

1 Table of Contents

Table of Contents

| | | |
|-----|--|----|
| 1 | Table of Contents | 1 |
| 1.1 | Revision History | 1 |
| 2 | Instant Mesh | 2 |
| 2.1 | Things you need | 2 |
| 3 | Instant AP Configuration..... | 3 |
| 3.1 | Normal Mesh Operation | 4 |
| 3.2 | Automatic Mesh Portal Selection | 7 |
| 3.3 | Mesh Profile Parameters..... | 9 |
| 3.4 | Reconnecting the Wired Port..... | 10 |
| 3.5 | Ethernet Bridging | 10 |
| 4 | Instant Mesh Cluster | 15 |
| 4.1 | Instant Cluster Manual Configuration | 16 |
| 4.2 | Multiple Mesh Clusters and Failover | 17 |
| 4.3 | Mesh Radio selection | 22 |
| 4.4 | Mesh Links and Fast Roaming | 23 |
| 4.5 | Mesh Fine Tuning | 24 |
| 4.6 | Show Cluster Commands | 24 |

1.1 Revision History

| DATE | VERSION | EDITOR | CHANGES |
|-------------|---------|-------------------|--------------------------|
| 11 Dec 2021 | 0.1 | Ariya Parsamanesh | Initial creation |
| 14 Jan 2022 | 0.2 | Ariya Parsamanesh | Addition of Mesh cluster |
| | | | |

2 Instant Mesh

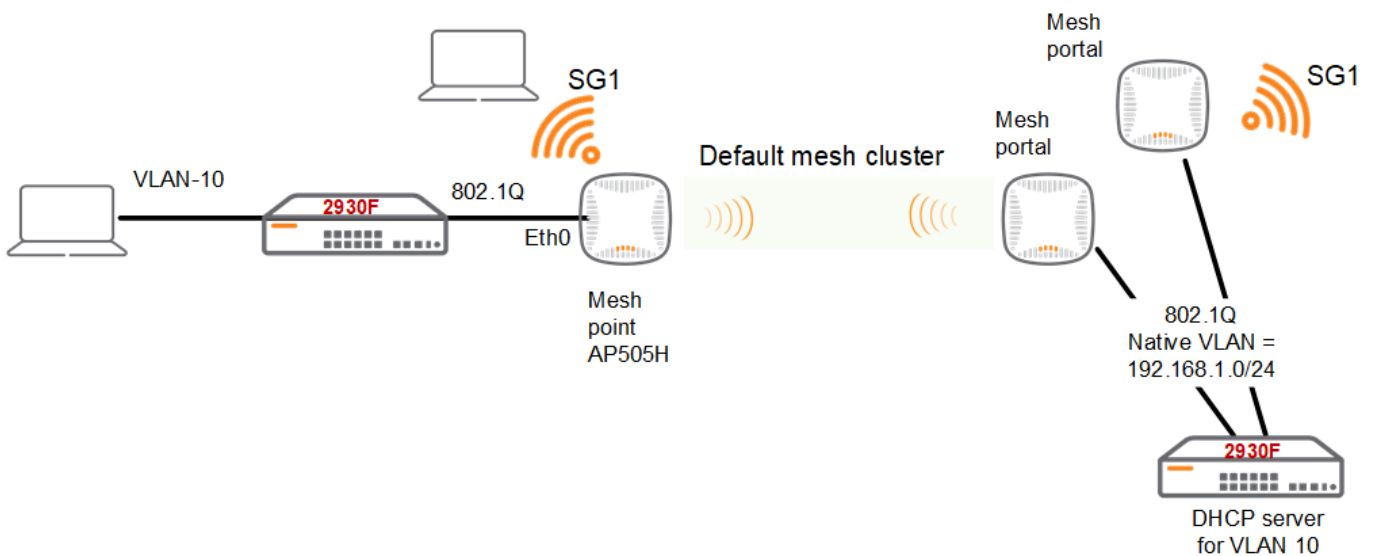
Aruba Instant APs (IAP) uses Wi-Fi mesh technology to extend Wi-Fi coverage for outdoor/ indoor environments. Instant Mesh network must have at least one valid uplink to provide mesh functionality. This uplink can either be wired or 3G/4G connection. As soon as an IAP has a valid uplink, it functions as a Mesh Portal, and IAP without an Ethernet link functions as a Mesh Point. Now if we have 2x IAPs with valid uplink connections this makes them both Mesh Portal. There is redundancy in the mesh network, and most mesh points try to mesh directly with one of the two portals. The selection is based on the actual deployment and RF environment. But generally, this happens automatically.

Here are the new enhancements.

- Role Assignment enhancement for Mesh point, IAP will check if the Eth0 is up and operational as it sends loop detection packets. If the Eth0 is up and operational then only will the mesh point reboots and becomes a mesh portal.
- We can now have more than one mesh cluster for IAP swarm and manually configure mesh clusters and assign it to specific IAPs
- Mesh cluster for fast moving environments with fast roaming

Here is the lab set-up to demonstrating three scenarios, showing the configuration steps for setting up

1. Mesh link with the default mesh cluster and enabling E0 bridging.



2. Manual mesh cluster for a specific Mesh portal/point with E0 bridging.
3. Manual mesh cluster for a specific Mesh portal/point with E0 bridging and backup mesh cluster.

2.1 Things you need

- Aruba Instant version 8.8.0.0 or later
- 3x IAPs in an existing Instant Cluster
- A Layer three switch and some Wi-Fi and wired clients

3 Instant AP Configuration

As long as IAPs are part of an Instant cluster, they automatically can connect to the nearest IAP to create a wireless mesh link using their 5GHz radio as a backhaul link. The mesh operation is only supported on the IAPs with dual radios. Generally, an IAP with an active Ethernet link is a Mesh Portal and acts like a gateway between wireless mesh and the main wired LAN.

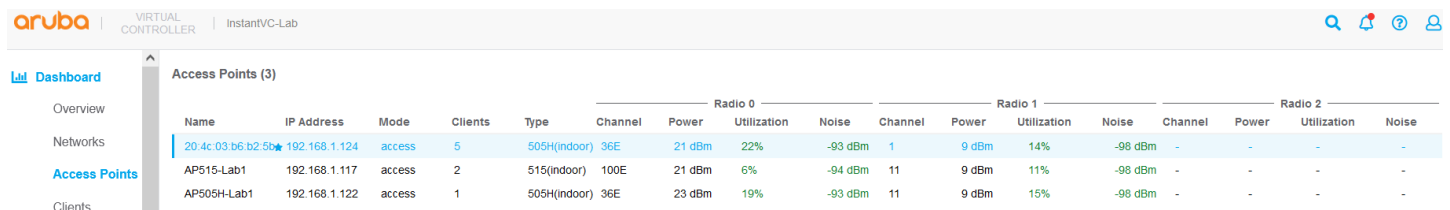
The IAP that connects to Mesh portal using its Wi-Fi radio is called Mesh Point. Then the mesh point provides wireless services to its clients like any other IAP.

In an Instant mesh network, the maximum

- Hop count is 2,
- Number of mesh points per mesh portal is 8.

On dual-radio Instant APs, the 2.4 GHz radio is always used for client traffic, while the 5 GHz radio is always used for both mesh-backhaul and client traffic. If you anticipate large number of 5G clients on the same radio that is used for mesh backhaul, it is advisable to separate it out so that the 5G radio is dedicated to the mesh backhaul. You can separate it out using zones and manual mesh cluster configuration shown later in this guide.

Here we have 3x IAPs in a cluster as shown below. At this stage both are connected to the LAN.



