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Revision History

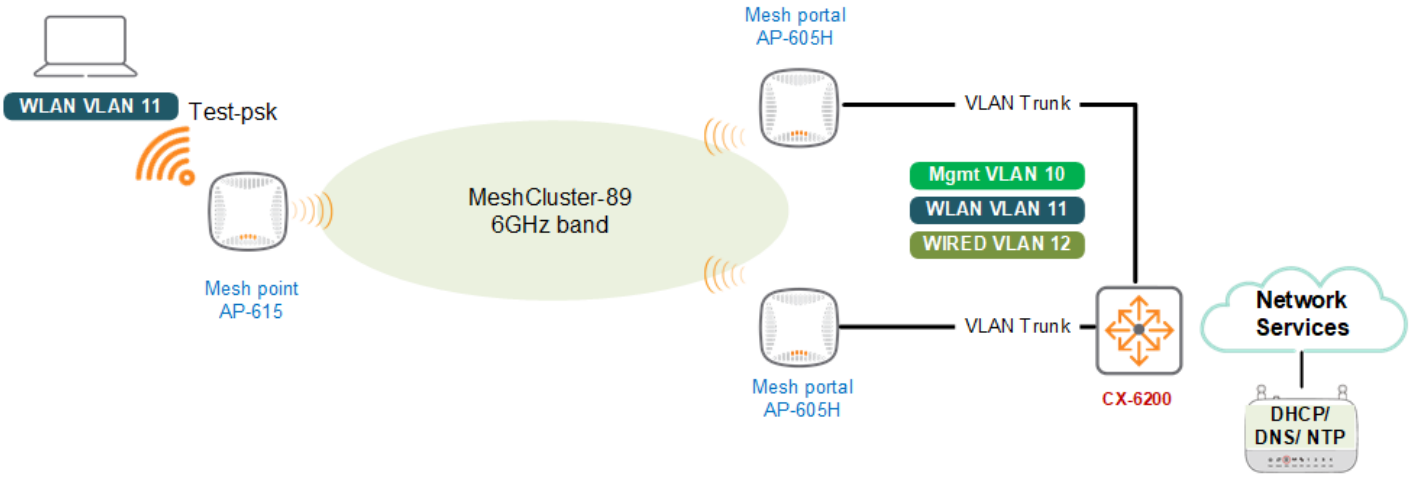
DATE	VERSION	EDITOR	CHANGES
29 Aug 2024	0.1	Ariya Parsamanesh	Initial creation
16 Sep 2024	0.2	Ariya Parsamanesh	Added CAS

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.

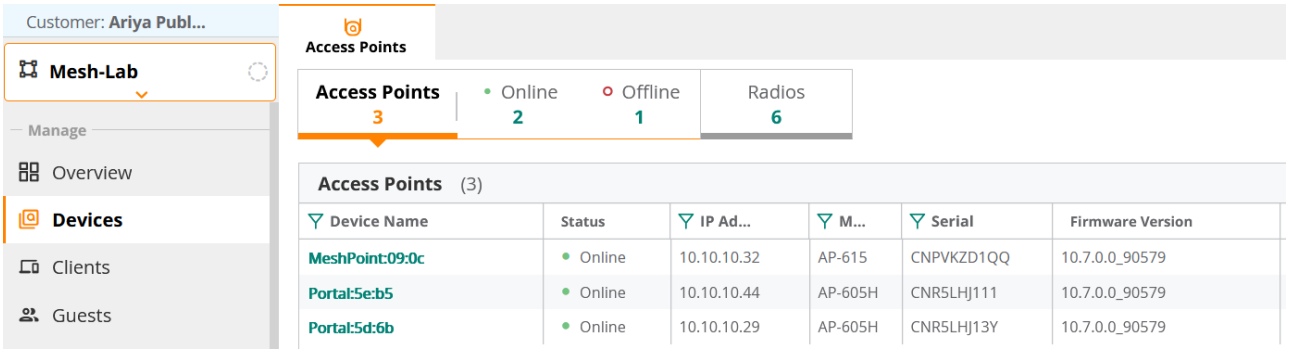
AOS10's wireless mesh functionality supports the default

- 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.

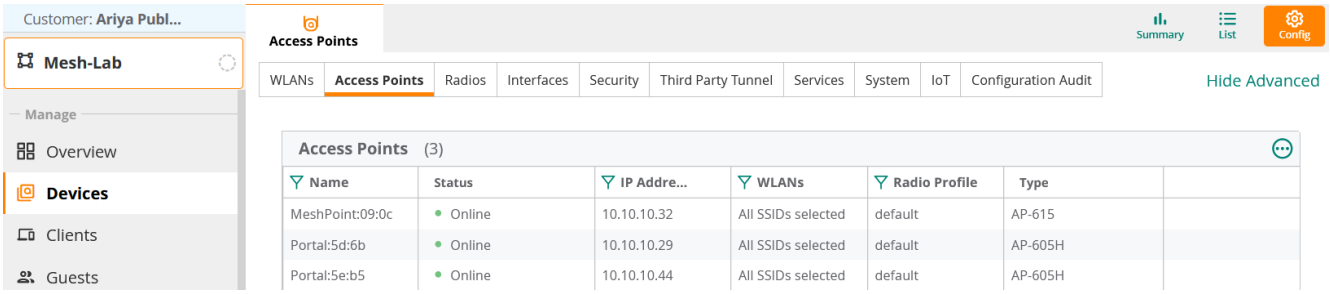
Here we have 3x APs as shown below. At this stage all are connected to the LAN.



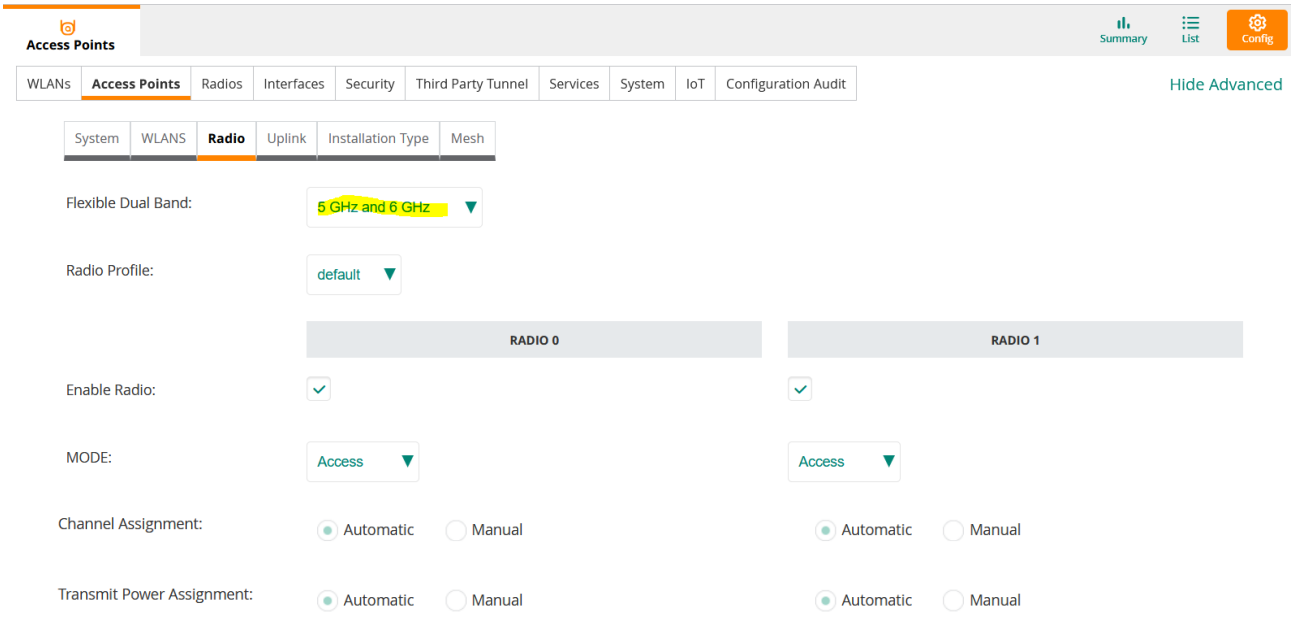
1.3 Dual Band Configuration

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.



