



# Troubleshooting a Mesh Network

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September 2007

This document addresses problems that can arise in a mesh network operating with Cisco 1500 series access points (AP1505, AP1510, AP1520) and a Cisco Wireless LAN Controller operating with Cisco Unified Wireless Software (CUWN) Release 4.1. Suggested solutions to those problems are also provided.

The following troubleshooting issues are addressed and listed in the order in which they should be diagnosed:

- [Power Fluctuations, page 2](#)
- [Radio Frequency \(RF\) Problems and Fluctuations, page 4](#)
- [LWAPP Discovery Request Never Sent by Access Point, page 9](#)
- [LWAPP Join Failures, page 13](#)
- [Access Point Disappears, page 16](#)
- [LWAPP Failure Debugging, page 20](#)
- [Performance Notes, page 22](#)



## Note

- Refer to the *Cisco Wireless Control System Configuration Guide* for details on accessing and reviewing SNMP trap logs and message logs (msglogs) mentioned in this section. The latest versions are found at the following link:  
[http://www.cisco.com/en/US/products/ps6305/tsd\\_products\\_support\\_series\\_home.html](http://www.cisco.com/en/US/products/ps6305/tsd_products_support_series_home.html).
- Refer to the *Cisco Wireless LAN Controller Configuration Guide* for details on accessing and reviewing logs using the controller GUI or CLI. The latest versions are found at the following link:  
[http://www.cisco.com/en/US/products/ps6366/tsd\\_products\\_support\\_series\\_home.html](http://www.cisco.com/en/US/products/ps6366/tsd_products_support_series_home.html)



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## Power Fluctuations

This section addresses possible AC and Power over Ethernet (PoE) power problems or anomalies with a mesh access point.

### AC Power Problems

**Table 1**      **AC Power Fluctuations**

| Possible cause                                                                                                                                         | Solution/Debug steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Not enough power.<br><br><b>Note</b> Intermittent power availability, low AP uptime and AP resets are all indicators of inadequate power availability. | 1) Verify that the PoE port on the switch or router is disabled by checking the PoE LED. If the LED is on continuously or fluttering, disable PoE on the port.<br><br><b>Note</b> Cisco mesh access points (1500 Series) are not compliant with 802.3af, which allows an access point to take power from a switch or router. PoE must always be disabled on the switch or router associated with the AP.<br><br>2) Check voltage level.<br><br>3) Verify that streetlight “bank switching” is not in use where the access point is installed.<br><br>4) Check for variations in power during the day and at night.<br><br>5) Connect the detachable LED indicator to the access point to verify that power is present (LED on = power)<br><br>6) Verify that the Ethernet port LED is active for the port that connects to the access point.<br><br>7) If the unit you are troubleshooting is an AP1520, then check the power failure trap. |

## PoE Problems

**Table 2** PoE Power Fluctuations

| Possible cause                         | Solution/Debug steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Power injector is not providing power. | <p>1) Verify that the PoE port on the switch or router is disabled by checking the PoE LED. If the LED is continuous or fluttering, disable PoE on the port.</p> <p><b>Note</b> Cisco mesh access points (1500 Series) are not compliant with 802.3af, which allows an access point to take power from a switch or router. PoE must always be disabled on the switch or router associated with the AP and a Cisco external power injector must be present.</p> <p>2) Verify that the LED of the power injector is on.</p> <p>3) Verify that the physical input and output cable connections of the PoE injector are correct.</p> <p><b>Note</b> The PoE injector <i>input</i> port should be connected to the network switch or router port. The PoE injector <i>output</i> port should be connected to the Ethernet port of the access point.</p> <p>4) Connect an Ethernet sniffer with an Ethernet hub to ensure packets are transmitting from an AP1510 or AP1505. If the unit is an AP1520, then check the power LED on the access point first.</p> <p>5) Verify that the total distance between the network device, the power injector and the access point meet the 802.3 specification.</p> <p>Distance between power injector, and the AP should be no more than 328 ft.</p> <ul style="list-style-type: none"><li>– Switch to injector (max 128 ft)</li><li>– Injector to AP (max 200 ft)</li></ul> |

## Radio Frequency (RF) Problems and Fluctuations

This section addresses problems with radio transmission in the mesh network that might cause a wireless link to not establish, to go down or be available intermittently.

Details on how to diagnose the problem both remotely and locally are summarized in the table below.

