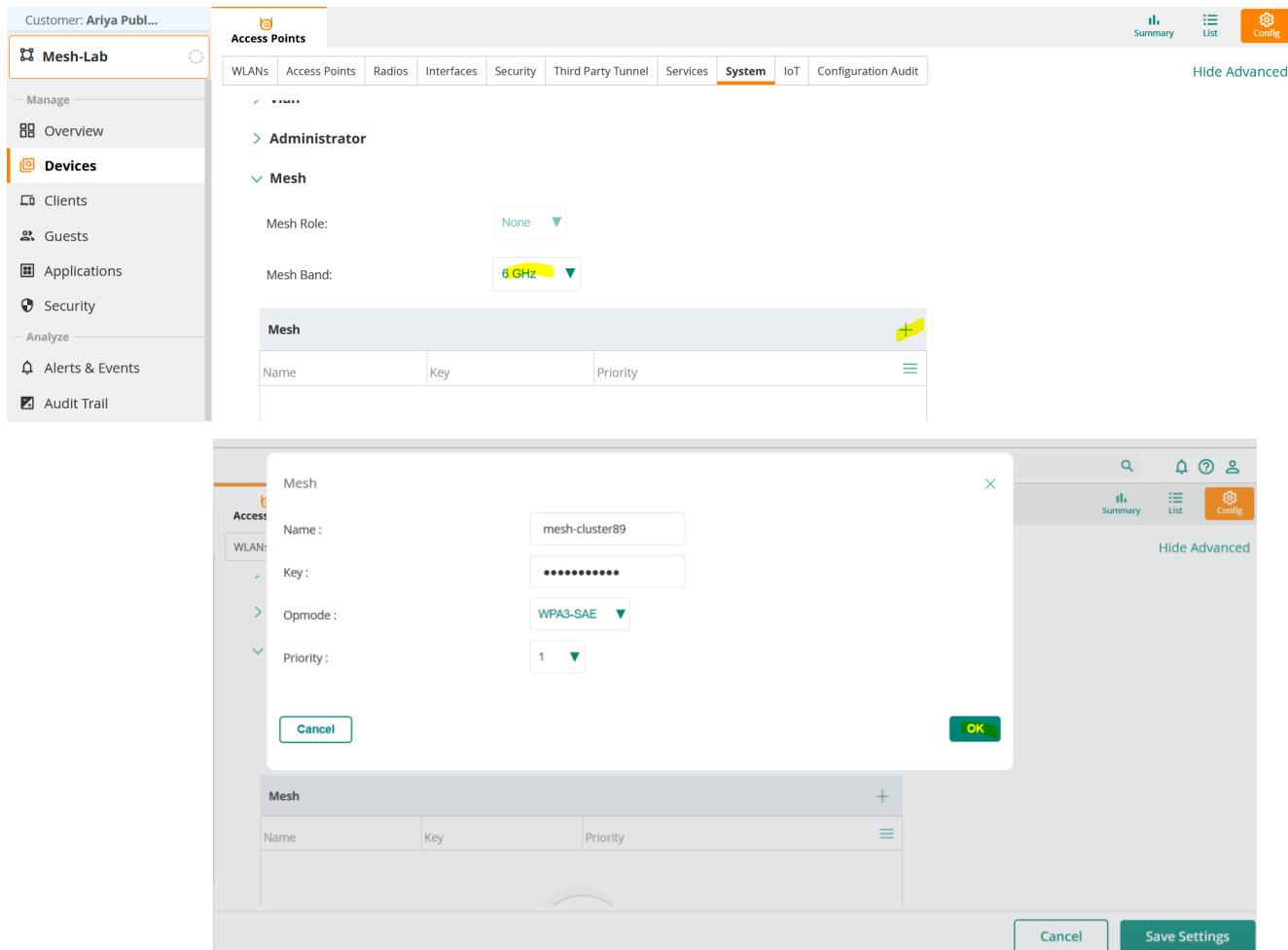
Transmit Power Assignment: Automatic Manual Automatic Manual

Select the Flexible dual band and if you need rename the AP name and save them.

1.4 Mesh Cluster Configuration

Here we'll setup and configure the mesh cluster profile. You can refer [here](#) for the details of Mesh clusters.

You can have multiple mesh clusters as well and use different priorities which you can use for mesh link redundancy. Mesh portal APs use the profile with the highest priority to bring up the mesh network. The mesh portal stores and advertises that profile to neighbouring mesh points to build the mesh network.



The screenshot shows the Aruba Central UI for Mesh Cluster Configuration. The top window displays the 'System' tab with 'Mesh' selected. The 'Mesh Role' is set to 'None' and the 'Mesh Band' is set to '6GHz'. The bottom window is a configuration dialog for a new mesh cluster, with the 'Name' field set to 'mesh-cluster89', 'Key' set to '.....', 'Opmode' set to 'WPA3-SAE', and 'Priority' set to '1'. The 'OK' button is highlighted in green.

Note that we have selected the mesh band as 6GHz and with that we need WPA3-SAE. Once you add the new mesh cluster profile, Mesh role and Metric mode.

The default setting for Mesh role is auto. This means that when the AP boots up and does not have a E0 link connected, it automatically becomes Mesh Point otherwise it will be Mesh Portal. In most deployments it is recommended to explicitly configure the roles to be Portal or Point.

Note that you need to reboot the APs for the configuration to take effect.

1.5 Mesh Cluster Status

Once the APs reboot you can check the following. Remember unlike Instant APs, with AOS10, you don't need to disable extended SSIDs. This happens as soon as you configure mesh cluster.

```
f0:1a:a0:2a:5d:6b# sh swarm state

AP Swarm State          :swarm_config_sync_complete
mesh auto eth0 bridging  :no
Config in flash          :yes
factory SSID in flash   :no
extended-ssid active     :no
advanced-zone configured :no
Factory default status   :no
Source of system time    :NTP server
Config load cnt          :1
IDS Client Gateway Detect :yes
Config Init success cnt for heartbeat :0
Config Init success cnt for register  :0
Config Init skipping cnt for heartbeat :0
Config Init skipping cnt for register  :0
Config Init last success reason   :N/A
Config Init last success time    :N/A
Radio down state          :0x0 / 0x0 / 0x0
Thermal Protect state    :None
6GHz disabled in MFG     :FALSE
6GHz AFC required         :FALSE
AFC Response Received    :FALSE
6GHz FILS status          :disabled
6GHz FILS auto selection :enabled
SAPD cfg sync state      :0 / 0
```

```
f0:1a:a0:2a:5d:6b#
```

Here are the commands to check the mesh functionality. Note that you can run all these from Tools section.

