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Revision History

DATE	VERSION	EDITOR	CHANGES
09 Sep 2021	0.1	Ariya Parsamanesh	Initial creation
24 Sep 2021	0.2	Ariya Parsamanesh	Added mesh section

2 Dual Ethernet Uplink

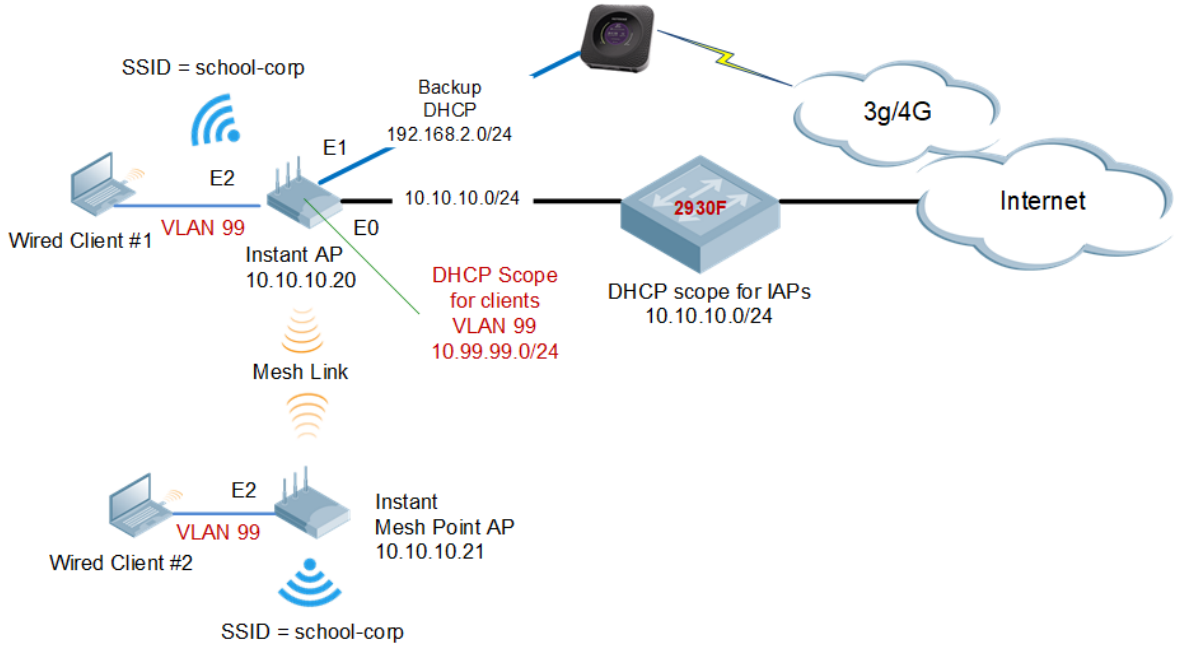
In this technote we'll cover a useful solution for small retail stores/remote sites that need 1-2 APs and require active-passive Ethernet uplink. Note that you can run IAP-VPN on top of this solution which his not covered here. This solution uses the new feature in Instant 8.8.x that basically supports use of multiple Ethernet uplinks. This solution will also cover the second IAP as a mesh point using the dual uplinks of the Mesh portal IAP.

The main points for this solution are

- One Ethernet port will be the active uplink port while the other Ethernet port will be backup uplink port.
- Only DHCP based IP address on the uplinks are supported
- Failover and pre-emption features are enabled by default when multiple Ethernet uplink is configured.
- This is only configurable using CLI
- This is only supported for standalone mode or 1 Conductor mesh portal + mesh points in the swarm and NOT supported on a cluster of more than 1x AP.

Note that you can run IAP-VPN on top of this solution which his not covered here.

Here is the lab set-up to demonstrate this feature with/without mesh point AP.



Things you need

- Two APs with two or more Ethernet ports (AP-303H /AP-505H)
- Aruba Instant version 8.8.0.0 or later
- A Layer three switch and some WiFi/wired clients
- Optionally two Internet links.

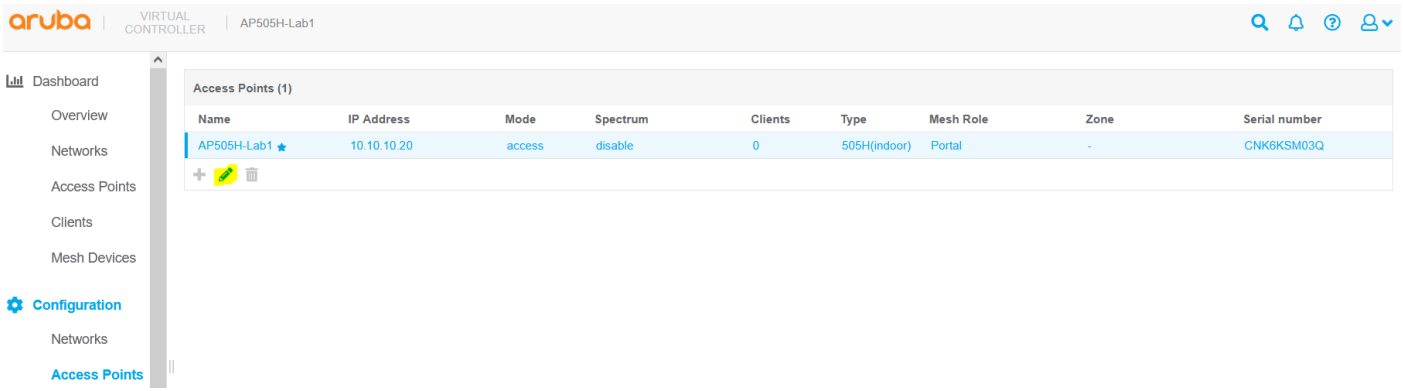
3 Dual Ethernet Uplinks

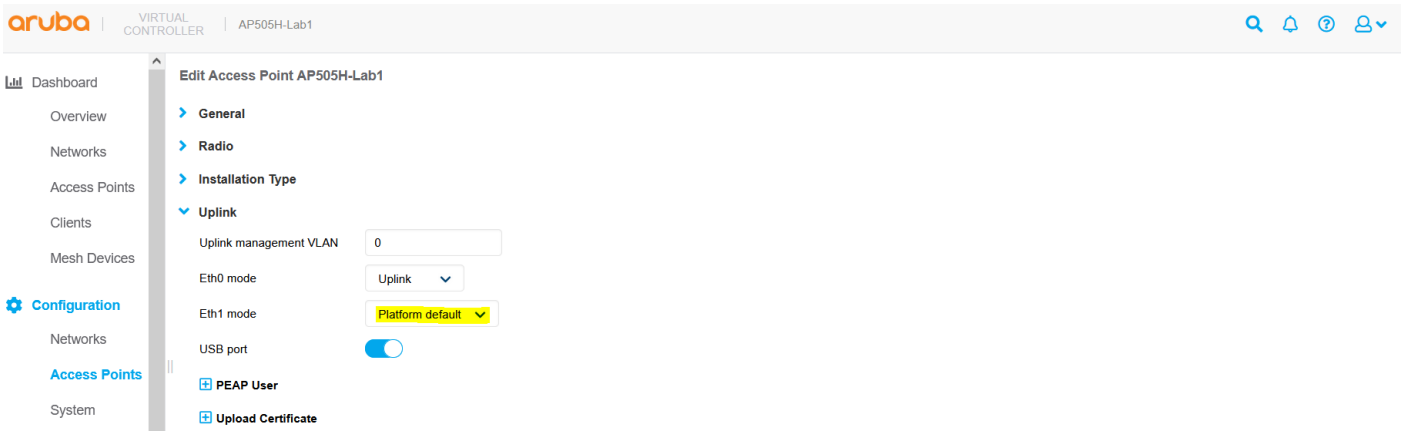
Here we have an existing Instant Cluster which consists of one AP-505H.

Some AP models with more than one Ethernet ports have uplink enabled for both E0 and E1 ports and some don't. in either way, it is best to check it. And set it correctly.

3.1 Uplink Configuration

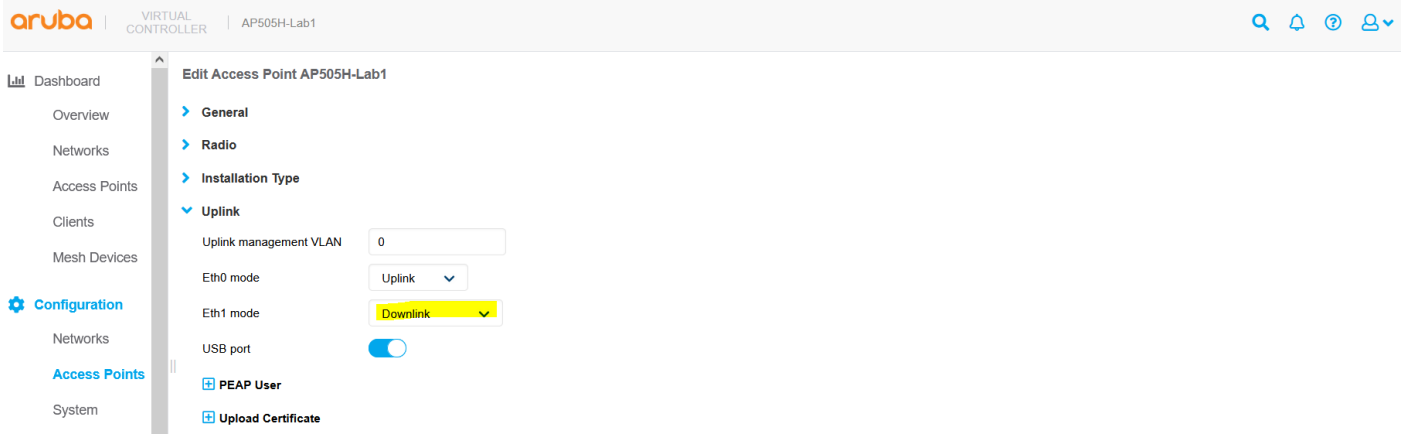
By default, Eth0 will be the uplink for the AP. Here we'll first need to change the mode of Eth1 from platform-default to downlink.





The main points here are that if Eth1 mode

1. is changed to "uplink", then E0 and E1 are bonded together, and the LAN switch ports should be configured in LACP.
2. is changed to "downlink" then E1 is not bonded to E0 and you can use it as a backup to E0



Once you have saved it, you need to reboot the AP for changes to take effect.