**Table 3**      **RF Problems and Fluctuations**

| Possible cause                        | Solution/Debug steps                                                                                                                                                                   |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>High-level, remote diagnostics</i> |                                                                                                                                                                                        |
| No neighbors found.                   | 1) Check the access point antenna.<br>2) Check to see if the AP power is ON using the detachable LED indicator.<br>3) Verify that the path to the AP is not obstructed by metal poles. |
| No valid parents found.               | 1) Check for RF asymmetric behavior.<br>2) Check for local interference.<br>3) Install APs as far from transformers as possible.                                                       |

**Table 3**      **RF Problems and Fluctuations (continued)**

| Possible cause                                                 | Solution/Debug steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Insufficient Signal to Noise (SNR) values to keep the link up. | <p>1) Conduct a link test on the problem link:</p> <p>In Cisco WCS, conduct the link test in both directions: parent-to-child and child-to-parent (Monitor &gt; Maps &gt; <i>Map Name</i> and mouse over the problem link in the map)</p> <p>2) In the controller GUI, run the AP-to-AP link test.</p> <p><b>Note</b> If link test shows asymmetric values between the two different directional link tests, there might be problems with the link at one end. Check the RF cables at each end, if applicable; and, in Cisco WCS, run a Busiest APs Report to view utilization (Path: Reports &gt; Performance Reports &gt; <i>Busiest APs Report</i>).</p> <p>3) Run the Worst SNR Report in Cisco WCS (Reports &gt; Mesh Reports &gt; <i>Mesh Worst SNR Links</i>).</p> <p>4) Run a throughput test (lperf) on the link for 24 hours to determine link robustness and vitality.</p> <p>5) Check the AP max retransmissions value in the trap logs.</p> <p>6) Recheck distances between access points</p> <ul style="list-style-type: none"> <li>• MAP deployment cannot exceed 35 feet in height above the street.</li> <li>• Typical 5 GHz RAP-to-MAP distances are 1000–4000 feet.</li> <li>• Typical 5 GHz MAP-to-MAP distances are 500–1000 feet.</li> <li>• Typical 2.4 GHz MAP-to-client distances are 300–500 feet.</li> </ul> <p>7) Look for obstructions (trees, buildings, etc.) in the path between the two access points.</p> <p>8) Find the AP by entering <b>show mesh neigh details</b> to determine the time the lost AP was <i>last heard</i> from a known good AP neighbor.</p> <p>9) Enable the secondary backhaul feature (AP1510s only) to provide a temporary, alternate path to address interference issues on the primary backhaul. For configuration details see the “Routing Around Interference” section in Chapter 7 of the <i>Cisco Wireless LAN Controller Configuration Guide, 4.1</i>.</p> |

**Table 3**      **RF Problems and Fluctuations (continued)**

| Possible cause                                            | Solution/Debug steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SNR is greater than 60 dBm or APs are too close together. | <p>1) Check distances between APs and their antennas.</p> <p><b>Note</b>    Verify that the distance between APs (within the US) is 40 ft or greater when OMNI directional antennas are attached (ETSI =&gt; 10 ft) to reduce high packet error rate (PER) and prevent possible hardware problems.</p>                                                                                                                                                                                                                                                                                                                              |
| High packet error rate (PER).                             | <p>1) In Cisco WCS, run the Mesh Packet Error Rate Report (Reports &gt; Mesh Reports &gt; <i>Mesh Packet Error Stats</i>).</p> <p>2) Run a link test from the controller or WCS.</p> <ul style="list-style-type: none"> <li>– If good SNR but high PER, then check for interference.</li> </ul> <p>3) Verify load in the network.</p> <p>4) Check distances between APs and their antenna placement.</p> <p><b>Note</b>    Verify that the distance between APs (within the US) is 40 ft. or greater when OMNI directional antennas are attached (ETSI =&gt; 10 ft.) to reduce high PER and prevent possible hardware problems.</p> |
| Traffic load is too heavy on a link.                      | <p>1) Verify the SNMP traps for queue overflows and verify reported overflows using an Ethereal sniffer.</p> <ul style="list-style-type: none"> <li>– Bronze queue overflow indicates too much broadcast or multicast traffic on a link.</li> <li>– Gold and platinum queue overflows might affect AWPP and LWAPP operation.</li> </ul> <p>2) Run channel utilization or throughput reports using WCS.</p> <p>3) Please ensure proper RF channel planning of RAPs to avoid co-channel interference.</p>                                                                                                                             |

**Table 3**      **RF Problems and Fluctuations (continued)**

| Possible cause                                            | Solution/Debug steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Low-level, local diagnostics</i>                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Ineffective antenna.                                      | <p>1) Check that antenna is screwed in correctly and in all the way.</p> <p>2) If antenna is in a vertical upward position, verify that the drain plug is inserted, if applicable.</p> <p>3) If antenna is in a vertical downward position, verify that the drain plug is not inserted, if applicable.</p> <p>4) Verify that the correct antenna is installed. Both the 2.4 and 5 GHz antennas use the same N-type connector and could accidentally be swapped.</p>                                                                                                                                                                |
| Interference.                                             | <p>1) Use a wireless 802.11 sniffer to measure packets per second (PPS). See the throughput vs. utilization chart (<a href="#">Figure 1</a>) in the “<a href="#">Performance Notes</a>” section on page 22.</p> <p>2) Move AP from its current location.</p>                                                                                                                                                                                                                                                                                                                                                                       |
| Radio is out of range of another network connected radio. | <p>1) See if the radio path is obstructed by buildings, trees or other objects.</p> <p>2) Verify that the radio is within the following suggested distances:</p> <ul style="list-style-type: none"> <li>• MAP deployment cannot exceed 35 ft in height above the street.</li> <li>• Typical 5 GHz RAP-to-MAP distances are 1000–4000 ft.</li> <li>• Typical 5 GHz MAP-to-MAP distances are 500–1000 ft.</li> <li>• Typical 2.4 GHz MAP-to-client distances are 300–500 ft.</li> <li>• RAP locations are typically towers or tall buildings.</li> <li>• MAP locations are typically short building tops or streetlights.</li> </ul> |