We'll start with cluster active command.

```
f0:1a:a0:2a:5d:6b# sh ap mesh cluster active

Mesh Cluster name: e1baf29f4ca4ed35645e0a937d9c9c7
-----
Name          AP Type  Mesh Role  IP Address  Portal AP  Parent AP  RSSI
Last Update   Uplink Age Children Num Children List
-----
f0:1a:a0:2a:5d:6b  AP-605H  Portal      10.10.10.29 f0:1a:a0:2a:5d:6b -          0
1m:38s        1h:24m:30s  0

Total APs: 1
(N): 11N Enabled. (AC): 11AC Enabled. (AD): 11AD Enabled. (AX): 11AX Enabled. For
Portals 'Uplink Age' equals uptime.

f0:1a:a0:2a:5d:6b#
```

Next let's check the mesh configuration.

```
MeshPoint:09:0c# sh ap mesh config

A Tx Rates          :6,9,12,18,24,36,48,54
Heartbeat Threshold :10
Link Threshold      :12
Metric Algorithm    :Metric_Distributed_Tree_Rssi
Max Children        :8
Max Hop Count       :2
Mesh Private Vlan   :0
Reselection Mode    :Reselect_Startup_Subthreshold
Prefer Uplink Radio  :No prefer uplink radio
Optimize Scan Interval :24
Retry Limit          :4
Mobility Beacon Miss Num :16

MeshPoint:09:0c#
```

Note that 48:b4:c3:c1:09:0c is our AP-615. We'll rename the APs so we can make it easier to identify where the CLI commands are being run on.

1.6 Normal Mesh Operation

Now I have disconnected the AP-615 from the LAN switch and is being powered up by a power pack. Once the AP is rebooted it will automatically try mesh functionality since their Eth0 is not connected. APs will check if the Eth0 is up and operational as it sends loop detection packets. Note that only if the Eth0 is up and operational, only then the AP will become a mesh portal.

Let's check the Mesh neighbours first.

```
MeshPoint:09:0c# sh ap mesh neighbours
```

Neighbor list

Radio	MAC	AP Name	Portal	Channel	Band	Age	Hops	Cost	Relation
Flags	RSSI	Rate Tx/Rx	A-Req	A-Resp	A-Fail	HT-Details	Cluster ID		
1	50:e4:e0:14:17:81	Portal:5e:b5	Yes	69S	6GHz	0	0	1.00	P 25s
ELK	39 1814/1361	1 1	0	HE-160MHz-2ss		e1baf29f4ca4ed35645e0a937d9c9c7			
1	50:e4:e0:14:0e:41	Portal:5d:6b	Yes	5S	6GHz	27	0	1.00	N 37s
ELK	32 -	2 1	1	HE-160MHz-2ss		e1baf29f4ca4ed35645e0a937d9c9c7			

Total count: 2, Children: 0

Relation: P = Parent; C = Child; N = Neighbor; B = Denylisted-neighbor

Flags: R = Recovery-mode; S = Sub-threshold link; D = Reselection backoff; F = Auth-failure; H = High Throughput; V = Very High Throughput, E= High efficient, L = Legacy allowed

K = Connected; U = Upgrading; G = Descendant-upgrading; Z = Config pending; Y = Assoc-resp/Auth pending

a = SAE Accepted; b = SAE Denylisted-neighbour; e = SAE Enabled; u = portal-unreachable; o = opensystem; m = Mobility Enabled

```
MeshPoint:09:0c#
```

Then after while, it will settle on one Mesh-Portal that has a better RSSI value.

```
MeshPoint:09:0c# sh ap mesh neighbours
```

Neighbor list

Radio	MAC	AP Name	Portal	Channel	Band	Age	Hops	Cost	Relation
Flags	RSSI	Rate Tx/Rx	A-Req	A-Resp	A-Fail	HT-Details	Cluster ID		
1	50:e4:e0:14:17:81	Portal:5e:b5	Yes	69S	6GHz	0	0	1.00	P 4m:6s
ELK	32 1814/1441	1 1	0	HE-160MHz-2ss		e1baf29f4ca4ed35645e0a937d9c9c7			

Total count: 1, Children: 0

Relation: P = Parent; C = Child; N = Neighbor; B = Denylisted-neighbor

Flags: R = Recovery-mode; S = Sub-threshold link; D = Reselection backoff; F = Auth-failure; H = High Throughput; V = Very High Throughput, E= High efficient, L = Legacy allowed

K = Connected; U = Upgrading; G = Descendant-upgrading; Z = Config pending; Y = Assoc-resp/Auth pending

a = SAE Accepted; b = SAE Denylisted-neighbour; e = SAE Enabled; u = portal-unreachable; o = opensystem; m = Mobility Enabled

```
MeshPoint:09:0c#
```

Next, we can check the mesh link that shows it is using 6GHz and 160MHz channel.

```
MeshPoint:09:0c# sh ap mesh neighbours
```

Neighbor list

Radio	MAC	AP Name	Portal	Channel	Band	Age	Hops	Cost	Relation
Flags	RSSI	Rate Tx/Rx	A-Req	A-Resp	A-Fail	HT-Details	Cluster ID		
1	50:e4:e0:14:17:81	Portal:5e:b5	Yes	69S	6GHz	0	0	1.00	P 16m:55s
ELK	32 1633/1729	2 2	0	HE-160MHz-2ss		e1baf29f4ca4ed35645e0a937d9c9c7			

Total count: 1, Children: 0

Relation: P = Parent; C = Child; N = Neighbor; B = Denylisted-neighbor

Flags: R = Recovery-mode; S = Sub-threshold link; D = Reselection backoff; F = Auth-failure; H = High Throughput; V = Very High Throughput, E= High efficient, L = Legacy allowed