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.

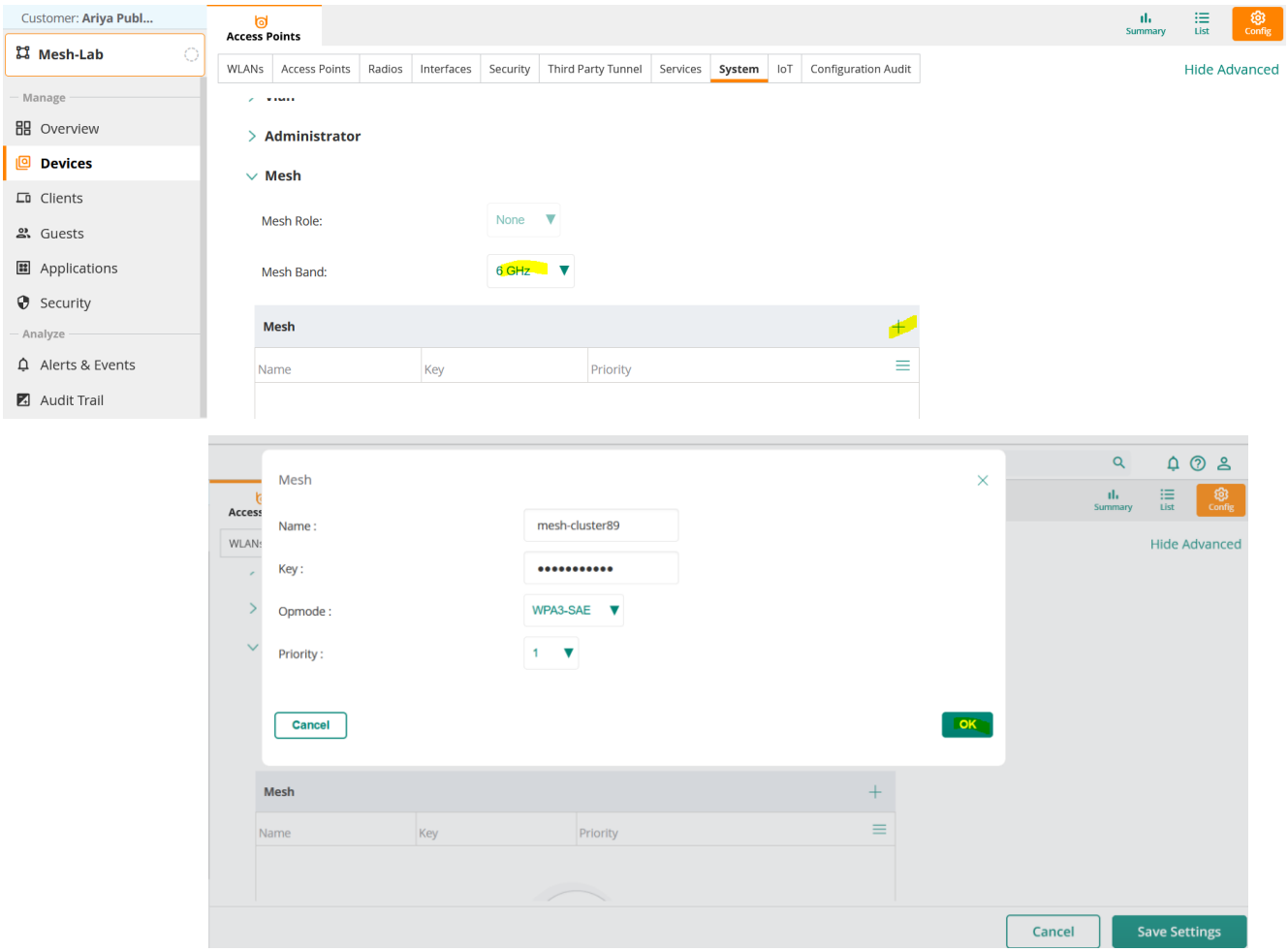


Select the Flexible dual band and if you need rename the AP name and save them.

1.4 Mesh Cluster Configuration

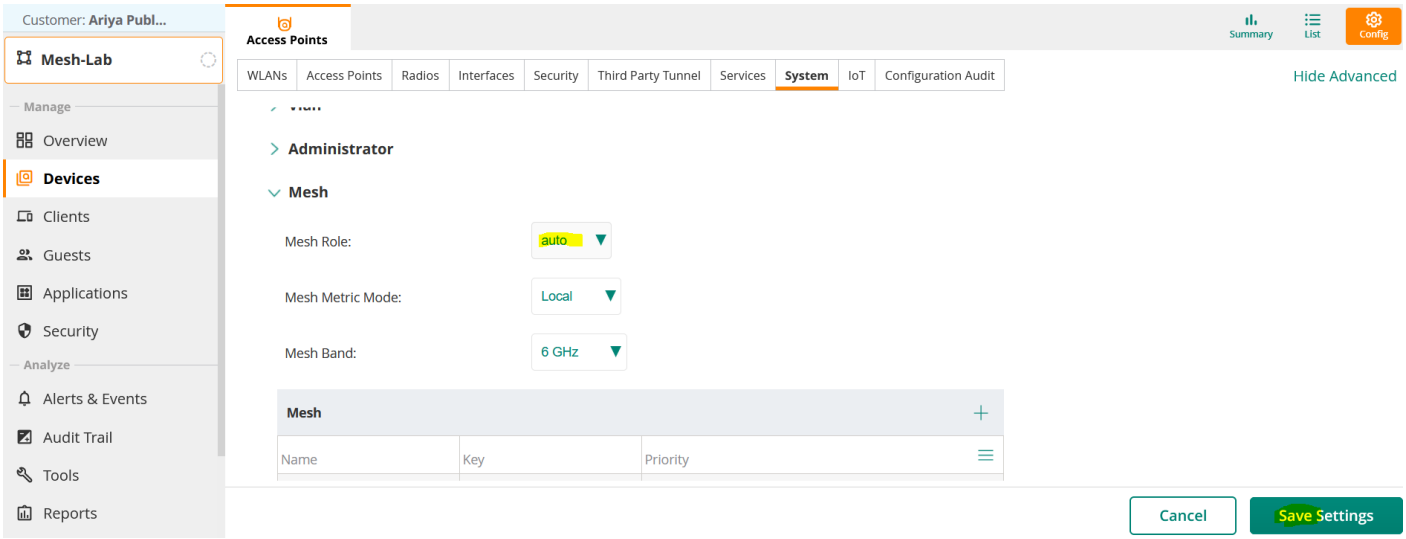
Here we'll setup and configure the mesh cluster profile. You can refer here for the details of Mesh clusters.