**Table 3**      **RF Problems and Fluctuations (continued)**

| Possible cause                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Solution/Debug steps                                                                                                                                                                                                                                             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Recommended data rate of 18 Mbps (AP1505 and AP1510) or 24 Mbps (AP1520 series) is not in use.</p> <p><b>Note</b>    The rate of 18 Mbps (24 Mbps for AP1520) is the optimal backhaul rate because it aligns with the maximum coverage of the wireless LAN portion of the client wireless LAN of the MAP; that is, the distance between MAPs using 18 Mbps backhaul should allow for seamless WLAN client coverage between the MAPs.</p> <p>A lower bit rate might allow a greater distance between APs, but there are likely to be gaps are likely in the wireless LAN client coverage, and the capacity of the backhaul network is reduced.</p> <p>An increased bit rate for the backhaul network either requires more APs, or results in a reduced SNR between APs, limiting mesh reliability and interconnection.</p> | <p>1) Enter <b>show config</b> to see current rate or using the controller GUI, select Data Rate from the blue drop-down menu for a given AP on the following controller page (Wireless &gt; All APs &gt; <i>Cisco-AP</i> &gt; Details)</p>                      |
| <p>Recommended number of backhaul hops is exceeded.</p> <p><b>Note</b>    Number of backhaul hops is limited to eight, but three to four hops are recommended to maintain sufficient backhaul throughput because each MAP uses the same radio for transmission and reception of backhaul traffic. This means that throughput is approximately halved over every hop. For example, the maximum throughput for an 18 Mbps backhaul is approximately 10 Mbps for the first hop, 5 Mbps for the second hop, and 2.5 Mbps for the third hop.</p>                                                                                                                                                                                                                                                                                  | <p>1) Run the Cisco WCS worst node hops report (Reports &gt; Mesh Reports &gt; <i>Mesh Worst Node Hops</i>)</p>                                                                                                                                                  |
| <p>Recommended latency is not met.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <p>1) Ping each AP radio IP address. Reported ping route time (a round-trip value) should be less than 100 msecs for clients; otherwise, they will look for another AP to associate with.</p> <p><b>Note</b>    Use the ping test link found in the WCS GUI.</p> |
| <p>Defective radio.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p>1) Contact technical support and request an Return Material Authorization (RMA).</p>                                                                                                                                                                          |



## LWAPP Discovery Request Never Sent by Access Point

This section highlights conditions associated with unsuccessful LWAPP joins by the access point and no receipt of a discovery request at the controller.

To monitor the messages being exchanged between APs and the controller, enter the following command and monitor (or capture) the information for at least 15 minutes.

(Cisco Controller) > **debug lwapp events enable**

- The **debug lwapp events enable** display provides information to help troubleshoot all of the possible problems listed in [Table 4](#).
- If after monitoring the **debug lwapp events enable** display for 15 minutes and, neither the NO DISCOVER RESPONSE nor the NO JOIN REQUEST event appears, enter the following CLI commands on the controller if you see this:

spamMeshRadiusProcessResponse: AP Authorization Failure for <MAC Address>

- Enter **debug disable-all** to turn off the **debug lwapp events enable** command
- Enter **config wlan mac filtering enable** *wlan-id* to enable the MAC filter on the WLAN



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**Note** The MAC filter is enabled by default in release 4.1.181 and later.

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- Enter **config macfilter add** *mac-addr wlan-id* to add the access point's MAC address to the WLAN's MAC filter

**Table 4** *LWAPP Discovery Request Never Sent by Access Point*

| Possible cause                                 | Solution/Debug steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MAC filter is enabled and blocking.            | <p>1) Enter the <b>debug lwapp events enable</b> command and monitor for 15 minutes.</p> <ul style="list-style-type: none"> <li>• If after 15 minutes, neither the NO DISCOVER RESPONSE nor the NO JOIN REQUEST event appears, enter the following CLI commands on the controller if you see the following message display:<br/>spamMeshRadiusProcessResponse:<br/>AP Authorization Failure for &lt;MAC address&gt;</li> <li>– Enter <b>debug disable-all</b> to turn off the <b>debug lwapp events enable</b> command</li> <li>– Enter <b>config wlan mac filtering enable wlan-id</b> to enable the MAC filter on the WLAN</li> </ul> <p> <b>Note</b> The MAC filter is enabled by default in release 4.1.181.0 and later.</p> <ul style="list-style-type: none"> <li>– Enter <b>config macfilter add mac-addr wlan-id</b> to add the access point's MAC address to the WLAN's MAC filter.</li> </ul> |
| A RAP has joined but MAPs have not.            | <p>1) Configure at least one access point in the mesh network as a RAP.</p> <p><b>Note</b> Default setting for all access points is as a MAP</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Incorrect VLAN configuration.                  | <p>1) Verify that the access point and its associated controller are on the same VLAN by pinging from various logical switch and subnet points.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Incorrect access point authorization settings. | <p>1) Enter CLI commands <b>show auth-list</b> and <b>show aaa</b> to verify settings.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| EAP and 802.1x authentication failure.         | <p>1) Verify status by entering the following CLI commands from the controller:</p> <p><b>debug mesh security all enable</b></p> <p><b>debug aaa all enable</b></p> <p><b>debug dot1x all enable</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