Now we'll check a few things from the CLI. This first command will show the AP environment parameters and here we'll see that the E1 link is set to downlink.

```
AP505H-Lab1# sh ap-env

Antenna Type:Internal
IoT Antenna Type:Internal
Need USB field:Yes
name:AP505H-Lab1
ap1xuser:InstantAP
ap1xpasswd:274d5d134a80c4ded537657e000f6cbb4801341fea639d54
uap_controller_less:1
enet1_mode:downlink
AP505H-Lab1#
```

Next, we'll make sure that the port bonding is active-backup.

```
AP505H-Lab1# sh port-bonding
Bonding Mode: fault-tolerance (active-backup)
Primary Interface: eth0 (primary_reselect always)
Currently Active Interface: eth0
MII Status: up
MII Polling Interval (ms): 400
Up Delay (ms): 0
Down Delay (ms): 0

Interface: eth0
MII Status: up
Speed: 1000 Mbps
Duplex: full
Link Failure Count: 1
Permanent HW addr: 20:4c:03:b2:75:97
Queue ID: 0
AP505H-Lab1#
```

Next, we need to configure the VLAN for the 2nd uplink. And it is done only through the CLI.

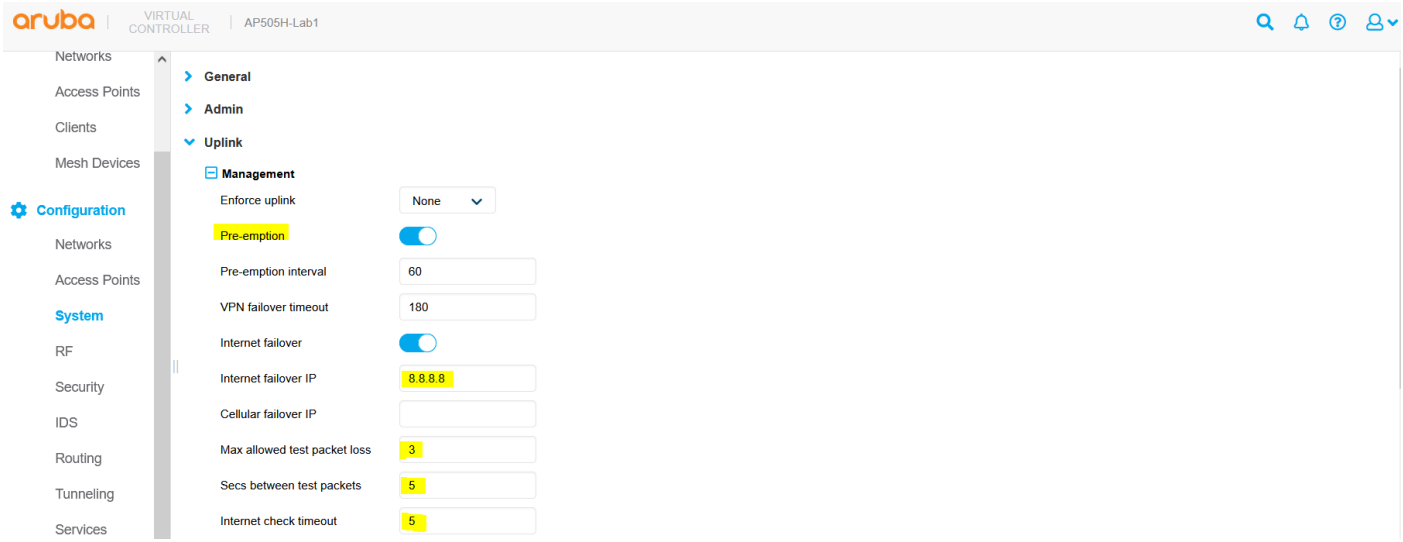
```
uplink-enforce-wired-port-vlan-setting
!
interface vlan 192
 ip address dhcp-client
!
```

I have also configured VLAN 192 which will be the VLAN 192 used for my backup uplink on E1. And finally assigning the priority for it under the uplink configuration.

```
!
uplink
uplink-wired vlan 192 priority 5
!
```

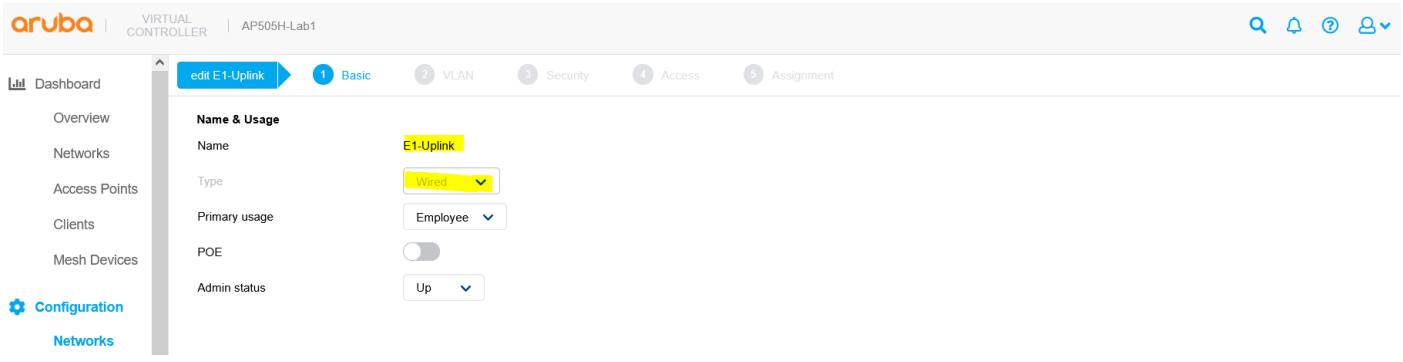
Remember priority for the E0 as an uplink is 0 which is the highest.

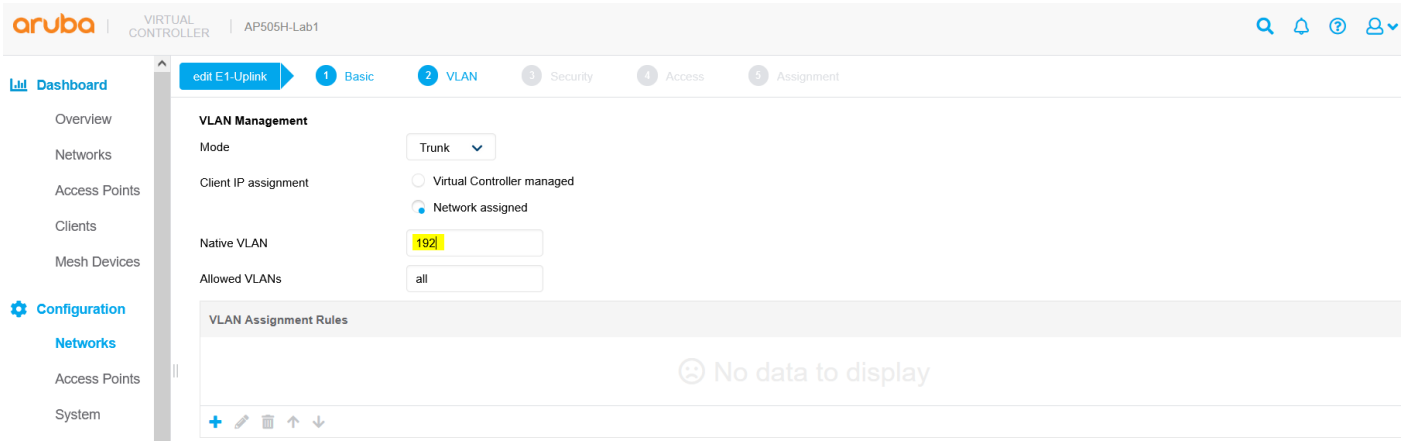
I'll also need to fine tune the uplink configuration by enabling pre-emption and change a few counters to shorten the time it takes for the backup link (eth1) to be activated.