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.



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.



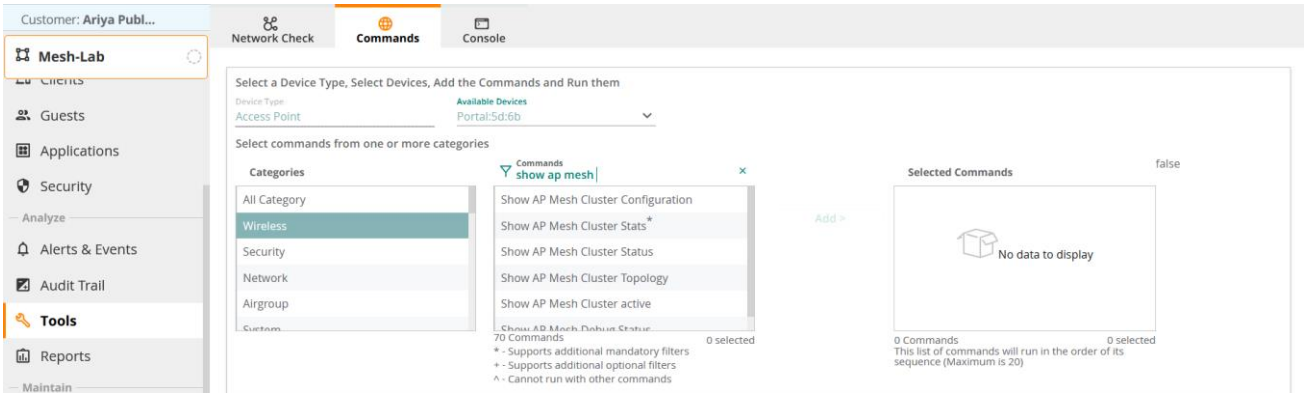
Note that you need to reboot the APs for the configuration to take effect.

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#
```

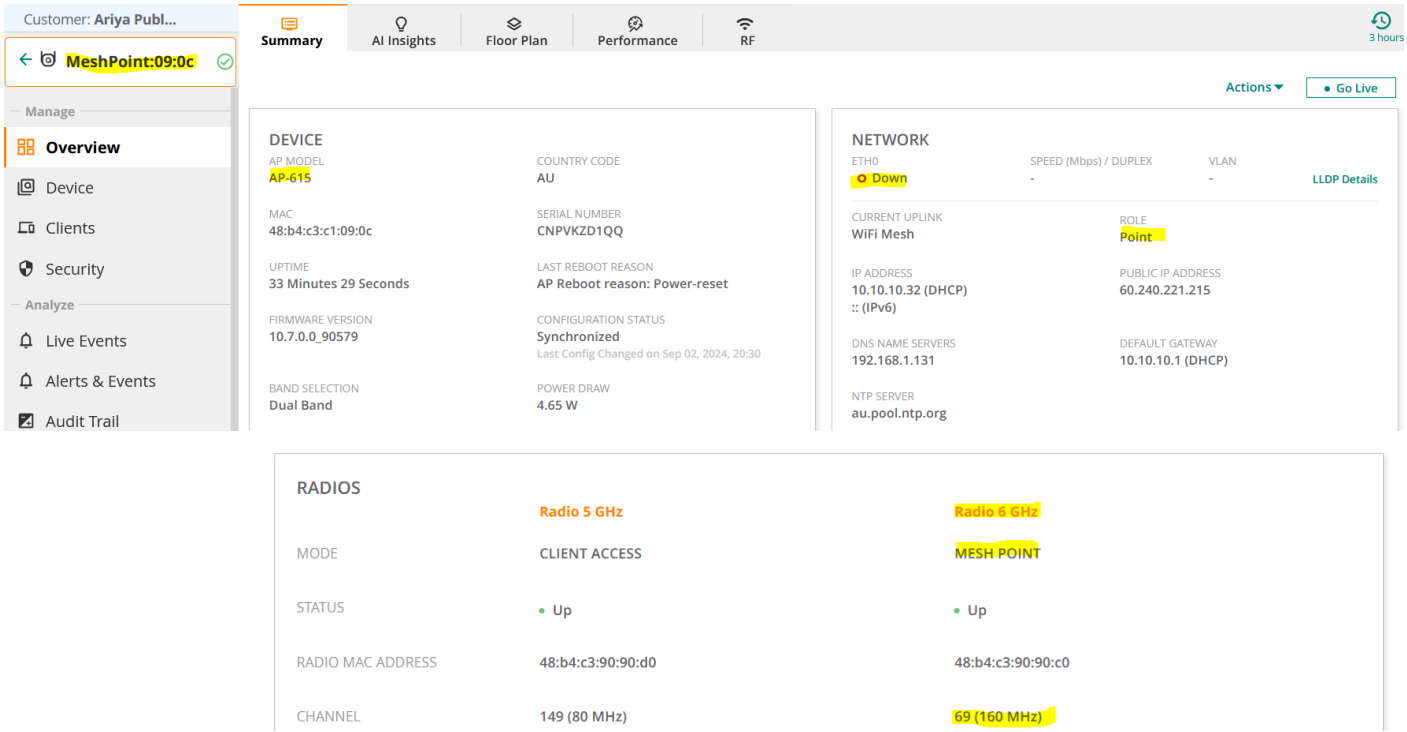
Next, we can check the mesh link that shows it is using 6GHz and 160MHz channel.

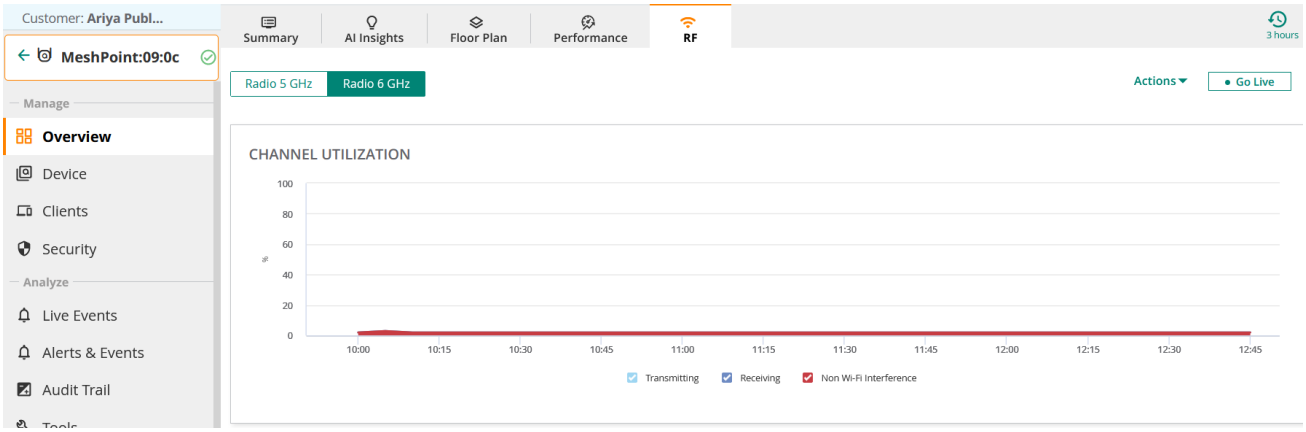
```
MeshPoint:09:0c# sh ap mesh neighbours

