Point-to-point mesh link configuration using 1562 AP on AireOS WLC

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Introduction

This article will describe the way to set up a mesh point to point link between two sites using 1562 AP and AireOS Wireless LAN Controller and configure ethernet bridging, in other words be able to trunk the VLANs between the sites.

Acronyms

WLC - Wireless LAN controller
RAP - Root Access Point
MAP - Mesh Access Point
SVI - Switch Virtual Interface
STP - Spanning Tree Protocol

Prerequisites

This document assumes that you have already joined the 1562 APs in local mode to the WLC.

It as well requires basic knowledge of STP and VLANs and how to tweak and configure those on Cisco IOS switch.

Recommended reading

Before proceeding with configuration it is recommended for the reader to browse through the following guides:

Components used

3504 WLC running AireOS 8.5.140.0

2x 1562 APs

2x Cisco IOS switches

**Note:** 1562 in mesh mode are supported starting from 8.4 AireOS WLC software. As the 8.4 release train has been deferred and is no longer supported, the minimal release to support mesh functionality on 1562 is 8.5. You can refer to the release notes of 8.3, section "Key features not supported on Cisco Aironet 1560"

The release 8.5.140.0 was chosen for this guide as it is still supported by end-of-life controllers (5508 and 2504) as well as the other currently not end of life AireOS controllers (such as 3504, 5520, 8510, 8540) and is not affected by the bugs mentioned in the end of this document.

**End-of-Sale and End-of-Life Announcement for the Cisco 5508 Wireless Controller:**

**End-of-Sale and End-of-Life Announcement for the Cisco 2504 Wireless Controller:**

Deployment scenarios

Let's assume that you have two separate sites (buildings) that you want to connect using a mesh link.

You have certain VLANs on Site A and Site B (in case of this guide, there were used VLANs 7,8,9,10) and you want those to be tagged while packets travel over the mesh link, in other words you want the mesh link to be acting as a trunk port between two sites.

There are basically two use cases for this deployment:

**Scenario #1**
On one side of the site (Site A) you will have a WLC and Root AP (RAP), on the other (Site B) you will have only Mesh AP (MAP).

Please note, in this case there is no other physical link interconnecting the sites.

This means that the mesh link between the sites will be the only one.

Scenario #2
Another scenario assumes that you already have a wired link connecting the sites (Site A and Site B) and you want to use the mesh link as a backup in case the wired link goes down.

**Note:** By default, the mesh APs are not forwarding BPDUs over the mesh link. This should be enabled on the WLC using command `config mesh ethernet-bridging allow-bpdu enable`. If this is not done, you risk creating a STP loop in the network if you are deploying scenario #2. In case of scenario #1, it is not mandatory to enable the BPDU forwarding.

**Configure the wired side**

**Port configuration on Site_B_switch to MAP AP:**

```
Site_B_switch#show run int f1/0/2
Building configuration...
Current configuration: 223 bytes
!
interface FastEthernet1/0/2
 switchport trunk native vlan 1460
 switchport trunk allowed vlan 7-10,1460
 switchport mode trunk
 ip access-group BLOCK_CAPWAP in
 spanning-tree cost 4000
end
```

The ACL is needed to block the CAPWAP traffic on the wired for the MAP AP, as we need the AP to join the RAP.

**Note:** If the CAPWAP traffic is not blocked, AP will join the WLC on the wired connection and there will be no mesh link.

```
Extended IP access list BLOCK_CAPWAP

10 deny udp any any eq 5246
20 deny udp any any eq 5247
30 permit ip any any
```

**Port configuration on Site_A_switch to RAP AP:**

```
Site_A_switch#show run int g0/2
Building configuration...
Current configuration: 225 bytes
!
interface GigabitEthernet0/2
 switchport trunk allowed vlan 7-10,1460
 switchport trunk native vlan 1460
 switchport mode trunk
 spanning-tree cost 4000
end
```
It is required to increase the STP cost for the interfaces (on both switches) connecting to the APs, to make sure that this link will be used exclusively as backup:

```
Site_B_switch(config)#int f1/0/2
Site_B_switch(config-if)#spanning-tree cost 4000
```

```
Site_A_switch(config)#int g0/2
Site_A_switch(config-if)#spanning-tree cost 4000
```

