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 Disconnecting the Wired Port 6
3.3 Automatic Mesh Portal Selection 9
3.4 Reconnecting the Wired Port 11
3.5 Ethernet Bridging 12
4 Instant Mesh Cluster 16

4.1 Instant Cluster Manual Configuration 17
4.2 Instant Cluster Configuration with Standalone mode 18

1.1 Revision History

DATE	VERSION	EDITOR	CHANGES
16 May 2019	0.1	Ariya Parsamanesh	Initial creation
24 May 2019	0.2	Ariya Parsamanesh	Standalone mesh

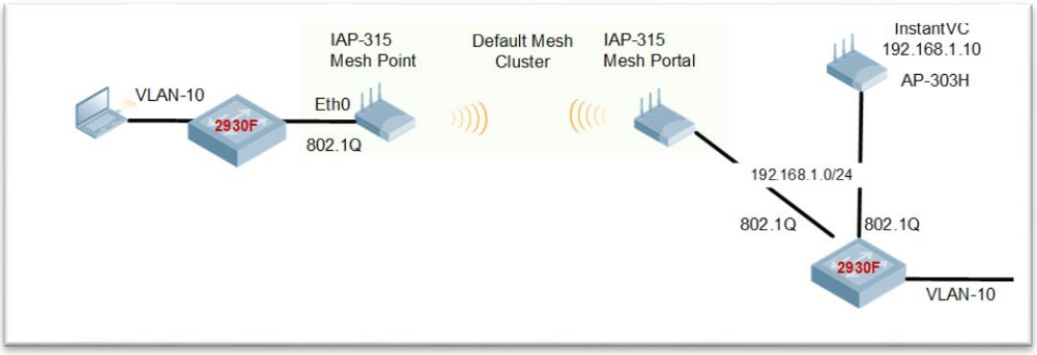
2 Instant Mesh

Aruba Instant APs (IAP) provide an effective way to extend WiFi coverage using wireless mesh 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.

With enhancement in Instant 8.3 and 8.4 versions, we can have much better control over the mesh cluster operation and selection. Here are the new enhancements.

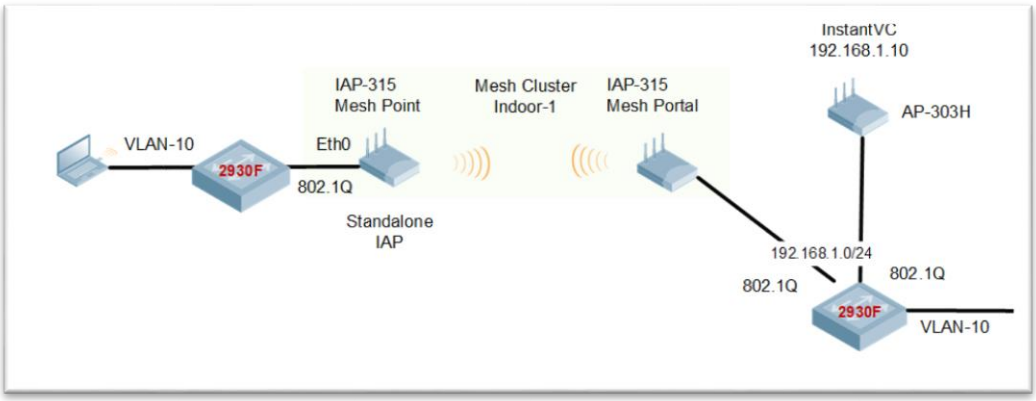
1. Role Assignment enhancement for Mesh point, IAP will check if the Eth0 is up and operational as it sends loop detection packets. If the Eth0 is up and operational then only will the mesh point reboots and becomes a mesh portal.
2. We can now have more than one mesh cluster for IAP swarm and manually configure mesh clusters and assign it to specific IAPs
3. IAPs in Standalone Mode can now connect to a mesh cluster.

Here is the lab set-up to demonstrate these feature, we are showing three scenarios. The first one is showing the configuration steps involved in setting mesh link with the default mesh cluster and enabling E0 bridging.



The second one is showing the configuration steps involved in setting manual mesh cluster for a specific Mesh porta/point with E0 bridging.

The third one is showing the configuration steps involved in setting manual mesh cluster for a specific Mesh porta/point with E0 bridging for a standalone IAP.



2.1 Things you need

- Aruba Instant version 8.4.0.0 or later
- 3x IAPs in an existing Instant Cluster
- A Layer three switch and some WiFi and wired clients

3 Instant AP Configuration

With IAPs, as long as they 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.

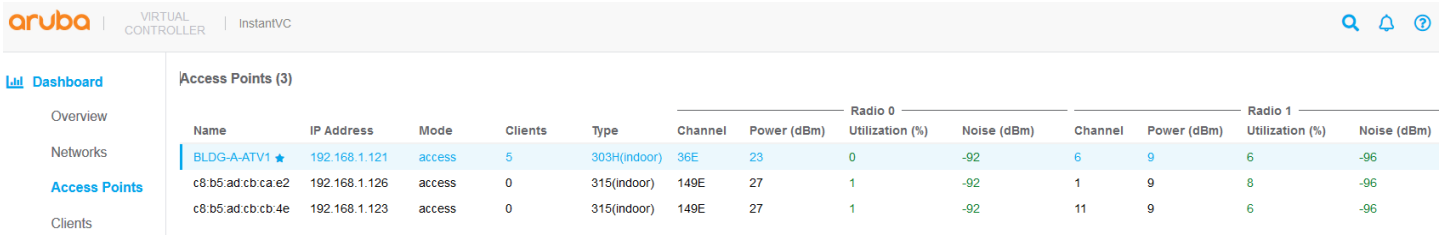
The IAP that connects to Mesh portal using its WiFi radio is called Mesh Point. Then the mesh point provides wireless services to its clients like any other IAP.

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. IAP-303H is the master while the two IAP-315 are the slaves. At this stage both are connected to the LAN.



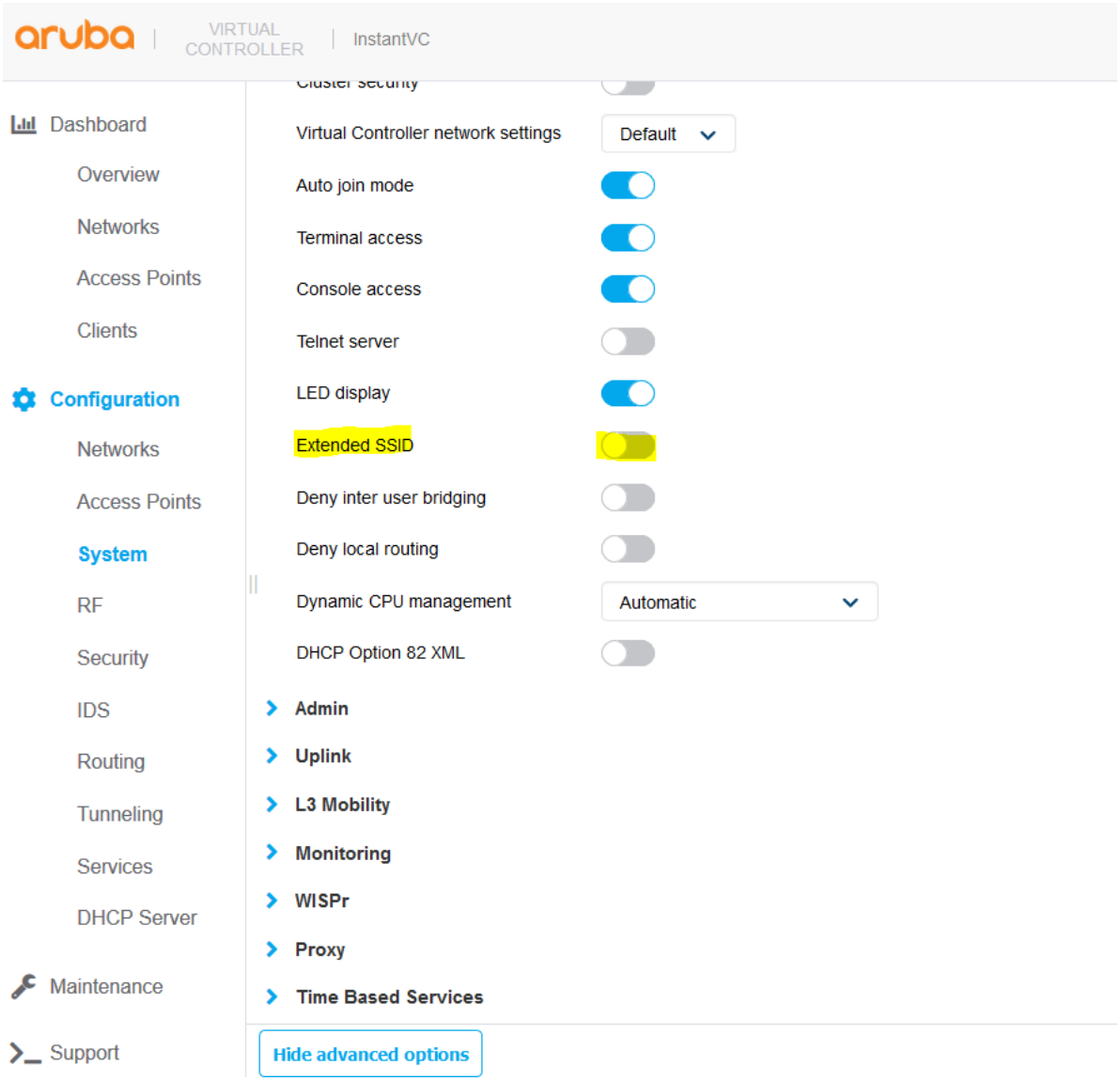
Now we check the state of the Instant Cluster and notice that extended-ssid is configured.

```
BLDG-A-ATV1# sh swarm mode

Swarm Mode        :Cluster
BLDG-A-ATV1# 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 :yes
extended-ssid active      :yes
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
BLDG-A-ATV1#
```