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

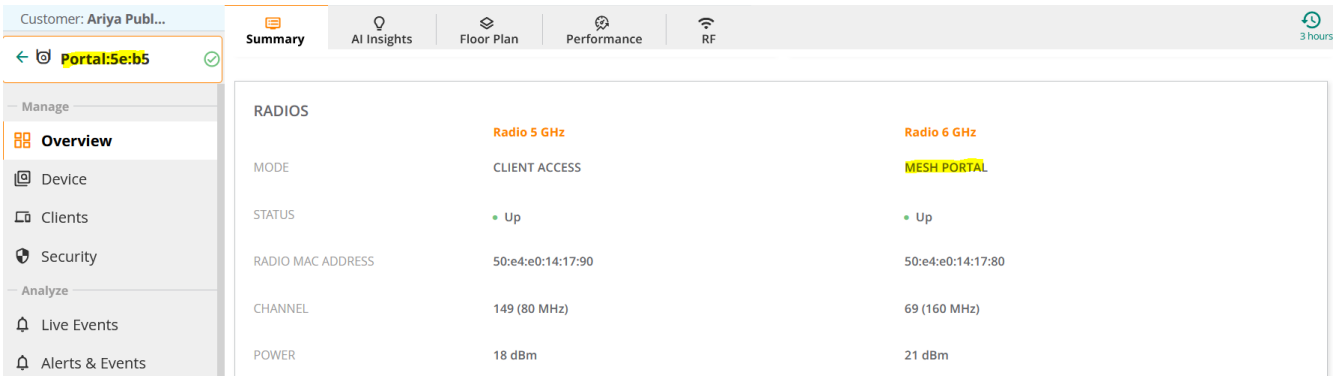
```
Portal:5e:b5# sh ap mesh neighbours

Neighbor list
-------------
Radio  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      48:b4:c3:90:90:c0  MeshPoint:09:0c  50:e4:e0:14:17:81  69-      6GHz  0    1     6.00  C
17m:8s                 ELK    37    1441/1633   2      2       0       HE-40MHzsgi-2ss
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-neighbour; 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,





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: e1baf29f4ca4ed35645e0a937d9c9c7
-------------------------------------------------
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: e1baf29f4ca4ed35645e0a937d9c9c7
-------------------------------------------------
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: <e1baf29f4ca4ed35645e0a937d9c9c7>, encrypted: TRUE, opmode: 0x20000,
priority:1
All Available Clusters(1):
 Cluster: <e1baf29f4ca4ed35645e0a937d9c9c7>, 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 Initted: 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 e1baf29f4ca4ed35645e0a937d9c9c7, 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.

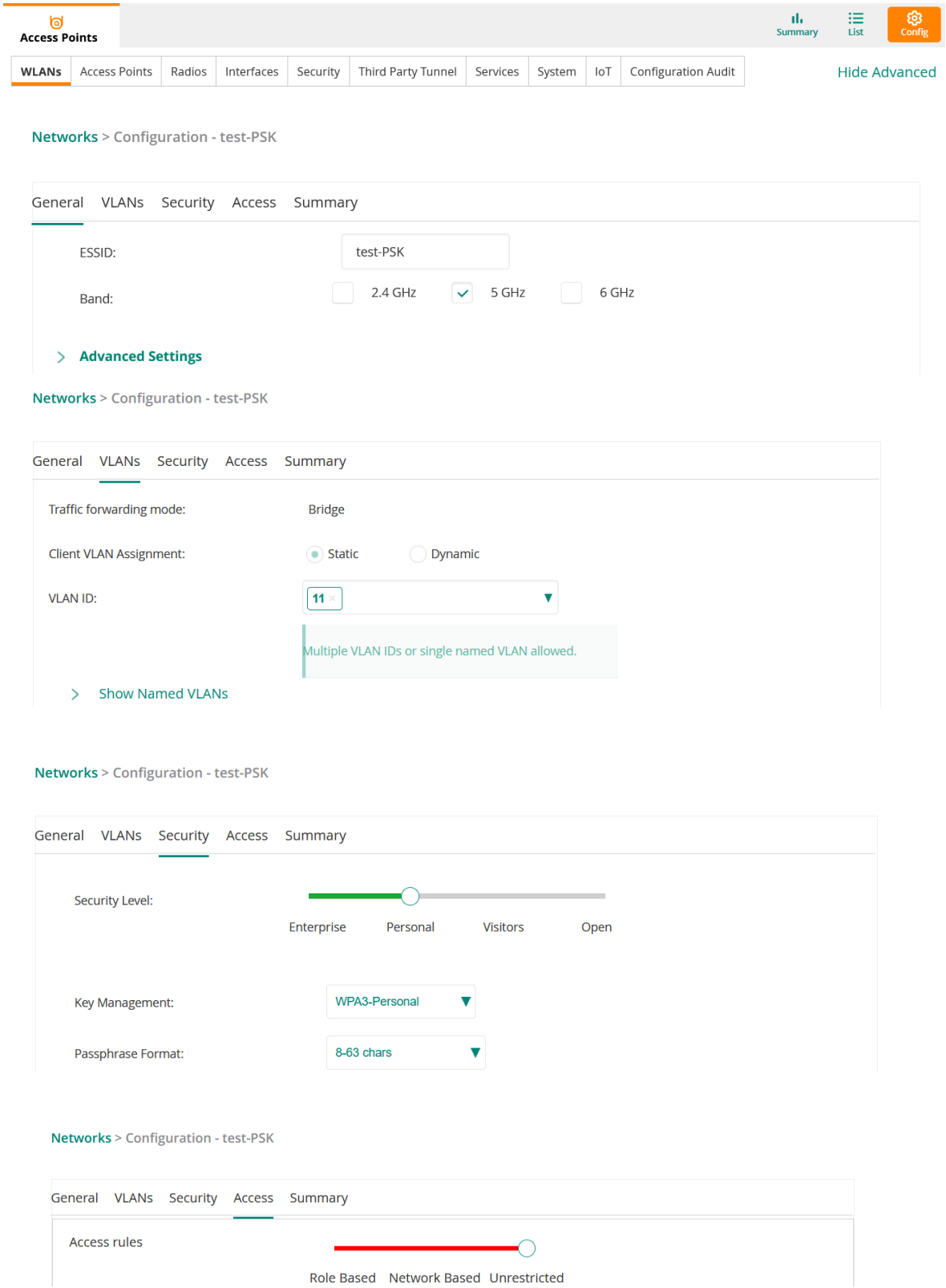
```
MeshPoint:09:0c# sh ap mesh counters

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

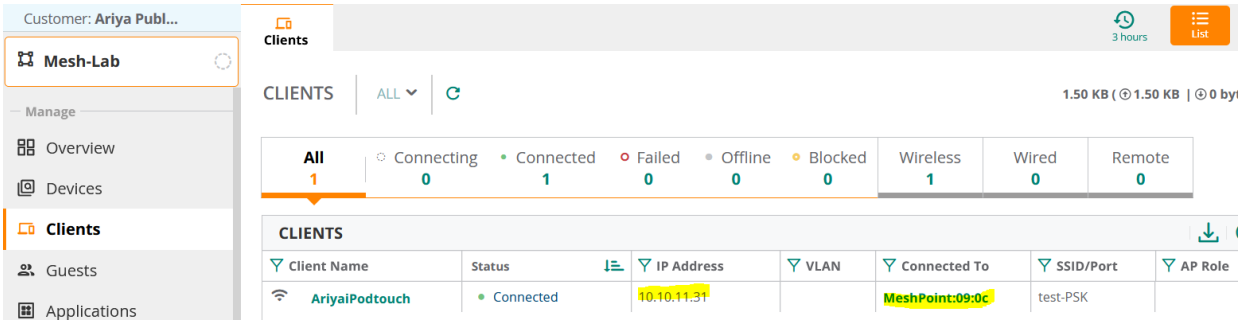
Here we have configured a simple “test-PSK” WLAN and set it for VLAN 11.