**Table 4**      **LWAPP Discovery Request Never Sent by Access Point (continued)**

| Possible cause                                         | Solution/Debug steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EAP and 802.1x authentication timeout.                 | <p>1) Verify status using the following CLI commands on the controller:</p> <pre>show eap adv timers debug mesh security all enable debug aaa all enable debug dot1x all enable</pre>                                                                                                                                                                                                                                                                                                                                                   |
| Parent changed in the middle of security verification. | <p>1) Verify status using the following CLI commands on the controller:</p> <pre>debug mesh security all enable debug aaa all enable debug dot1x all enable</pre> <p>In some cases, the following CLI command on the controller might also be useful:</p> <pre>debug client MAP-MAC-address</pre> <p><b>Note</b>    If problems are identified in the command displays, then wait for convergence to complete (see <a href="#">Table 7</a>)</p> <p>If none of these commands indicates any problems, look for RF or power problems.</p> |
| RAP has lost its Ethernet connection.                  | <p>1) Check the physical connection between the RAP and the Ethernet port on the switch or router.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| RAP occasionally connects as a MAP.                    | <p>1) Check the physical connection between the RAP and the Ethernet port on the switch or router.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                  |

**Table 4**      **LWAPP Discovery Request Never Sent by Access Point (continued)**

| Possible cause                                                                                                              | Solution/Debug steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>PoE from the switch or router is enabled.</p> <p><b>Note</b>    Connections are generally erratic or inconsistent.</p>   | <p>1) Verify that the PoE port on the switch or router is disabled by checking the PoE LED or configuration with the CLI. If the LED is continuous or fluttering, disable PoE on the port.</p> <p><b>Note</b>    Cisco mesh access points (1500 Series) are not compliant with 802.3af, which allows an access point to take power from a switch or router. PoE must always be disabled on the switch or router associated with the AP.</p> <p><b>Note</b>    Cisco external power injectors are mandatory for PoE configurations.</p> <p>2) Verify that the recommended distance (<math>\leq 128</math> ft) between the switch or router and the PoE injector is not exceeded.</p> |
| <p>Duplicate IP addresses on the access point.</p> <p><b>Note</b>    Connections are generally erratic or inconsistent.</p> | <p>1) Reconfigure the access point by removing the static IP address, if applicable.</p> <p>2) Have DHCP server assign the access point IP address.</p> <p><b>Note</b>    Ensure that the DHCP server is configured and accessible on the same subnet as the access point.</p>                                                                                                                                                                                                                                                                                                                                                                                                      |

## LWAPP Join Failures

This section highlights conditions associated with receipt of Discovery Requests and the non-receipt of LWAPP Joins from the access point.

To monitor the messages being exchanged between APs and the controller, enter the following command and monitor (or capture) the information for at least 15 minutes.

(Cisco Controller) > **debug lwapp events enable**

- The **debug lwapp events enable** text display provides information to help troubleshoot all of the possible join problems listed in [Table 5](#).
- If after monitoring the **debug lwapp events enable** text display for 15 minutes and, neither the NO DISCOVER RESPONSE nor the NO JOIN REQUEST event is seen, enter the following CLI commands on the controller, if you see the following display:

spamMeshRadiusProcessResponse: AP Authorization Failure for <mac>

- Enter **debug disable-all** to turn off the **debug lwapp events enable** command.
- Enter **config wlan mac filtering enable wlan-id** to enable the MAC filter on the WLAN.



**Note** The MAC filter is enabled by default in release 4.1.181.0 and later.

- Enter **config macfilter add mac-addr wlan-id** to add the access point's MAC address to the WLAN's MAC filter.