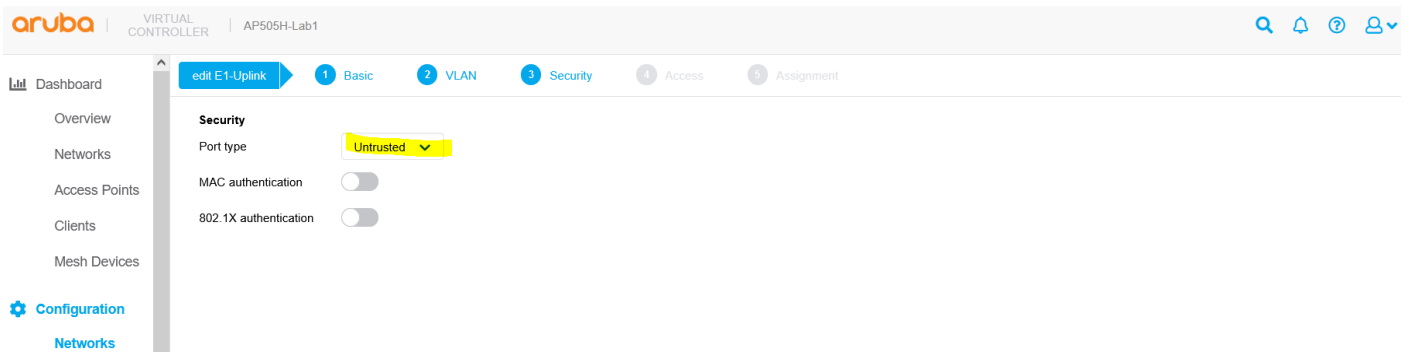


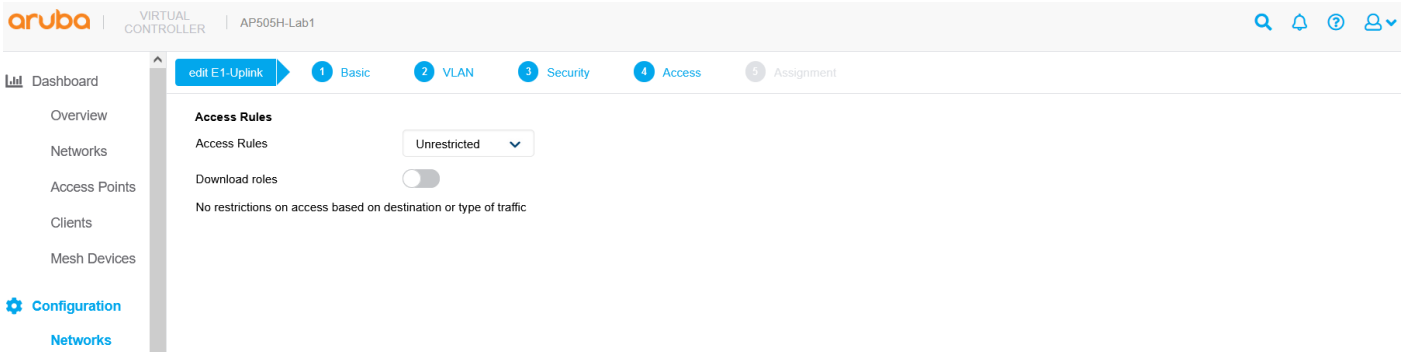
3.2 Port Profile Configuration

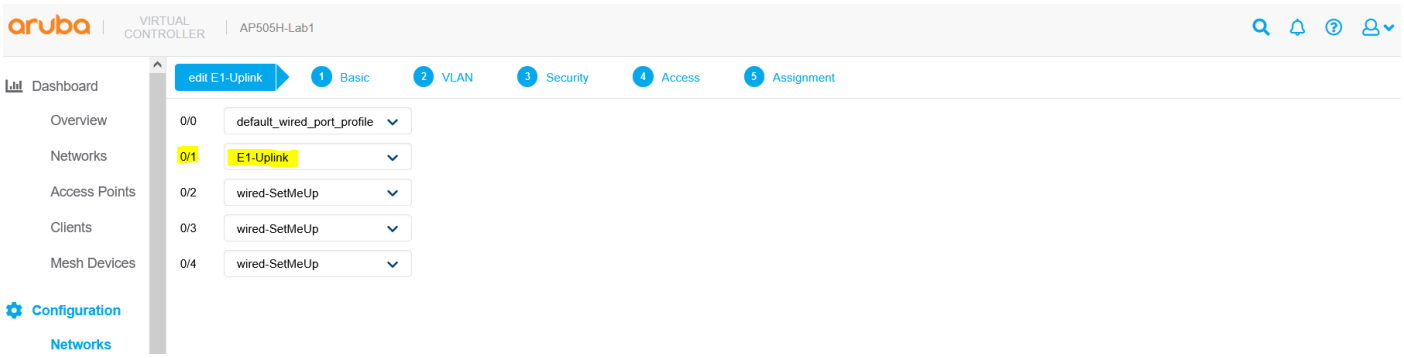
Now we need to create a Wired network port profile and assign in to E1 port, which we can do through the WebUI.











You'll note that we are assigning VLAN192 that we configured as a DHCP client to E1 port. Now we can connect the second Internet connection to E1 port and then check the uplink status

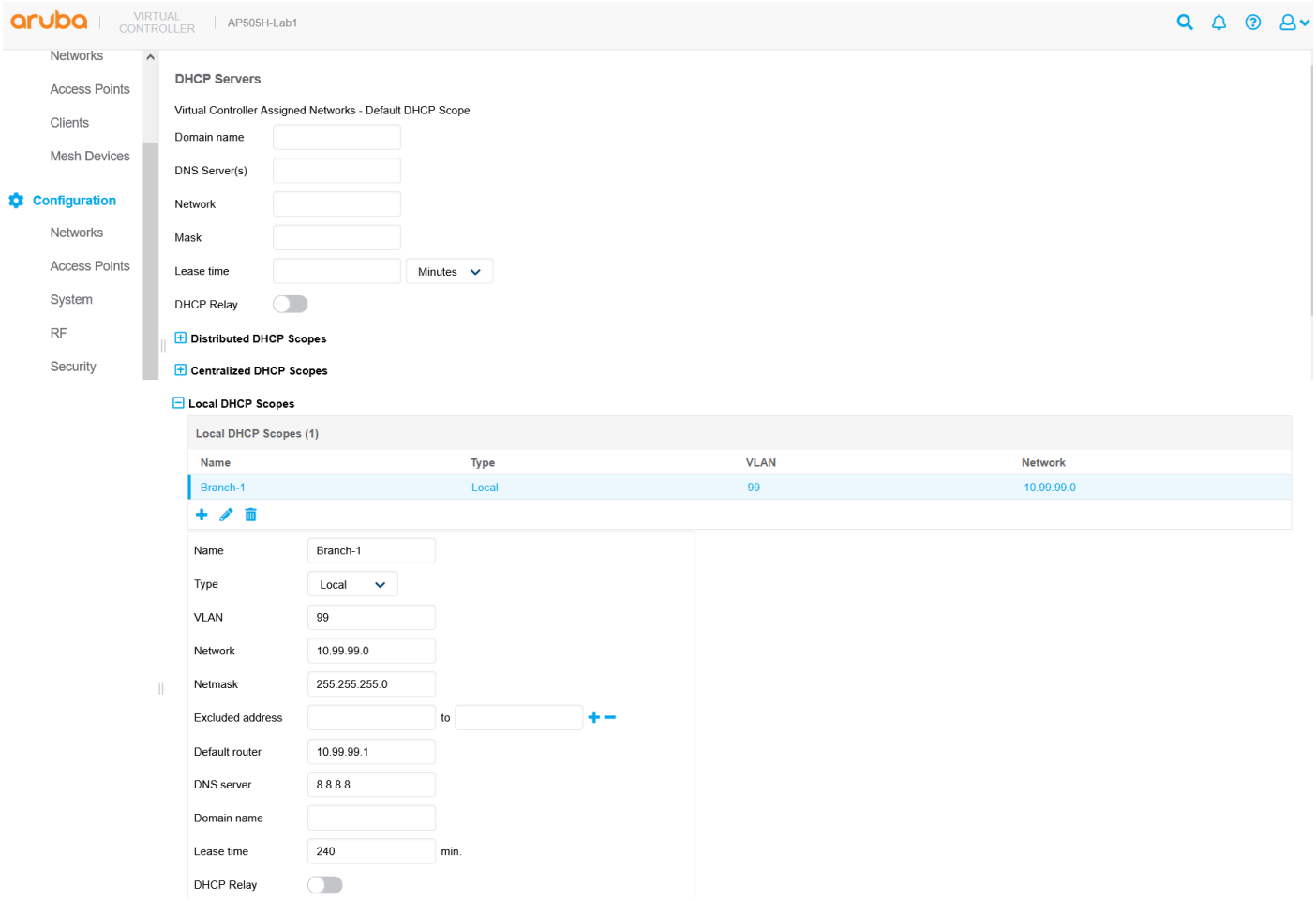
```
AP505H-Lab1# sh uplink status

Uplink preemption              :enable
Uplink preemption interval     :60
Uplink enforce                 :none
Uplink wired-1                 :DHCP
Uplink wired-192               :DHCP
Internet failover                          :enable
Max allowed test packet loss               :3
Secs between test packets                  :5
VPN failover timeout (secs)                :180
Internet check timeout (secs)              :5
AP1X type:PEAP
Certification type:NONE
Validate server:Disable

Uplink Table
--------------
Type       VLAN  State  Reach State  Prio  In Use  Interface  IP             Mask           GW           Sent
Lost  Cont lost
----       ----  -----  -----------  ----  ------  ---------  --             ----           --           ----
----  ---------
Ethernet   1     UP     UP           0     Yes     br0        10.10.10.20    255.255.255.0  10.10.10.1   590
1     0
Ethernet   192   UP     UP           5     No      br0.192    192.168.2.49   255.255.255.0  192.168.2.1  541
0     0
Cellular   0     INIT   INIT         22    No      ppp0       0.0.0.0        0.0.0.0        0.0.0.0      0
0     0
Wifi-sta   0     INIT   INIT         20    No      wuplink0   0.0.0.0        0.0.0.0        0.0.0.0      0
0     0

Wired Port Table
------------------
Port  State  Type  Bonding(Admin/Oper/Active)
----  -----  ----  --------------------------
eth0  UP     WAN   Yes/Yes/Yes
eth1  UP     WAN   No/No/No
eth2  UP     LAN   No/No/No
eth3  DOWN   LAN   No/No/No
eth4  DOWN   LAN   No/No/No
AP505H-Lab1#
```

We also need to check the IP addresses of the interfaces and the routing.

```
AP505H-Lab1# sh ip int brief
Interface                          IP Address / IP Netmask       Admin  Protocol
br0                               10.10.10.20 / 255.255.255.0    up     up
br0.192                           192.168.2.49 / 255.255.255.0   up     up
br0.3333                          172.31.98.1 / 255.255.254.0    up     up
AP505H-Lab1#
AP505H-Lab1#
AP505H-Lab1# sh ip route
default via 10.10.10.1 dev br0
8.8.8.8 via 192.168.2.1 dev br0.192
8.8.8.8 via 10.10.10.1 dev br0
10.10.10.0/24 dev br0  src 10.10.10.20
172.31.98.0/23 dev br0.3333  src 172.31.98.1
192.168.2.0/24 dev br0.192  src 192.168.2.49
AP505H-Lab1#
```

3.3 Local DHCP Configuration

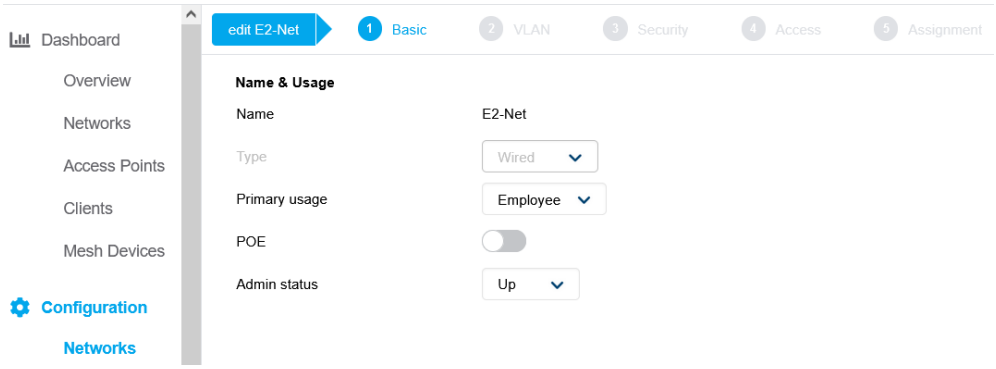
Even though we can use the IAP assigned magic VLAN which is 172.31.98.0/23, here we'll configura a local DHCP pool which will be used for a wired client that will be connected to E2 port of the AP and for the wireless users.