The screenshot shows the Aruba InstantVC-Lab dashboard with the 'Access Points (3)' section selected. It displays a table of three access points: 20:4c:03:b6:b2:5b, AP515-Lab1, and AP505H-Lab1. Each AP is in 'access' mode and has 5, 2, and 1 clients respectively. The table also shows radio configuration details for Radio 0, Radio 1, and Radio 2, including channel, power, utilization, and noise levels.

| Name | IP Address | Mode | Clients | Type | Radio 0 | | | Radio 1 | | | Radio 2 | | | | | |
|-------------------|---------------|--------|---------|--------------|---------|--------|-------------|---------|---------|-------|-------------|---------|---------|-------|-------------|-------|
| | | | | | Channel | Power | Utilization | Noise | Channel | Power | Utilization | Noise | Channel | Power | Utilization | Noise |
| 20:4c:03:b6:b2:5b | 192.168.1.124 | access | 5 | 505H(indoor) | 36E | 21 dBm | 22% | -93 dBm | 1 | 9 dBm | 14% | -98 dBm | - | - | - | - |
| AP515-Lab1 | 192.168.1.117 | access | 2 | 515(indoor) | 100E | 21 dBm | 6% | -94 dBm | 11 | 9 dBm | 11% | -98 dBm | - | - | - | - |
| AP505H-Lab1 | 192.168.1.122 | access | 1 | 505H(indoor) | 36E | 23 dBm | 19% | -93 dBm | 11 | 9 dBm | 15% | -98 dBm | - | - | - | - |

Mesh networks requires that extended-ssid to be turned off.

```
20:4c:03:b6:b2:5b# 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 configured :no
extended-ssid active :no
advanced-zone configured :no
Factory default status :no
Source of system time :NTP server
Config load cnt :1
VC Channel index :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 VAP numbers :0 / 0
20:4c:03:b6:b2:5b#
```

Here is where we need to disable extended SSID

The screenshot shows the Aruba InstantVC configuration interface. The left sidebar contains navigation menus for Dashboard, Configuration, System, and Maintenance. The main content area is titled 'Cluster Security' and lists various settings. The 'Extended SSID' setting is highlighted in yellow and is currently turned off. Other settings include 'Auto join mode', 'Terminal access', 'Console access', 'Telnet server', 'LED display', 'Deny inter user bridging', 'Deny local routing', 'Dynamic CPU management', and 'DHCP Option 82 XML'. A 'Hide advanced options' button is visible at the bottom of the configuration area.

When you make this change you need to reboot the APs for this to take effect.

3.1 Normal Mesh Operation

Now I have disconnected the AP505H-Lab1 from the LAN switch and is being powered up by an adapter. Once the IAP is rebooted they will automatically try mesh functionality since their Eth0 is not connected.

This command is executed on the Instant conductor that is Mesh portal.

```
20:4c:03:b6:b2:5b# 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
-----  ---
0      d0:d3:e0:b2:41:70   AP505H-Lab1  d0:d3:e0:b2:2a:91  36E    5GHz  0   1   1.00  C 7m:11s
ELK    29    612/544    1      1      0      HE-80MHz-2ss  b4afc01b0ce08dcc578432086842f21

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

20:4c:03:b6:b2:5b#
```

And this is the corresponding command on the Mesh Point

```

AP505H-Lab1# 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
-----  ---  -----  -----  -----  -----  -----  -----  -----  ---
0      d0:d3:e0:b2:2a:91  20:4c:03:b6:b2:5b  Yes      36E      5GHz  0    0    1.00  P 8m:49s
ELK    28    612/612    2      1      1      HE-80MHz-2ss  b4afc01b0ce08dcc578432086842f21

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

AP505H-Lab1#
  
```

Here is the WebUI view, you can see we have two Mesh Portals and one Mesh point APs.

The screenshot shows the Aruba InstantVC-Lab WebUI. The 'Mesh Devices (3)' table lists the following devices:

| Name | IP Address | Clients | Type | Mesh Role | Portal AP | Parent | Last Update | Uplink Age |
|-------------------|---------------|---------|--------------|-----------|-------------------|-------------------|-------------|----------------|
| AP505H-Lab1 | 192.168.1.122 | 1 | 505H(indoor) | Point | 20.4c.03.b6.b2.5b | 20.4c.03.b6.b2.5b | 1m:55s | 9m:33s |
| AP515-Lab1 | 192.168.1.117 | 3 | 515(indoor) | Portal | AP515-Lab1 | - | 2m:3s | 45m:16s |
| 20.4c.03.b6.b2.5b | 192.168.1.124 | 4 | 505H(indoor) | Portal | 20.4c.03.b6.b2.5b | - | 1m:40s | 6d:18h:42m:13s |

The 'Details' section for AP505H-Lab1 shows the following information:

- Name: AP505H-Lab1
- MAC: 20:4c:03:b2:75:97
- Mesh Name: b4afc01b0ce08dcc578432086842f21
- Type: 505H(indoor)
- IPv6 Address: --
- IP Address: 192.168.1.122
- Serial number: CNK6KSM03Q
- CPU utilization: 6%
- Memory free: 520 MB

Below the details are four performance graphs for Radio 0 - Mesh Link Band: 5G:

- Channel Utilization (%)**: Line graph showing utilization between 0% and 10% over time.
- RSSI**: Line graph showing RSSI levels between 0 and 40 over time.
- Goodput (bps)**: Stacked area chart showing Tx (blue) and Rx (orange) goodput up to 1Gbps.
- Throughput (bps)**: Stacked area chart showing Tx (blue) and Rx (orange) throughput up to 1Mbps.

We see that the mesh link is on 5G radio. There are other mesh commands as well, like mesh cluster topology. These commands are run on the Virtual controller (VC).

```

20:4c:03:b6:b2:5b# sh ap mesh cluster topology

Mesh Cluster name: b4afc01b0ce08dcc578432086842f21
-----
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
-----  -----  -----  -----  -----  -----  -----  -----  -----  ---
AP505H-Lab1  AP-505H  Point      192.168.1.122  20:4c:03:b6:b2:5b  0      MPC (AX)    d0:d3:e0:b2:41:71
20:4c:03:b6:b2:5b  1      0      0      1      612/612    28    25s          10m:34s
-
AP515-Lab1   AP-515   Portal     192.168.1.117  AP515-Lab1  0      MPP (AX)    9c:8c:d8:12:b3:11
-
-
-
  
```


3.2 Automatic Mesh Portal Selection

Instant mesh also provide automatic Mesh portal selection. In our setup since we have 2x mesh portals, the system automatically selects the better mesh portal.

Here we see that AP505H-Lab1 which is our mesh point that is connected to the VC because it has a better RSSI.

```
AP505H-Lab1# 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
-----  ---  -----  -
0      d0:d3:e0:b2:2a:91  20:4c:03:b6:b2:5b  Yes   36E      5GHz  0   0   1.00  P 15m:55s
ELK    27      612/612      2     1     1     HE-80MHz-2ss   b4afc01b0ce08dcc578432086842f21

Total count: 1, Children: 0
Relation: P = Parent; C = Child; N = Neighbor; B = Denylistd-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 Denylistd-neighbor; e = SAE Enabled; u = portal-unreachable; o = opensystem;
m = Mobility Enabled

AP505H-Lab1#
```

Here is how the Mesh Point AP keeps track of the best Mesh Portal through its neighbour table

```
AP505H-Lab1# 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
-----  ---  -----  -
0      d0:d3:e0:b2:2a:91  20:4c:03:b6:b2:5b  Yes   100E     5GHz  0   0   1.00  P 3h:30m:24s
ELK    24      680/612      4     4     0     HE-80MHz-2ss   b4afc01b0ce08dcc578432086842f21
0      9c:8c:d8:12:b3:11  AP515-Lab1         Yes   100E     5GHz  0   0   0.00  N 21m:30s
ELK    16      -            0     0     0     HE-80MHz-4ss   b4afc01b0ce08dcc578432086842f21

Total count: 2, Children: 0
Relation: P = Parent; C = Child; N = Neighbor; B = Denylistd-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 Denylistd-neighbor; e = SAE Enabled; u = portal-unreachable; o = opensystem;
m = Mobility Enabled

AP505H-Lab1#
```

The AP515-Lab1 has lower RSSI value and hence not been selected.

Checking the mesh counters on the mesh point shows the change record, look for previous portals.

```
AP505H-Lab1# 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      0      0
-        -      0
Child   12852  12920  71      72 (72 HT)  4 (4 HT)  4 (4 HT)  0
0        0      143354

Received Packet Statistics: Total 297862, Mgmt 143964 (dropped non-mesh 0), Data 25757 (dropped
unassociated 0)HT: pns=0 ans=0 pnr=72 ars=4 arr=0 anr=4

Recovery Profile Usage Counters
-----
Item                Value
-----
Enter recovery mode 0
Exit recovery mode  0
```

Total connections to switch 0

Mesh loop-prevention Sequence No.:846041
Mesh timer ticks:12951

Change-record: HT-link renegotiation, linkdown:3h:34m:39s, linkup:3h:34m:39s, previous portal:d0:d3:e0:b2:2a:91, previous parent: d0:d3:e0:b2:2a:91
Scan-summary:34:1 36:s 38:1 40:s 42:1 44:s 46:1 48:0 52:0 56:0 60:s 64:s 100:1 104:s 108:s 112:s 116:s 120:1 124:1 128:1 132:s 136:s 140:s 144:1 149:s 153:s 157:s 161:s 165:s 169:1 173:1
scan-key: n:not-set,i:invalid,b:denylisted,s:set,<number>:probe-resp-cnt.
AP505H-Lab1#

Now we move the AP515-Lab1 to a better location to improve its RSSI.