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#
```



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
-----  ---               -------       ------  -------  ----  ---  ----  ----  --------
---------        -----  ----  ----------  -----  ------  ------  ----------     --------
--
1      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.

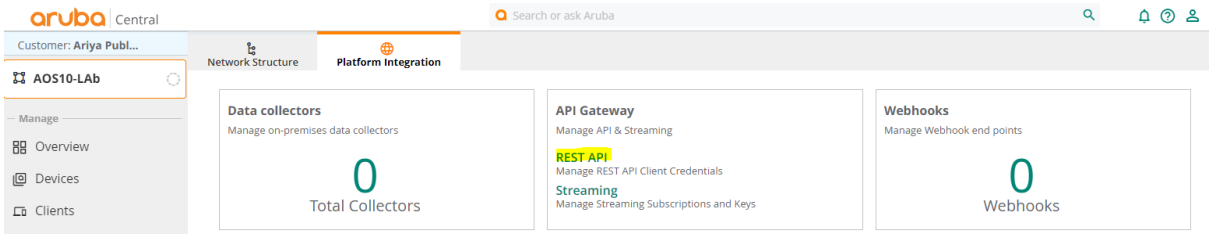
```
MeshPoint:09:0c# sh ap mesh config

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

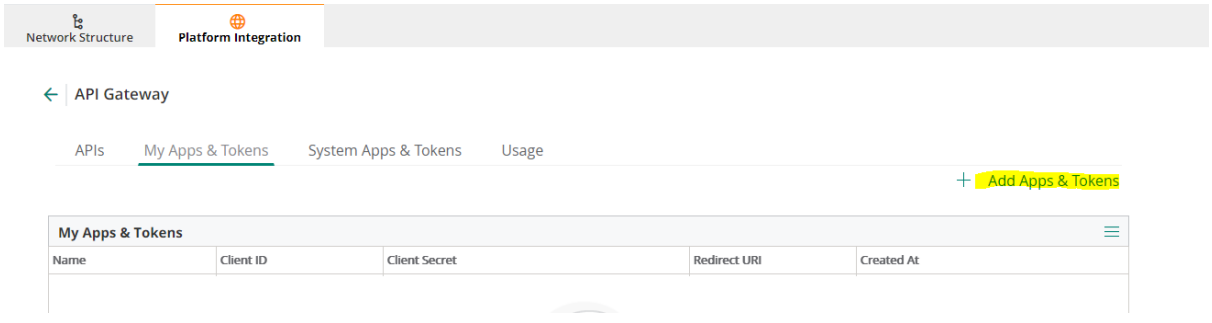
The interesting settings are link-threshold value and optimize-scan-interval and in my lab I'll changed it to threshold to 16 and 1 hour respectively.

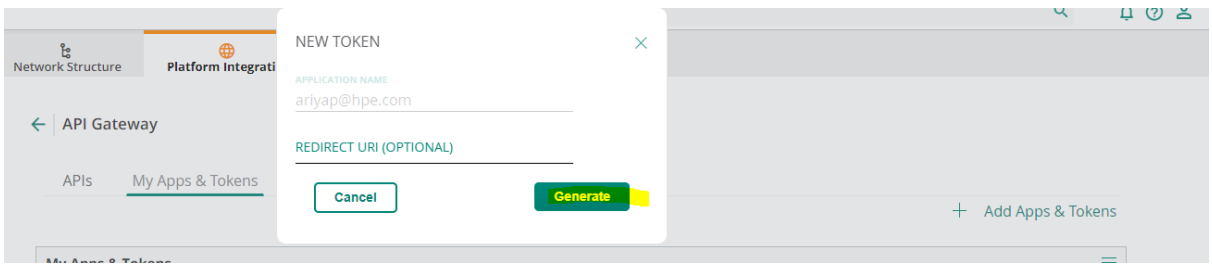
I am using Central Automation Studio (CAS) to modify the setting using APIs. But before that I need to add an API app for my Central account so that CAS can use it.

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

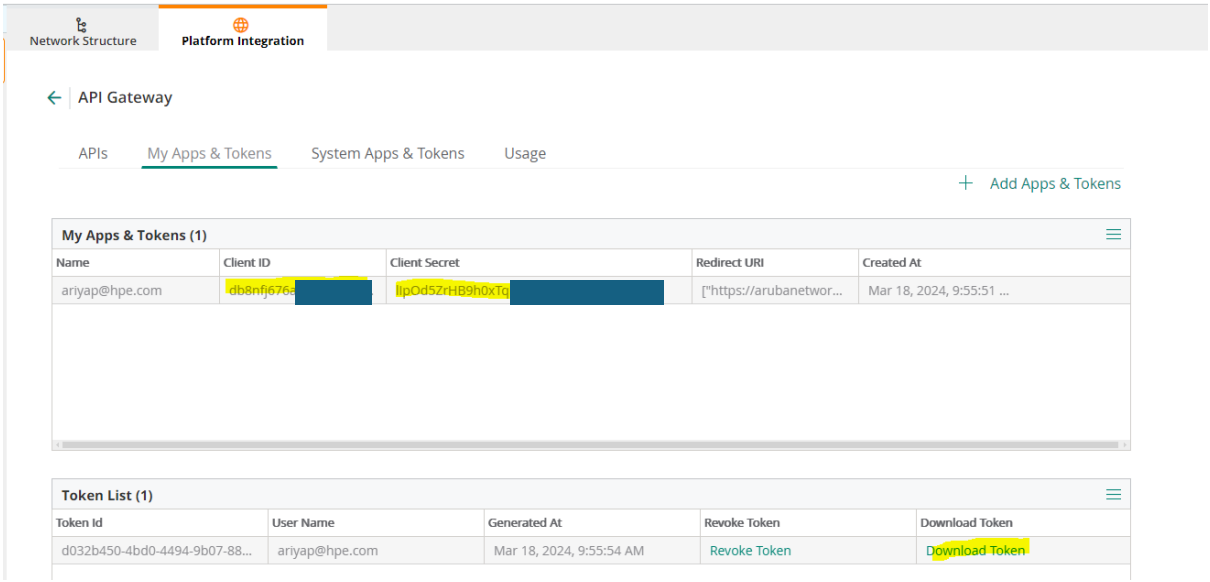


Next add a new App as shown.