Next we'll check the mesh link status and see that it is not supported in the current mode.

```
BLDG-A-ATV1# sh ap mesh link
No mesh supported in current mode
BLDG-A-ATV1#
```

This is because we have extended SSID enabled and will not disable it.



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

3.1 Normal Mesh Operation

Once the IAPs are rebooted now they are ready to support mesh functionality. Now when we issue the commands we see that Extended SSID is disabled and the other previous message "No mesh supported in current mode" is no longer displayed.

```
BLDG-A-ATV1# 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       :2
VC Channel index      :2
IDS Client Gateway Detect :yes
Config Init success cnt for heartbeat   :1
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   :heartbeat
Config Init last success time     :2019-05-19 12:13:49
BLDG-A-ATV1#

BLDG-A-ATV1# sh ap mesh link

Neighbor list
-------------
MAC  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, 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
BLDG-A-ATV1#
```

There are other mesh commands as well, like mesh cluster topology. These commands are run on the Virtual controller (VC).

```
BLDG-A-ATV1# sh ap mesh cluster topology

Mesh Cluster name: Default mesh group
-------------------------------------
Name               AP Type  Mesh Role    Parent  IP Address     Path Cost  Node Cost
Link Cost  Hop Count  Rate Tx/Rx  RSSI  Last Update  Uplink Age  Children
----               -------  ---------    ------  ----------     ---------  ---------  ---
------  ---------  ----------  ----  -----------  ----------  --------
BLDG-A-ATV1        AP-303H  Portal (AC)  -       192.168.1.121  0          0          0
0          -          0     4m:52s       12h:2m:1s   0
c8:b5:ad:cb:ca:e2  AP-315   Portal (AC)  -       192.168.1.126  0          0          0
0          -          0     4m:38s       53m:16s     0
c8:b5:ad:cb:cb:4e  AP-315   Portal (AC)  -       192.168.1.123  0          0          0
0          -          0     4m:21s       47m:57s     0

Total APs: 3
(N): 11N Enabled. (AC): 11AC Enabled. (AD): 11AD Enabled. For Portals 'Uplink Age' equals
uptime.

BLDG-A-ATV1#
```

Note that the three mesh roles are mesh Portals.

```
BLDG-A-ATV1# sh ap mesh cluster status

Mesh cluster      :Disabled
Mesh role         :Mesh Portal
BLDG-A-ATV1#
```

3.2 Disconnecting the Wired Port

Now we will disconnect the Ethernet cable from IAP-315 (c8:b5:ad:cb:ca:e2). Briefly the WiFi LED goes blank and then back to green. And after around 5 minutes the IAP-315 reboots and come up as Mesh point. Here are the main console messages.

```
Enter non-FIPS mode
Cfg len is 13730
Starting watchdog process...
Aruba watchdog daemon started [2 thread(s)]
Loading configuration file of length 13730...
wifi uplink detected...
Terminal access enabled...
Valid SSID detected...

Ethernet uplink not active yet
Ethernet uplink not active yet
Ethernet uplink not active yet
Ethernet uplink not active yet
Ethernet uplink not active yet
Ethernet uplink not active yet

No uplink active. Becoming Mesh Point
copying bootuplog ...
[  110.590128] uol: module license 'Proprietary' taints kernel.
[  110.672383] Disabling lock debugging due to kernel taint
[  110.736894] UOL ctf init done
[  110.771352] uol_hw_offload_enable:609 enable=1
[  110.824492] uol_hw_offload_enable:621 Abort to enable offload, reason=mesh point
[  110.913027] UOL nss init done
[  110.948453] init_uol_mod: offload cap: 0x140, mesh mode point, strapless_enabled 0,
uplink_vlan 0
[  111.080099] AP xml model 95, num_radios 2 (jiffies 55537)
[  111.132239] apType 95 hw_opmode 0
[  111.171915] radio 0: band 1 ant 0 max_ssid 16
[  111.223867] radio 1: band 0 ant 0 max_ssid 16
[  111.276038] init_asap_mod: installation:0
[  111.323898] election init: rand=13 HZ=500
[  111.372008] IAP client match init
[  111.718244] anul_radio_bond_sysctl_init
allow PAPI
set device anul0 mtu to 2000
Starting DHCP
Compressing all files in the /etc/httpd directory...
Done.

        <<<<<       Welcome to the Access Point     >>>>>

Power supply mode is POE-AF:, USB Modem is not present.
Completed SW FIPS KAT test

[  159.849547] enet0 bridging is enabled
```

```
[  173.651233] bond0 acl set to 100 0
[  176.083380] VAP device aruba000 created osifp: (d6a1a540) os_if: (d5e78000)
[  176.159668] wmi_unified_set_psmode:set psmode=1
[  176.208747] wmi_unified_set_psmode:set psmode=0
[  176.265823] VAP device aruba001 created osifp: (d6a1c540) os_if: (d5e90000)
[  200.140487] ieee80211_connection_state_connecting_entry:668, enter......,sm-
>candidate_aplist_index = 0
[  200.240612] wlan_assoc_sm_start:890, enter......
[  200.295751] ieee80211_assoc_state_init_event:142, enter......, event 0
[  200.376476] probereq timeout happen in state machine but we donot care it event =
4,186,ieee80211_assoc_state_join_event
[  200.504123] ieee80211_assoc_state_join_event:197, goto AUTH
[  200.570759] wlan_mlme_auth_request:344, enter >>>>>>>>>>
[  200.640456] ieee80211_assoc_state_assoc_event:333, ASSOC sucess and transition to RUN
state
[  202.012183] Picked up default IP a9fe7162, rand 7162
[  202.059231] (23:34:52) !!! Init ---> Slave
[  202.108059] wait for stm to initialize over
[  202.158075] asap_send_elected_master: sent successfully
[  202.736488] Mesh point ap ip is ready: 2114037952
[  203.738487] ip_time_handler: Got ip and packets on bond0 Started master election 1-0,
rand 33
[  252.139768] bond0 acl set to 100 0
[  254.008528] VAP device aruba002 created osifp: (ddbe6540) os_if: (daae8000)
[  254.980849] VAP device aruba102 created osifp: (d7e7c540) os_if: (d50c8000)
[  255.775507] asap_send_elected_master: sent successfully
ble_ready is  present @115 .... start processing msgs from APB
```