AP505H-Lab1# 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  
-----  
0      d0:d3:e0:b2:2a:91  20:4c:03:b6:b2:5b  Yes    100E    5GHz  0  0  1.00  P 4h:7m:0s  
ELK    25      612/612    4      4      0      HE-80MHz-2ss    b4afc01b0ce08dcc578432086842f21  
0      9c:8c:d8:12:b3:11  AP515-Lab1        Yes    100E    5GHz  0  0  0.00  N 2m:8s  
ELK    32      -          0      0      0      HE-80MHz-4ss    b4afc01b0ce08dcc578432086842f21  
  
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
```

AP505H-Lab1#

But it is still connected to the first Mesh-Portal. 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.

AP505H-Lab1# 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  
-----  
0      d0:d3:e0:b2:2a:91  20:4c:03:b6:b2:5b  Yes    100E    5GHz  0  0  1.00  P 4h:24m:28s  
ELK    23      680/680    4      4      0      HE-80MHz-2ss    b4afc01b0ce08dcc578432086842f21  
0      9c:8c:d8:12:b3:11  AP515-Lab1        Yes    100E    5GHz  0  0  0.00  N 19m:36s  
ELK    29      -          0      0      0      HE-80MHz-4ss    b4afc01b0ce08dcc578432086842f21  
  
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
```

AP505H-Lab1# 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  
-----  
0      9c:8c:d8:12:b3:11  AP515-Lab1        Yes    100E    5GHz  0  0  1.00  P 11s  
DELK   29      1020/1020  1      1      0      HE-80MHz-4ss    b4afc01b0ce08dcc578432086842f21  
0      d0:d3:e0:b2:2a:91  20:4c:03:b6:b2:5b  Yes    100E    5GHz  0  0  1.00  N 11s  
ELK    13      -          4      4      0      HE-80MHz-2ss    b4afc01b0ce08dcc578432086842f21  
  
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
AP505H-Lab1#

```

Show once the backoff timer expires the new Mesh-Portal is selected.

```

AP505H-Lab1# 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
-----  ---  -----  -
0      9c:8c:d8:12:b3:11  AP515-Lab1           Yes  100E    5GHz  0    0    1.00  P 10m:0s
ELK    29    1020/1020  1      1      0      HE-80MHz-4ss  b4afc01b0ce08dcc578432086842f21
0      d0:d3:e0:b2:2a:91  20:4c:03:b6:b2:5b   Yes  100E    5GHz  0    0    0.00  N 10m:0s
ELK    14    -          4      4      0      HE-80MHz-2ss  b4afc01b0ce08dcc578432086842f21

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
AP505H-Lab1#

```

Now checking the mesh link status and we'll see that AP515-Lab1 is selected.

```

AP505H-Lab1# 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
-----  ---  -----  -
0      9c:8c:d8:12:b3:11  AP515-Lab1           Yes  100E    5GHz  0    0    1.00  P 10m:38s  ELK  29
1020/1020  1    1    0      HE-80MHz-4ss  b4afc01b0ce08dcc578432086842f21

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
AP505H-Lab1#

```

And here is the WebUI view.

| aruba VIRTUAL CONTROLLER InstantVC-Lab | | | | | | | | |
|--|-------------------|---------------|---------|--------------|-----------|-------------------|------------|-------------|
| Mesh Devices (3) | | | | | | | | |
| | Name | IP Address | Clients | Type | Mesh Role | Portal AP | Parent | Last Update |
| Overview | AP505H-Lab1 | 192.168.1.122 | 0 | 505H(indoor) | Point | AP515-Lab1 | AP515-Lab1 | 20s |
| Networks | AP515-Lab1 | 192.168.1.117 | 6 | 515(indoor) | Portal | AP515-Lab1 | - | 23s |
| Access Points | 20:4c:03:b6:b2:5b | 192.168.1.124 | 2 | 505H(indoor) | Portal | 20:4c:03:b6:b2:5b | - | 46s |
| Clients | Details | | | | | | | |
| Mesh Devices | Info | | | | | | | |

3.3 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. There are three settings that influence this scan
 - a. link-threshold
 - b. optimize-scan-interval
 - c. reselection-mode

Here are the default setting of the mesh profile from the VC.

```
20:4c:03:b6:b2:5b# 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
20:4c:03:b6:b2:5b#
```

3.4 Reconnecting the Wired Port

Here we'll recon]nect the Ethernet cable from AP505H-Lab1. When we re-connect the Ethernet cable the default behaviour is that the IAP immediately reboots as soon as it senses that the physical interface is up. This is not the best option as the link could be up and the Ethernet network may not be operational.

With Instant 8.4 we have "enhanced-mesh-role-detect" command that sends loop detection packets to check if the Ethernet 0 link is available. This is a CLI command only.

```
20:4c:03:b6:b2:5b#
20:4c:03:b6:b2:5b# conf t
We now support CLI commit model, please type "commit apply" for configuration to take effect.
BLDG-A-ATV1 (config) # enhanced-mesh-role-detect
BLDG-A-ATV1 (config) #
BLDG-A-ATV1# com app
committing configuration...
configuration committed.
20:4c:03:b6:b2:5b#
```

So now with this command when we connect the Ethernet cable to just bring up the interface, the IAP will not reboot immediately unless it sees that the Ethernet network is operations. This really enhances the uptime and functionality of the mesh links.

3.5 Ethernet Bridging

This feature is used to use the Ethernet port of the Mesh Point IAP as a downlink, so you can connect a wired device either on the same VLAN as that of the IAP or on any other VLAN through 802.1Q VLAN trunking. You can do this by simply selecting the AP505H-Lab1 as shown below

aruba | VIRTUAL CONTROLLER | InstantVC-Lab

Dashboard

- Overview
- Networks
- Access Points
- Clients
- Mesh Devices

Configuration

- Networks
- Access Points

| Access Points (3) | | | | | | | |
|-------------------|---------------|--------|----------|---------|--------------|-----------|------|
| Name | IP Address | Mode | Spectrum | Clients | Type | Mesh Role | Zone |
| 20:4c:03:b6:b2:5b | 192.168.1.124 | access | enable | 6 | 505H(indoor) | Portal | - |
| AP505H-Lab1 | 192.168.1.120 | access | enable | 2 | 505H(indoor) | Point | - |
| AP515-Lab1 | 192.168.1.122 | access | enable | 0 | 515(indoor) | Portal | - |

If you re-call this is the Mesh-Point and enabling Eth0 bridging is by setting it to downlink.

aruba | VIRTUAL CONTROLLER | InstantVC-Lab

Dashboard

- Overview
- Networks
- Access Points
- Clients
- Mesh Devices

Configuration

- Networks
- Access Points
- System

Edit Access Point AP505H-Lab1

- General
- Radio
- Installation Type
- Uplink
 - Uplink management VLAN: 0
 - Eth0 mode: Downlink
 - Eth1 mode: Downlink
 - USB port:
- PEAP User
- Upload Certificate

You should then reboot the IAP for this change to take effect. Note that if an IAP is set to Ethernet 0 bridging, it always acts as a mesh point. When an IAP is configured with Eth0 bridging and then rebooted, the E0 bridging will become AP environment setting.

Here you can check the AP environment parameters.