**Table 5** *LWAPP Join Failures*

| Possible cause                                                 | Solution/Debug steps                                                                                                                                                                                                               |
|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Incorrect regulatory domain is configured on the access point. | 1) Enter <b>show country</b> on the controller to view country setting.<br>2) Enter <b>show msglog</b> to view country setting.<br>3) Check label on access point for assigned country code.<br>4) Configure correct country code. |
| A RAP has joined but MAPs have not.                            | 1) Configure at least one access point in the mesh network as a RAP.<br><b>Note</b> Default setting for all access points is as a MAP.                                                                                             |

**Table 5**      **LWAPP Join Failures (continued)**

| Possible cause                      | Solution/Debug steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MAC filter is enabled and blocking. | <p>1) Verify that the MAC address was correctly entered into the MAC filter on the controller.</p> <p><b>Note</b>    To limit MAC address entry errors, you can cut and paste addresses from the <b>debug LWAPP events</b> CLI command display.</p> <p>2) Enter <b>debug lwapp events enable</b> and monitor for 15 minutes.</p> <ul style="list-style-type: none"> <li>• If after 15 minutes, and neither the NO DISCOVER RESPONSE nor the NO JOIN REQUEST event displays, enter the following CLI commands on the controller if you see the following message display:<br/> <pre>spamMeshRadiusProcessResponse: AP Authorization Failure for &lt;MAC address&gt;</pre> <ul style="list-style-type: none"> <li>– Enter <b>debug disable-all</b> to turn off the <b>debug lwapp events enable</b> command.</li> <li>– Enter <b>config wlan mac filtering enable</b> <i>wlan-id</i> to enable the MAC filter on the wireless LAN.</li> </ul> </li> </ul> <p> <b>Note</b>    The MAC filter is enabled by default in release 4.1.181.0 and later.</p> <ul style="list-style-type: none"> <li>– Enter <b>config macfilter add</b> <i>mac-addr</i> <i>wlan-id</i> to add the access point's MAC address to the WLAN's MAC filter.</li> </ul> |

**Table 5**      **LWAPP Join Failures (continued)**

| Possible cause                                                                                                                                                                                                                                | Solution/Debug steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>APs are associating with the wrong controller</p> <p><b>Note</b>    Incorrect associations often occur when multiple controllers exist on the same subnet and if the AAA server is configured to allow all MAC addresses to associate.</p> | <p>1) Enter the MAC address of the AP into the MAC filter of all controllers on the subnet. After the access point associates with one of the controllers, define the selected controller as the primary controller.</p> <p><b>Note</b>    An access point attempts to associate with the first controller that provides a Discovery Response if it has not been previously connected to a controller or primed to a specific controller.</p> <p>[Primed = Assigned to a primary, secondary or tertiary controller.]</p> <p>See the quick start guides for the Cisco 1500 and 1520 series access points at the following URL for details on priming a controller.</p> <p><a href="http://www.cisco.com/en/US/docs/wireless/access_point/1500/quick/guide/ap1500qs.html">http://www.cisco.com/en/US/docs/wireless/access_point/1500/quick/guide/ap1500qs.html</a></p> <p>2) In the Controller GUI, verify that the Authorize APs against AAA option (Security &gt; AAA &gt; <i>AP Policies</i>) is disabled.</p> <p><b>Note</b>    When Authorize APs against AAA is enabled, it allows an AP to associate to a controller regardless of other settings (it overrides MAC filter settings)</p> |
| <p>DHCP server is not providing an IP address.</p>                                                                                                                                                                                            | <p>1) Verify that the DHCP is defined on the controller.</p> <p>2) Verify that Option 43 is configured on the DHCP server.</p> <p><b>Note</b>    See the <i>Cisco Aironet 1500 Series Outdoor Mesh Hardware Installation Guide</i> for details on configuring Option 43 at initial install at: <a href="http://www.cisco.com/en/US/docs/wireless/access_point/1500/installation/guide/1500_axg.html#wpixref62208">http://www.cisco.com/en/US/docs/wireless/access_point/1500/installation/guide/1500_axg.html#wpixref62208</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <p>ARP request is not successful. No resolved address was received and cached.</p>                                                                                                                                                            | <p>1) Enter <b>show route gateway summary</b> to verify the gateway configuration and path.</p> <p>2) Perform diagnostics on switch or router using ethereal tools to verify status of ARP requests.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

**Table 5** *LWAPP Join Failures (continued)*

| Possible cause                                                                                                        | Solution/Debug steps                                                                                                                                                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A bridge group name (BGN) is configured for the RAP but not for MAPs.                                                 | 1) Assign a BGN to the MAP.<br><b>Note</b> MAPs will only connect to a controller with a default BGN.                                                                                                                                                                                             |
| A bridge group name mismatch exists between a RAP and a MAP.                                                          | 1) Reconfigure the MAP bridge group name to match the BGN of the appropriate RAP.<br><b>Note</b> You have up to 30 minutes to make this adjustment before the RAP reboots.                                                                                                                        |
| Controller has defaulted to the manufacturing time setting or is not set correctly causing the certification to fail. | 1) Set correct time on the controller by entering the following commands:<br><br><b>config time manual mm/dd/yy</b><br><br><b>config time timezone delta-hours</b><br>(delta-hours = difference in current time in hours from the universal coordinated time)<br><br>2) Configure the NTP server. |

## Access Point Disappears

This section summarizes possible reasons why an access point might disappear from a mesh network.

- When an access point disappears, it is not viewable from the controller GUI or CLI 60 seconds after its disappearance.
- On Cisco WCS, the icon remains on the map display until the next polling period (default of 15 minutes) but is not available (greyed out). Limited historical information is available during this time.