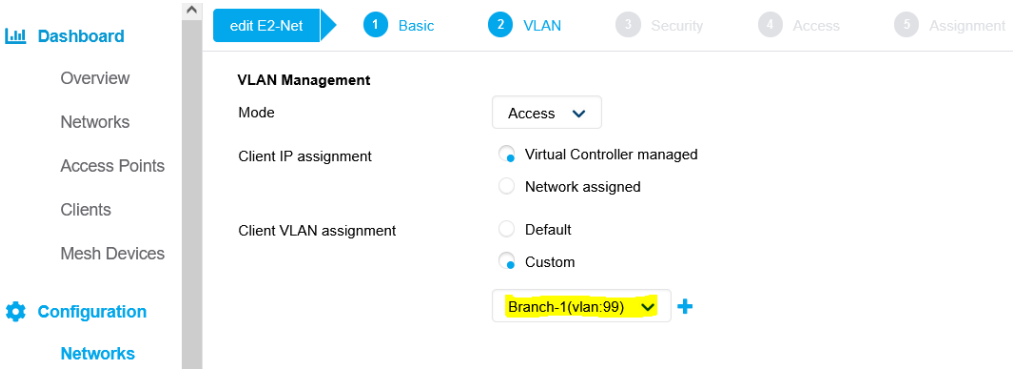


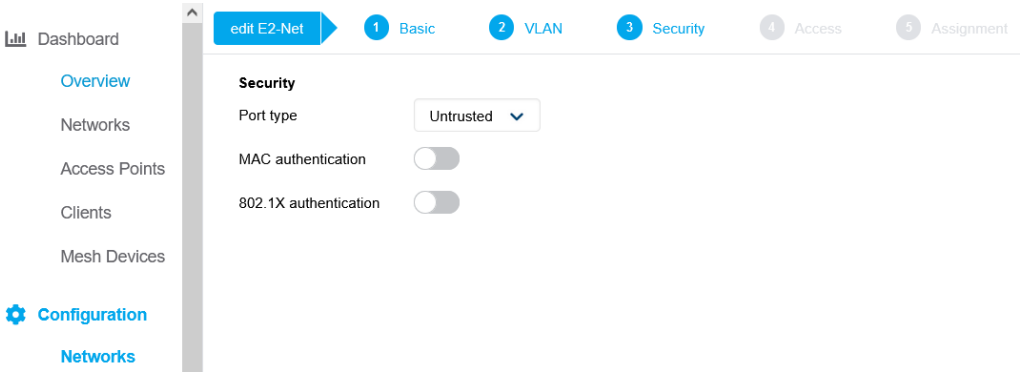
Once you have finished configuration save it. We'll be using this VLAN ID (99) in the next section.

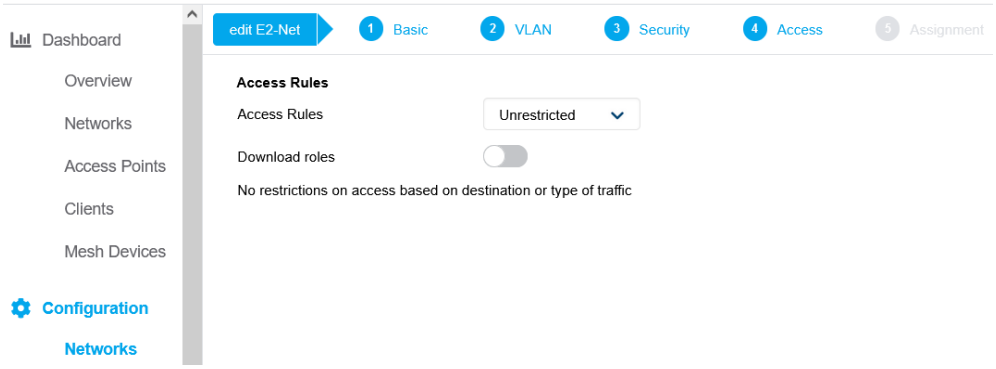
3.4 Client Wired Network Configuration

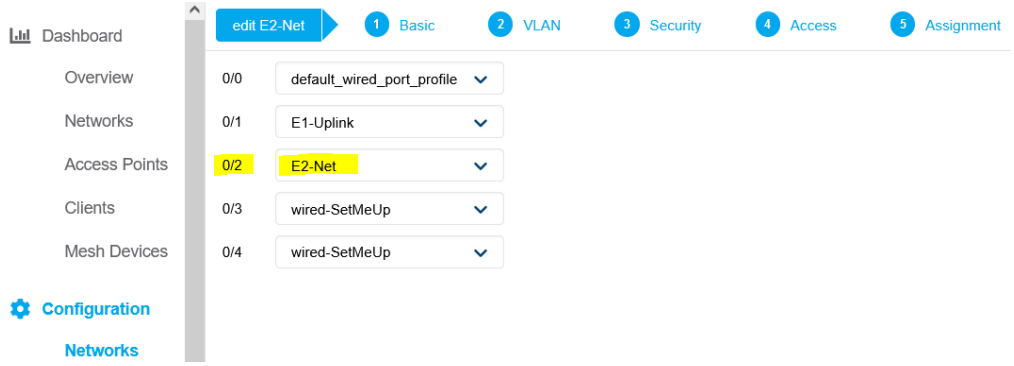
Here we have just added a wired network called E2-Net that is for our wired connected client on E2 port.


Dashboard
Overview
Networks
Access Points
Clients
Mesh Devices
Configuration
Networks
edit E2-Net
1 Basic
2 VLAN
3 Security
4 Access
5 Assignment
Name & Usage
Name
E2-Net
Type
Wired
Primary usage
Employee
POE
Admin status
Up


Dashboard
Overview
Networks
Access Points
Clients
Mesh Devices
Configuration
Networks
edit E2-Net
1 Basic
2 VLAN
3 Security
4 Access
5 Assignment
VLAN Management
Mode
Access
Client IP assignment
Virtual Controller managed
Network assigned
Client VLAN assignment
Default
Custom
Branch-1(vlan:99)


Dashboard
Overview
Networks
Access Points
Clients
Mesh Devices
Configuration
Networks
edit E2-Net
1 Basic
2 VLAN
3 Security
4 Access
5 Assignment
Security
Port type
Untrusted
MAC authentication
802.1X authentication


Dashboard
Overview
Networks
Access Points
Clients
Mesh Devices
Configuration
Networks
edit E2-Net
1 Basic
2 VLAN
3 Security
4 Access
5 Assignment
Access Rules
Access Rules
Unrestricted
Download roles
No restrictions on access based on destination or type of traffic


Dashboard
Overview
Networks
Access Points
Clients
Mesh Devices
Configuration
Networks
edit E2-Net
1 Basic
2 VLAN
3 Security
4 Access
5 Assignment
0/0
default_wired_port_profile
0/1
E1-Uplink
0/2
E2-Net
0/3
wired-SetMeUp
0/4
wired-SetMeUp

4 Dual Uplink Testing

We'll start testing the solution we have put together.

4.1 Initial Observation

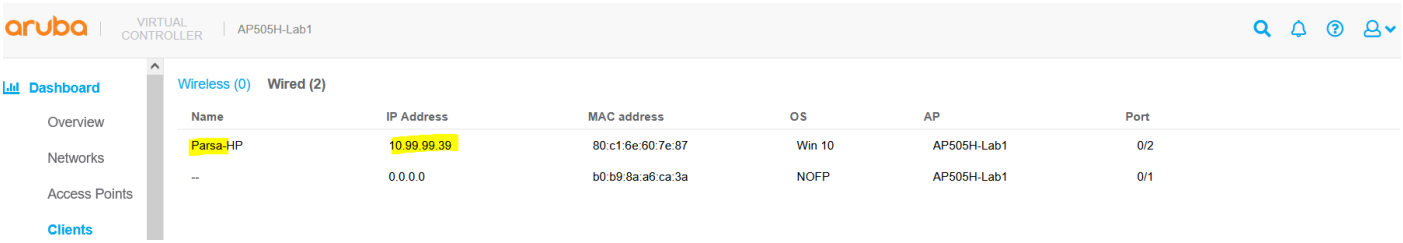
Lets check the IP address of various interfaces on the IAP. Note VLAN 99 for our local DHCP pool.

```
AP505H-Lab1# sh ip int brief
Interface                          IP Address / IP Netmask       Admin  Protocol
br0                               10.10.10.20 / 255.255.255.0    up     up
br0.99                             10.99.99.1 / 255.255.255.0    up     up
br0.192                         192.168.2.49 / 255.255.255.0     up     up
br0.3333                         172.31.98.1 / 255.255.254.0     up     up
AP505H-Lab1#


AP505H-Lab1# sh ip route
default via 10.10.10.1 dev br0
8.8.8.8 via 192.168.2.1 dev br0.192
8.8.8.8 via 10.10.10.1 dev br0
10.10.10.0/24 dev br0  src 10.10.10.20
10.99.99.0/24 dev br0.99  src 10.99.99.1
172.31.98.0/23 dev br0.3333  src 172.31.98.1
192.168.2.0/24 dev br0.192  src 192.168.2.49
AP505H-Lab1#
```

Next we'll connect a laptop to the E2 port of the AP-505H.

We now also have a wired clients connected to E2 port

```
Wired Client List
-----------------
Name       IP Address    MAC Address        OS      Network  Access Point  Role       IPv6 Address  Speed
(mbps)
----       ----------    -----------        --      -------  ------------  ----       ------------  -----------
Parsa-HP   10.99.99.39   80:c1:6e:60:7e:87  Win 10  eth2     AP505H-Lab1   E2-Net     --            -
           0.0.0.0       b0:b9:8a:a6:ca:3a  NOFP    eth1     AP505H-Lab1   E1-Uplink  --            -
Info timestamp      :5152
AP505H-Lab1#
AP505H-Lab1#
```



4.2 Disconnect Cable Test

In this test we'll

- do a non-stop ping test to 8.8.8.8 from the the Win10 Client
- disconnect the Ethernet cable from E0 port

- see how long till E1 backup uplink will get activated
- and then reconnect the E0 and see if the pre-emption works

After disconnecting the E0 cable, we'll observe the following that E0 link is down but the default route is still pointing to 10.10.10.1 which is on E0.

```
AP505H-Lab1# [ 5343.959577] eth0 (Int switch port: 1) (Logical Port: 1) (phyId: 1e) Link DOWN.

AP505H-Lab1#
AP505H-Lab1# sh ip route
default via 10.10.10.1 dev br0
8.8.8.8 via 192.168.2.1 dev br0.192
8.8.8.8 via 10.10.10.1 dev br0
10.10.10.0/24 dev br0  src 10.10.10.20
10.99.99.0/24 dev br0.99  src 10.99.99.1
172.31.98.0/23 dev br0.3333  src 172.31.98.1
192.168.2.0/24 dev br0.192  src 192.168.2.49
AP505H-Lab1#
```