```
AP505H-Lab1# sh ap-env
Antenna Type:Internal
IoT Antenna Type:Internal
Need USB field:Yes
name:AP505H-Lab1
enet0_bridging:1
aplxuser:InstantAP
aplxpasswd:274d5d134a80c4ded537657e000f6cbb4801341fea639d54
uap_controller_less:1
enet1_mode:downlink
AP505H-Lab1#
```

Next, we need to configure a network profile for our mesh bridge and assign it to Eth0, this is so that we can have network connectivity across the mesh link. We have called it "Mesh-Bridge".

aruba | VIRTUAL CONTROLLER | InstantVC-Lab

Dashboard

- Overview
- Networks
- Access Points
- Clients
- Mesh Devices

Configuration

- Networks

edit Mesh-Bridge

- Basic
- VLAN
- Security
- Access
- Assignment

Name & Usage

- Name: Mesh-Bridge
- Type: Wired
- Primary usage: Employee
- POE:
- Admin status: Up

Note that the admin status should be set to Up.

The screenshot shows the 'edit Mesh-Bridge' configuration page for 'InstantVC-Lab' in the 'VIRTUAL CONTROLLER' section. The navigation tabs are 'Basic', 'VLAN', 'Security', 'Access', and 'Assignment'. The 'VLAN Management' section is active, showing the following settings:

- Mode: Trunk
- Client IP assignment: Virtual Controller managed, Network assigned
- Native VLAN: 1
- Allowed VLANs: all

Below these settings is a section for 'VLAN Assignment Rules'.

The screenshot shows the 'edit Mesh-Bridge' configuration page for 'InstantVC-Lab' in the 'VIRTUAL CONTROLLER' section. The navigation tabs are 'Basic', 'VLAN', 'Security', 'Access', and 'Assignment'. The 'Security' section is active, showing the following settings:

- Port type: Untrusted
- MAC authentication:
- 802.1X authentication:

The screenshot shows the 'edit Mesh-Bridge' configuration page for 'InstantVC-Lab' in the 'VIRTUAL CONTROLLER' section. The navigation tabs are 'Basic', 'VLAN', 'Security', 'Access', and 'Assignment'. The 'Access Rules' section is active, showing the following settings:

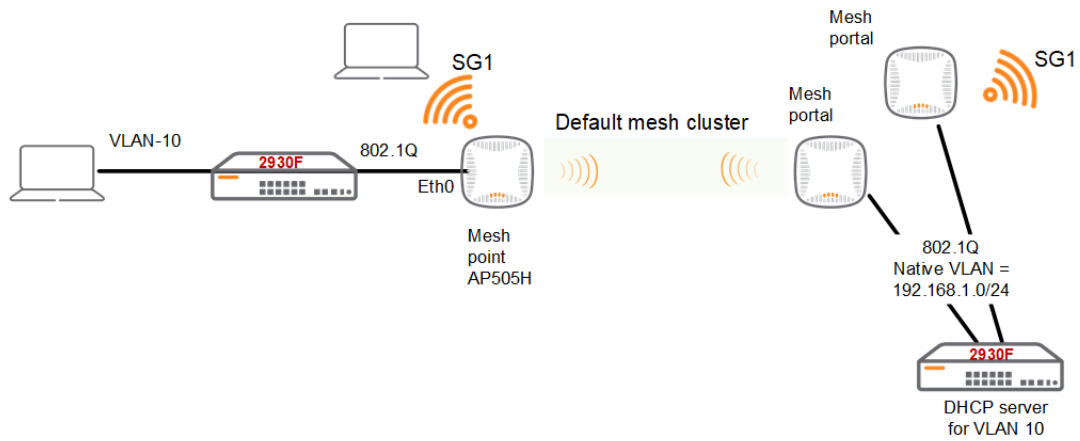
- Access Rules: Unrestricted
- Download roles:

Below these settings is the text: 'No restrictions on access based on destination or type of traffic'.

The screenshot shows the 'edit Mesh-Bridge' configuration page for 'InstantVC-Lab' in the 'VIRTUAL CONTROLLER' section. The navigation tabs are 'Basic', 'VLAN', 'Security', 'Access', and 'Assignment'. The 'Assignment' section is active, showing a table of interface assignments:

| | |
|-----|---------------|
| 0/0 | Mesh-Bridge |
| 0/1 | wired-SetMeUp |
| 0/2 | wired-SetMeUp |
| 0/3 | wired-SetMeUp |
| 0/4 | wired-SetMeUp |

Once you have configured this profile and assigned it to 0/0 as shown above, you can then connect the LAN switch to this Eth0 interface of the Mesh point AP.



The MAC address of the laptop is F0:DE:F1:64:0A:82

Now you can check the bridging table with this command and should see the MAC address of the device that is connected to the Eth0 port.

```

AP505H-Lab1# show datapath bridge
Datapath Bridge Devices
-----
Flags: F - source-filter, T - trusted, Q - tagged, I - IP
      S - split-tunnel, B - bridge, M - mesh, P - PPPoE, W - WAN
      C - content-filter, O - corp-access, h - to HAP, f - to FAP
      h - dhcp-redirect b - blocked by STP, H - Hierarchy AP connected

Dev  Name          VLANs  PVID  ACLs          MTU  FramesRx  FramesTx  Flags
---  ---          -
9    eth1           1      3333  151/0         0   1500      0          0   FB
10   eth2           1      3333  151/0         0   1500      0          0   FB
11   eth3           1      3333  151/0         0   1500      0          0   FB
12   eth4           1      3333  151/0         0   1500      0          0   FB
13   bond0         4095   1      197/0         106 1500      1043       10756 FQB
22   br0           0      1      105/0         0   1300      3512        0     FIB
24   mesh0        4095   1      0/0           0   1500      14452       7633  FTQBM
34   aruba002     1      1      159/0         0   1500      3037        3265  B
35   aruba102     1      1      159/0         0   1500      0            0     B
36   aruba003     1      1      201/0         0   1500      0            0     B
37   aruba103     1      1      201/0         0   1500      0            0     B

Datapath Bridge Table Entries
-----
Flags: P - Permanent, D - Deny, R - Route, M - Mobile, X - Xsec, A - Auth
AP Flags: X - Awaiting 1X reply, B - Block all non-1X traffic, F - Force bridge role, G - Gateway

MAC          VLAN  Assigned VLAN  Destination  Flags  AP Flags  Bridge Role  ACL
-----
20:4C:03:B2:75:97 3333 3333           local        P              0
20:4C:03:B6:B2:5B 1      1              dev24        0
B8:9A:2A:B4:A9:6A 1      1              dev34        0
F8:60:F0:C8:70:E0 10     10            dev24        G             0
F8:60:F0:C8:70:E0 1      1              dev24        0
20:4C:03:B2:75:97 1      1              local        P             0
20:4C:03:B6:B2:5B 3333 3333            dev24        P             0
DE:CE:95:F5:7A:76 1      1              dev24        0
D0:D3:E0:B2:41:72 1      1              dev34        0
9C:8C:D8:C9:2B:30 1      1              dev24        0
F0:DE:F1:64:0A:82 10     10            dev13        0
14:5F:94:81:56:26 1      1              dev24        G             0
F8:60:F0:C8:70:F1 10     10            dev24        0
F8:60:F0:C8:70:F1 1      1              dev24        0
9C:20:7B:AB:B5:71 1      1              dev24        0
D0:AB:D5:C2:06:55 1      1              dev24        0

AP505H-Lab1#

```

And since we have made the port untrusted, we can see the wired clients with this command. The laptop as shown below is on VLAN 10. (10.10.10.100)

```

AP505H-Lab1# sh clients wired

Wired Client List
-----
Name      IP Address  MAC Address      OS      Network  Access Point  Role      IPv6 Address
Speed (mbps)
-----
AriyaP    10.10.10.22 f0:de:f1:64:0a:82 Win 10   eth0      AP505H-Lab1  Mesh-Bridge --
          10.10.10.2  b0:5a:da:98:b5:70 NOFP    eth0      AP505H-Lab1  Mesh-Bridge --
Info timestamp      :3672

AP505H-Lab1#

```

And the other MAC addresses are the wireless devices on the mesh point

```

AP505H-Lab1# sh clients

Client List
-----
Name      IP Address  MAC Address      OS      ESSID  Access Point  Channel  Type  Role
IPv6 Address      Signal      Speed (mbps)
-----
VKELONX1GR 192.168.1.123 b8:9a:2a:b4:a9:6a Win 10   SG1    AP505H-Lab1  36E   a-HE  SG1
fd14:5f94:8156:2600:11d2:be8d:b7f0:e99f 52 (good) 1080 (good)
Number of Clients      :1
Info timestamp      :3720