Checking the system logs on IAP-315 we see the mesh cluster ID is generated and sent.

```
c8:b5:ad:cb:ca:e2# sh log sys 10

May 20 10:36:06  cli[5728]: <341004> <WARN> |AP c8:b5:ad:cb:ca:e2@192.168.1.126 cli|
cli_dpimgr_stop: pid= 7049
May 20 10:36:06  cli[5728]: <341004> <WARN> |AP c8:b5:ad:cb:ca:e2@192.168.1.126 cli|
cli_dpimgr_stop: dpimgr pid= 7049 is reset now
May 20 10:36:06  cli[5728]: <341004> <WARN> |AP c8:b5:ad:cb:ca:e2@192.168.1.126 cli|
cli_dpimgr_launch: called with cmd dpimgr returns pid status 8868
May 20 10:36:06  cli[5728]: <341004> <WARN> |AP c8:b5:ad:cb:ca:e2@192.168.1.126 cli|  CLI
to PAPI port 8516 communication code 1
May 20 10:36:06  syslog: <393003> <WARN> |AP c8:b5:ad:cb:ca:e2@192.168.1.126 dpimgr|
dpimgr_brightcloud_init 312 BCA init done
May 20 10:36:07  cli[5728]: <341004> <WARN> |AP c8:b5:ad:cb:ca:e2@192.168.1.126 cli|  Do
CLI wlan factory
May 20 10:36:09  cli[5728]: <341004> <WARN> |AP c8:b5:ad:cb:ca:e2@192.168.1.126 cli|
is_factory_reset_on_running : factory default status changed reason : ssid_config
May 20 10:36:10  cli[5728]: <341131> <WARN> |AP c8:b5:ad:cb:ca:e2@192.168.1.126 cli|  AP
sends meshd parameters 3538224001885c18df9b4527802f2a183829d2bea0df98b430-
3538224001885c18d-31-0.
May 20 10:36:17  nanny[5642]: <303073> <ERRS> |AP c8:b5:ad:cb:ca:e2@192.168.1.126 nanny|
Process /aruba/bin/radiusd-term [pid 9051] died: got signal SIGTERM
May 20 10:36:17  nanny[5642]: <303079> <ERRS> |AP c8:b5:ad:cb:ca:e2@192.168.1.126 nanny|
Restarted process /aruba/bin/radiusd-term, new pid 9516
c8:b5:ad:cb:ca:e2#
```

Now when we login to IAP-315 which is a slave to the VC (IAP-303H), the mesh link is up.

```
c8:b5:ad:cb:ca:e2# sh ap mesh link

Neighbor list
-------------
MAC                Portal  Channel  Age  Hops  Cost  Relation                 Flags  RSSI
Rate Tx/Rx  A-Req  A-Resp  A-Fail   HT-Details        Cluster ID
---                ------  -------  ---  ----  ----  -----------------        -----  ----
----------  -----  ------  ------   ----------        ----------
24:f2:7f:d5:fa:d0  Yes     36E       0    0     5.00  P 3m:17s                 VLK    38
702/866     1      1       0        VHT-80MHzsgi-2ss  b4afc01b0ce08dcc578432086842f21

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, 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

c8:b5:ad:cb:ca:e2#
```

Note the RSSI value which in this case is 38 and also the 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. The IP address of the IAP-315 is from the DHCP server over the wireless backhaul.

```
c8:b5:ad:cb:ca:e2# sh ip int b
Interface                          IP Address / IP Netmask       Admin  Protocol
br0                              192.168.1.126 / 255.255.255.0     up     up
br0.3333                          172.31.98.1 / 255.255.254.0    up     up
c8:b5:ad:cb:ca:e2#
```

Now we'll check the VC which is one of the Mesh Portals. We can see that the mesh link from the IAP-315-ca:e2 is establish with the VC.

```
BLDG-A-ATV1# sh ap mesh link

Neighbor list
-------------
MAC                Portal             Channel  Age  Hops  Cost  Relation
Flags  RSSI  Rate Tx/Rx  A-Req  A-Resp  A-Fail  HT-Details        Cluster ID
---                ------             -------  ---  ----  ----  -----------------
-----  ----  ----------  -----  ------  ------  ----------        ----------
c8:b5:ad:3c:ae:31  24:f2:7f:d5:fa:d0  36E      0    1     5.00  C 5m:15s
VLK    39    866/585     1      1       0       VHT-80MHzsgi-4ss
b4afc01b0ce08dcc578432086842f21

Total count: 1, Children: 1
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, 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

BLDG-A-ATV1#
```

The Mesh cluster topology looks like this.

```
BLDG-A-ATV1# sh ap mesh cluster topology

Mesh Cluster name: Default mesh group
-------------------------------------
Name                AP Type  Mesh Role    Parent       IP Address     Path Cost  Node Cost
Link Cost  Hop Count  Rate Tx/Rx  RSSI  Last Update  Uplink Age   Children
----                -------  ---------    ------       ----------     ---------  ---------
---------  ---------  ----------  ----  -----------  ----------   --------
BLDG-A-ATV1         AP-303H  Portal (AC)  -            192.168.1.121  0          1
0          0          -           0     59s          12h:21m:30s  1
c8:b5:ad:cb:ca:e2   AP-315   Point (AC)   BLDG-A-ATV1  192.168.1.126  5          0
4          1          526/866     49    5m:2s        6m:14s       0
c8:b5:ad:cb:cb:4e   AP-315   Portal (AC)  -            192.168.1.123  0          0
0          0          -           0     3m:41s       1h:7m:24s    0

Total APs: 3
(N): 11N Enabled. (AC): 11AC Enabled. (AD): 11AD Enabled. For Portals 'Uplink Age' equals
uptime.

BLDG-A-ATV1#
```

3.3 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 IAP-315-ca:e2 which is our mesh point changes the mesh portal to the other IAP-315.

```
c8:b5:ad:cb:ca:e2# sh ap mesh link

Neighbor list
-------------
MAC                 Portal  Channel  Age  Hops  Cost  Relation                 Flags  RSSI
Rate Tx/Rx  A-Req   A-Resp  A-Fail   HT-Details        Cluster ID
---                 ------  -------  ---  ----  ----  ----------------         -----  ----
----------  -----   ------  ------   ----------       ----------
c8:b5:ad:3c:b4:f0   Yes     149E      0    0     3.00  P 9m:57s                 VLK    59
1300/1560   2       1       1        VHT-80MHzsgi-4ss  b4afc01b0ce08dcc578432086842f21

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, 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

c8:b5:ad:cb:ca:e2#
```