**Note:** It is important here to make the BPDUs run over the wireless as this is not enabled by default.

This is done using the following command:

```
(WLC_3504) >config mesh ethernet-bridging allow-bdpu enable
```

If the BPDUs are not enabled, then we can have the situation that none of the ports will be in ALT/BLK state, and thus it will create a loop in case of broadcast.

The ideal situation should be looking like this:

```
Site_B_switch#show spanning-tree vlan 7
```

```
VLAN0007
   Spanning tree enabled protocol ieee
   Root ID  Priority 32775
   Address 0045.1dbe.4280
   Cost 19
   Port 1 (FastEthernet1/0/1)
   Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

   Bridge ID Priority 32775 (priority 32768 sys-id-ext 7)
   Address 6c99.89f7.8a80
   Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
   Aging Time 300 sec

   Interface Role Sts Cost Prio.Nbr Type ------------------- ---- --- -------- ---- ---- -----
   ---- ----------- ---- --- -------- ---- ---- -----
   Fa1/0/1 Root FWD 19 128.1 P2p
   Fa1/0/2 Altn BLK 4000 128.2 P2p
```

Where Fa1/0/2 is the interface connected to 1562 MAP.

On the Site_A_switch (which is STP root for the VLAN 7) we have both ports in designated (as it is root for this VLAN):

```
Site_A_switch#show spanning-tree vlan 7
```

```
VLAN0007
   Spanning tree enabled protocol ieee
   Root ID  Priority 32775
   Address 00c0.20da.4280
   Cost 19
   Port 1 (FastEthernet1/0/1)
   Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

   Bridge ID Priority 32775 (priority 32768 sys-id-ext 7)
   Address 00c0.20da.4280
   Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
   Aging Time 300 sec

   Interface Role Sts Cost Prio.Nbr Type ------------------- ---- --- -------- ---- ---- -----
   ---- ----------- ---- --- -------- ---- ---- -----
   Fa1/0/2 Root FWD 19 128.1 P2p
```

```
Site_A_switch(config)#int g0/2
Site_A_switch(config-if)#spanning-tree cost 4000
```
Spanning tree enabled protocol rstp

This bridge is the root

Hello Time 2 sec Max Age 20 sec Forward

Delay 15 sec Bridge ID Priority 32775 (priority 32768 sys-id-ext 7)

Address 0045.1dbe.4280 Hello Time 2 sec Max Age 20 sec Forward

Delay 15 sec Aging Time 300 sec Interface Role Sts Cost Prio.Nbr

<table>
<thead>
<tr>
<th>Type</th>
<th>Interface</th>
<th>Role</th>
<th>Sts</th>
<th>Cost</th>
<th>Prio.Nbr</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gi0/1</td>
<td>Desg</td>
<td>FWD</td>
<td>19</td>
<td>128.1</td>
</tr>
<tr>
<td></td>
<td>Gi0/2</td>
<td>Desg</td>
<td>FWD</td>
<td>4000</td>
<td>128.2</td>
</tr>
</tbody>
</table>

There were SVIs created on both switches in order to test the connectivity after performing all configuration.