AP505H-Lab1#

```

And Here is the WebUI view, first the wired client

| Name | IP Address | MAC address | OS | AP | Port |
|-------|-------------|-------------------|--------|-------------|------|
| AnyaP | 10.10.10.22 | f0:de:f1:64:0a:82 | Win 10 | AP505H-Lab1 | 0/0 |
| -- | 10.10.10.2 | b0:5a:da:98:b5:70 | NOFP | AP505H-Lab1 | 0/0 |

And here is the wireless client on the same AP.

| Name | IP Address | MAC address | OS | ESSID | Access Point | Channel | Type | Role | IPv6 Address | Signal | Speed (Mbps) |
|----------------|---------------|-------------------|---------|-------|-------------------|---------|------|--------------|------------------------|--------|--------------|
| Chromecast | 192.168.1.121 | 6c:ad:f8:5b:6a:c6 | Android | SG1 | AP515-Lab1 | 6 | GN | SG1 | fd14:5f94:8156:2600... | 52 | 65 |
| EPSON34E912 | 192.168.1.115 | f8:d0:27:34:e9:12 | NOFP | SG1 | AP515-Lab1 | 6 | GN | EpsonPrinter | -- | 56 | 72 |
| VKELONX1GR | 192.168.1.123 | b8:9a:2a:b4:a9:6a | Win 10 | SG1 | AP505H-Lab1 | 36E | a-HE | SG1 | fd14:5f94:8156:2600... | 51 | 1020 |
| DESKTOP-PJA... | 192.168.1.129 | d0:ab:d5:c2:06:55 | Win 10 | SG1 | 20:4c:03:b6:b2:5b | 36E | AC | SG1 | fd14:5f94:8156:2600... | 50 | 866 |

4 Instant Mesh Cluster

By default, Instant automatically generates mesh cluster ID and a password on 5GHz band. All the mesh portal automatically broadcasts a mesh services set identifier/cluster name so that the mesh points can identify it and then connect to it using AES encryption to authenticate to the mesh portals. This is not configurable and happens behind the scenes.

Now with the new Mesh enhancement we can

- Create multiple Mesh cluster
- Support mesh function in standalone mode AP

As per our previous configuration we are still running the default Mesh cluster.

```
20:4c:03:b6:b2:5b# sh ap mesh cluster topology
Mesh Cluster name: b4afc01b0ce08dcc578432086842f21
-----
Name                AP Type  Mesh Role  IP Address      Portal AP      Radio ID  Radio Mode
BSSID              Parent AP  Children  Path Cost      Node Cost     Link Cost Hop Count  Rate Tx/Rx  RSSI
Last Update       Uplink Age  Children Num  Children List
-----
-
-----
AP505H-Lab1        AP-505H  Point      192.168.1.122  20:4c:03:b6:b2:5b  0          MPC (AX)
d0:d3:e0:b2:41:71  20:4c:03:b6:b2:5b  1          0              0              1          1134/1134  42
1m:48s            59m:46s    0
AP515-Lab1        AP-515   Portal     192.168.1.117  AP515-Lab1      0          MPP (AX)
9c:8c:d8:12:b3:11  -         -         -              -              -         -          -
1m:26s            1h:14m:25s  0
20:4c:03:b6:b2:5b AP-505H  Portal     192.168.1.124  20:4c:03:b6:b2:5b  0          MPP (AX)
d0:d3:e0:b2:2a:91  -         -         -              -              -         -          -
1m:38s            7d:17h:13m:56s  1          AP505H-Lab1

Total APs: 3
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.

20:4c:03:b6:b2:5b#
20:4c:03:b6:b2:5b# 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
-----
0      d0:d3:e0:b2:41:70  AP505H-Lab1  d0:d3:e0:b2:2a:91  36E     5GHz  0    1    1.00  C
1h:2m:11s            ELK  47    1134/1134  5      5      0      HE-80MHz-2ss
b4afc01b0ce08dcc578432086842f21

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
20:4c:03:b6:b2:5b#
```

Here you can see that the mesh cluster ID is **b4afc01b0ce08dcc578432086842f21**, you'll notice that this is being broadcasted as a hidden SSID.

4.1 Instant Cluster Manual Configuration

Starting with Instant 8.4.0.0 you can now support multiple mesh clusters. We can do this by manually configuring Mesh cluster name and password. Mesh cluster function is a per-AP setting and must be configured manually. When an IAP boots up, it attempts to find a mesh cluster configuration so when IAP is already configured with a mesh cluster then it will use that otherwise it uses the default mesh cluster.

There is no limit to the number of profiles that can be configured.

There are basically three commands

```
To configure the cluster password
c8:b5:ad:cb:ca:e2# mesh-cluster-key <key>
```

```
To configure the name in a mesh network:
c8:b5:ad:cb:ca:e2# mesh-cluster-name <name>
```

```
To disable mesh functionality in a network:
c8:b5:ad:cb:ca:e2# mesh-disable
```

So we login to our AP505H-Lab1 which is already a Mesh point and execute the following commands.

```
AP505H-Lab1# mesh-cluster-key Aruba123456789
AP505H-Lab1# mesh-cluster-name MeshCluster-89
```

```
AP505H-Lab1# sh ap mesh cluster configuration
```

```
Mesh cluster name :MeshCluster-89
Mesh cluster key  :Manual
AP505H-Lab1#
```

```
AP505H-Lab1# sh ap mesh cluster status
```

```
Mesh cluster      :Disabled
Mesh role         :Mesh Point
Mesh Split5G Band Range :full
Mesh mobility     :Disabled
AP505H-Lab1#
```

Because these are per AP setting, they'll get saved on the AP environment parameters.

```
AP505H-Lab1# sh ap-env
```

```
Antenna Type:Internal
IoT Antenna Type:Internal
Need USB field:Yes
name:AP505H-Lab1
enet0_bridging:1
uap_controller_less:1
mesh-cluster-name:MeshCluster-89
mesh-cluster-key:746c9b89a2059a31575b2977ffa6da8c26b7c336de3f06d5
AP505H-Lab1#
```

We also login to our AP525-Lab1 which is a Mesh portal and configure the same.

```
AP515-Lab1# mesh-cluster-key Aruba123456789
AP515-Lab1# mesh-cluster-name MeshCluster-89
```

Then we'll reload both of them. Once they get rebooted and are online we check the VC which is the AP505H-Lab1 and AP515-Lab1

The screenshot shows the Aruba InstantVC-Lab dashboard. The main table displays Mesh Devices (3) with columns: Name, IP Address, Clients, Type, Mesh Role, Portal AP, Parent, Last Update, and Uplink Age. The details for AP505H-Lab1 are shown below, including Name, MAC, Mesh Name, Type, IPv6 Address, IP Address, Serial number, CPU utilization, and Memory free.

| Name | IP Address | Clients | Type | Mesh Role | Portal AP | Parent | Last Update | Uplink Age |
|-------------------|---------------|---------|--------------|-----------|-------------------|------------|-------------|----------------|
| AP505H-Lab1 | 192.168.1.122 | 0 | 505H(indoor) | Point | AP515-Lab1 | AP515-Lab1 | 12s | 8m 8s |
| AP515-Lab1 | 192.168.1.117 | 0 | 515(indoor) | Portal | AP515-Lab1 | - | 27s | 13m 29s |
| 20:4c:03:b6:b2:5b | 192.168.1.124 | 9 | 505H(indoor) | Portal | 20:4c:03:b6:b2:5b | - | 16s | 7d:17h:44m:35s |

| Info | |
|-----------------|---------------------------------|
| Name | AP505H-Lab1 |
| MAC | 20:4c:03:b2:75:97 |
| Mesh Name | 76c9c9c2d1467c44b4b7f50b906d00c |
| Type | 505H(indoor) |
| IPv6 Address | -- |
| IP Address | 192.168.1.122 |
| Serial number | CNK6KSM03Q |
| CPU utilization | 3 % |
| Memory free | 528 MB |

Lets check the mesh topology from the AP505H-Lab1 and AP515-Lab1 APs.