Here is the output of the ping test and roughly we'll lose 4-5 pings.

```
C:\Users\Parsa>ping 8.8.8.8 -t

Pinging 8.8.8.8 with 32 bytes of data:
Reply from 8.8.8.8: bytes=32 time=38ms TTL=57
Reply from 8.8.8.8: bytes=32 time=13ms TTL=57
Reply from 8.8.8.8: bytes=32 time=17ms TTL=57
Reply from 8.8.8.8: bytes=32 time=11ms TTL=57
Reply from 8.8.8.8: bytes=32 time=19ms TTL=57
Reply from 8.8.8.8: bytes=32 time=12ms TTL=57
Reply from 8.8.8.8: bytes=32 time=15ms TTL=57
Reply from 8.8.8.8: bytes=32 time=14ms TTL=57
Reply from 8.8.8.8: bytes=32 time=11ms TTL=57
Reply from 8.8.8.8: bytes=32 time=78ms TTL=57
Reply from 8.8.8.8: bytes=32 time=20ms TTL=57
Reply from 8.8.8.8: bytes=32 time=13ms TTL=57
Reply from 8.8.8.8: bytes=32 time=13ms TTL=57
Reply from 8.8.8.8: bytes=32 time=14ms TTL=57
Reply from 8.8.8.8: bytes=32 time=15ms TTL=57
Reply from 8.8.8.8: bytes=32 time=22ms TTL=57
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Reply from 8.8.8.8: bytes=32 time=52ms TTL=54
Reply from 8.8.8.8: bytes=32 time=67ms TTL=54
Reply from 8.8.8.8: bytes=32 time=82ms TTL=54
Reply from 8.8.8.8: bytes=32 time=44ms TTL=54
Reply from 8.8.8.8: bytes=32 time=69ms TTL=54
Reply from 8.8.8.8: bytes=32 time=67ms TTL=54
Reply from 8.8.8.8: bytes=32 time=38ms TTL=54
Reply from 8.8.8.8: bytes=32 time=63ms TTL=54
Reply from 8.8.8.8: bytes=32 time=82ms TTL=54
Reply from 8.8.8.8: bytes=32 time=56ms TTL=54
Reply from 8.8.8.8: bytes=32 time=47ms TTL=54
Reply from 8.8.8.8: bytes=32 time=82ms TTL=54
Reply from 8.8.8.8: bytes=32 time=76ms TTL=54
Reply from 8.8.8.8: bytes=32 time=64ms TTL=54
Reply from 8.8.8.8: bytes=32 time=65ms TTL=54
Reply from 8.8.8.8: bytes=32 time=40ms TTL=54
Reply from 8.8.8.8: bytes=32 time=43ms TTL=54
Reply from 8.8.8.8: bytes=32 time=68ms TTL=54
```

```
Reply from 8.8.8.8: bytes=32 time=70ms TTL=54

Ping statistics for 8.8.8.8:
    Packets: Sent = 518, Received = 507, Lost = 11 (2% loss),
Approximate round trip times in milli-seconds:
    Minimum = 6ms, Maximum = 1068ms, Average = 47ms
Control-C
^C
C:\Users\Parsa>
```

So once the pings are again successful, we'll notice that the default route has changed and now it is pointing to 192.168.2.1 which is on E1 port.

```
AP505H-Lab1# sh ip route
default via 192.168.2.1 dev br0.192
8.8.8.8 via 192.168.2.1 dev br0.192
8.8.8.8 via 10.10.10.1 dev br0
10.10.10.0/24 dev br0  src 10.10.10.20
10.99.99.0/24 dev br0.99  src 10.99.99.1
172.31.98.0/23 dev br0.3333  src 172.31.98.1
192.168.2.0/24 dev br0.192  src 192.168.2.49
AP505H-Lab1#
```

Checking the uplink status

```
AP505H-Lab1# sh uplink status

Uplink preemption             :enable
Uplink preemption interval    :60
Uplink enforce                :none
Uplink wired-1          :DHCP
Uplink wired-192          :DHCP
Internet failover                         :enable
Max allowed test packet loss              :3
Secs between test packets                 :5
VPN failover timeout (secs)               :180
Internet check timeout (secs)             :5
AP1X type:PEAP
Certification type:NONE
Validate server:Disable

Uplink Table
--------------
Type       VLAN  State  Reach State  Prio  In Use  Interface  IP            Mask           GW           Sent
Lost  Cont lost
----       ----  -----  -----------  ----  ------  ---------  --            ----           --           ----
Ethernet   1     UP     DOWN         0     No      br0        10.10.10.20   255.255.255.0  10.10.10.1   2
1     1
Ethernet   192   UP     UP           5     Yes     br0.192    192.168.2.49  255.255.255.0  192.168.2.1  1004
0     0
Cellular   0     INIT   INIT         22    No      ppp0       0.0.0.0       0.0.0.0        0.0.0.0      0
0     0
Wifi-sta   0     INIT   INIT         20    No      wuplink0   0.0.0.0       0.0.0.0        0.0.0.0      0
0     0

Wired Port Table
-----------------
Port  State  Type  Bonding(Admin/Oper/Active)
----  -----  ----  --------------------------
eth0  DOWN   WAN   Yes/Yes/Yes
eth1  UP     WAN   No/No/No
eth2  UP     LAN   No/No/No
eth3  DOWN   LAN   No/No/No
eth4  DOWN   LAN   No/No/No
AP505H-Lab1#
```

Now we'll reconnect E0, and there will be no ping loses.

```
AP505H-Lab1# [ 5444.310591] eth0 (Int switch port: 1) (Logical Port: 1) (phyId: 1e) Link Up at 1000 mbps full
duplex
[ 5449.832734] eth0 (Int switch port: 1) (Logical Port: 1) (phyId: 1e) Link DOWN.
[ 5453.024233] eth0 (Int switch port: 1) (Logical Port: 1) (phyId: 1e) Link Up at 1000 mbps full duplex

AP505H-Lab1# sh ip route
default via 10.10.10.1 dev br0
8.8.8.8 via 192.168.2.1 dev br0.192
8.8.8.8 via 10.10.10.1 dev br0
10.10.10.0/24 dev br0  src 10.10.10.20
10.99.99.0/24 dev br0.99  src 10.99.99.1
172.31.98.0/23 dev br0.3333  src 172.31.98.1
192.168.2.0/24 dev br0.192  src 192.168.2.49
AP505H-Lab1#
```

Lets have a look at the system logs

```
AP505H-Lab1# sh log system 40

Sep  9 14:08:21   cli[6041]: <341227> <WARN> |AP AP505H-Lab1@10.10.10.20 cli|  uplink detection:
total_icmp_sent 980, total_icmp_lost 4, continuous_icmp_lost 3.
Sep  9 14:08:21   cli[6041]: <341264> <WARN> |AP AP505H-Lab1@10.10.10.20 cli|  disable uplink wired-1.
Sep  9 14:08:21   cli[6041]: <341006> <CRIT> |AP AP505H-Lab1@10.10.10.20 cli|  route delete default
Sep  9 14:08:21   cli[6041]: <341185> <WARN> |AP AP505H-Lab1@10.10.10.20 cli|  Retrieving ip address from
br0, ip 10.10.10.20, mask 255.255.255.0.
Sep  9 14:08:21   cli[6041]: <341274> <WARN> |AP AP505H-Lab1@10.10.10.20 cli|  Update election ip from br0,
election ip 10.10.10.20/255.255.255.0.
Sep  9 14:08:21   cli[6041]: <341004> <WARN> |AP AP505H-Lab1@10.10.10.20 cli|  build_my_ip_address: old ip
and new ip same; skipping
Sep  9 14:08:21   cli[6041]: <341005> <ERRS> |AP AP505H-Lab1@10.10.10.20 cli|  DDNS: ddns update for IAP is
not enabled
Sep  9 14:08:21   cli[6041]: <341177> <WARN> |AP AP505H-Lab1@10.10.10.20 cli|  Try next uplink because
current uplink is down: wired-1 --> wired-192.
Sep  9 14:08:21   cli[6041]: <341004> <WARN> |AP AP505H-Lab1@10.10.10.20 cli|  set uplink failed reason to
failover internet
Sep  9 14:08:21   cli[6041]: <341185> <WARN> |AP AP505H-Lab1@10.10.10.20 cli|  Retrieving ip address from
br0.192, ip 192.168.2.49, mask 255.255.255.0.
Sep  9 14:08:21   cli[6041]: <341274> <WARN> |AP AP505H-Lab1@10.10.10.20 cli|  Update election ip from
br0.192, election ip 192.168.2.49/255.255.255.0.
Sep  9 14:08:21   cli[6041]: <341004> <WARN> |AP AP505H-Lab1@10.10.10.20 cli|  build_my_ip_address:setting
this as new IP address for swarm
Sep  9 14:08:21   cli[6041]: <341004> <WARN> |AP AP505H-Lab1@10.10.10.20 cli|
build_my_ip_address_stage2:setting this as new IP address for swarm/clients
Sep  9 14:08:43   cli[6041]: <341227> <WARN> |AP AP505H-Lab1@192.168.2.49 cli|  uplink detection:
total_icmp_sent 4, total_icmp_lost 3, continuous_icmp_lost 3.
Sep  9 14:09:18   cli[6041]: <341005> <ERRS> |AP AP505H-Lab1@192.168.2.49 cli|   uplink ap1x: entering ap1x
receive handler.
Sep  9 14:09:24   cli[6041]: <341227> <WARN> |AP AP505H-Lab1@192.168.2.49 cli|  uplink detection:
total_icmp_sent 4, total_icmp_lost 3, continuous_icmp_lost 3.
Sep  9 14:09:49   cli[6041]: <341272> <ERRS> |AP AP505H-Lab1@192.168.2.49 cli|  ethernet eth0 link up.
Sep  9 14:09:51   cli[6041]: <341339> <WARN> |AP AP505H-Lab1@192.168.2.49 cli|  Uplink wired-1, reach-state
DOWN->UP.
Sep  9 14:09:51   cli[6041]: <341185> <WARN> |AP AP505H-Lab1@192.168.2.49 cli|  Retrieving ip address from
br0.192, ip 192.168.2.49, mask 255.255.255.0.
Sep  9 14:09:51   cli[6041]: <341274> <WARN> |AP AP505H-Lab1@192.168.2.49 cli|  Update election ip from
br0.192, election ip 192.168.2.49/255.255.255.0.
Sep  9 14:09:51   cli[6041]: <341004> <WARN> |AP AP505H-Lab1@192.168.2.49 cli|  build_my_ip_address: old ip
and new ip same; skipping
Sep  9 14:09:51   cli[6041]: <341005> <ERRS> |AP AP505H-Lab1@192.168.2.49 cli|  DDNS: ddns update for IAP is
not enabled
Sep  9 14:10:23   cli[6041]: <341266> <WARN> |AP AP505H-Lab1@192.168.2.49 cli|  uplink preempt to wired-1.
Sep  9 14:10:23   cli[6041]: <341004> <WARN> |AP AP505H-Lab1@192.168.2.49 cli|  Preemption: trying a higher
uplink
Sep  9 14:10:23   cli[6041]: <341264> <WARN> |AP AP505H-Lab1@192.168.2.49 cli|  disable uplink wired-192.
Sep  9 14:10:23   cli[6041]: <341006> <CRIT> |AP AP505H-Lab1@192.168.2.49 cli|  route del default gw
192.168.2.1
Sep  9 14:10:23   cli[6041]: <341185> <WARN> |AP AP505H-Lab1@192.168.2.49 cli|  Retrieving ip address from
br0.192, ip 192.168.2.49, mask 255.255.255.0.
```