K = Connected; U = Upgrading; G = Descendant-upgrading; Z = Config pending; Y = Assoc-resp/Auth pending

a = SAE Accepted; b = SAE Denylisted-neighbour; e = SAE Enabled; u = portal-unreachable; o = opensystem; m = Mobility Enabled

```
MeshPoint:09:0c#
```

And this is the corresponding command on the Mesh Portal

```
Portal:5e:b5# sh ap mesh neighbours
```

Neighbor list

Radio Relation ID	MAC Flags	AP Name RSSI	Portal Rate Tx/Rx	A-Req	A-Resp	A-Fail	Channel HT-Details	Band	Age	Hops	Cost Cluster
1 17m:8s	48:b4:c3:90:90:c0	MeshPoint:09:0c	50:e4:e0:14:17:81	37	1441/1633	2	69-	6GHz HE-40MHzsgi-2ss	0	1	6.00 C
e1baf29f4ca4ed35645e0a937d9c9c7											

Total count: 1, Children: 1

Relation: P = Parent; C = Child; N = Neighbor; B = Denylisted-neighbor

Flags: R = Recovery-mode; S = Sub-threshold link; D = Reselection backoff; F = Auth-failure; H = High Throughput; V = Very High Throughput, E= High efficient, L = Legacy allowed

K = Connected; U = Upgrading; G = Descendant-upgrading; Z = Config pending; Y = Assoc-resp/Auth pending

a = SAE Accepted; b = SAE Denylisted-neighbor; e = SAE Enabled; u = portal-unreachable; o = opensystem; m = Mobility Enabled

```
Portal:5e:b5#
```

As you can see the mesh link is up. Here is the Aruba Central view,

Customer: Ariya Publ...

MeshPoint:09:0c

Summary AI Insights Floor Plan Performance RF

Actions ▾ • Go Live 3 hours

Manage

Overview

Device Clients Security

Analyze

Live Events Alerts & Events Audit Trail

DEVICE

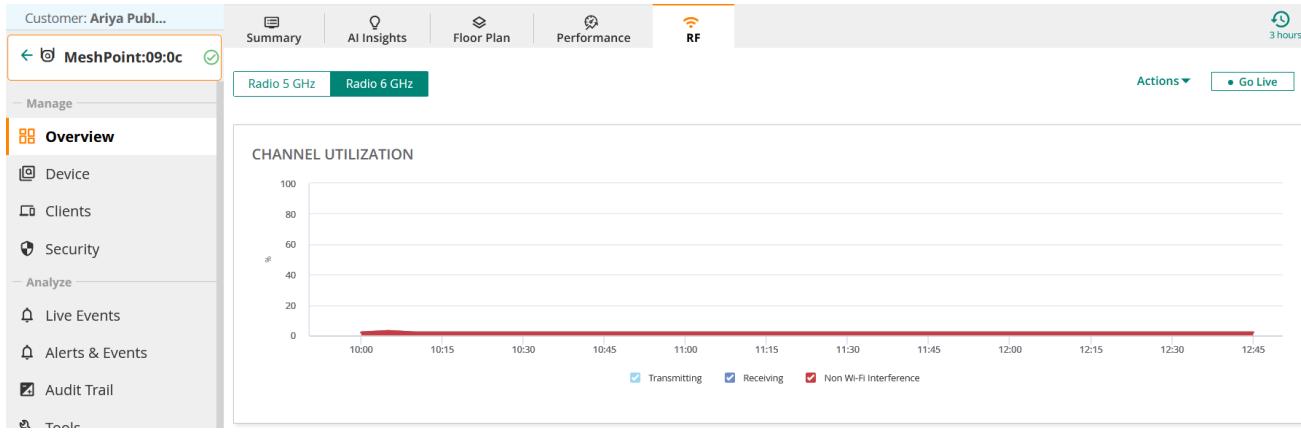
AP MODEL	AP-615	COUNTRY CODE	AU
MAC	48:b4:c3:c1:90:90:c0	SERIAL NUMBER	CNPVKZD1QQ
UPTIME	33 Minutes 29 Seconds	LAST REBOOT REASON	AP Reboot reason: Power-reset
FIRMWARE VERSION	10.7.0.0_90579	CONFIGURATION STATUS	Synchronized
BAND SELECTION	Dual Band	POWER DRAW	4.65 W

NETWORK

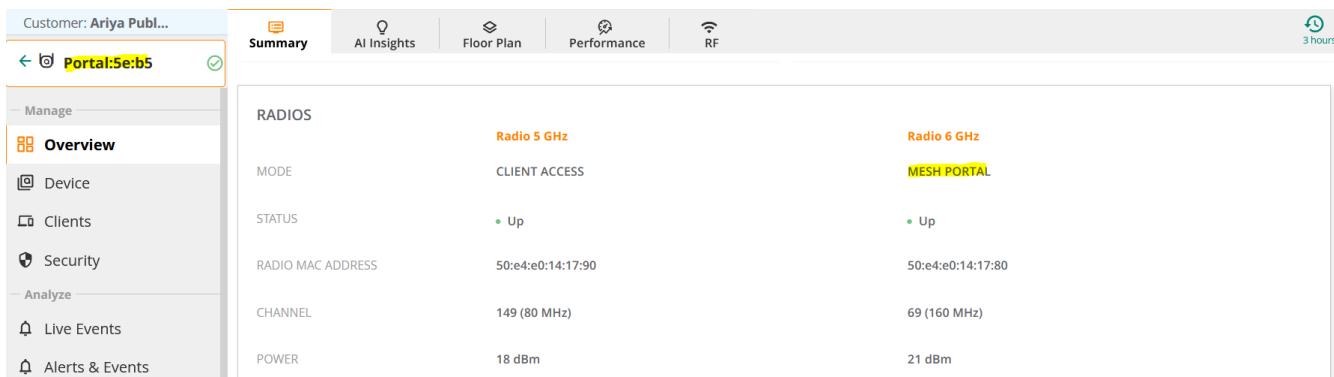
ETH0	DOWN	SPEED (Mbps) / DUPLEX	-	VLAN	-
CURRENT UPLINK	WiFi Mesh	ROLE	Point	LLDP Details	
IP ADDRESS	10.10.10.32 (DHCP)	PUBLIC IP ADDRESS	60.240.221.215	IPv6	
DNS NAME SERVERS	192.168.1.131	DEFAULT GATEWAY	10.10.10.1 (DHCP)		
NTP SERVER	au.pool.ntp.org				