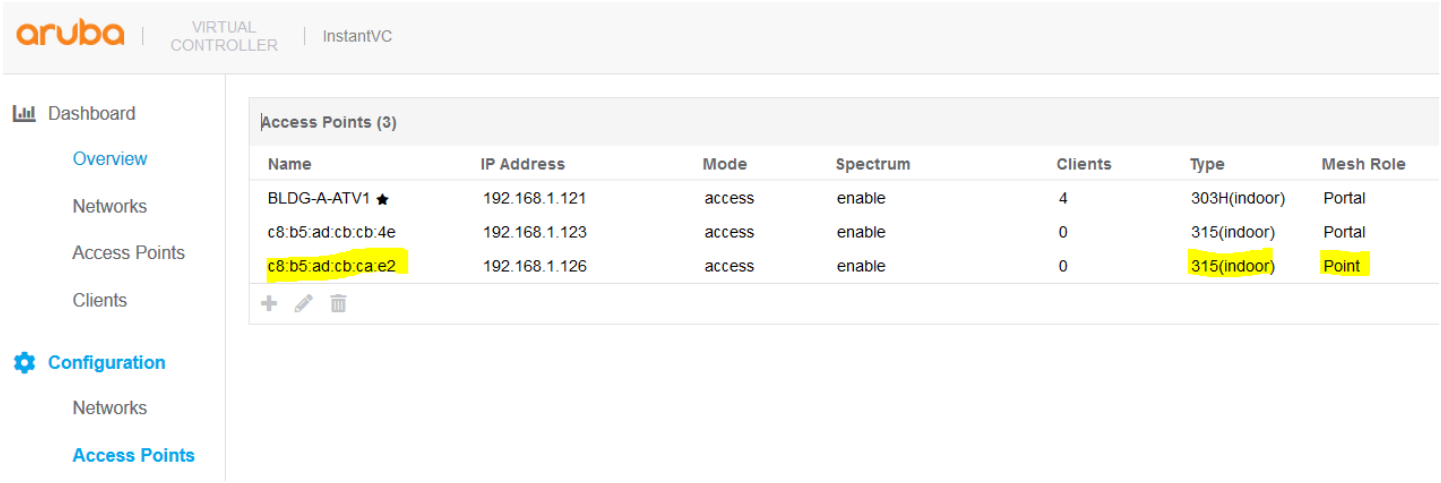
Checking the mesh counters on the mesh point shows the change record and also the previous mesh portal.

```
c8:b5:ad:cb:ca:e2# 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
1              -       -       0
Child      1383       1407       27         3(3 HT)     3(3 HT)    2 (2 HT)    1
0              0       1       17426

Received Packet Statistics: Total 20223, Mgmt 17440 (dropped non-mesh 0), Data 2774
(dropped unassociated 0)HT: pns=0 ans=0 pnr=3 ars=3 arr=0 anr=2

Recovery Profile Usage Counters
-------------------------------
Item                          Value
----                          -----
Enter recovery mode           0
Exit recovery mode            0
Total connections to switch   0

Mesh loop-prevention Sequence No.:4917

Mesh timer ticks:1462

Change-record: improved metric, linkdown:17m:40s, linkup:17m:7s, previous
portal:24:f2:7f:d5:fa:d0, previous parent: 24:f2:7f:d5:fa:d0
Scan-summary:36:0 40:s 44:0 48:s 52:s 56:s 60:s 64:s 100:s 104:s 108:s 112:s 116:s 132:s
136:s 140:s 149:0 153:s 157:s 161:s 165:s
   scan-key: n:not-set,i:invalid,b:blacklisted,s:set,<number>:probe-resp-cnt.

c8:b5:ad:cb:ca:e2#
```

Now on the VC we can confirm that the Mesh portal is now the other IAP-315

```
BLDG-A-ATV1# sh ap mesh cluster topology

Mesh Cluster name: Default mesh group
-------------------------------------
Name               AP Type  Mesh Role    Parent             IP Address     Path Cost
Node Cost  Link Cost  Hop Count  Rate Tx/Rx  RSSI  Last Update  Uplink Age   Children
----               -------  ---------    ------             ----------     ---------  ---
------  ---------  ---------  ----------  ----  -----------  ----------   --------
BLDG-A-ATV1        AP-303H  Portal (AC)  -                  192.168.1.121  0          0
0          0          -          0     1m:24s       12h:43m:22s  0
c8:b5:ad:cb:ca:e2  AP-315   Point (AC)   c8:b5:ad:cb:cb:4e  192.168.1.126  3          0
2          1          1733/1560  58    1m:8s        21m:17s      0
c8:b5:ad:cb:cb:4e  AP-315   Portal (AC)  -                  192.168.1.123  0          1
0          0          -          0     54s          1h:29m:19s   1

Total APs: 3
(N): 11N Enabled. (AC): 11AC Enabled. (AD): 11AD Enabled. For Portals 'Uplink Age' equals
uptime.

BLDG-A-ATV1#
```



3.4 Reconnecting the Wired Port

Now we will reconnect the Ethernet cable from IAP-315 (c8:b5:ad:cb:ca:e2). 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.

```
BLDG-A-ATV1#
BLDG-A-ATV1# 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.

BLDG-A-ATV1#
```

So now with this command when we connect the Eth cable to just bring up the interface, the IAP will not reboot immediately unless it sees that the Ethernet network is operations.

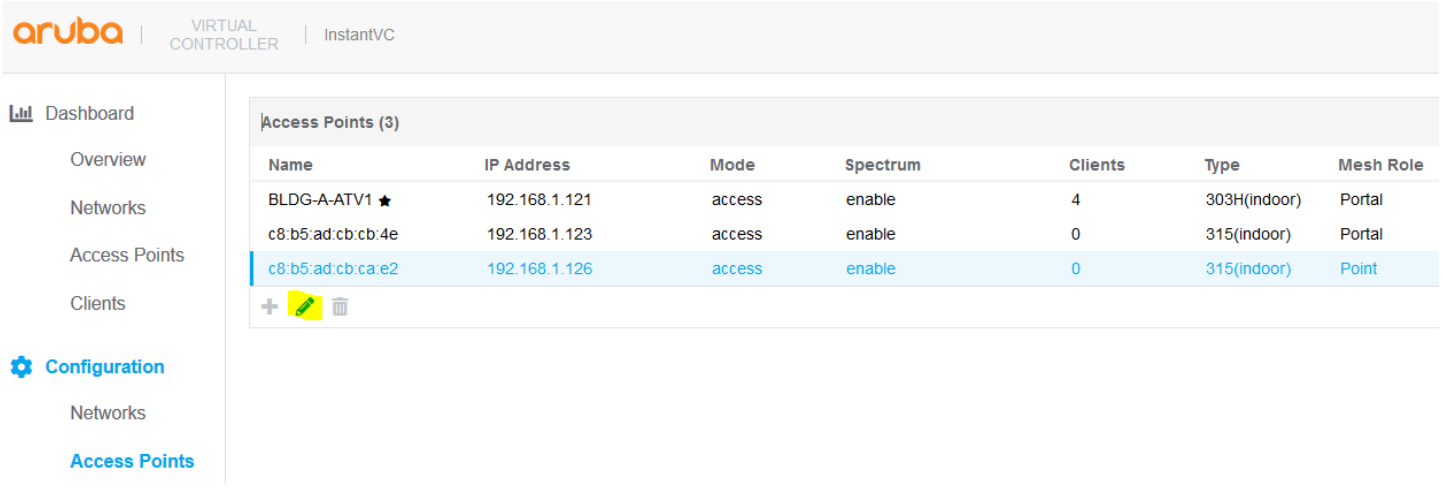
```
c8:b5:ad:cb:ca:e2# sh log sys 20

May 20 11:24:20  syslog: <393003> <WARN> |AP c8:b5:ad:cb:ca:e2@192.168.1.126 dpimgr|
dpimgr_brightcloud_init 312 BCA init done
May 20 12:06:42  cli[5728]: <341004> <WARN> |AP c8:b5:ad:cb:ca:e2@192.168.1.126 cli|
Detected eth link become up, send loop detect packet.
May 20 12:07:15  cli[5728]: <341004> <WARN> |AP c8:b5:ad:cb:ca:e2@192.168.1.126 cli|
Detected eth link become up, send loop detect packet.
May 20 12:08:16  cli[5728]: <341004> <WARN> |AP c8:b5:ad:cb:ca:e2@192.168.1.126 cli|
Detected eth link become up, send loop detect packet.
May 20 12:09:19  cli[5728]: <341004> <WARN> |AP c8:b5:ad:cb:ca:e2@192.168.1.126 cli|
Detected eth link become up, send loop detect packet.
May 20 12:10:20  cli[5728]: <341004> <WARN> |AP c8:b5:ad:cb:ca:e2@192.168.1.126 cli|
Detected eth link become up, send loop detect packet.
May 20 12:11:21  cli[5728]: <341004> <WARN> |AP c8:b5:ad:cb:ca:e2@192.168.1.126 cli|
Detected eth link become up, send loop detect packet.
May 20 12:12:24  cli[5728]: <341004> <WARN> |AP c8:b5:ad:cb:ca:e2@192.168.1.126 cli|
Detected eth link become up, send loop detect packet.
```

```
c8:b5:ad:cb:ca:e2#
```