**Table 6** *Access Point Disappears*

| Possible cause                                 | Solution/Debug Steps                                                                                                                                                                                                                                                                                                |
|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RAP admin status was disabled then re-enabled. | 1) Wait several minutes for MAPs to reassociate with the controller.<br><b>Note</b> MAPs ignore admin status enable and disable.                                                                                                                                                                                    |
| Parent of access point has rebooted.           | 1) Wait the approximate times specified in <a href="#">Table 7</a> .                                                                                                                                                                                                                                                |
| Access point has excluded its parent.          | 1) To check for parent exclusion, look for the <i>ciscoLwappMeshChildExcludedParent</i> SNMP trap and the following Cisco WCS message: "Parent AP being excluded by child AP due to failed authentication, AP current parent MAC address "{yy.yy.yy.yy.yy.yy}"," previous parent MAC address "{xx.xx.xx.xx.xx.xx}." |



**Table 6**      **Access Point Disappears (continued)**

| Possible cause                                                            | Solution/Debug Steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link is lost because of poor SNR or radio hardware failure.               | <p>1) Check the node-to-node LinkSNR. See <a href="#">Table 8</a> for the minimum LinkSNR required by data rate to maintain a link. See <a href="#">Table 9</a> for supporting LinkSNR calculation details.</p> <p>The following diagnostic information is available:</p> <ul style="list-style-type: none"> <li>• Controller CLI (show mesh path).</li> <li>• Controller GUI (Wireless &gt; Access Points &gt; All APs &gt; <i>AP Name</i> &gt; <i>Neighbor Info</i> (drop-down menu) &gt; <i>Link Test</i> (drop-down menu option for parent and child APs).</li> <li>• Cisco WCS (Reports &gt; Mesh Reports &gt; <i>Mesh Link Stats</i>).</li> </ul> <p><b>Note</b> Refer to the “RF Issues and Fluctuations” troubleshooting section in this document for additional diagnostic steps.</p> |
| 802.11a (802.11b if AP1505) network is disabled on the RAP.               | <p>1) Enable the 802.11a Network Status <i>or</i> 802.11b/g Network Status option on the controller GUI at the following page using the appropriate path:</p> <ul style="list-style-type: none"> <li>• Wireless &gt; 802.11a &gt; Network (AP1510)</li> <li>• Wireless &gt; 802.11b &gt; Network (AP1505)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Access point is not staying up due to either a power problem or reboot.   | <p>1) Enter the following CLI command:</p> <p style="text-align: center;"><b>show ap config general ap-name</b></p> <p>Check the status of the following parameters:</p> <ul style="list-style-type: none"> <li>- AP Uptime</li> <li>- LWAPP uptime</li> <li>- Join Date and Time</li> <li>- Join Taken Time</li> </ul> <p>2) If a poletop installation, verify if:</p> <ul style="list-style-type: none"> <li>a) Power is bank-switched.</li> <li>b) Power is stable (using voltmeter or visibly checking light stability at night).</li> </ul>                                                                                                                                                                                                                                               |
| A bridge group name (BGN) is configured for the RAP but not for the MAPs. | <p>1) Assign a BGN to the MAP.</p> <p><b>Note</b> MAPs connect only to a controller with a default BGN.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

**Table 6**      **Access Point Disappears (continued)**

| Possible cause                    | Solution/Debug Steps                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AP is stranded.                   | 1) Use a spectrum analyzer to detect the presence of any local noise, interference or AP transmission.<br><br>2) Physically connect the AP directly to the controller, if possible, to see if the AP joins.<br><br>3) A ground-level installation of a local controller and AP prior to its permanent installation on a pole or tower is recommended to verify that the AP will join the controller. |
| Image is being/has been upgraded. | See <a href="#">Table 7</a> .                                                                                                                                                                                                                                                                                                                                                                        |
| Controller has rebooted.          | See <a href="#">Table 7</a> .                                                                                                                                                                                                                                                                                                                                                                        |
| RAP has rebooted.                 | See <a href="#">Table 7</a> .                                                                                                                                                                                                                                                                                                                                                                        |
| MAP has rejoined.                 | See <a href="#">Table 7</a> .                                                                                                                                                                                                                                                                                                                                                                        |
| MAP has changed its parents.      | See <a href="#">Table 7</a> .                                                                                                                                                                                                                                                                                                                                                                        |

[Table 7](#) provides a summary of transitional events that can occur within a mesh network along with the approximate time required for an event to propagate from the RAP to lower level MAPs in the mesh network hierarchy (RAP, MAP1, MAP2, MAP3).