RADIOS

MODE	Radio 5 GHz	CLIENT ACCESS	Radio 6 GHz
STATUS	Up	MESH POINT	Up
RADIO MAC ADDRESS	48:b4:c3:90:90:d0	48:b4:c3:90:90:c0	
CHANNEL	149 (80 MHz)	69 (160 MHz)	



Now checking the Portal AP



We see that the mesh link is on 6G radio. There are other mesh commands as well, like mesh cluster topology as shown below.

```
MeshPoint:09:0c#sh ap mesh cluster topology
Mesh Cluster name: elbaf29f4ca4ed35645e0a937d9c9c7
-----
Name          AP Type  Mesh Role  IP Address  Portal AP    Radio ID  Radio Mode  BSSID
Parent AP     Path Cost  Node Cost  Link Cost  Hop Count  Rate Tx/Rx  RSSI  Last Update  Uplink
Age          Children Num  Children List
-----
48:b4:c3:c1:09:0c  AP-615  Point      10.10.10.32  Portal:5d:6b  1      MPC (AX)
48:b4:c3:90:90:c1  Portal:5d:6b  1          0          0          1      2268/2041  41
2m:23s          1h:15m:28s  0          -
Total APs: 1
MPP: portal's radio. MPC: point's radio with active uplink. MPA: point's radio without active uplink.
(N): 11N Enabled. (AC): 11AC Enabled. (AD): 11AD Enabled. (AX): 11AX Enabled. For Portals 'Uplink Age' equals uptime.

MeshPoint:09:0c#
```

And this is when you run this command on the Portal APs.

```
Portal:5d:6b# sh ap mesh cluster topology
Mesh Cluster name: elbaf29f4ca4ed35645e0a937d9c9c7
-----
Name          AP Type  Mesh Role  IP Address  Portal AP    Radio ID  Radio Mode  BSSID
Parent AP     Path Cost  Node Cost  Link Cost  Hop Count  Rate Tx/Rx  RSSI  Last Update  Uplink
Age          Children Num  Children List
```

```
-----  
-----  
Portal:5d:6b AP-605H Portal      10.10.10.29  Portal:5d:6b 1          MPP (AX)  
50:e4:e0:14:0e:41 -      -      -      -      -      -      -      1m:0s  
4h:23m:14s 1          48:b4:c3:c1:09:0c
```

Total APs: 1

MPP: portal's radio. MPC: point's radio with active uplink. MPA: point's radio without active uplink.

(N): 11N Enabled. (AC): 11AC Enabled. (AD): 11AD Enabled. (AX): 11AX Enabled. For Portals 'Uplink Age' equals uptime.

```
Portal:5d:6b#
```

Another interesting command is “show ap mesh debug status” which is useful for debugging if your mesh link is not establishing.

```
MeshPoint:09:0c# sh ap mesh debug status
```

```
State: CONNECTED(1), since: 3h:12m:52s, recovery: FALSE  
Topology algo:local, svc topo empty.  
Country-code: 33 ("AU"), Outdoor: FALSE  
Active Cluster: <elbaf29f4ca4ed35645e0a937d9c9c7>, encrypted: TRUE, opmode: 0x20000,  
priority:1  
All Available Clusters(1):  
Cluster: <elbaf29f4ca4ed35645e0a937d9c9c7>, encrypted: TRUE, opmode: 0x20000, priority:  
1  
  
Working RF Band: 2, RF Split 5G Range: 0  
SM State: CONNECTED, Descendant Upgrading: FALSE, Portal Reachability: TRUE  
Topology Adjust Scan: False, Scan Times: 1, Scan Interval: 1000s,  
Portal ID: 50:e4:e0:14:0e:41, Loop Protect Seq NO: 22231, Hop Count: 1, Path Cost: 1,  
Portal MTU: 1578,  
Metric Reselection State: Idle, Optimize Scan Tick: 11992, Reselection Tick: 11570,  
Switch Interval: 0, Switch Tick: 11570,  
SAPD Pending: FALSE, Received Config: TRUE, Thermal Protect: FALSE, Reboot Me: FALSE,  
Shutting Down: FALSE,  
SAPD Radio Off Tick: 0, CLI IP address Tick: 0 FIPS Change Tick: 0, LMS change Tick: 0,  
LMS IP: 10.10.10.29,  
Mesh Ctrl Socket: 15, Hostapd Recreate Pending: FALSE, Hostapd PID: 10615, Hostapd Sent  
Config: TRUE, Hostapd Sync Count: 0,  
Supplicant Initiated: 1,
```

Mesh Radios Status:

```
Radio 1, Running Opmode: 0x20000, Phy Down: FALSE, Band: 3, Current Channel: 69/0,  
Total 24 channels:  
1,5,9,13,17,21,25,29,33,37,41,45,49,53,57,61,65,69,73,77,81,85,89,93,  
  
Scan Active: FALSE, Scan Started 11577 Ticks, Scanned 24 channels, Curring Scanning  
Channel 1,  
Schedule Renegotiate: 0, Renegotiate: 0, Authenticate Pending: 0, Assoc Pending: 0,  
Assoc Tick: 12238, WPA Auth Pending 0,  
Marginal Uplink: FALSE, Hop Count: 1, Past Cost CH: 100, Path Cost: 1, Children Num:  
0, Node Cost: 0, Subtree Weight: 0,  
Commit Pending: 0, Mesh_P VAP Up: TRUE, SAPD Radio Off Tick: 0, Point Radar Tick: 0,  
Radar Channel: 0,  
Supplicant EAPOL Socket: 16, VAP Added: 1, VAP Name: aruba100, MAC c0:00:00:00:00:00,  
BSSID 50:e4:e0:14:0e:41, SSID elbaf29f4ca4ed35645e0a937d9c9c7, KEY MGMT 4  
Mesh Configurations:  
Max children: 8, Max Hop Count: 2, Heartbeat Threshold: 10, Roaming: FALSE/RSSI-limit  
0, Prefer Uplink Radio: No prefer uplink radio, Remote Mesh MPV: 0  
Metric Algorithm: Distribute Tree RSSI, Reselection Mode: Startup Subthreshold,  
Optimize Scan Interval: 86400(s), Link Threshold: 12, Max RSSI: 38, RSSI Delta: 1,  
Penalty: 10, Offset: 0  
HT Enabled: 1, VHT Enabled: 1, HE Enabled: 1, 40M: 1, 80M: 1, 160M: 1
```

```
Mesh Access List Type: Deny, Hostname list(0):
```

```
MeshPoint:09:0c#
```