4.3 Block the Traffic on the primary uplink

In this test we'll

- do a non-stop ping test to 8.8.8.8 from the Win10 Client
- block the traffic in the upstream router, which is connected to E0 port, simulating a logical failure
- see how long till E1 backup uplink will get activated
- and then permit traffic in the upstream router on E0 and see if the pre-emption works

After blocking th traffic on the upstream router of E0, we'll notice that the E0 port is up, but after about 4-5 ping misses the default route is pointing to E1

```
C:\Users\Parsa>ping 8.8.8.8 -t

Pinging 8.8.8.8 with 32 bytes of data:
Reply from 8.8.8.8: bytes=32 time=13ms TTL=57
Reply from 8.8.8.8: bytes=32 time=16ms TTL=57
Reply from 8.8.8.8: bytes=32 time=14ms TTL=57
Reply from 8.8.8.8: bytes=32 time=25ms TTL=57
Request timed out.
Request timed out.
Request timed out.
Reply from 192.168.1.130: Destination host unreachable.
Reply from 192.168.1.130: Destination host unreachable.
Reply from 8.8.8.8: bytes=32 time=41ms TTL=54
Reply from 8.8.8.8: bytes=32 time=65ms TTL=54
Reply from 8.8.8.8: bytes=32 time=28ms TTL=54
Reply from 8.8.8.8: bytes=32 time=54ms TTL=54
Reply from 8.8.8.8: bytes=32 time=40ms TTL=54
Reply from 8.8.8.8: bytes=32 time=39ms TTL=54
Reply from 8.8.8.8: bytes=32 time=68ms TTL=54

AP505H-Lab1# sh port status

Port Status
-----------
Port  Type   Admin-State  Oper-State  STP-State  Dot3az   Loop-Protect  Storm-Control  Loop-Detection-TX
Loop-Detection-RX
----  ----   -----------  ----------  ---------  ------   ------------  -------------  -----------------  ---
--------------
eth0  2.5GE  up           up          Off        Disable  OFF           OFF            0                  0
eth1  GE     up           up          Off        Disable  OFF           OFF            0                  0
eth2  GE     up           up          Off        Disable  OFF           OFF            0                  0
eth3  GE     up           down        Off        Disable  OFF           OFF            0                  0
eth4  GE     up           down        Off        Disable  OFF           OFF            0                  0
eth5  USB    up           down        Off        Disable  OFF           OFF            0                  0
AP505H-Lab1#
AP505H-Lab1# sh ip route
default via 192.168.2.1 dev br0.192
8.8.8.8 via 192.168.2.1 dev br0.192
8.8.8.8 via 10.10.10.1 dev br0
10.10.10.0/24 dev br0  src 10.10.10.20
10.99.99.0/24 dev br0.99  src 10.99.99.1
172.31.98.0/23 dev br0.3333  src 172.31.98.1
192.168.2.0/24 dev br0.192  src 192.168.2.49
AP505H-Lab1#
```

Checking the uplink status, we'll notice that the reachability of E0 is down that's why it has switches to the backup uplink on E1

```
AP505H-Lab1# sh uplink status

Uplink preemption             :enable
Uplink preemption interval    :60
Uplink enforce                :none
```

```
Uplink wired-1         :DHCP
Uplink wired-192         :DHCP
Internet failover                        :enable
Max allowed test packet loss             :3
Secs between test packets                :5
VPN failover timeout (secs)              :180
Internet check timeout (secs)            :5
AP1X type:PEAP
Certification type:NONE
Validate server:Disable

Uplink Table
--------------
Type      VLAN  State  Reach State  Prio  In Use  Interface  IP            Mask           GW
Sent  Lost  Cont lost
----      ----  -----  -----------  ----  ------  ---------  --            ----           --
----  ----  ---------
Ethernet  1     UP     DOWN         0     No      br0        10.10.10.20   255.255.255.0
10.10.10.1   3     2     2
Ethernet  192   UP     UP           5     Yes     br0.192    192.168.2.49  255.255.255.0
192.168.2.1  1972  0     0
Cellular  0     INIT   INIT         22    No      ppp0       0.0.0.0       0.0.0.0        0.0.0.0
0     0     0
Wifi-sta  0     INIT   INIT         20    No      wuplink0   0.0.0.0       0.0.0.0        0.0.0.0
0     0     0

Wired Port Table
------------------
Port  State  Type  Bonding(Admin/Oper/Active)
----  -----  ----  -------------------------
eth0  UP     WAN   Yes/Yes/Yes
eth1  UP     WAN   No/No/No
eth2  UP     LAN   No/No/No
eth3  DOWN   LAN   No/No/No
eth4  DOWN   LAN   No/No/No
AP505H-Lab1#
```

Now when we permit the traffic on the upstream router of E0, we should see the default route going back to 10.10.10.1 which is on E0. You'll also notice that the reachability of E0 is up.

```
AP505H-Lab1# sh ip route
default via 10.10.10.1 dev br0
8.8.8.8 via 192.168.2.1 dev br0.192
8.8.8.8 via 10.10.10.1 dev br0
10.10.10.0/24 dev br0  src 10.10.10.20
10.99.99.0/24 dev br0.99  src 10.99.99.1
172.31.98.0/23 dev br0.3333  src 172.31.98.1
192.168.2.0/24 dev br0.192  src 192.168.2.49
AP505H-Lab1#
AP505H-Lab1#
AP505H-Lab1# sh uplink status

Uplink preemption             :enable
Uplink preemption interval    :60
Uplink enforce                :none
Uplink wired-1         :DHCP
Uplink wired-192         :DHCP
Internet failover                        :enable
Max allowed test packet loss             :3
Secs between test packets                :5
VPN failover timeout (secs)              :180
Internet check timeout (secs)            :5
AP1X type:PEAP
Certification type:NONE
Validate server:Disable
```

```
Uplink Table
--------------
Type      VLAN  State  Reach State  Prio  In Use  Interface  IP            Mask           GW
Sent  Lost  Cont lost
----      ----  -----  -----------  ----  ------  ---------  --            ----           --
----  ----  ---------
Ethernet  1     UP     UP           0     Yes     br0        10.10.10.20   255.255.255.0
10.10.10.1   27    0     0
Ethernet  192   UP     UP           5     No      br0.192    192.168.2.49  255.255.255.0
192.168.2.1  2032  0     0
Cellular  0     INIT   INIT         22    No      ppp0       0.0.0.0       0.0.0.0        0.0.0.0
0     0     0
Wifi-sta  0     INIT   INIT         20    No      wuplink0   0.0.0.0       0.0.0.0        0.0.0.0
0     0     0

Wired Port Table
------------------
Port  State  Type  Bonding(Admin/Oper/Active)
----  -----  ----  --------------------------
eth0  UP     WAN   Yes/Yes/Yes
eth1  UP     WAN   No/No/No
eth2  UP     LAN   No/No/No
eth3  DOWN   LAN   No/No/No
eth4  DOWN   LAN   No/No/No
AP505H-Lab1#
```

5 Instant Mesh Network

Instant Mesh network must have at least one valid uplink to provide mesh functionality. In this specific scenario, the IAP that has wired uplink is called Mesh Portal and IAP without an Ethernet link functions as a Mesh Point.

Instant mesh functionality is supported only on dual-radio Instant APs. The Mesh Point APs always use the 2.4 GHz radio is for client traffic, while the 5 GHz radio is always used for both mesh-backhaul and client traffic.

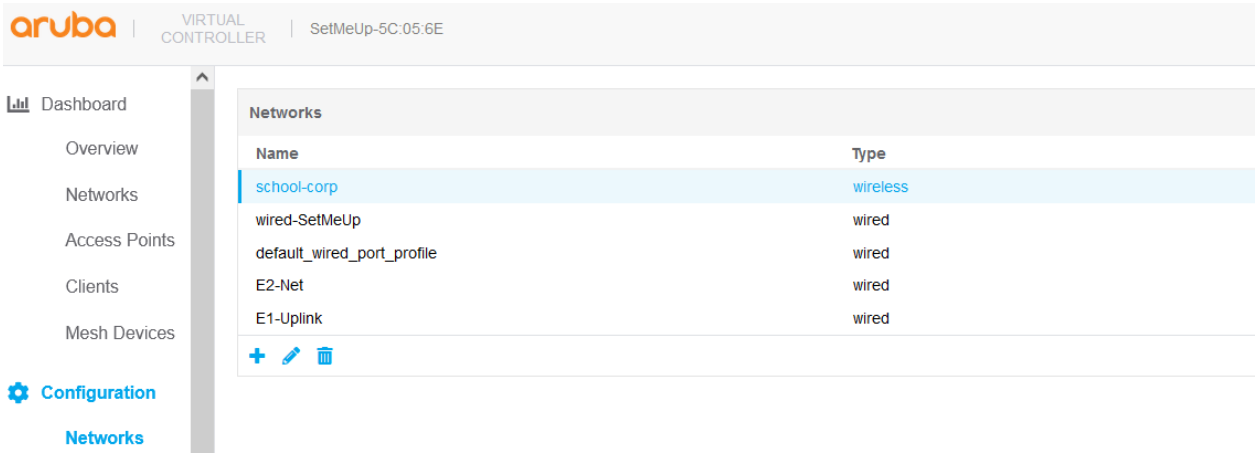
The mesh network must be provisioned for the first time by plugging into the wired network.

5.1 Mesh Configuration

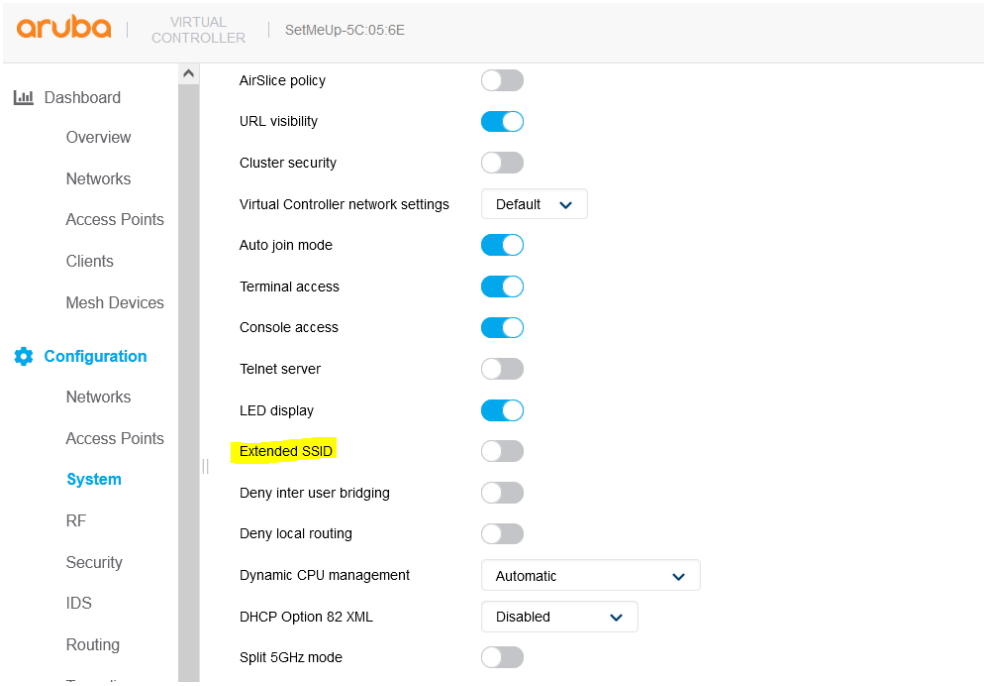
To configure mesh, we need to ensure we have

1. configured at least one WLAN for the Instant Cluster
2. disable extended SSID
3. Configure the mesh point's Eth0 interface to enable bridging

Here we already have a WLAN configured,



Next, we'll disable extended SSID which by default it is enabled.