**Table 7**      **Approximate Convergence Times for Mesh Network Transitions**

| Convergence Time (Mins.) <sup>1</sup>  |     |      |      |      |
|----------------------------------------|-----|------|------|------|
| Transition Event                       | RAP | MAP1 | MAP2 | MAP3 |
| Image Upgrade                          | < 4 | < 9  | < 15 | < 20 |
| Controller reboot                      | < 1 | < 3  | < 5  | < 7  |
| RAP reboot                             | < 1 | < 3  | < 5  | < 8  |
| MAP rejoin                             | < 1 | < 3  | < 3  | < 3  |
| MAP changes parent (same channel)      | –   | < 4  | –    | –    |
| MAP changes parent (different channel) | –   | < 4  | –    | –    |

- The convergence times are approximate for a specific transition event to occur as it propagates from the RAP outward to the lower tiers of the network (MAP1, MAP2, and MAP3). RAP is at the top of the mesh hierarchy. MAP1 nodes are children of the RAP; MAP2 nodes are the children of MAP1 nodes; and MAP3 nodes are the children of MAP2 nodes.

**Table 8**      **AP1500 Series Backhaul Data Rates and Minimum LinkSNR Requirements**

| Data Rate | Minimum Required LinkSNR (dB) |
|-----------|-------------------------------|
| 36 Mbps   | 26                            |
| 24 Mbps   | 22                            |

**Table 8** *AP1500 Series Backhaul Data Rates and Minimum LinkSNR Requirements*

| Data Rate | Minimum Required LinkSNR (dB) |
|-----------|-------------------------------|
| 18 Mbps   | 18                            |
| 12 Mbps   | 16                            |
| 9 Mbps    | 15                            |
| 6 Mbps    | 14                            |

- The required minimum LinkSNR is driven by the data rate and the following formula: Minimum SNR + fade margin. [Table 9](#) summarizes the calculation by data rate.
  - Minimum SNR refers to an ideal state of non-interference, non-noise and a system packet error rate (PER) of no more than 10%
  - Typical fade margin is approximately 9 to 10 dB
  - We do not recommend using data rates greater than 18 Mbps(24 Mbps for AP1520) in municipal mesh deployments as the SNR requirements do not make the distances practical

**Table 9** *Minimum Required LinkSNR Calculations by Data Rate*

| Data Rate | Minimum SNR (dB) + | Fade Margin = | Minimum Required LinkSNR (dB) |
|-----------|--------------------|---------------|-------------------------------|
| 6         | 5                  | 9             | 14                            |
| 9         | 6                  | 9             | 15                            |
| 12        | 7                  | 9             | 16                            |
| 18        | 9                  | 9             | 18                            |
| 24        | 13                 | 9             | 22                            |
| 36        | 17                 | 9             | 26                            |

# LWAPP Failure Debugging

After an access point has connected to the controller over LWAPP, a logical connection is created. This logical connection may shut down for a variety of reasons. A number of the more typical events reported and behaviors associated with LWAPP failures are noted in the table below.

LWAPP connection failures are generally caused by something other than RF, but intermittent interference or poor link SNR can be the cause of these failures.

To find information for the following LWAPP failures, refer to either the Trap Logs or Msglogs on the controller:

- In the controller GUI, refer to the Trap Log (Management > SNMP > Trap Logs) for messages of the following type: “AP Interface: 0 (802.11a) Operation State {Up | Down}.”
- In the controller CLI, enter **show msglogs**. Refer to the associated LWAPP troubleshooting messages below for more guidance on debugging.

**Table 10**      **LWAPP Failure Debugging**

| Problem                                                                                                                                                                                                                                                                    | Solution/Debug Steps                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Access point resets.                                                                                                                                                                                                                                                       | 1) Power or manual reset of the AP has occurred.<br>2) AP has not been connected to a controller for 30 minutes or longer and the AP will reboot automatically.                                                                                                                                                                                                                                                                                   |
| Configuration changes.<br>Reason given: Did not get a join response.<br><b>Note</b> In LWAPP there is a LWAPP join reply message for every join request. If the AP does not receive a join reply message, the LWAPP does not form and the above error message is reported. | Problem is mostly likely caused by poor SNR between APs or packet lost in the airwaves.<br>1) Run a link test between the two APs from the controller or WCS.<br>2) In Cisco WCS, run the Mesh Packet Error Rate Report (Path: Reports > Mesh Reports > <i>Mesh Packet Error Stats</i> ). <ul style="list-style-type: none"> <li>– If SNR is good but there is a high PER, then check for interference.</li> </ul> 3) Verify load in the network. |
| Configuration changes.<br>Reason given: Found configured or master controller.<br><b>Note</b> With a master controller set, if the AP does not have a primary or secondary controller name pre-configured, an AP will associate with the master controller.                | 1) Limit the number of associated APs on the master controller, to allow for initial association of such “strays.”<br>2) AP might have switched from a secondary, tertiary (or other) controller to a master controller that was inactive when the AP first joined.                                                                                                                                                                               |