Now, we'll take a closer look at the output of mesh link.

```
MeshPoint:09:0c# sh ap mesh link
```

```
Neighbor list
```

Radio	MAC	AP Name	Portal	Channel	Band	Age	Hops	Cost	Relation
Flags	RSSI	Rate Tx/Rx	A-Req	A-Resp	A-Fail	HT-Details	Cluster	ID	
1	50:e4:e0:14:0e:41	Portal:5d:6b	Yes	69S	6GHz	0	0	1.00	P 3h:20m:10s
ELK	39	2268/2401	1	1	0	HE-160MHz-2ss	e1baf29f4ca4ed35645e0a937d9c9c7		

Total count: 1, Children: 0

Relation: P = Parent; C = Child; N = Neighbor; B = Denylisted-neighbor

Flags: R = Recovery-mode; S = Sub-threshold link; D = Reselection backoff; F = Auth-failure; H = High Throughput; V = Very High Throughput, E= High efficient, L = Legacy allowed

K = Connected; U = Upgrading; G = Descendant-upgrading; Z = Config pending; Y = Assoc-resp/Auth pending

a = SAE Accepted; b = SAE Denylisted-neighbour; e = SAE Enabled; u = portal-unreachable; o = opensystem; m = Mobility Enabled

```
48:b4:c3:c1:09:0c#
```

Note in this case, the RSSI value is 39 and A-Req/A-Resp/A-Fail columns which provide the number of association requests from clients, number of association responses from the mesh node and number of association failures. Also note the tx/Rx data rates over 2.2Gbps

Lastly checking all the available mesh counters, look for previous parents.

```
MeshPoint:09:0c# sh ap mesh counters
```

```
Mesh Packet Counters
```

Interface	Echo Sent	Echo Recv	Probe Req	Probe Resp	Assoc Req	Assoc Resp	Assoc Fail	Link up/down	Resel.	Switch	Other
Mgmt											
Parent	0	0	0	0	0	0	0	2	-	-	0
Child	1999	2025	57	55	7 (7 HT)	4	3	1	0	2	20127

Received Packet Statistics: Total 44302, Mgmt 20213 (dropped non-mesh 0), Data 4016 (dropped unassociated 0) HT: pns=0 ans=0 pnr=0 ars=7 arr=0 anr=0

```
Recovery Profile Usage Counters
```

Item	Value
Enter recovery mode	0
Exit recovery mode	0
Total connections to switch	0

```
Mesh loop-prevention Sequence No.:2852
```

```
Mesh timer ticks:2079
```

Change-record: HT-link renegotiation, linkdown:27m:2s, linkup:26m:51s, previous portal:50:e4:e0:14:0e:41, previous parent: 50:e4:e0:14:0e:41
Scan-summary:1:1 5:0 9:0 13:0 17:1 21:s 25:s 29:1 33:s 37:s 41:s 45:s 49:s 53:s 57:s 61:s 65:0 69:0 73:0 77:0 81:1 85:s 89:s 93:s
scan-key: n:not-set,i:invalid,b:denylisted,s:set,<number>:probe-resp-cnt.

```
MeshPoint:09:0c#
```

Also note that the IP address of the MeshPoint AP is from the DHCP server over the wireless mesh backhaul.

```
MeshPoint:09:0c#sh ip int b
```

Interface	IP Address / IP Netmask	Admin	Protocol
br0	10.10.10.32 / 255.255.255.0	up	up
br0.3333	172.31.98.1 / 255.255.254.0	up	up

```
MeshPoint:09:0c#
```

1.7 Wireless Clients over Mesh Link

Here we have configured a simple “test-PSK” WLAN and set it for VLAN 11.

The screenshot shows the 'WLANs' tab selected in the navigation bar. The 'ESSID' is set to 'test-PSK'. Under 'Band', '5 GHz' is selected. A 'Hide Advanced' button is visible on the right.

[Networks > Configuration - test-PSK](#)

General VLANs Security Access Summary

ESSID: test-PSK
Band: 2.4 GHz 5 GHz 6 GHz

[Advanced Settings](#)

[Networks > Configuration - test-PSK](#)

General VLANs Security Access Summary

Traffic forwarding mode: Bridge
Client VLAN Assignment: Static Dynamic
VLAN ID: 11
Multiple VLAN IDs or single named VLAN allowed.

[Show Named VLANs](#)

[Networks > Configuration - test-PSK](#)

General VLANs Security Access Summary

Security Level:
Enterprise Personal Visitors Open
Key Management: WPA3-Personal
Passphrase Format: 8-63 chars

[Networks > Configuration - test-PSK](#)

General VLANs Security Access Summary

Access rules
Role Based Network Based Unrestricted

Next, we'll get a wireless client that connects to test-PSK on the Mesh Point AP. Not the Client's IP address which should be from VLAN 11.

```
MeshPoint:09:0c# sh client
```

```
Client List
```

```

Name          IP Address      MAC Address      OS      ESSID      Access Point      Channel      Type
Role          IPv6 Address      Signal (dB)      Speed (Mbps)
---          -----
---          -----
AriyaiPodtouch 10.10.11.31 2c:1f:23:d0:2f:48 Apple test-PSK MeshPoint:09:0c 149+      AN
test-PSK fe80::18e1:e05a:9e:f5b8 52 (good)      135 (good)
Number of Clients :1
Info timestamp :15017

MeshPoint:09:0c#