```
AP515-Lab1# sh ap mesh cluster status

Mesh cluster      : Enabled
Mesh cluster name : MeshCluster-89
Mesh role         : Mesh Portal
Mesh Split5G Band Range : full
Mesh mobility     : Disabled
AP515-Lab1#
```

```
AP505H-Lab1# sh ap mesh cluster status

Mesh cluster      : Enabled
Mesh cluster name : MeshCluster-89
Mesh role         : Mesh Point
Mesh Split5G Band Range : full
Mesh mobility     : Disabled
AP505H-Lab1#
```

The important thing here is that we now have good predictivity and control for choosing Mesh Points that need to connect to specific Mesh portals. You also have the ability to disable mesh cluster on per IAP basis.

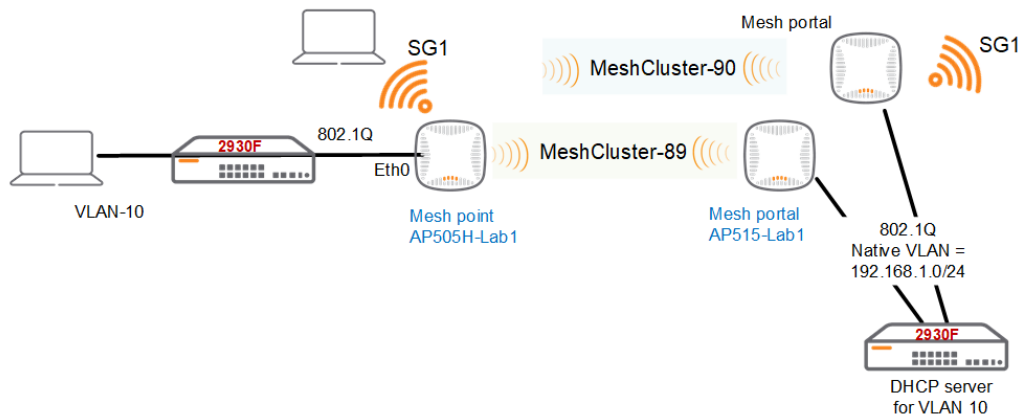
4.2 Multiple Mesh Clusters and Failover

Starting with Instant 8.4.0.0 you can now support multiple mesh clusters. We can do this by manually configuring Mesh cluster name and password. Mesh cluster function is a per-AP setting and must be configured manually. When an IAP boots up, it attempts to find a mesh cluster configuration, if there is a mesh cluster configured then it will use that other wise it'll use the default mesh cluster. Since you can define more than one mesh cluster profile, you can also assign priorities to each cluster profile. This way you can have a recovery or backup cluster profile. This is useful in the initial deployment or if you want to add a backup mesh link.

Here we'll configure a

- manual mesh cluster "MeshCluster-89"
- backup mesh cluster "MeshCluster-90"

So the mesh-point AP (AP505H) will first will use the MeshCluster-89 mesh link and in case it is not avilable it will then switch to MeshCluster-90.



Note that we already have configured the mesh cluster “MeshCluster-89”, we’ll continue with the Instant cluster level configuration of “MeshCluster-90”. The only command needed is this.

```
mesh-cluster MeshCluster-90 wpa2-psk 7c47c625a20b3e39056aa159f780fed60385bbbe2f0fd644
priority 1
```

Once you have saved the configuration, that cluster name will be used as a backup to the mesh cluster that was manually configured on the AP515-Lab1 and AP505H-Lab1. Note that the priority for it should only be 1 as highlighted.

Now we’ll do the basic checks and then will test the failover.

The first AP is the VC. Note that there are no manual mesh cluster-89 configured on VC which is our backup mesh-portal AP.

```
20:4c:03:b6:b2:5b# show ap-env

Antenna Type:Internal
Need USB field:Yes
uap_controller_less:1

20:4c:03:b6:b2:5b# show run | incl mesh-cluster
mesh-cluster MeshCluster-90 wpa2-psk e9cb6fe7fc5efe4c5c3b6f86306faa50022727c3895f9608
priority 1

20:4c:03:b6:b2:5b# sh ap mesh cluster configuration

Mesh cluster name :MeshCluster-90
Mesh cluster key :Manual
20:4c:03:b6:b2:5b#
```

Here are the outputs on AP515-Lab1 which is our primary mesh-portal.

```
AP515-Lab1# sh ap-env

Antenna Type:Internal
Need USB field:Yes
name:AP515-Lab1
uap_controller_less:1
mesh-cluster-name:MeshCluster-89
mesh-cluster-key:7d01c2941ab3854e60a6951fa0b75d4ca6068fee69607806
enet1_mode:uplink

AP515-Lab1# show run | incl mesh-cluster
mesh-cluster MeshCluster-90 wpa2-psk e9cb6fe7fc5efe4c5c3b6f86306faa50022727c3895f9608
priority 1

AP515-Lab1# sh ap mesh cluster configuration

Mesh cluster name :MeshCluster-89
Mesh cluster key :Manual
AP515-Lab1#
```

And lastly AP505H-Lab1 which is our Mesh point AP.

```

AP505H-Lab1# show ap-env

Antenna Type:Internal
Need USB field:Yes
name:AP505H-Lab1
enet0_bridging:1
uap_controller_less:1
mesh-cluster-name:MeshCluster-89
mesh-cluster-key:5db83aa119840be171fa77906f37fff5886810af793b3dd4

AP505H-Lab1# show running-config | incl mesh-cluster
mesh-cluster MeshCluster-90 wpa2-psk 32b173d7f117a40c4e7bf9159831b7e8c32f4c6654b2452
priority 1

AP505H-Lab1# show ap mesh cluster configuration

Mesh cluster name :MeshCluster-89
Mesh cluster key :Manual
AP505H-Lab1#

```

Mesh Devices (3)

| Name | IP Address | Clients | Type | Mesh Role | Portal AP | Parent | Last Update | Uplink Age |
|-------------------|---------------|---------|--------------|-----------|-------------------|------------|-------------|------------|
| AP505H-Lab1 | 192.168.1.132 | 1 | 505H(indoor) | Point | AP515-Lab1 | AP515-Lab1 | 1m:39s | 36m:58s |
| AP515-Lab1 | 192.168.1.131 | 1 | 515(indoor) | Portal | AP515-Lab1 | - | 1m:58s | 2h:19m:15s |
| 20:4c:03:b6:b2:5b | 192.168.1.119 | 4 | 505H(indoor) | Portal | 20:4c:03:b6:b2:5b | - | 1m:44s | 2h:37m:35s |

Details

Info

| | | | | | |
|---------------|--------------|-----------------|-------------------|-------------|---------------------------------|
| Name | AP505H-Lab1 | MAC | 20:4c:03:b2:75:97 | Mesh Name | 76c9cbc2d1467c44b4b7f50b906d00c |
| Type | 505H(indoor) | IPv6 Address | -- | IP Address | 192.168.1.132 |
| Serial number | CHK6KSM03Q | CPU utilization | 6% | Memory free | 451 MB |

Radio 0 - Mesh Link Band: 5G

Radio Info

| | | | |
|-----------------|------|-----------------------|-----|
| Channel | 100E | Radio utilization (%) | 13 |
| Power (dBm) | 26 | Noise (dBm) | -93 |
| Children Number | 0 | | |

Children List

No data to display

Channel Utilization (%)

RSSI

You should also see the VC (backup mesh portal) as a neighbour on mesh point AP.

```

AP505H-Lab1# sh ap mesh neighbours

Neighbor list
-----
Radio  MAC                AP Name                Portal Channel  Age  Hops  Cost  Relation
Flags  RSSI  Rate Tx/Rx  A-Req  A-Resp  A-Fail  HT-Details  Cluster ID
-----  ---  -----  -----  -----  -----  -----  -----
0       9c:8c:d8:12:b3:11  AP515-Lab1            Yes    100E    0     0     1.00  P 34m:28s
ELK    32    1134/1134  4      4      0      HE-80MHz-4ss
76c9cbc2d1467c44b4b7f50b906d00c
0       d0:d3:e0:b2:2a:91  20:4c:03:b6:b2:5b    Yes    100E    0     0     0.00  N 35m:43s
ELK    53    -          0      0      0      HE-80MHz-2ss
3966c305bd519386cb3abaea2c67f4c

Total count: 2, Children: 0

```

```

Relation: P = Parent; C = Child; N = Neighbor; B = Blacklisted-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 Blacklisted-neighbour; e = SAE Enabled; u = portal-
unreachable; o = opensystem; m = Mobility Enabled
AP505H-Lab1#

```

So now we'll power down the AP515-Lab1 to simulate a failure.