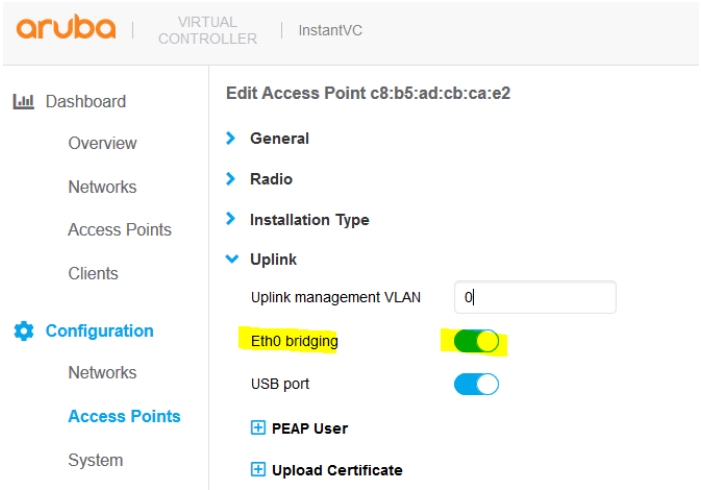
This really enhances the uptime and functionality of the mesh links.

3.5 Ethernet Bridging

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



And editing the selected IAP and enabling Eth0 bridging. Obviously this is meant for IAPs that have one Ethernet port that being Eth0.



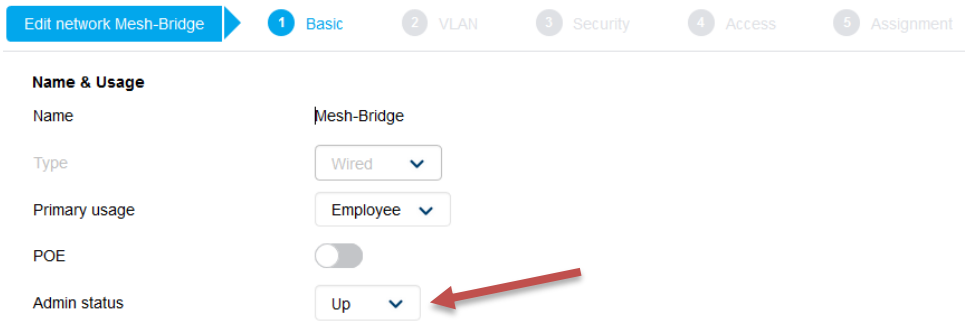
You should then reboot the IAP for this change to take effect. Note that if an IAP is set to Ethernet 0 bridging, it always acts as a mesh point. When an IAP is configured with Eth0 bridging and then rebooted, the E0 bridging will become AP environment setting.

I have shown this here when I have interrupted the boot sequence of the IAP and printing the env attributes.

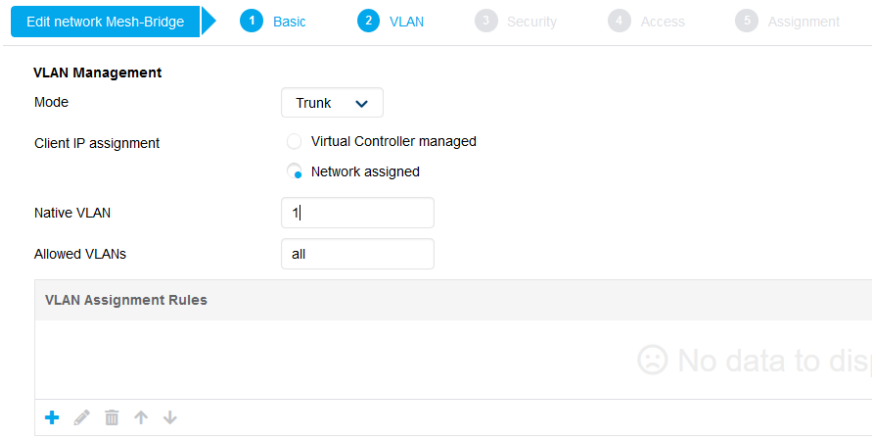
```
apboot> printenv
bootdelay=2
baudrate=9600
autoload=n
boardname=Glenfarclas
servername=aruba-master
bootcmd=boot ap
autostart=yes
```

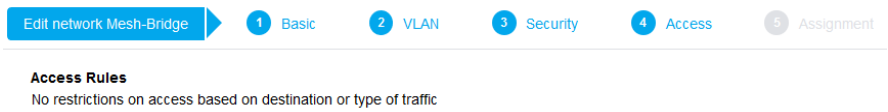
```
bootfile=ipq806x.ari
mtdids=nand0=nand0
ethaddr=c8:b5:ad:cb:ca:e2
NEW_SBL2=1
uap_controller_less=1
os_partition=1
enet0_bridging=1
mesh_cluster_key=longstring
mesh_cluster_name= longstring
start_type=warm_start
stdin=serial
stdout=serial
stderr=serial
machid=1260

Environment size: 655/65532 bytes
apboot>
```

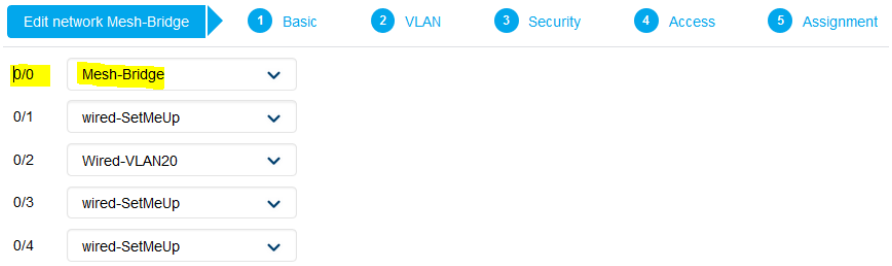
Next we need to configure a network profile for our mesh bridge and assign it to Eth0, this is so that we can have network connectivity across the mesh link.



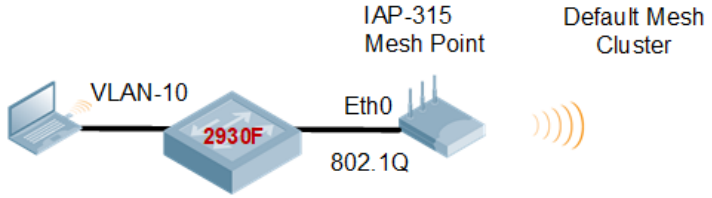
Note that the admin status should be set to Up.







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.

```
c8:b5:ad:cb:ca:e2# 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
       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
---  ------------------------  -----  ----  ------------ -----  --------  --------  --------
3    bond0                     4095   1     196/0     0  1500    188106   1925287  FTQB
15   br0                       0      1     105/0     0  1300     94106         0  FIB
16   mesh0                     4095   1       0/0     0  1500   2542492    898459  FTQBM
26   aruba002                  1      1     158/0     0  1500    435001   1490087  B
27   aruba102                  1      1     158/0     0  1500        32     10820  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

      MAC          VLAN  Assigned VLAN  Destination  Flags  AP Flags  Bridge Role ACL
-----------------  ----  -------------  -----------  -----  --------  ---------------
E8:50:8B:ED:39:18  1     1              dev16                                      0
20:4C:03:23:A7:C0  3333  3333           dev16        P                             0
FC:3F:DB:44:5E:91  1     1              dev16                                      0
F0:D5:BF:4B:67:11  1     1              vlan 1                                     0
20:4C:03:23:A7:C0  1     1              dev16                                      0
C8:B5:AD:CB:CB:4E  1     1              dev16                                      0
B0:5A:DA:98:B5:70  10    10             dev16                                      0
B0:5A:DA:98:B5:70  1     1              dev16                                      0
B0:5A:DA:98:8E:B0  1     1              dev3                                       0
B8:41:A4:74:E5:46  1     1              dev16                                      0
C8:B5:AD:CB:CA:E2  3333  3333           local        P                             0
F8:D0:27:34:E9:12  1     1              dev27                                      0
F0:DE:F1:64:0A:82  10    10             dev3                                       0
C8:B5:AD:CB:CB:4E  3333  3333           dev16        P                             0
14:5F:94:81:56:26  1     1              dev16                                      0
A4:D1:D2:5F:32:52  1     1              dev26                                      0
```

```
C8:B5:AD:CB:CA:E2  1     1              local        P                              0
c8:b5:ad:cb:ca:e2#
```