In my case, the native VLAN for both APs is 1460, and I am trunking VLANs 7 – 10:

Site_B_switch#show ip int br

<table>
<thead>
<tr>
<th>Interface</th>
<th>IP-Address</th>
<th>OK? Method</th>
<th>Status</th>
<th>Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vlan1</td>
<td>unassigned</td>
<td>YES manual</td>
<td>up</td>
<td></td>
</tr>
<tr>
<td>Vlan7</td>
<td>10.0.7.1</td>
<td>YES manual</td>
<td>up</td>
<td></td>
</tr>
<tr>
<td>Vlan8</td>
<td>10.0.8.1</td>
<td>YES manual</td>
<td>up</td>
<td></td>
</tr>
<tr>
<td>Vlan9</td>
<td>10.0.9.1</td>
<td>YES manual</td>
<td>up</td>
<td></td>
</tr>
<tr>
<td>Vlan10</td>
<td>10.0.10.1</td>
<td>YES manual</td>
<td>up</td>
<td></td>
</tr>
</tbody>
</table>

Site_A_switch#show ip int br

<table>
<thead>
<tr>
<th>Interface</th>
<th>IP-Address</th>
<th>OK? Method</th>
<th>Status</th>
<th>Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vlan1</td>
<td>unassigned</td>
<td>YES NVRAM</td>
<td>up</td>
<td></td>
</tr>
<tr>
<td>Vlan7</td>
<td>10.0.7.2</td>
<td>YES NVRAM</td>
<td>up</td>
<td></td>
</tr>
<tr>
<td>Vlan8</td>
<td>10.0.8.2</td>
<td>YES NVRAM</td>
<td>up</td>
<td></td>
</tr>
<tr>
<td>Vlan9</td>
<td>10.0.9.2</td>
<td>YES NVRAM</td>
<td>up</td>
<td></td>
</tr>
<tr>
<td>Vlan10</td>
<td>10.0.10.2</td>
<td>YES NVRAM</td>
<td>up</td>
<td></td>
</tr>
</tbody>
</table>

Note: Make sure VLANs are up on the switch

Configure the wireless side

In the GUI: Wireless > Mesh:

- Disable VLAN transparent
Set static channel on both AP on backhaul radio and static Tx power level:

In the GUI: **Wireless > Access Points > 802.11a/n/ac (or 802.11b/g/n if using 2.4 GHz as backhaul) > Configure:**

Add AP MAC addresses to the Security > AAA > AP policies.

Convert the AP mode to Bridge:

**Wireless > Access Points > All APs > 1562 RAP (and 1562 MAP):**
AP will reboot and come back with the Mesh tab available.

1562 RAP configuration:

1562 RAP Gig0 configuration:
1562 MAP configuration:

<table>
<thead>
<tr>
<th>Interface Name</th>
<th>GigabitEthernet0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mode</strong></td>
<td>Trunk</td>
</tr>
<tr>
<td><strong>Native VLAN Id</strong></td>
<td>1460</td>
</tr>
</tbody>
</table>

**Allowed VLAN Id**

<table>
<thead>
<tr>
<th>Allowed VLANs</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

**Configured VLANs**

**Allowed VLANs**

---

1562 MAP Gig 0 interface configuration:

Here it is necessary to indicate which VLANs are going to be allowed, by default none.
Verify

Make sure that the mesh link is up between the RAP and MAP.

From AP:

```
MAP1562#show mesh adjacency all
Mesh Wired Adjacency Info
Flags: Parent(P), Child(C), Reachable(R), CapwapUp(W), BlackListed(B) Authenticated(A)
Address Cost RawCost BlistCount Flags: P C R W B A
00:62:EC:4A:5A:A6 16 16 32 T/F: F F F F T T

------------------------------------------------------------------------------
AdjInfo: Radio Backhaul: 1 [00:62:EC:06:85:C1]
Mesh AWPP Radio adjacency info
Flags: Parent(P), Child(C), Neighbor(N), Reachable(R), CapwapUp(W),
       BlackListed(B), Authenticated(A), HTCapable(H), VHTCapable(V)
       OldParent(O)
Address Cost RawCost LinkCost Snr BCount Ch Width Bgn Flags: P O C N R W B A H V
4C:77:6D:60:85:B1 244 306 290 52 0 100 20 MHz (T/F): T F F T T T F T T T - -
```