```

AP505H-Lab1# sh ap mesh link

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

Total count: 0, Children: 0
Relation: P = Parent; C = Child; N = Neighbor; B = Blacklisted-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 Blacklisted-neighbour; e = SAE Enabled; u = portal-
unreachable; o = opensystem; m = Mobility Enabled

AP505H-Lab1# sh ap mesh link

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

0      d0:d3:e0:b2:2a:91  20:4c:03:b6:b2:5b  Yes  100E  0  0  1.00  P  5s
ELK    53  1020/816  1  1  0  HE-80MHz-2ss
3966c305bd519386cb3abaea2c67f4c

Total count: 1, Children: 0
Relation: P = Parent; C = Child; N = Neighbor; B = Blacklisted-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 Blacklisted-neighbour; e = SAE Enabled; u = portal-
unreachable; o = opensystem; m = Mobility Enabled

AP505H-Lab1#

```

Here is the WebUI view. And soon AP515-Lab1 will disappear from the web UI as it is powered down.

Dashboard

- Overview
- Networks
- Access Points
- Clients
- Mesh Devices**
- Configuration
- Maintenance
- Support

Mesh Devices (3)

| Name | IP Address | Clients | Type | Mesh Role | Portal AP | Parent | Last Update | Uplink Age |
|-------------------|---------------|---------|--------------|-----------|-------------------|-------------------|-------------|------------|
| AP515-Lab1 | 192.168.1.131 | 1 | 515(indoor) | Portal | AP515-Lab1 | - | 1m:45s | 2h:21m:33s |
| AP505H-Lab1 | 192.168.1.132 | 1 | 505H(indoor) | Point | 20.4c.03.b6.b2.5b | 20.4c.03.b6.b2.5b | 10s | 15s |
| 20.4c.03.b6.b2.5b | 192.168.1.119 | 3 | 505H(indoor) | Portal | 20.4c.03.b6.b2.5b | - | 1m:28s | 2h:39m:52s |

Details

Info

| | | | | | |
|---------------|--------------|-----------------|-------------------|-------------|---------------------------------|
| Name | AP505H-Lab1 | MAC | 20.4c.03.b2.75.97 | Mesh Name | 3966c305bd519386cb3abaea2c67f4c |
| Type | 505H(indoor) | IPv6 Address | -- | IP Address | 192.168.1.132 |
| Serial number | CNKGKSM03Q | CPU utilization | 5% | Memory free | 452 MB |

Radio 0 - Mesh Link Band: 5G

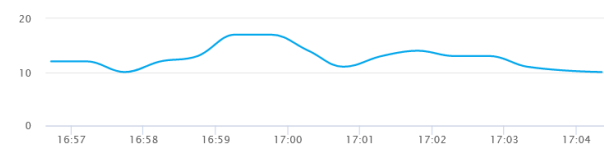
Radio Info

| | | | |
|-----------------|------|-----------------------|-----|
| Channel | 100E | Radio utilization (%) | 10 |
| Power (dBm) | 26 | Noise (dBm) | -93 |
| Children Number | 0 | | |

Children List

| Name |
|--------------------|
| No data to display |

Channel Utilization (%)



RSSI



We can also check the mesh debug status that shows which is the active mesh cluster. Note that the manual mesh cluster always has priority of 0.

```

AP505H-Lab1# sh ap mesh debug status

State: CONNECTED(1), since: 2m:44s, recovery: FALSE
Country-code: 31 ("AU"), Outdoor: FALSE
Active Cluster: <3966c305bd519386cb3abaea2c67f4c>, encrypted: TRUE, priority:1
All Available Clusters(2):
  Cluster: <76c9cbc2d1467c44b4b7f50b906d00c>, encrypted: TRUE, priority: 0
  Cluster: <3966c305bd519386cb3abaea2c67f4c>, encrypted: TRUE, priority: 1
Working RF Band: 1, RF Split 5G Range: 0
SM State: CONNECTED, Descendant Upgrading: FALSE, Portal Reachability: TRUE
Topology Adjust Scan: False, Scan Times: 2, Scan Interval: 1000s,
Portal ID: d0:d3:e0:b2:2a:91, Loop Protect Seq NO: 9418, Hop Count: 1, Path Cost: 1,
Portal MTU: 1500,
Metric Reselection State: Idle, Optimize Scan Tick: 164, Reselection Tick: 8, Switch
Interval: 0, Switch Tick: 163,
SAPD Pending: FALSE, Received Config: TRUE, Thermal Protect: FALSE, Reboot Me: FALSE,
Shutting Down: FALSE,
SAPD Radio Off Tick: 0, FIPS Change Tick: 0, LMS change Tick: 0, LMS IP: 192.168.1.119,
Mesh Ctrl Socket: 13, Hostapd Recreate Pending: FALSE, Hostapd PID: 8156, Hostapd Sent
Config: TRUE, Hostapd Sync Count: 0,
Supplicant Initiated: 1,
Mesh Radios Status:
  Radio 0, Phy Down: FALSE, Band: 1, Current Channel: 100/0,
  Total 31 channels:
  34,36,38,40,42,44,46,48,52,56,60,64,100,104,108,112,116,120,124,128,132,136,140,144,149,1
  53,157,161,165,169,173,

  Scan Active: FALSE, Scan Started 179 Ticks, Scanned 31 channels, Curring Scanning
  Channel 34,
  Schedule Renegotiate: 0, Renegotiate: 0, Authenticate Pending: 0, Assoc Pending: 0,
  Assoc Tick: 2585, 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, Point Radar Tick: 0, Radar Channel: 0,
  Supplicant EAPOL Socket: 14, VAP Added: 1, VAP Name: aruba000, MAC 70:00:00:00:00:00,
  BSSID d0:d3:e0:b2:2a:91, SSID 3966c305bd519386cb3abaea2c67f4c, KEY MGMT 1
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: Anytime, Optimize Scan
Interval: 86400(s), Link Threshold: 20, Max RSSI: 46, RSSI Delta: 2, 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):

AP505H-Lab1#

```

You can also check the meshd-log to see the switch over.

```

AP505H-Lab1# sh ap mesh debug meshd-log 0

[6397]2021-11-29 17:04:09.597 meshd_set_active_profile:3840 set meshd_hostapd_ready_flag
FALSE
[6397]2021-11-29 17:04:09.597 meshd_set_active_profile:3844 call meshd_hostapd_ready
[6397]2021-11-29 17:04:09.597 meshd_hostapd_ready:4698 syncing up with hostapd
[6397]2021-11-29 17:04:09.597 Sending cmd to hostapd:CONFIG /- - -
RecoveryClusterProfile *** ***
[6397]2021-11-29 17:04:09.598 meshd_hostapd_recv: recv-err:No such file or directory
[6397]2021-11-29 17:04:09.598 meshd_hostapd_ready:4700 set meshd hostapd ready flag TRUE
[6397]2021-11-29 17:04:09.598 meshd_scan_complete_all: Switching active profile to
3966c305bd519386cb3abaea2c67f4c
[6397]2021-11-29 17:04:09.599 meshd_program_active_profile: set meshc VAP ssid to
3966c305bd519386cb3abaea2c67f4c
[6397]2021-11-29 17:04:09.607 meshd_program_active_profile: Adding supplicant iface phy=0
[6397]2021-11-29 17:04:09.690 aruba000: deleting key mac=00:00:00:00:00:00 key_id=0
[6397]2021-11-29 17:04:09.690 aruba000: deleting key mac=00:00:00:00:00:00 key_id=1
[6397]2021-11-29 17:04:09.691 aruba000: deleting key mac=00:00:00:00:00:00 key_id=2
[6397]2021-11-29 17:04:09.691 aruba000: deleting key mac=00:00:00:00:00:00 key_id=3
[6397]2021-11-29 17:04:09.692 meshd_supplicant_interface_add,463, supplicant interface
added.

[6397]2021-11-29 17:04:09.692 meshd_scan_complete_all: candidates:1, profiles:2,
recovery:FALSE, num_scans 2, disconnected-time: 13(secs)

```

Now when the AP515-Lab1 is powered up, the mesh-point will not automatically change the current mesh link back to it. By default, Optimize scan internal is set to 24 hours and we can reduce the scan internal to minimum one hour.