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)

```
c8:b5:ad:cb:ca:e2# show clients wired

Wired Client List
-----------------
Name     IP Address     MAC Address         OS   Network   Access Point        Role
IPv6 Address   Speed (mbps)
----     ----------     -----------         --   -------   ------------        ----          ---
---------   ------------
AriyaP   10.10.10.100   f0:de:f1:64:0a:82        bond0     c8:b5:ad:cb:ca:e2   Mesh-Bridge   --
-
Info timestamp      :23603
c8:b5:ad:cb:ca:e2#
```

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

```
c8:b5:ad:cb:ca:e2# sh clients

Client List
-----------
Name   IP Address      MAC Address         OS     ESSID   Access Point        Channel   Type
Role           IPv6 Address                Signal     Speed (mbps)
----   ----------      -----------         --     -----   ------------        -------   ----   --
--           ------------                ------     ------------
       192.168.1.15        f8:d0:27:34:e9:12          SG1     c8:b5:ad:cb:ca:e2   11        GN
EpsonPrinter   --                          60(good)   1(poor)
       192.168.1.127   a4:d1:d2:5f:32:52   iPad   SG1     c8:b5:ad:cb:ca:e2   149       AN
SG1            fe80::1016:5191:c8f2:7703   54(good)   58(good)
Number of Clients   :2
Info timestamp      :23778

c8:b5:ad:cb:ca:e2#
```

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.

```
BLDG-A-ATV1# sh ap mesh cluster topology

Mesh Cluster name: Default mesh group
-------------------------------------
Name               AP Type  Mesh Role    Parent             IP Address     Path Cost  Node Cost
Link Cost  Hop Count  Rate Tx/Rx  RSSI  Last Update  Uplink Age   Children
----               -------  ---------    ------             ----------     ---------  ---------  --
-------  ---------  ----------  ----  -----------  ----------   --------
BLDG-A-ATV1        AP-303H  Portal (AC)  -                  192.168.1.121  0          0          0
0          -          0     30s          15h:13m:14s  0
c8:b5:ad:cb:ca:e2  AP-315   Point (AC)   c8:b5:ad:cb:cb:4e  192.168.1.126  3          0          2
1          1733/1733  52    2m:50s       19m:11s      0
c8:b5:ad:cb:cb:4e  AP-315   Portal (AC)  -                  192.168.1.123  0          1          0
0          -          0     3m:49s       3h:59m:6s    1

Total APs: 3
(N): 11N Enabled. (AC): 11AC Enabled. (AD): 11AD Enabled. For Portals 'Uplink Age' equals uptime.

BLDG-A-ATV1#

c8:b5:ad:cb:cb:4e  # sh ap mesh link

Neighbor list
-------------
MAC                Portal             Channel  Age  Hops  Cost  Relation                Flags
RSSI  Rate Tx/Rx  A-Req  A-Resp  A-Fail  HT-Details        Cluster ID
---                ------             -------  ---  ----  ----  ------------------      -----  ---
-  ----------  -----  ------  ------  ----------        ----------
c8:b5:ad:3c:ae:31  24:f2:7f:d5:fa:d0  36E      0    1     5.00  C 1h:30m:0s             VLK    48
866/866     1      1       0       VHT-80MHzsgi-4ss  b4afc01b0ce08dcc578432086842f21

Total count: 1, Children: 1
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, 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
BLDG-A-ATV1#
```

Here you can see that the mesh cluster ID is `b4afc01b0ce08dcc578432086842f21`, you'll notice that this is being broadcasted as well.

4.1 Instant Cluster Manual Configuration

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 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
```

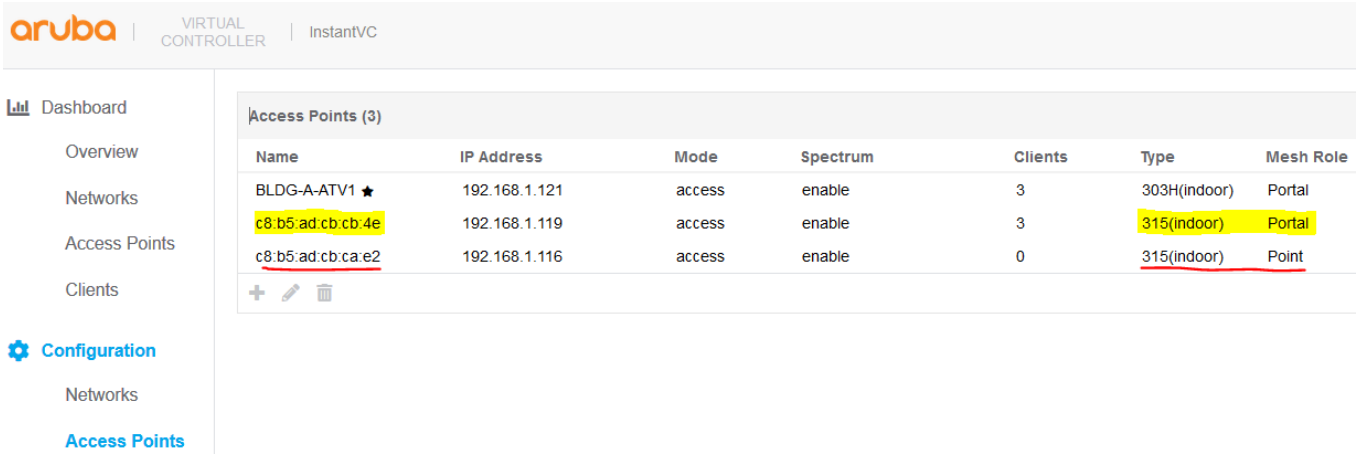
So we login to our IAP-315 which is already a Mesh point and configure the following

```
c8:b5:ad:cb:ca:e2# mesh-cluster-key Aruba123456789
c8:b5:ad:cb:ca:e2# mesh-cluster-name MeshCluster-1
```

We also login to our IAP-315 which is a Mesh portal and configure the same (note the MAC addresses.

```
c8:b5:ad:cb:cb:4e# mesh-cluster-key Aruba123456789
c8:b5:ad:cb:cb:4e# mesh-cluster-name MeshCluster-1
```

Then we'll reload both of them. Once they get rebooted and are online we check the VC which is the AP-303H



Lets check the mesh topology from the VC. Here we see the two mesh clusters, one that was manually configured and the other the default cluster.

```
BLDG-A-ATV1# sh ap mesh cluster topology

Mesh Cluster name: MeshCluster-1
--------------------------------
Name               AP Type  Mesh Role    Parent             IP Address     Path Cost
Node Cost  Link Cost  Hop Count  Rate Tx/Rx  RSSI  Last Update  Uplink Age  Children
----               -------  ---------    ------             ----------     ---------  ---
------  ---------  ---------  ----------  ----  -----------  ----------  --------
c8:b5:ad:cb:ca:e2  AP-315   Point (AC)   c8:b5:ad:cb:cb:4e  192.168.1.116  3          0
2          1          1733/1560   49    6s           3h:47m:12s  0
c8:b5:ad:cb:cb:4e  AP-315   Portal (AC)  -                  192.168.1.119  0          1
0          0          -           0     1m:2s        3h:57m:46s  1

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

Mesh Cluster name: Default mesh group
-------------------------------------
Name         AP Type  Mesh Role    Parent  IP Address     Path Cost  Node Cost  Link Cost
Hop Count  Rate Tx/Rx  RSSI  Last Update  Uplink Age  Children
----         -------  ---------    ------  ----------     ---------  ---------  ---------
---------  ----------  ----  -----------  ----------  --------
BLDG-A-ATV1  AP-303H  Portal (AC)  -       192.168.1.121  0          0          0
0          -           0     4m:36s       22h:17m:5s  0

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

BLDG-A-ATV1#
```

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 Instant Cluster Configuration with Standalone mode

Here we have converted our previous IAP-315 (c8:b5:ad:cb:ca:e2) Mesh point to standalone mode. It still retained all the info regarding the mesh cluster-1 as before. But you should note that if the mesh cluster that was configured is not available the standalone IAP will not be able to connect to the default mesh cluster if the Instant cluster and you should design your mesh cluster with standalone IAPs accordingly.