From WLC:

```
(WLC_3504) > show mesh ap tree
```

```
AP Name [Hop Ctr,Link SNR,BG Name,Channel,Pref Parent,Chan Util,Clients]
```

```
[Sector 1]
-----
```
Make sure that BPDUs are allowed over the mesh link (for Scenario #2 this is a mandatory point):

(WLC_3504) >show mesh config

Mesh Range................................. 12000
Mesh Statistics update period............. 3 minutes
Backhaul with client access status........ disabled
Backhaul with extended client access status.. disabled
Background Scanning State.................. disabled
Subset Channel Sync State.................. disabled
Backhaul Amsdu State....................... enabled
Backhaul RRM............................... disabled
Mesh Auto RF.............................. disabled

Mesh Security
  Security Mode............................ PSK
  PSK Provisioning........................ enabled
  Default PSK............................. enabled
  Provisioned PSKs(Maximum 5)

<table>
<thead>
<tr>
<th>Index</th>
<th>Timestamp</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-----</td>
<td>------------------</td>
<td>-------------------------</td>
</tr>
</tbody>
</table>

  External-Auth........................... disabled
  Use MAC Filter in External AAA server.. disabled
  Force External Authentication........... disabled
  LSC Only MAP Authentication............... disabled

Mesh Alarm Criteria

  Max Hop Count........................... 4
  Recommended Max Children for MAP......... 10
  Recommended Max Children for RAP.......... 20
  Low Link SNR............................. 12
  High Link SNR................................ 60
  Max Association Number.................... 10
  Association Interval..................... 60 minutes
  Parent Change Numbers.................... 3
  Parent Change Interval................... 60 minutes

Mesh Multicast Mode........................ In-Out
Mesh CAC Mode............................... enabled
Mesh Full Sector DFS........................ enabled

Mesh Ethernet Bridging VLAN Transparent Mode..... disabled

Mesh DCA channels for serial backhaul APs........ disabled

Outdoor Ext. UNII B Domain channels(for BH)..... disabled
Mesh Advanced LSC.......................... disabled
Advanced LSC AP Provisioning.................. disabled
Open Window.................................. disabled
Provision Controller......................... disabled
Mesh Slot Bias..................................... enabled
Mesh Convergence Method............................. standard
Mesh Channel Change Notification............... disabled
Mesh Ethernet Bridging STP BPDU Allowed........ enabled
Mesh RAP downlink backhaul.................. 802.11Radio-A (Slot 1)

From switch side (in case on Scenario #2 you need to shutdown the wired link between the Site A and Site B)

Site_A_switch#show ip int br | in 10.
Vlan7  10.0.7.2  YES manual up  up
Vlan8  10.0.8.2  YES manual up  up
Vlan9  10.0.9.2  YES manual up  up

Site_B_switch#show ip int br | in 10.
Vlan7  10.0.7.1  YES manual up  up
Vlan8  10.0.8.1  YES manual up  up
Vlan9  10.0.9.1  YES manual up  up

Site_B_switch#ping 10.0.7.2 source vlan 7
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.7.2, timeout is 2 seconds:
Packet sent with a source address of 10.0.7.1
!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 3/6/7 ms

Site_B_switch#ping 10.0.8.2 source vlan 8
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.8.2, timeout is 2 seconds:
Packet sent with a source address of 10.0.8.1
!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 3/6/7 ms

Site_B_switch#ping 10.0.9.2 source vlan 9
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.9.2, timeout is 2 seconds:
Packet sent with a source address of 10.0.9.1
!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 3/4/7 ms

Troubleshoot

Please be aware of the following bugs:

Affecting pre 8.5.140.0 releases:

CSCvi86834 - Mesh Ethernet bridging - wired client associated to MAP fails to pass traffic over tagged VLAN

CSCvij25768 - Bridge mode Cisco Wave 2 Mesh APs bridging issues

Affecting 8.5.151.0:

CSCvq83638 - COS AP (1562) does not pass traffic in Ethernet Bridging Mode on 8.5.151

In case after following all the steps of the configuration guide you still face issue configuring the mesh link between the sites, please open a TAC case.