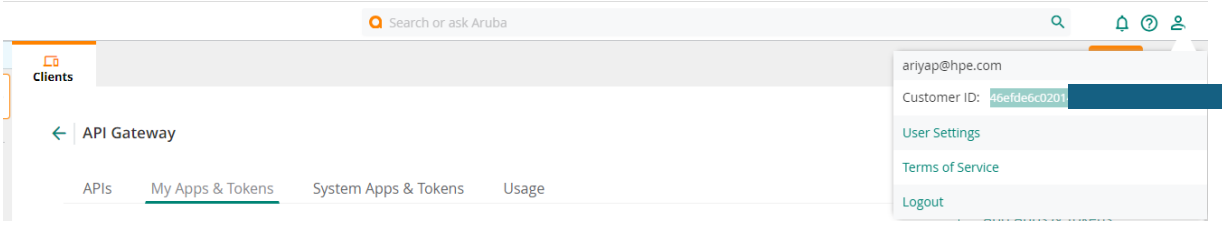
Here is my new app.



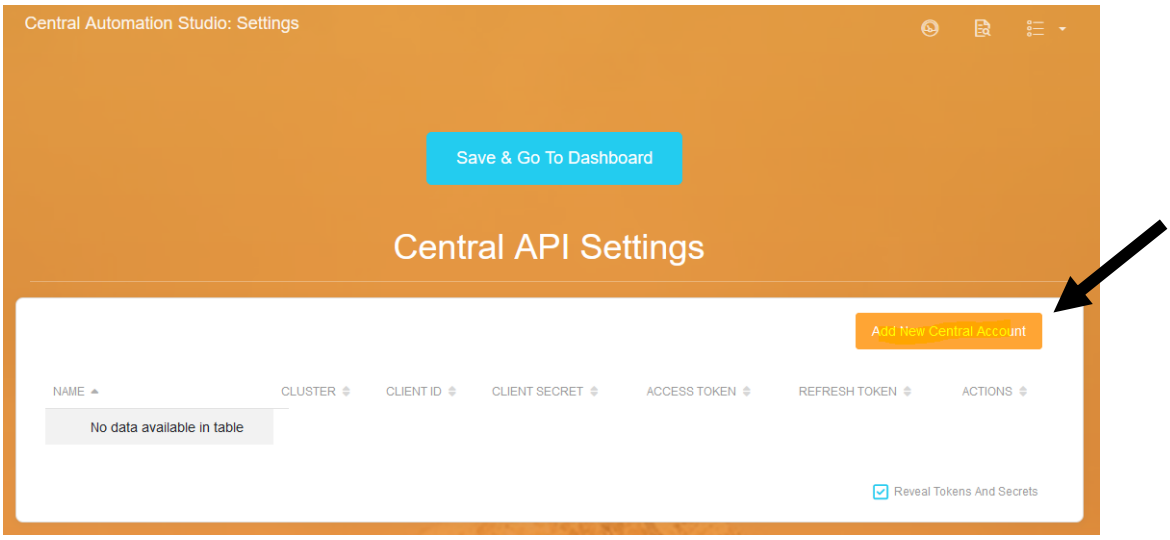
You need to click on "Download Token" and copy the following

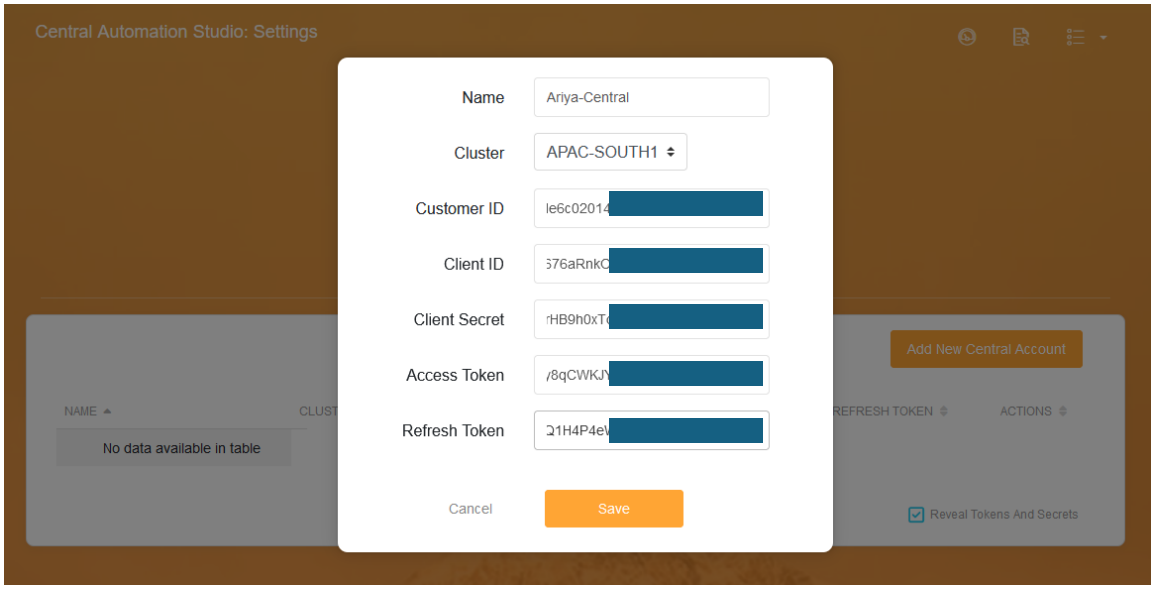

```
{"access_token":"Lup92Oy8qCWKJY<removed>",
"appname":"nms","authenticated_userid":"ariyap@hpe.com",
"created_at":1710716154604,
"credential_id":"96d-removed-d6",
"expires_in":7200,
"id":"d032b450-4bd0-4494-9b07-88e87661d927",
"refresh_token":"vQISlrFQ1H4P4e<removed>",
"scope":"all",
"token_type":"bearer"}
```

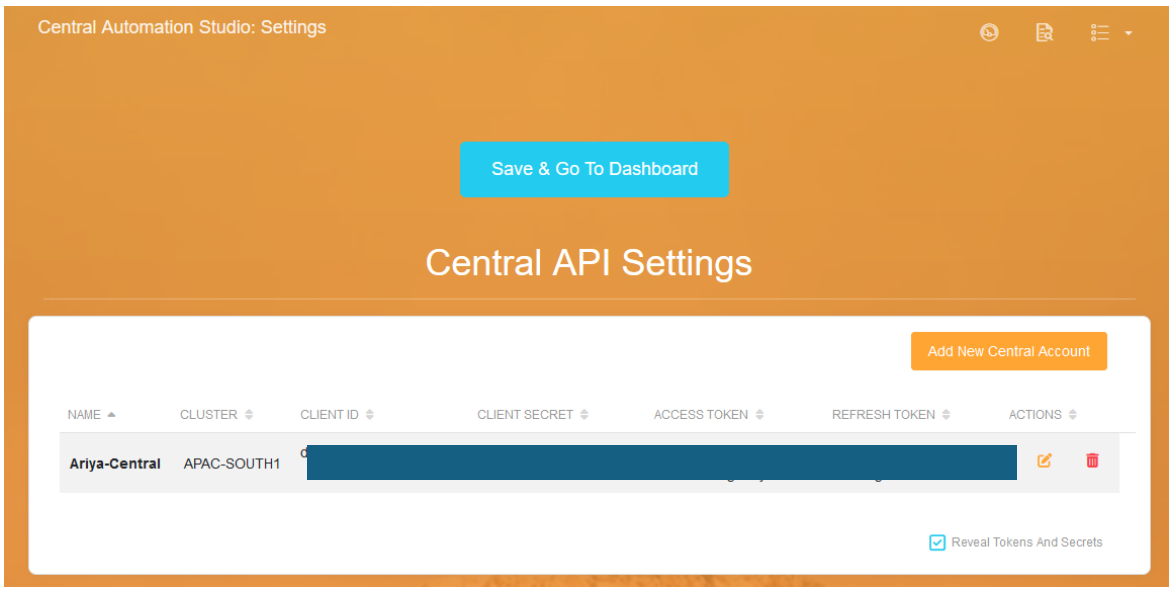

Copy your customer ID as well.