```
        <<<<<       Welcome to the Access Point     >>>>>

Power supply mode is POE-AF:, USB Modem is not present.
Completed SW FIPS KAT test
[  109.789097] Starting Kernel HMAC SHA1 FIPS KAT ...
[  109.845423] Completed Kernel HMAC SHA1 FIPS KAT
[  110.527585] Kernel watchdog refresh ended on core 0.
[  110.529397] Kernel watchdog refresh ended on core 1.
[  111.789597] Starting Kernel HMAC SHA256 FIPS KAT ...
[  112.045798] Completed Kernel HMAC SHA256 FIPS KAT
```

```
[  113.797594] Starting Kernel HMAC SHA384 FIPS KAT ...
[  113.958106] Completed Kernel HMAC SHA384 FIPS KAT
[  115.797594] Starting Kernel HMAC SHA512 FIPS KAT ...
[  115.859856] Completed Kernel HMAC SHA512 FIPS KAT
[  130.456950] aruba_commit_radio 1542 d6680540
[  130.460980] aruba_commit_radio 1542 d6780540
[  131.047735] enet0 bridging is enabled
[  136.154920] enet0 bridging is enabled
[  145.269447] bond0 acl set to 196 0
[  155.703030] enet0 bridging is enabled
[  156.762636] VAP device aruba000 created osifp: (dcc07540) os_if: (da380000)
[  156.836738] wmi_unified_set_psmode:set psmode=1
[  156.888003] wmi_unified_set_psmode:set psmode=0
[  156.948297] VAP device aruba001 created osifp: (ddec1540) os_if: (d8a48000)
[  180.995563] ieee80211_connection_state_connecting_entry:668, enter......,sm-
>candidate_aplist_index = 0
[  181.095657] wlan_assoc_sm_start:890, enter......
[  181.150827] ieee80211_assoc_state_init_event:142, enter......, event 0
[  181.231552] probereq timeout happen in state machine but we donot care it event =
4,186,ieee80211_assoc_state_join_event
[  181.359169] ieee80211_assoc_state_join_event:197, goto AUTH
[  181.425804] wlan_mlme_auth_request:344, enter >>>>>>>>>>
[  181.493533] ieee80211_assoc_state_assoc_event:333, ASSOC sucess and transition to RUN
state
[  182.097344] ip_time_handler: Got ip and packets on bond0 Started master election 26-0,
rand 20

[  202.247266] i am master now
[  202.268166] (03:08:05) !!! Init ---> Master
[  202.318150] asap_send_elected_master: sent successfully
[  220.726522] ADDRCONF(NETDEV_CHANGE): bond0: link becomes ready
[  220.784317] bond0: 1000 Mbps Full Duplex
[  221.843517] Settng Jumbo MRU 2000
[  230.572227] enet0 bridging is enabled
[  248.709965] bond0 acl set to 196 0
[  250.730365] VAP device aruba002 created osifp: (dcc06540) os_if: (d52c0000)
[  251.252452] VAP device aruba102 created osifp: (dca9f540) os_if: (d3d40000)
```

Checking the mode to ensure it is standalone.

```
c8:b5:ad:cb:ca:e2# sh swarm mode

Swarm Mode        :Standalone
Reason            :Manual provision
c8:b5:ad:cb:ca:e2#
```

Now lets check ther mesh cluster status, as you can see the cluster confguration is still there.

```
c8:b5:ad:cb:ca:e2# sh ap mesh cluster config

Mesh cluster name :MeshCluster-1
Mesh cluster key  :Manual

c8:b5:ad:cb:ca:e2# sh ap mesh cluster status

Mesh cluster      :Enabled
Mesh cluster name :MeshCluster-1
Mesh role         :Mesh Point
```

```
c8:b5:ad:cb:ca:e2#

c8:b5:ad:cb:ca:e2# sh ap mesh cluster topology

Mesh Cluster name: MeshCluster-1
--------------------------------
Name               AP Type  Mesh Role   Parent     IP Address     Path Cost  Node Cost  Link Cost
Hop Count  Rate Tx/Rx  RSSI  Last Update  Uplink Age  Children
----               -------  ---------   ------     ----------     ---------  ---------  ---------
---------  ----------  ----  -----------  ----------  --------
c8:b5:ad:cb:ca:e2  AP-315   Point (AC)  Not Found  192.168.1.115  3          0          2
1          1560/975    54    18s          36m:52s     0

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

c8:b5:ad:cb:ca:e2#
```

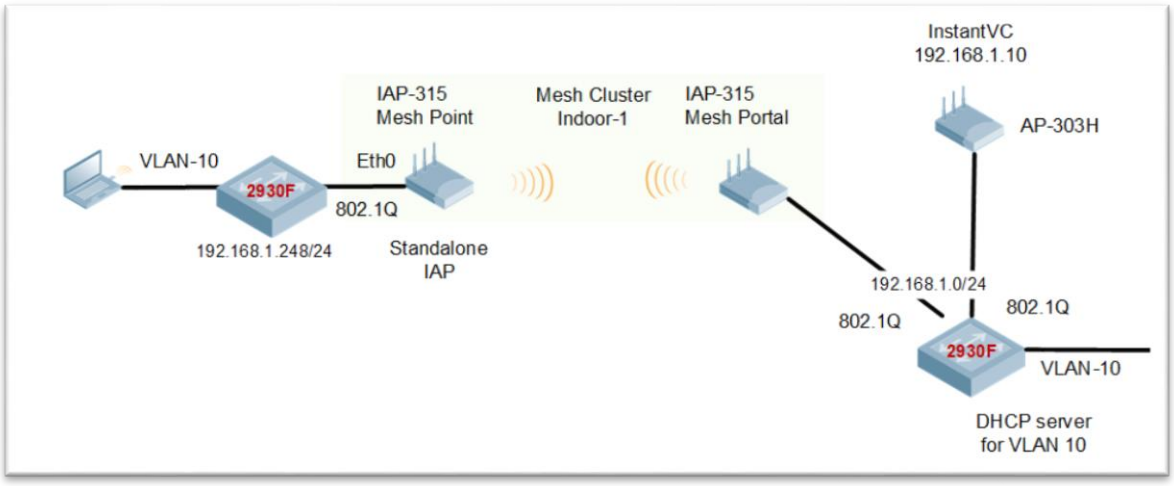
Now lets check the mesh link status.

```
c8:b5:ad:cb:ca:e2# sh ap mesh link

Neighbor list
-------------
MAC                Portal  Channel  Age  Hops  Cost  Relation                Flags  RSSI  Rate
Tx/Rx  A-Req  A-Resp  A-Fail  HT-Details        Cluster ID
---                ------  -------  ---  ----  ----  ------------------      -----  ----  --------
--  -----  ------  ------  ----------        ----------
c8:b5:ad:3c:b4:f0  Yes     149E     0    0     3.00  P 35m:16s               VLK    53    702/1053
1      1       0       VHT-80MHzsgi-4ss  b4bd690840b87c3b9ac3d916cf6baa1

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, 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
c8:b5:ad:cb:ca:e2#
```

Here we check all mesh neighbors for this stadalone IAP.