```

Client Name	Status	IP Address	VLAN	Connected To	SSID/Port	AP Role
AriyaiPodtouch	Connected	10.10.11.31		MeshPoint:09:0c	test-PSK	

1.8 Neighbour Selection

As mentioned before Mesh Point APs select their Mesh Portal based on RSSI value. Note that the system tries to avoid mesh link flapping so the RSSI value of the existing Mesh Portal should be around 12 for the neighbour to be considered. We'll execute this command a few times.

```
MeshPoint:09:0c# sh ap mesh neighbours
```

```

Neighbor list
-----
Radio  MAC          AP Name      Portal      Channel      Band      Age      Hops      Cost      Relation
Flags  RSSI  Rate Tx/Rx  A-Req  A-Resp  A-Fail  HT-Details      Cluster ID
-----  ---  -----  -----  -----  -----  -----  -----  -----  -----
-- 50:e4:e0:14:17:81  Portal:5e:b5  Yes  37S  6GHz  0  0  2.00  P 3m:7s
ELK  18  408/288  2  2  0  HE-160MHz-2ss
e1baf29f4ca4ed35645e0a937d9c9c7
1  50:e4:e0:14:0e:41  Portal:5d:6b  Yes  37S  6GHz  0  0  0.00  N 2m:11s
ELK  14  -  5  3  2  HE-160MHz-2ss
e1baf29f4ca4ed35645e0a937d9c9c7

Total count: 2, Children: 0
Relation: P = Parent; C = Child; N = Neighbor; B = Denylisted-neighbor
Flags: R = Recovery-mode; S = Sub-threshold link; D = Reselection backoff; F = Auth-failure; H = High Throughput; V = Very High Throughput, E = High efficient, L = Legacy allowed
K = Connected; U = Upgrading; G = Descendant-upgrading; Z = Config pending; Y = Assoc-resp/Auth pending
a = SAE Accepted; b = SAE Denylisted-neighbour; e = SAE Enabled; u = portal-unreachable; o = opensystem; m = Mobility Enabled

```

```
MeshPoint:09:0c#
```

Here is the second time we run the command, notice the **DELK** flag.

```
MeshPoint:09:0c# sh ap mesh neighbours
```

```

Neighbor list
-----
Radio  MAC          AP Name      Portal      Channel      Band      Age      Hops      Cost      Relation
Flags  RSSI  Rate Tx/Rx  A-Req  A-Resp  A-Fail  HT-Details      Cluster ID
-----  ---  -----  -----  -----  -----  -----  -----  -----

```

```

-----
1      50:e4:e0:14:0e:41  Portal:5d:6b  Yes      37S      6GHz  0  0  1.00  P 21s
DELK  21      1088/408   8      5      3      HE-160MHz-2ss
e1baf29f4ca4ed35645e0a937d9c9c7
1      50:e4:e0:14:17:81  Portal:5e:b5  Yes      37S      6GHz  0  0  1.00  N 37s
ELK   12      -          2      2      0      HE-160MHz-2ss
e1baf29f4ca4ed35645e0a937d9c9c7

Total count: 2, Children: 0
Relation: P = Parent; C = Child; N = Neighbor; B = Denylisted-neighbor
Flags: R = Recovery-mode; S = Sub-threshold link; D = Reselection backoff; F = Auth-failure; H = High Throughput; V = Very High Throughput, E= High efficient, L = Legacy allowed
K = Connected; U = Upgrading; G = Descendant-upgrading; Z = Config pending; Y = Assoc-resp/Auth pending
a = SAE Accepted; b = SAE Denylisted-neighbour; e = SAE Enabled; u = portal-unreachable; o = opensystem; m = Mobility Enabled

MeshPoint:09:0c#

```

Once the backoff timer expires the new Mesh-Portal is selected. Now checking the mesh link status and we'll see that Portal:5d:6b is selected.

```
MeshPoint:09:0c# sh ap mesh link

Neighbor list
-----
Radio  MAC          AP Name      Portal  Channel  Band  Age  Hops  Cost  Relation
Flags  RSSI  Rate Tx/Rx  A-Req  A-Resp  A-Fail  HT-Details  Cluster ID
-----  ---  -----  -----  -----  -----  -----  -----  -----  -----  -----
-----  -----  -----  -----  -----  -----  -----  -----  -----  -----  -----
--  
1      50:e4:e0:14:0e:41  Portal:5d:6b  Yes      37S      6GHz  0      0      1.00  P
2h:39m:59s          ELK        20      1088/680      8          5      3      HE-160MHz-2ss
e1baf29f4ca4ed35645e0a937d9c9c7

Total count: 1, Children: 0
Relation: P = Parent; C = Child; N = Neighbor; B = Denylisted-neighbor
Flags: R = Recovery-mode; S = Sub-threshold link; D = Reselection backoff; F = Auth-failure; H = High Throughput; V = Very High Throughput, E= High efficient, L = Legacy allowed
K = Connected; U = Upgrading; G = Descendant-upgrading; Z = Config pending; Y = Assoc-resp/Auth pending
a = SAE Accepted; b = SAE Denylisted-neighbour; e = SAE Enabled; u = portal-unreachable; o = opensystem; m = Mobility Enabled

MeshPoint:09:0c#
```

1.9 Mesh Profile Parameters

There is a default mesh profile that is used for all the mesh links. When an AP is a mesh point, it does two types of scans.