**Table 10**      **LWAPP Failure Debugging (continued)**

| <b>Problem</b>                                                                                                                                                                                                                                   | <b>Solution/Debug Steps</b>                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Configuration change.<br>Reason given: Image upgraded.                                                                                                                                                                                           | 1) An image upgrade was initiated from the controller or Cisco WCS and was sent to the AP.<br><br><b>Note</b> After the AP image upgrades, the AP reboots.                                                                                                                                                                                                                                                        |
| Configuration change.<br>Reason given: Controller reboot command.                                                                                                                                                                                | 1) A controller reboot request was initiated from the controller.                                                                                                                                                                                                                                                                                                                                                 |
| Configuration changes.<br>Reason given: Did not get config response.<br><br><b>Note</b> When a configuration change occurs, an AP should signal back and acknowledge it has gotten the configuration change.                                     | Problem is mostly likely caused by poor SNR between APs or packet lost in the airwaves.<br><br>1) Run a link test between the two APs from the controller or WCS.<br><br>2) In Cisco WCS, run the Mesh Packet Error Rate Report (Path: Reports > Mesh Reports > <i>Mesh Packet Error Stats</i> ).<br>– If SNR is good but there is a high PER, then check for interference.<br><br>3) Verify load in the network. |
| Link failure.<br>Reason given: ECHO_REQUEST.<br><br><b>Note</b> LWAPP connection did not receive the acknowledgment (ACK) and the APs are disassociating because they are unable to reach the controller.                                        | 1) Lack of connectivity between the controller and the access points could be tied to either problems with network elements (wireless backhaul, switches, or routers) or because of low SNR.<br><br><b>Note</b> Refer to the beginning of this document, and begin step-by-step troubleshooting.                                                                                                                  |
| Link failure.<br>Reason given: RRM_DATA_REQ.                                                                                                                                                                                                     | 1) Error message indicates LWAPP did not receive an ACK from the AP; and the APs are disassociating because the controller is unable to reach them.<br><br>1) Check network connections (wireless backhaul, switches, routers).<br>2) Check link for low SNR.                                                                                                                                                     |
| Link failure.<br>Reason given: STATISTICS_INFO.<br><br><b>Note</b> Error message indicates that LWAPP could not pull statistical information from the AP. This could be due to low SNR or just packet lost in the airwaves from 802.11 behavior. | 1) Run a link test between the two APs from the controller or WCS.<br><br>2) In Cisco WCS, run the Mesh Packet Error Rate Report (Path: Reports > Mesh Reports > <i>Mesh Packet Error Stats</i> ).<br>– If good SNR but high PER, then check for interference.<br><br>3) Verify load in the network.                                                                                                              |

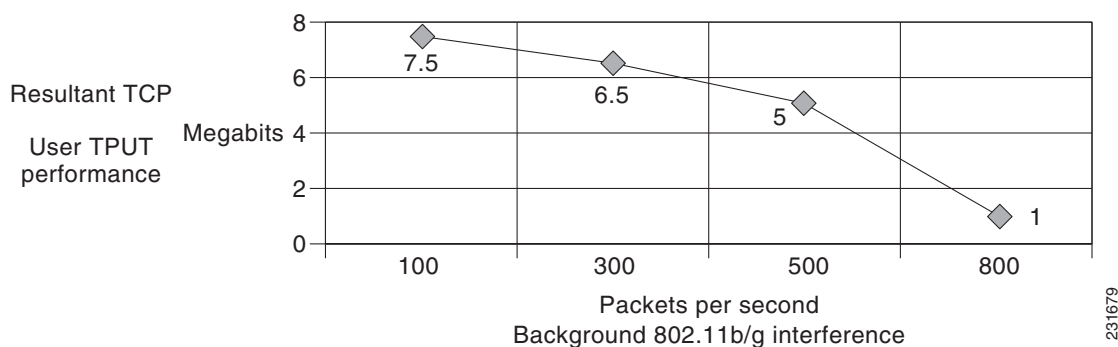
**Table 10**      **LWAPP Failure Debugging (continued)**

| Problem                                                                                                                                              | Solution/Debug Steps                                                                                                                                                                                                                                                                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link failure.<br>Reason given:<br>CHANGE_STATE_EVENT.<br><b>Note</b> Link failures are, in general, tied to the non-receipt of LWAPP ACKs by the AP. | 1) Lack of connectivity between the controller and the access points could be tied to either problems with network elements (wireless backhaul, switches, or routers) or because of low SNR.<br><b>Note</b> Refer to the beginning of this document, and begin step-by-step troubleshooting. |
| Maximum retransmissions timer has exceeded its setting (60 retries).                                                                                 | 1) Refer to the beginning of this document, and begin step-by-step troubleshooting.                                                                                                                                                                                                          |

## Performance Notes

Typical throughput and performance are based on backhaul performance delivered to the RAP, the number of mesh hops, the noise and interference on the mesh wireless backhaul and on the wireless access side as well as client transmit uplink power. Tools such as wireless 802.11 sniffers and software spectrum analyzers can be used to troubleshoot local on-site issues.

Additionally, Cisco WCS and the controller already have noise and interference feedback tools built-in to the controller AP monitor and WCS Report pages; in general, these tools display Pass or Fail results based on default criteria.

**Figure 1**      **Transmission Control Protocol (TCP) Throughput vs. Channel Utilization**



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