```
c8:b5:ad:cb:ca:e2# sh ap mesh neighbours

Neighbor list
-------------
MAC                Portal  Channel  Age  Hops  Cost  Relation                Flags  RSSI  Rate
Tx/Rx  A-Req  A-Resp  A-Fail  HT-Details        Cluster ID
---                ------  -------  ---  ----  ----  ------------------      -----  ----  --------
--  -----  ------  ------  ----------        ----------
c8:b5:ad:3c:b4:f0  Yes     149E     0    0     3.00  P 39m:10s               VLK    53
1560/1560   1      1       0       VHT-80MHzsgi-4ss  b4bd690840b87c3b9ac3d916cf6baa1

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, 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
c8:b5:ad:cb:ca:e2#
```

now we connect the Eth0 of the standalone IAP-315 to a LAN switch (2930F) and connect a laptop on VLAN 10 to the switch. Note that E0 bridging is enabled as before.



The laptop (with the MAC address of F0:DE:F1:64:0A:82) gets an IP address from VLAN 10 at the far side.

```
c8:b5:ad:cb:ca:e2# sh datapath bridge
Datapath Bridge Devices
-----------------------------
Flags: F - source-filter, T - trusted, Q - tagged, I - IP
       S - split-tunnel, B - bridge, M - mesh, P - PPPoE
       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
---  ------------------------  -----  ----  ----------- -----  --------  --------  --------
3    bond0                     4095   1     196/0     0  1500      764     28095  FQB
15   br0                       0      1     105/0     0  1300     3759         0  FIB
16   mesh0                     4095   1       0/0     0  1500    30974      4559  FTQBM

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

      MAC           VLAN  Assigned VLAN  Destination  Flags  AP Flags  Bridge Role ACL
-----------------  ----  -------------  -----------  -----  --------  ---------------
FC:3F:DB:44:5E:91  1     1              dev16                                      0
20:4C:03:23:A7:C0  1     1              dev16                                      0
C8:B5:AD:CB:CB:4E  1     1              dev16                                      0
B0:5A:DA:98:B5:70  10    10             dev16                                      0
B0:5A:DA:98:B5:70  1     1              dev16                                      0
B0:5A:DA:98:8E:B0  1     1              dev3                                       0
C8:B5:AD:CB:CA:E2  3333  3333           local        P                             0
F0:DE:F1:64:0A:82  10    10             dev3                                       0
14:5F:94:81:56:26  1     1              dev16                                      0
C8:B5:AD:CB:CA:E2  1     1              local        P                             0
c8:b5:ad:cb:ca:e2#
```

Here we can check the wired clients on the standalone IAP-315. Note that 192.168.1.248 is the IP address of the LAN switch.

```
c8:b5:ad:cb:ca:e2# sh clients wired

Wired Client List
-----------------
```

```
Name    IP Address     MAC Address        OS  Network  Access Point       Role         IPv6 Address
Speed (mbps)
----    ----------     -----------        --  -------  ------------       ----         ------------
------------
AriyaP  10.10.10.100   f0:de:f1:64:0a:82      bond0    c8:b5:ad:cb:ca:e2  Mesh-Bridge  --
-
        192.168.1.248  b0:5a:da:98:8e:b0      bond0    c8:b5:ad:cb:ca:e2  Mesh-Bridge  --
-
Info timestamp      :8500
c8:b5:ad:cb:ca:e2#
```

When we start successfully pinging from the laptop (10.10.10.100) to the default gateway (10.10.10.1) which is across the mesh link, we should see the entries in the datapath sessino table on the standalone IAP, demonstrating the traffic is flowing through the mesh link.

```
c8:b5:ad:cb:ca:e2# sh datapath session
Datapath Session Table Entries
------------------------------
Flags: F - fast age, S - src NAT, N - dest NAT
       D - deny, R - redirect, Y - no syn
       H - high prio, P - set prio, T - set ToS
       C - client, M - mirror, V - VOIP
       I - Deep inspect, U - Locally destined
       s - media signal, m - media mon, a - rtp analysis
       E - Media Deep Inspect, G - media signal
       A - Application Firewall Inspect
       L - ALG session
       O - Session is programmed through SDN/Openflow controller
       p - Session is marked as permanent
RAP Flags: 0 - Q0, 1 - Q1, 2 - Q2, r - redirect to master, t - time based

Source IP         Destination IP  Prot SPort Dport Cntr Prio ToS Age Destination TAge Packets Bytes  Flags
---------------   --------------  ---- ----- ----- ---- ---- --- --- ----------- ---- ------- -----  -----
10.10.10.100      10.10.10.1      1    37    2048  0    0    0   0   dev3        e    0       0      FYCI
10.10.10.100      10.10.10.1      1    36    2048  0    0    0   0   dev3        13   0       0      FYCI
10.10.10.100      10.10.10.1      1    35    2048  0    0    0   0   dev3        18   0       0      FYCI
10.10.10.100      10.10.10.1      1    34    2048  0    0    0   0   dev3        1d   0       0      FYCI
192.168.1.130     10.10.10.100    17   53    60046 0    0    0   1   dev3        5b   0       0      FYIA
F0:DE:F1:64:0A:82               0806              0    0    0   0   dev3        80   2       1000   F
10.10.10.1        10.10.10.100    1    35    0     0    0    56  0   dev3        18   0       0      FI
10.10.10.1        10.10.10.100    1    34    0     0    0    56  0   dev3        1d   0       0      FI
10.10.10.1        10.10.10.100    1    37    0     0    0    56  0   dev3        e    0       0      FI
10.10.10.1        10.10.10.100    1    36    0     0    0    56  0   dev3        13   0       0      FI
10.10.10.100      192.168.1.130   17   60046 53    0    0    0   1   dev3        5b   0       0      FCIA
c8:b5:ad:cb:ca:e2#
```

Just a side note to show that the WiFi mesh autmatically becomes highest priority uplink.

```
c8:b5:ad:cb:ca:e2# sh uplink status

Uplink preemption              :enable
Uplink preemption interval     :600
Uplink enforce                 :none
Ethernet uplink bond0         :DHCP
Uplink Table
------------
Type        State  Priority  In Use
----        -----  --------  ------
Wifi-mesh   UP     0         Yes
Wifi-sta    INIT   7         No
3G/4G       INIT   8         No
Internet failover                          :disable
Max allowed test packet loss               :10
Secs between test packets                  :30
VPN failover timeout (secs)                :180
```

```
Internet check timeout (secs)            :10
ICMP pkt sent         :0
ICMP pkt lost         :0
Continuous pkt lost   :0
VPN down time         :0
AP1X type:NONE
Certification type:NONE
Validate server:NONE
c8:b5:ad:cb:ca:e2#
```

Laslty this is view from the VC on the Instant Cluster. The “1” indicates that there is one child

```
BLDG-A-ATV1# sh ap mesh cluster topology

Mesh Cluster name: MeshCluster-1
--------------------------------
Name               AP Type  Mesh Role    Parent  IP Address     Path Cost  Node Cost  Link Cost
Hop Count  Rate Tx/Rx  RSSI  Last Update  Uplink Age  Children
----               -------  ---------    ------  ----------     ---------  ---------  ---------  --
-------  ----------  ----  -----------  ----------  --------
c8:b5:ad:cb:cb:4e  AP-315   Portal (AC)  -       192.168.1.120  0          1          0          0
-           0     4m:19s       2h:36m:56s  1

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


Mesh Cluster name: Default mesh group
-------------------------------------
Name         AP Type  Mesh Role    Parent  IP Address     Path Cost  Node Cost  Link Cost  Hop
Count  Rate Tx/Rx  RSSI  Last Update  Uplink Age  Children
----         -------  ---------    ------  ----------     ---------  ---------  ---------  --------
-  ----------  ----  -----------  ----------  --------
BLDG-A-ATV1  AP-303H  Portal (AC)  -       192.168.1.121  0          0          0          0
-           0     2m:56s       4h:32m:52s  0

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

BLDG-A-ATV1#
```