1. Uplink scan in which the AP without an uplink connection scans all the channels sequentially to find a Mesh Portal. If a scan fails on a channel, then AP retires based on “max-retries” before moving on to the next channel.
2. Topology scan in which the AP that is already part of a mesh cluster, scans to find a better link. Here are the settings that influence this scan
 - a. link-threshold – by default this is set to 12 RSSI
 - b. optimize-scan-interval – by default this is set to 24 hours

Here is the default mesh profile setting for the in AOS10.

```
MeshPoint:09:0c# sh ap mesh config

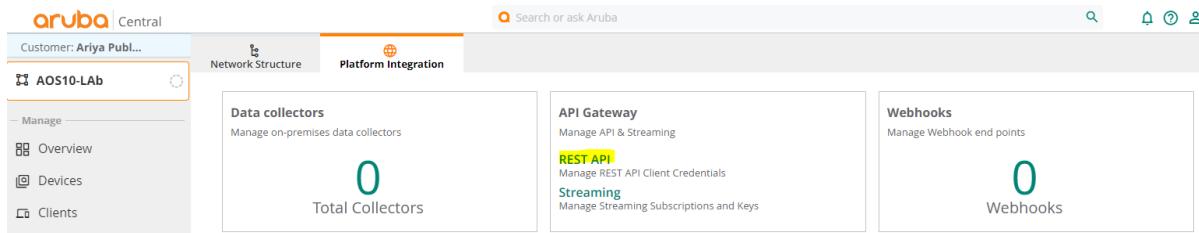
A Tx Rates           :6,9,12,18,24,36,48,54
Heartbeat Threshold :10
Link Threshold       :12
Metric Algorithm     :Metric_Distributed_Tree_Rssi
Max Children         :8
Max Hop Count        :2
Mesh Private Vlan   :0
Reselection Mode     :Reselect_Startup_Subthreshold
Prefer Uplink Radio  :No prefer uplink radio
Optimize Scan Interval:24
Retry Limit          :4
Mobility Beacon Miss Num:16
MeshPoint:09:0c#
```

1.10 Modifying Mesh config Using API

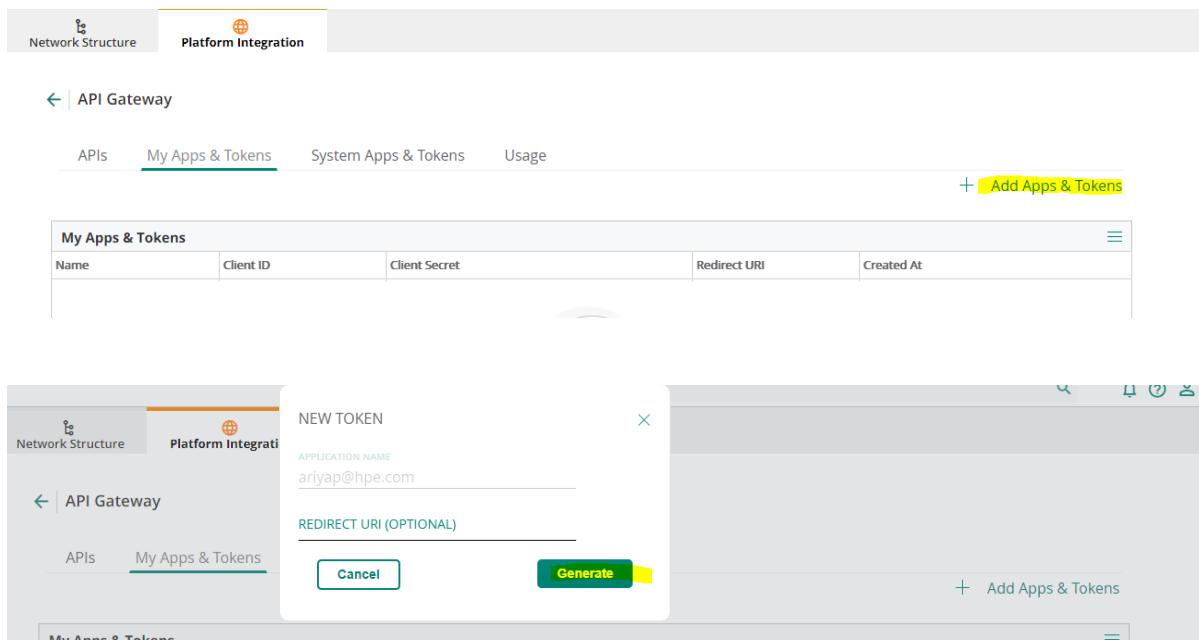
The interesting settings are link-threshold value and optimize-scan-interval and in my lab I'll changed it to threshold to 16 and 1 hour respectively.

I am using [Central Automation Studio](#) (CAS) to modify the setting using APIs. But before that I need to add an API app for my Central account so that CAS can use it.

We'll start by going to the API gateway which is under Organisation.



Next add a new App as shown.



Here is my new app.

The screenshot shows the Aruba API Gateway interface. At the top, there are tabs for 'APIs', 'My Apps & Tokens' (which is selected), 'System Apps & Tokens', and 'Usage'. A 'Platform Integration' icon is also present. Below the tabs, there are two tables:

- My Apps & Tokens (1)**: A table with columns: Name, Client ID, Client Secret, Redirect URI, and Created At. One row is shown: 'ariyap@hpe.com' with Client ID 'db8nfj670...' and Client Secret 'lipOd527i189h0xTq...'. Redirect URI is '["https://arubanetwork...']' and Created At is 'Mar 18, 2024, 9:55:51 ...'.
- Token List (1)**: A table with columns: Token Id, User Name, Generated At, Revoke Token, and Download Token. One row is shown: 'd032b450-4bd0-4494-9b07-88...' with User Name 'ariyap@hpe.com', Generated At 'Mar 18, 2024, 9:55:54 AM', and Download Token 'Download Token'.

You need to click on “Download Token” and copy the following

```
{"access_token": "Lup920y8qCWKJY<removed>",
"appname": "nms", "authenticated_userid": "ariyap@hpe.com",
"created_at": 1710716154604,
"credential_id": "96d-removed-d6",
"expires_in": 7200,
"id": "d032b450-4bd0-4494-9b07-88e87661d927",
"refresh_token": "vQIS1rFQ1H4P4e<removed>",
"scope": "all",
"token_type": "bearer"}
```

Copy your customer ID as well.

The screenshot shows the Aruba API Gateway interface. At the top, there are tabs for 'APIs', 'My Apps & Tokens' (selected), 'System Apps & Tokens', and 'Usage'. A search bar says 'Search or ask Aruba'. On the left, there's a 'Clients' section. On the right, a user profile menu is open for 'ariyap@hpe.com' with 'Customer ID: 46efde6c0201'. The menu includes 'User Settings', 'Terms of Service', and 'Logout'.