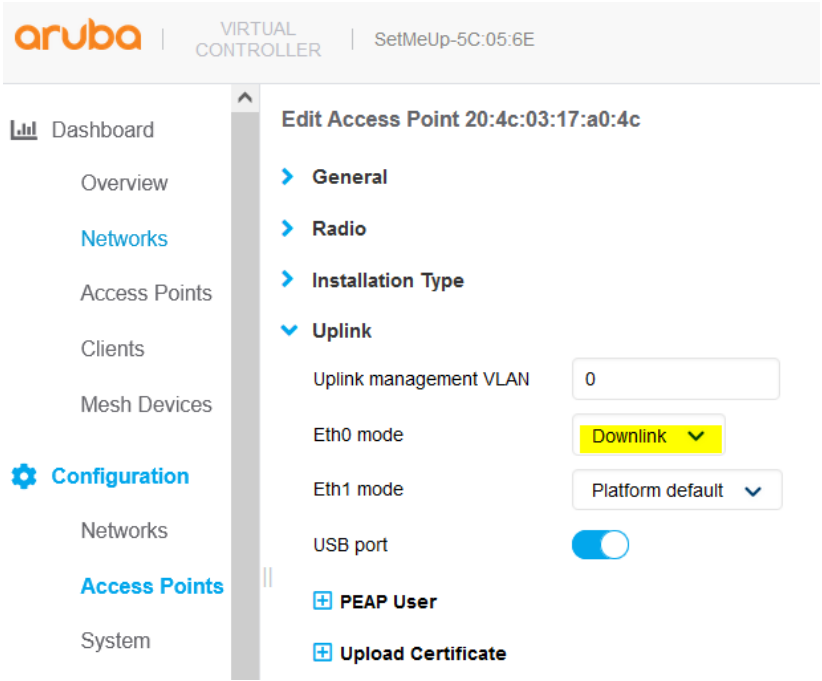


And finally enable ethernet bridging on E0 for the AP that is going to be the mesh point.

You can do that using CLI or WebUI. The command to use is "`enet0-bridging`"

```
20:4c:03:17:a0:4c# show ap-env

Antenna Type:Internal
IoT Antenna Type:Internal
Need USB field:Yes
uap_controller_less:1
enet1_mode:downlink
20:4c:03:17:a0:4c# ap-env ?
<env_name>     string

20:4c:03:17:a0:4c# enet0-bridging
20:4c:03:17:a0:4c# show ap-env

Antenna Type:Internal
IoT Antenna Type:Internal
Need USB field:Yes
enet0_bridging:1
uap_controller_less:1
enet1_mode:downlink
20:4c:03:17:a0:4c#
20:4c:03:17:a0:4c#
```

Or you can configure it using the WebUI, by changing the uplink mode for E0 to "Downlink"



Once you have done all the configuration, you need to reboot the mesh point.

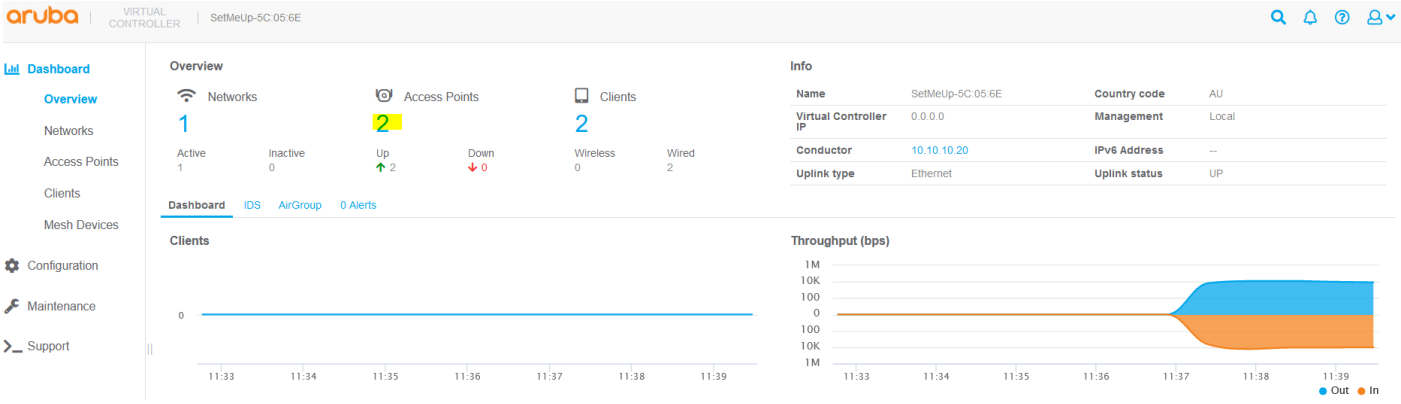
5.2 Mesh Link Monitoring

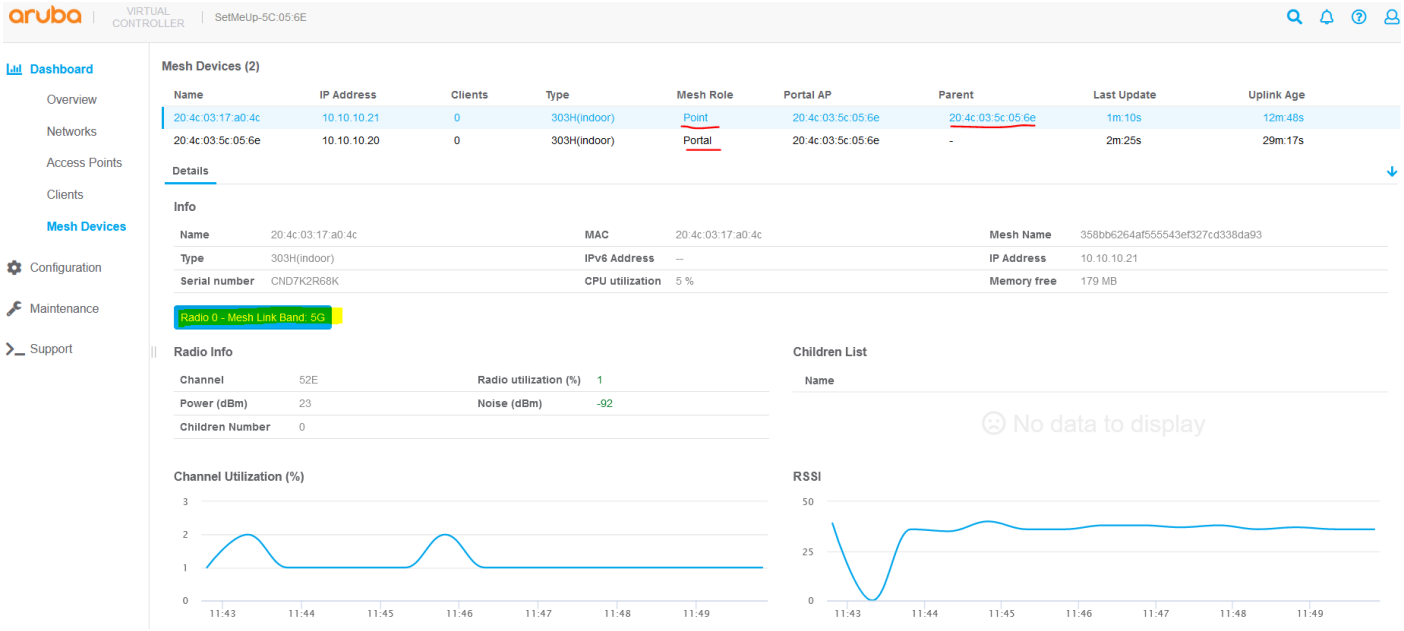
Here is the console logs of the Mesh Point AP that is rebooting.

```
Populate AP type info
Domain Name: SetMeUp.arubanetworks.com
Current OEM Name : Aruba Networks
Disabling ipv6 for devices by default
```

```
AP-type has_ble_support: ONBOARD.
IPv6 capability is supported for devices
No panic info available
Writing /dev/ttyMSM1 into /tmp/ble_port
Enabling ble_daemon and ble_relay via nanny
glenmorangie: Start hotplug
Backup ENV.
Installing glenmorangie ethernet driver
[   46.917938] edma module_init
[   47.791508] asap_switch: module license 'Proprietary' taints kernel.
[   47.855126] Disabling lock debugging due to kernel taint
Enter non-FIPS mode
Cfg len is 4114
enet0 bridging detected
Mesh enabled
dual uplink platform just by config
Ethernet port 1 mode: active-standby
Eth1 works as downlink when enet1_mode is downlink
Eth0 has been enslaved into bond0 working as downlink with Eth1
Starting watchdog process...
Aruba watchdog daemon started [4 thread(s)]
training packets starting...
training packets on interface:
eth0 eth1

wifi uplink not present...
Terminal access enabled...
Valid SSID detected...
touching file /tmp/ip_mode_0
do ethtool autoneg on for eth0
do ethtool autoneg on for eth1
do ethtool autoneg on for eth2
cp: /lib/nls_base.ko: No such file or directory
cp: /lib/usbcore.ko: No such file or directory
init usb modem ...
[   59.579224] SCSI subsystem initialized
No USB Plugged in
Skip wired uplink detection
error in reading source file
No uplink active. Becoming Mesh Point
Str Mesh Split5G Band Range:
Mesh Split5G Band Range: 0
disable auto topology rules
apdot1x authentication is not enabled
```

It boots up as Mesh Point.