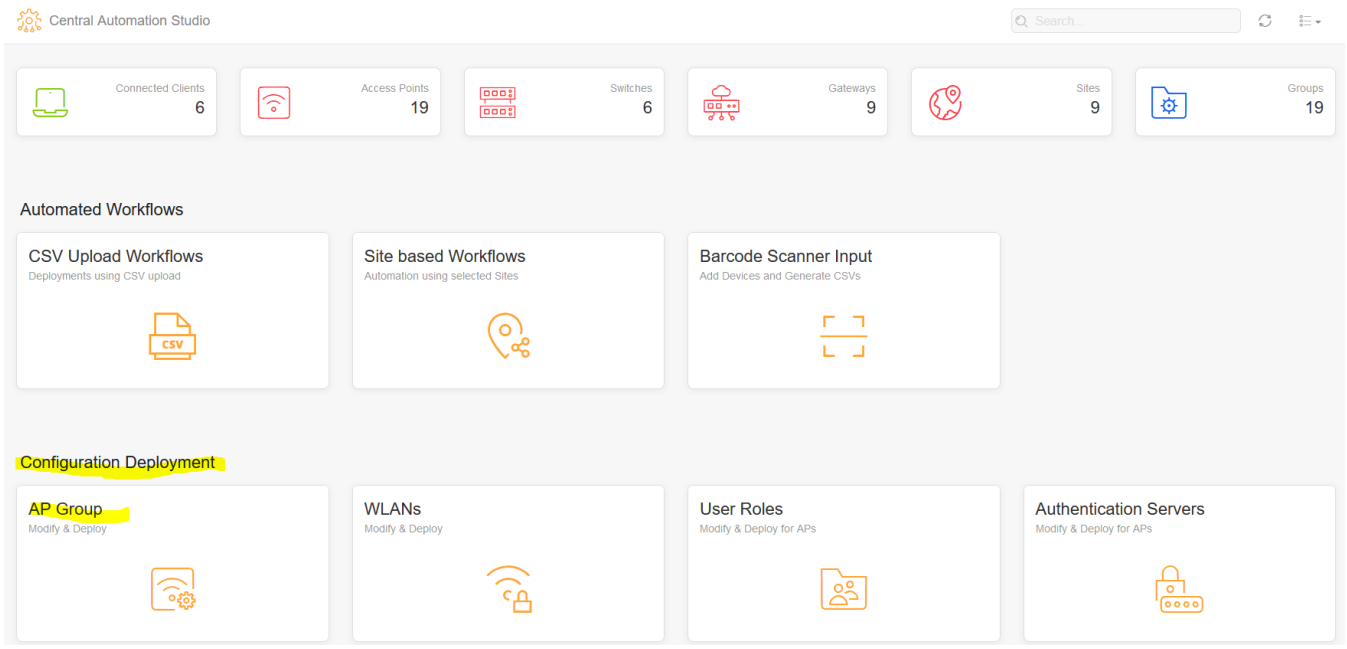
Customer ID = 46efde6c0<removed>. Once you have this information, go to the CAS site https://central.wifidownunder.com and add your Central account to it.