Customer ID = 46efde6c0<removed>. Once you have this information, go to the CAS site <https://central.wifidownunder.com> and add your Central account to it.

The screenshot shows the Central Automation Studio: Settings interface. The main title is 'Central API Settings'. At the top right is a 'Save & Go To Dashboard' button. Below it is an 'Add New Central Account' button with a black arrow pointing to it. The main area has a table with columns: NAME, CLUSTER, CLIENT ID, CLIENT SECRET, ACCESS TOKEN, REFRESH TOKEN, and ACTIONS. A message 'No data available in table' is shown. At the bottom right is a 'Reveal Tokens And Secrets' checkbox.

Central Automation Studio: Settings

Name: Ariya-Central

Cluster: APAC-SOUTH1

Customer ID: le6c02014...

Client ID: 376aRnkC...

Client Secret: rHB9h0xT...

Access Token: /8qCWKJN...

Refresh Token: 21H4P4e...

[Save](#)

Reveal Tokens And Secrets

No data available in table

Central Automation Studio: Settings

[Save & Go To Dashboard](#)

Central API Settings

Ariya-Central APAC-SOUTH1

[Add New Central Account](#)

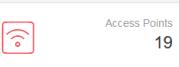
Reveal Tokens And Secrets

Now Save and go to the Dashboard and then go to Configuration Deployment for the AP Group as shown below.

Central Automation Studio



Connected Clients
6



Access Points
19



Switches
6



Gateways
9



Sites
9



Groups
19

Automated Workflows

CSV Upload Workflows
Deployments using CSV upload



Site based Workflows
Automation using selected Sites



Barcode Scanner Input
Add Devices and Generate CSVs



Configuration Deployment

AP Group
Modify & Deploy



WLANS
Modify & Deploy



User Roles
Modify & Deploy for APs



Authentication Servers
Modify & Deploy for APs



Here we'll select our ap-group

Central Automation Studio: AP Group Configuration

Connected Clients 6 Access Points 19 Switches 6 Gateways 9

Group / Virtual Controller Selection
Choose a group or Virtual Controller to obtain the Wireless config

Mesh-Lab

Configuration

```
syslog-level warn user
syslog-level warn user-debug
syslog-level warn wireless
hostnames au.pool.drr.org
clock timezone Melbourne 10 0
clock summer-time EST recurring first sunday october 02:00 first sunday april 03:00
terminal-access
deny-local-routing
dpi
url-visibility
location-session timeout 0
application-monitoring
mesh-band 6ghz
mesh-cluster mesh-cluster89 wpa3-sae ***** priority 1
mesh-role auto
mesh-topology-algorithm central
cp-serial-chassis b037fb77b76d99cdb9fdb564a3c202e
enable-automatic-placement
cluster-security
allow-low-assurance-devices
wan mesh-profile
link-threshold 16
optimize-scan-interval 1
# dot11-6ghz-radio-profile
max-tx-power 18
allowed-channels 1,5,9,13,17,21,25,29,33,37,41,45,49,53,57,61,65,69,73,77,81,85,89,93
```

Config Shortcuts

Clear Airwave Configuration Disable Auto DRT Update

Update Configuration

Add the highlighted commands and save it.

Configuration

```
access-rule-name default_wired_port_profile
speed auto
duplex full
type employee
captive-portal disable
inactivity-timeout 1000
port-bonding
wired-profile wired-Setup
no shutdown
switchport-mode access
allowed-ports all
port-security guest
access-rule-name wired-Setup
speed auto
duplex auto
type guest
captive-portal disable
inactivity-timeout 1000
wan mesh-profile
link-threshold 16
optimize-scan-interval 1
uplink
preemption
enforce none
failover-internet-pkt-loss-thr 10
failover-internet-pkt-loss-thr 30
#wan-profile wan-180
```

Config Shortcuts

Clear Airwave Configuration Disable Auto DRT Update

Update Configuration

WLAN Configuration
WLAN was deployed to the "Mesh-Lab" Group

OK

After that we can see the changes we have made in the mesh configuration as seen below.

```
MeshPoint:09:0c# sh ap mesh config

A Tx Rates          :6,9,12,18,24,36,48,54
Heartbeat Threshold :10
Link Threshold      :16
Metric Algorithm    :Metric_Distributed_Tree_Rssi
Max Children        :8
Max Hop Count       :2
Mesh Private Vlan   :0
Reselection Mode    :Reselect_Startup_Subthreshold
Prefer Uplink Radio  :No prefer uplink radio
Optimize Scan Interval :1
Retry Limit          :4
Mobility Beacon Miss Num :16

MeshPoint:09:0c#
```

You can also use CAS for Mesh Monitoring as well see below.

Central Automation Studio

Monitoring and Statistics

- Client Statistics**
View a variety of Client statistics
- AP Statistics**
View a variety of AP statistics
- Switch Statistics**
View a variety of Switch statistics
- AP Rebooting**
Reboot APs or Clusters
- RAPIDS**
Monitor Rogue APs
- Mesh**
Monitor Mesh APs
- VisualRF**
Monitoring using Floorplans
- Event Dashboard**
Dashboard for Event Wi-Fi Networks

That will bring up the following page that lists all the mesh Portal APs in your Central account. Here we can see our 2x portal APs. You can then click on the “Topology” button.

Central Automation Studio: Mesh Monitoring

Mesh Portals

NAME	STATUS	STATUS TEXT	IP ADDRESS	MODEL	SERIAL	MAC ADDRESS	SITE	GROUP	UPTIME	ACTIONS
Portal:5d:6b	Up	Up	10.10.10.29	605H	[REDACTED]	[REDACTED]5d:6b	Mesh-Lab	36 minutes	Topology	
Portal:5e:b5	Up	Up	10.10.10.44	605H	[REDACTED]	[REDACTED]5e:b5	Mesh-Lab	an hour	Topology	

Showing 1 to 3 of 3 entries

Previous 1 Next

And here you can quickly get the relevant mesh info by selecting from the drop-down menu.