Here is the CLI version for the above screenshot. This is the mesh topology from the Mesh Portal AP.

```
20:4c:03:5c:05:6e# show ap mesh cluster topology

Mesh Cluster name: 358bb6264af555543ef327cd338da93
-------------------------------------------------
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
----                -------  ---------  ----------   ---------          --------  ----------  ----
-              ---------          ---------  ---------  ---------  ---------  ----------  ----  -
----------  ----------  ------------  -------------
20:4c:03:17:a0:4c  AP-303H  Point      10.10.10.21  20:4c:03:5c:05:6e  0         MPC (AC)
c8:b5:ad:16:26:10  20:4c:03:5c:05:6e  4          0          3          1          650/866     39
1m:14s       4h:16m:59s  0             -
20:4c:03:5c:05:6e  AP-303H  Portal     10.10.10.20  20:4c:03:5c:05:6e  0         MPP (AC)
00:4e:35:7b:2c:d0  -                   -          -          -          -          -           -
4s           4h:34m:6s   1             20:4c:03:17:a0:4c

Total APs: 2
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:03:5c:05:6e#
```

Note that Split 5G lined below is referring to APs that have dual 5GHz radio like AP-555 and AP-345, in which you can split the 5G band into lower and upper to have one set aside for mesh backhaul and the other for client associations.

Here it is automatically set to “full” because these APs don’t have dual 5GHz radios. This output is from he Mesh Point.

```
20:4c:03:5c:05:6e# sh ap mesh cluster  status

Mesh cluster       :Disabled
Mesh role          :Mesh Portal
Mesh Split5G Band Range :full
Mesh mobility      :Disabled
20:4c:03:5c:05:6e#
```

This is the CLI command to show the mesh config.

```
20:4c:03:5c:05:6e# 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:03:5c:05:6e#
```

Here check the mesh link and the flags should be VLK

```
20:4c:03:5c:05:6e# 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      c8:b5:ad:16:26:11  20:4c:03:17:a0:4c  00:4e:35:7b:2c:d0  52E      5GHz  0    1     7.00  C
8m:44s                  VLK    50    866/780     1      1       0       VHT-80MHzsgi-2ss
358bb6264af555543ef327cd338da93

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:03:5c:05:6e#
```

Lastly, we'll check the BSS-Table showing that the Mesh Point AP is also broadcasting WLANs on both radios.

```
20:4c:03:17:a0:4c# sh ap bss-table

Aruba AP BSS Table
------------------
bss                ess          port  ip           band/ht-mode/bandwidth  ch/EIRP/max-EIRP  type
cur-cl  ap name            in-t(s)  tot-t      flags
---                ---          ----  --           ----------------------  ----------------  ----
------  -------            -------  -----      -----
c8:b5:ad:16:26:12  school-corp  ?/?   10.10.10.21  5GHz/VHT/80MHz          52E/23.0/23.0     ap
0       20:4c:03:17:a0:4c  0        3h:9m:21s  -
c8:b5:ad:16:26:02  school-corp  ?/?   10.10.10.21  2.4GHz/HT/20MHz         11/6.2/23.0       ap
0       20:4c:03:17:a0:4c  0        3h:9m:21s  -

Channel followed by "*" indicates channel selected due to unsupported configured channel.
"Spectrum" followed by "^" indicates Local Spectrum Override in effect.

Num APs:2
Num Associations:0
```

```
Flags:       a = Airslice policy; A = Airslice app monitoring; c = MBO Cellular Data Capable BSS;
d = Deferred Delete Pending; D = VLAN Discovered; E = Enhanced-open BSS without transition mode;
I = Imminent VAP Down; K = 802.11K Enabled; m = Agile Multiband (MBO) BSS; M = WPA3-SAE mixed
mode BSS; o = Enhanced-open transition mode open BSS; O = Enhanced-open BSS with transition mode;
r = 802.11r Enabled; t = Broadcast TWT Enabled; T = Individual TWT Enabled; W = 802.11W Enabled;
x = MBSSID Tx BSS; 3 = WPA3 BSS;
20:4c:03:17:a0:4c#
```

Here we see that the WiFi mesh autmatically becomes highest priority uplink on the Mesh Point AP.

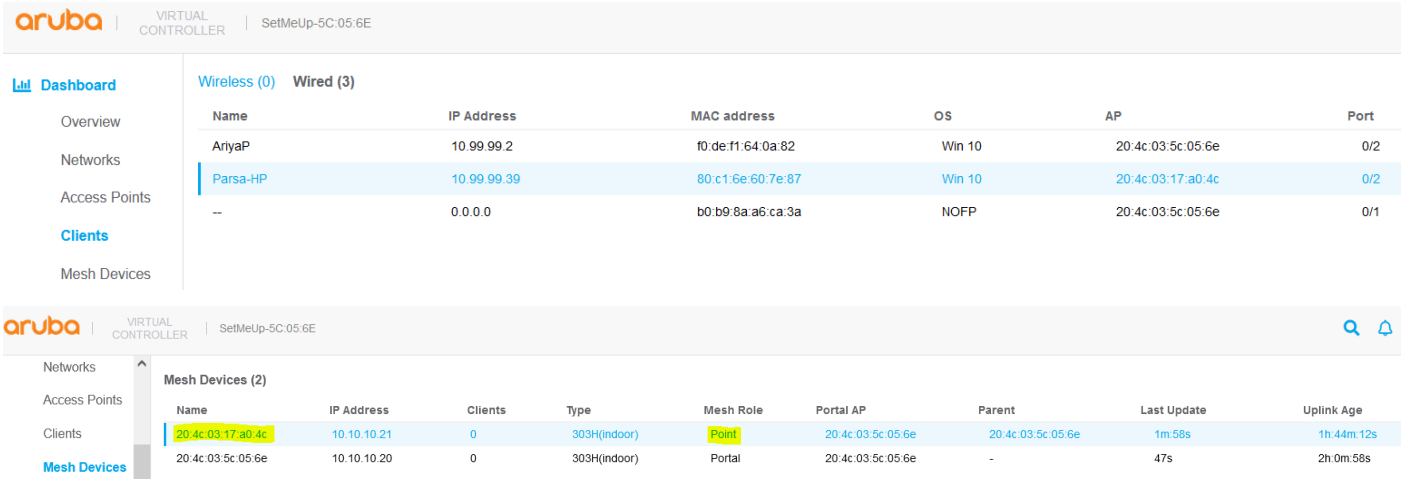
```
20:4c:03:17:a0:4c# sh uplink status

Uplink preemption             :enable
Uplink preemption interval    :45
Uplink enforce                :none
Uplink wired-1         :DHCP
Uplink wired-192         :DHCP
Internet failover                        :enable
Max allowed test packet loss             :3
Secs between test packets                :5
VPN failover timeout (secs)              :180
Internet check timeout (secs)            :5
AP1X type:NONE
Certification type:NONE
Validate server:NONE

Uplink Table
--------------
Type        VLAN  State  Reach State  Prio  In Use  Interface  IP           Mask           GW
Sent  Lost  Cont lost
----        ----  -----  -----------  ----  ------  ---------  --           ----           --
----  ----  ---------
Ethernet    1     DOWN   DOWN         0     No      br0        0.0.0.0      0.0.0.0        0.0.0.0
0     0     0
Ethernet    192   DOWN   DOWN         5     No      br0.192    0.0.0.0      0.0.0.0        0.0.0.0
0     0     0
Cellular    0     INIT   INIT         7     No      ppp0       0.0.0.0      0.0.0.0        0.0.0.0
0     0     0
Wifi-sta    0     INIT   INIT         6     No      wuplink0   0.0.0.0      0.0.0.0        0.0.0.0
0     0     0
Wifi-mesh   0     UP     UP           0     Yes     br0        10.10.10.21  255.255.255.0
10.10.10.1  0     0      0

Wired Port Table
------------------
Port  State  Type  Bonding(Admin/Oper/Active)
----  -----  ----  --------------------------
eth0  DOWN   LAN   No/Yes/Yes
eth1  DOWN   WAN   No/No/No
eth2  UP     LAN   No/No/No
eth3  DOWN   LAN   No/No/No
20:4c:03:17:a0:4c#
```

And lastly, the IP address for the Mesh Point AP that is from the native VLAN on E0 port of the Mesh Portal AP.

```
20:4c:03:17:a0:4c# sh ip int b
Interface                  IP Address / IP Netmask       Admin  Protocol
br0                        10.10.10.21 / 255.255.255.0   up     up
br0.3333                   172.31.98.1 / 255.255.254.0   up     up
20:4c:03:17:a0:4c#
```

5.3 Mesh Link Test with Wired Client

Now we are going to connect the second wired client to the E2 port of Mesh Point AP. As you recall, we had configured the E2 port of the cluster to use the local DHCP pool that is on 10.99.99.0/24



We have full connectivity between the two wired clients. And you get the same result when you have wired client connected to the Mesh AP and do continuous ping to say 1.1.1.1 and you then disconnect the primary uplink on E0 of the Mesh Portal.

Here is the output of the ping test from Client that is connected to Mesh Point roughly we'll lose 4-5 pings.

```
C:\Users\Parsa>ping 10.99.99.2

Pinging 10.99.99.2 with 32 bytes of data:
Reply from 10.99.99.2: bytes=32 time=4ms TTL=128
Reply from 10.99.99.2: bytes=32 time=4ms TTL=128
Reply from 10.99.99.2: bytes=32 time=3ms TTL=128
Reply from 10.99.99.2: bytes=32 time=4ms TTL=128

C:\Users\Parsa>ping 1.1.1.1 -t

Pinging 1.1.1.1 with 32 bytes of data:
Reply from 1.1.1.1: bytes=32 time=18ms TTL=57
Reply from 1.1.1.1: bytes=32 time=13ms TTL=57
Reply from 1.1.1.1: bytes=32 time=17ms TTL=57
Reply from 1.1.1.1: bytes=32 time=11ms TTL=57
Reply from 1.1.1.1: bytes=32 time=19ms TTL=57
Reply from 1.1.1.1: bytes=32 time=12ms TTL=57
Reply from 1.1.1.1: bytes=32 time=15ms TTL=57
Reply from 1.1.1.1: bytes=32 time=14ms TTL=57
Reply from 1.1.1.1: bytes=32 time=11ms TTL=57
Reply from 1.1.1.1: bytes=32 time=23ms TTL=57
Reply from 1.1.1.1: bytes=32 time=20ms TTL=57
Reply from 1.1.1.1: bytes=32 time=13ms TTL=57
Reply from 1.1.1.1: bytes=32 time=13ms TTL=57
Reply from 1.1.1.1: bytes=32 time=14ms TTL=57
Reply from 1.1.1.1: bytes=32 time=17ms TTL=57
Reply from 1.1.1.1: bytes=32 time=23ms TTL=57
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Reply from 1.1.1.1: bytes=32 time=45ms TTL=54
Reply from 1.1.1.1: bytes=32 time=49ms TTL=54
Reply from 1.1.1.1: bytes=32 time=63ms TTL=54
```