```

# show 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

```

After 1 hour the mesh point starts to re-scan, it reselects parent only depends on better RSSI metrics, not the priority.

Now if it's a must that mesh point has to connect back to the original mesh portal, in our case AP515-Lab1, then we need to enable preferred conductor. So now when the AP515-Lab1 comes up then the previous VC that was the AP portal will reboot which would force the point to connect to the AP515-Lab1.

4.3 Mesh Radio selection

Generally 5GHz radio will be used for mesh links but for the APs with dual 5GHz radios, you can specify either to use both 5GHz radios or split them. Refer to the user guide for details.

You need to be aware of this command.

```
mesh-split5g-range-band { full | lower | upper | first }
```

Also note that the AP must be rebooted for the configuration to take effect.

4.4 Mesh Links and Fast Roaming

Now you can have IAPs in buses or other fast moving environments that needs fast roaming for APs deployed in a wireless mesh network. To support fast roaming, mobility mesh points perform a scan of other mesh points in the background first and then choose the best neighbor to connect from all the neighbors. The background scan implies when mesh is connected, the mesh point collects information about surrounding channels through background scanning. The mobility mesh point scan time between radio channels is altered to be faster than the mesh point scan in a regular mesh network.

Here is the mesh cluster status

```
AP505H-Lab1# sh ap mesh cluster status

Mesh cluster      :Enabled
Mesh cluster name :MeshCluster-89
Mesh role         :Mesh Point
Mesh Split5G Band Range :full
Mesh mobility     :Disabled

AP505H-Lab1#
```

You need the following on the mesh point AP. The choices are mesh-mobility [high|low|<number>]

```
AP505H-Lab1# mesh-mobility high

AP505H-Lab1# sh ap mesh cluster status

Mesh cluster      :Enabled
Mesh cluster name :MeshCluster-89
Mesh role         :Mesh Point
Mesh Split5G Band Range :full
Mesh mobility     :Enabled

AP505H-Lab1#
```

The options for mesh-mobility commands are:

- high Enables mesh roaming function and RSSI threshold less than or equal to 22
- low Enables mesh roaming function and RSSI threshold less than or equal to 15.
- <number> Enables mesh roaming function and RSSI is set as a definite value. Range: 10-50

Once you have enabled mesh mobility, that should show up in the mesh link flags.

```
AP515-Lab1# 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
-----  ---  -----  -----  -----  -----  -----  -----  -----  -----
0      d0:d3:e0:b2:41:70  AP505H-Lab1  9c:8c:d8:12:b3:11  52      5GHz  0    1    1.00  C 16m:7s
ELmK   42    1134/1134  4      4      0      HE-20MHzsgi-2ss  76c9cbc2d1467c44b4b7f50b906d00c

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
```

```
AP515-Lab1#
```

4.5 Mesh Fine Tuning

Here are the default mesh parameters that are used. You don't need to changed it in most of the cases.

```
20:4c:03:b6:b2:5b# 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
```

However here we are changing a few of them. You need to make these chages through the CLI.

```
wlan mesh-profile
 reselection-mode anytime
 optimize-scan-interval 1
 link-threshold 20
 max-retries 2
20:4c:03:b6:b2:5b# sh ap mesh config

A Tx Rates           :6,9,12,18,24,36,48,54
Heartbeat Threshold  :10
Link Threshold       :20
Metric Algorithm     :Metric_Distributed_Tree_Rssi
Max Children         :8
Max Hop Count        :2
Mesh Private Vlan    :0
Reselection Mode     :Reselect_Anymtime
Prefer Uplink Radio  :No prefer uplink radio
Optimize Scan Interval :1
Retry Limit          :2
Mobility Beacon Miss Num :16
20:4c:03:b6:b2:5b#
```

4.6 Show Cluster Commands

There are a few interesting show commands that need to be excuted form the VC.

"Show ap mesh cluster active" provide the active mesh clusters.

```
20:4c:03:b6:b2:5b# sh ap mesh cluster active

Mesh Cluster name: 76c9cbc2d1467c44b4b7f50b906d00c
-----
Name          AP Type  Mesh Role  IP Address      Portal AP  Parent AP  RSSI  Last Update  Uplink Age  Children Num  Children List
-----
AP505H-Lab1  AP-505H  Point      192.168.1.122  AP515-Lab1 AP515-Lab1  41    2m:5s        14m:45s     0            -
AP515-Lab1   AP-515   Portal     192.168.1.117  AP515-Lab1 -          0     2m:0s        20m:8s      1            AP505H-Lab1

Total APs: 2
(N): 11N Enabled. (AC): 11AC Enabled. (AD): 11AD Enabled. (AX): 11AX Enabled. For Portals 'Uplink Age' equals uptime.

Mesh Cluster name: b4afc01b0ce08dcc578432086842f21
-----
Name          AP Type  Mesh Role  IP Address      Portal AP  Parent AP  RSSI  Last Update  Uplink Age  Children Num  Children List
-----
20:4c:03:b6:b2:5b  AP-505H  Portal     192.168.1.124  20:4c:03:b6:b2:5b -          0     1m:42s      9d:22h:53m:9s  0            -

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

20:4c:03:b6:b2:5b#
```


From the above output ou can get the IP addresses of the mesh points and portals and then execute the stats command.

Here is the mesh-point AP.

```
20:4c:03:b6:b2:5b# sh ap mesh cluster stats 192.168.1.122

Radio ID : 0
Mesh link on radio : Yes
Mesh link band : 5G
Children Num : 0
Children List : -
Metrics stats:
-----
Timestamp  RSSI  Channel Utilization (%)  Goodput [Tx] (bps)  Goodput [Rx] (bps)  Throughput [Tx] (bps)
Throughput [Rx] (bps)
-----
-----
15:23:15  41    3                35563849           831507331          4392                9337
15:22:44  43    2                33375266           834958904          4126                10041
15:22:14  43    3                34330935           820579710          4401                11190
15:21:44  44    2                35242455           808572748          4461                11531
15:21:13  42    2                35397050           829784615          4270                8885
15:20:43  41    2                34970526           818845481          4378                9253
15:20:12  43    3                34546192           829770897          4483                8827
15:19:42  41    3                35834817           820960000          4359                9435
15:19:11  44    3                34250770           827977142          4365                9491
15:18:41  40    2                34319198           825813953          4396                9353
15:18:10  43    2                34944340           828298136          4316                8773
15:17:40  44    3                36101511           831319148          4404                9008
15:17:09  43    3                35223435           831000000          4358                9200
15:16:39  43    3                35377729           838690058          4317                9438
15:16:08  41    2                34126582           827893175          4529                9190

Radio ID : 1
Mesh link on radio : No

Radio ID : 2
Mesh link on radio : No

20:4c:03:b6:b2:5b#
```

And the Mesh portal AP.

```
20:4c:03:b6:b2:5b# sh ap mesh cluster stats 192.168.1.117

Radio ID : 0
Mesh link on radio : Yes
Mesh link band : 5G
Children Num : 1
Children List : AP505H-Lab1
Metrics stats:
-----
Timestamp  RSSI  Channel Utilization (%)  Goodput [Tx] (bps)  Goodput [Rx] (bps)  Throughput [Tx] (bps)
Throughput [Rx] (bps)
-----
-----
15:22:52  0     2                22262677           768156097          6984                5241
15:22:22  0     2                21248095           766070351          8076                5074
15:21:52  0     2                20682120           757319587          8165                4889
15:21:22  0     2                20561531           771569230          6005                5007
15:20:52  0     2                21758347           764179104          6590                5110
15:20:22  0     2                21669650           773832512          6205                5228
15:19:52  0     2                21776488           762857142          6498                4976
15:19:21  0     3                20749054           767437185          6940                5083
15:18:52  0     2                21300270           772000000          6804                5138
15:18:21  0     2                21726904           765532338          6418                5121
15:17:51  0     3                21759162           767437185          6362                5083
15:17:22  0     2                21431013           775402985          6426                5187
15:16:52  0     2                21297996           767437185          6579                5082
15:16:22  0     3                21005827           764271844          6358                5239
15:15:52  0     3                21196548           757500000          5969                4841

Radio ID : 1
Mesh link on radio : No

Radio ID : 2
Mesh link on radio : No

20:4c:03:b6:b2:5b#
```