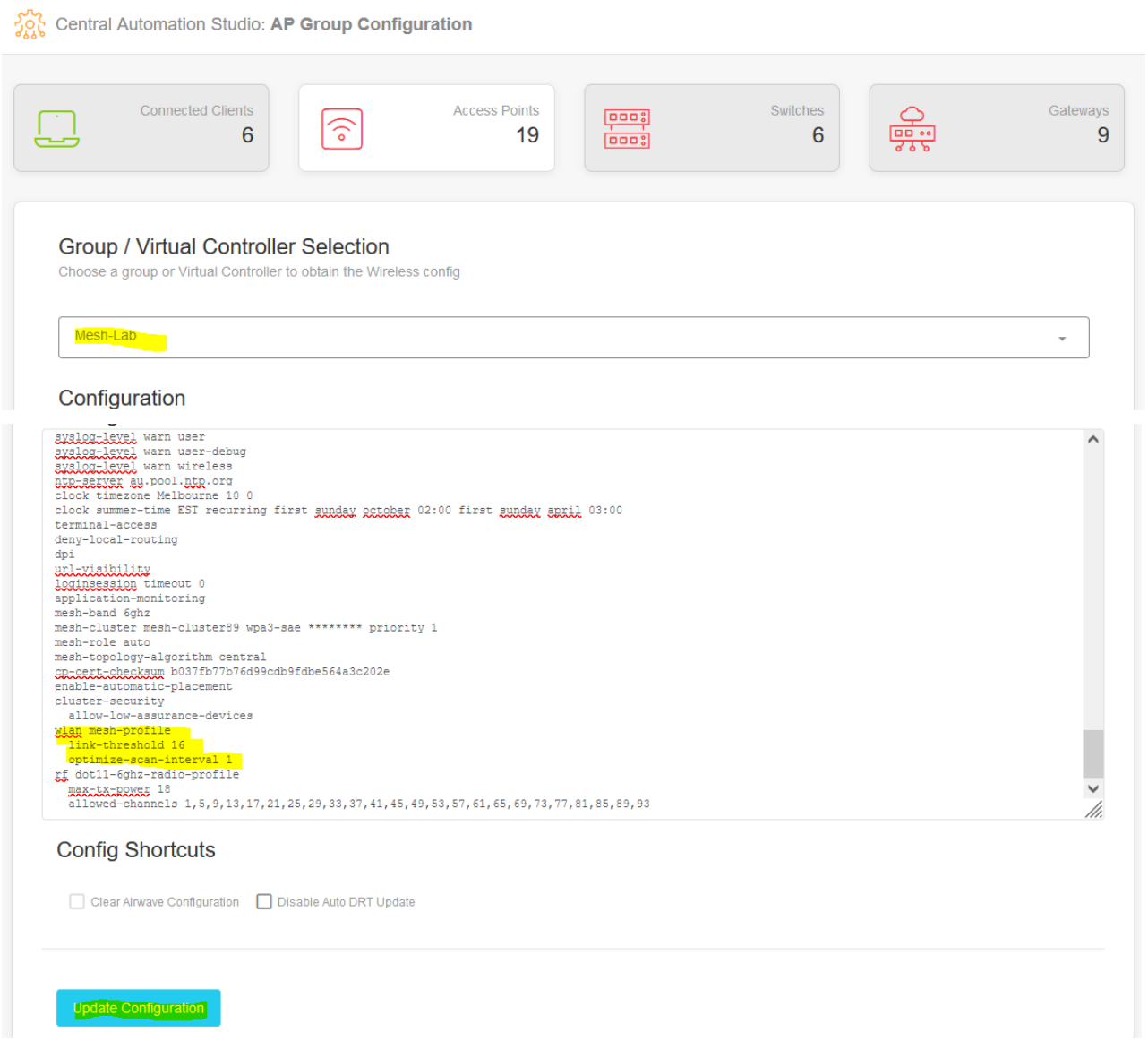




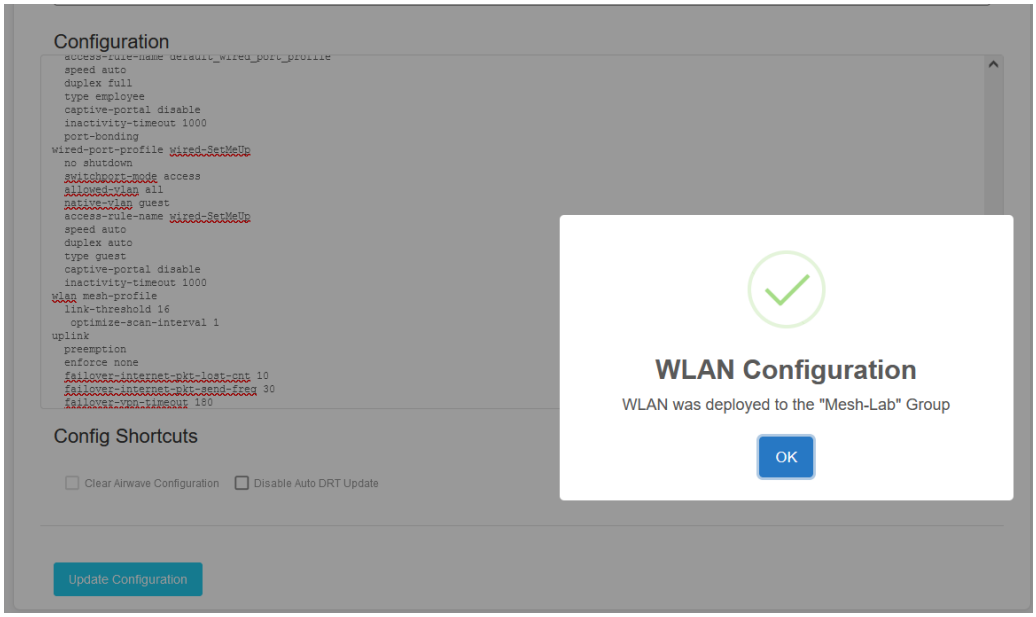
Now Save and go to the Dashboard and then go to Configuration Deployment for the AP Group as shown below.



Here we'll select our ap-group



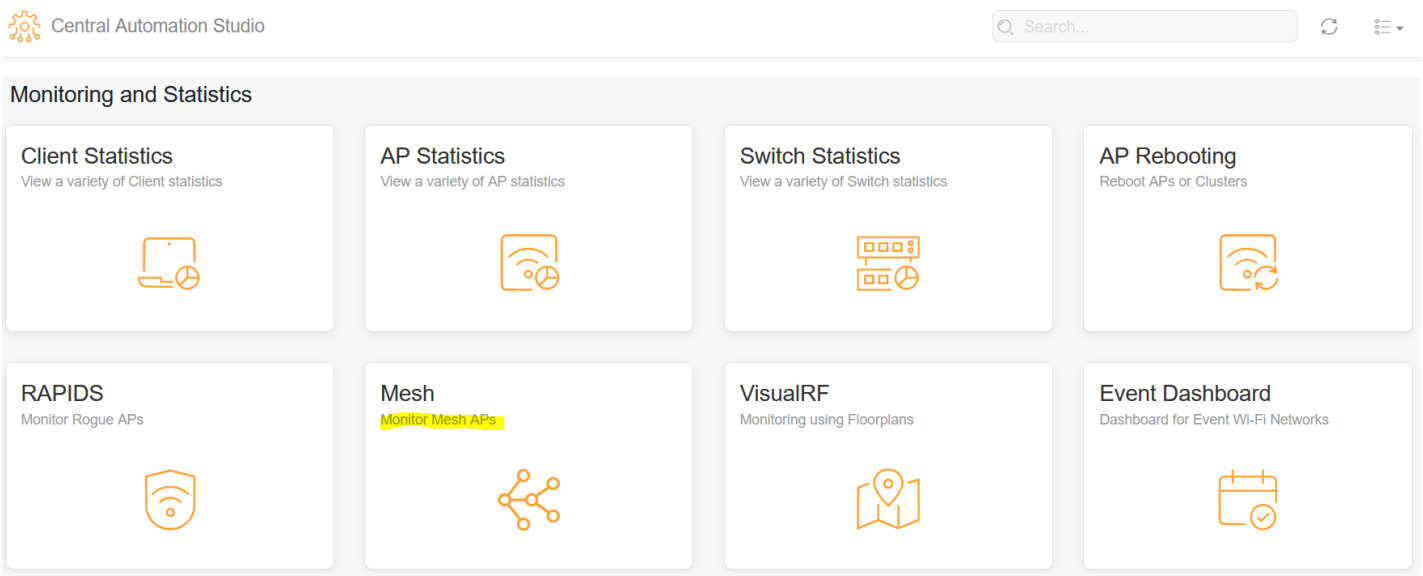
Add the highlighted commands and save it.



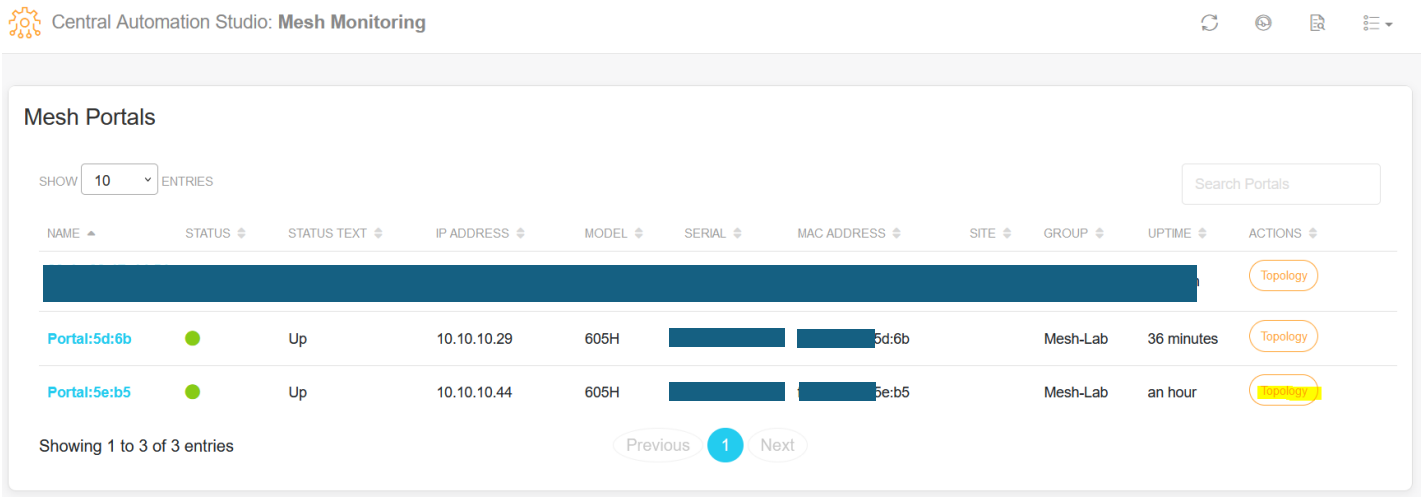
After that we can see the changes we have made in the mesh configuration as seen below.

```
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.



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.



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