Configuring Link Latency

Finding Feature Information

Your software release may not support all of the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Configuring Link Latency

- The switch displays the current round-trip time as well as a running minimum and maximum round-trip time. The minimum and maximum times continue to run as long as the switch is up or can be cleared and allowed to restart.
- You can configure link latency for a specific access point using the switch GUI or CLI or for all access points joined to the switch using the CLI.

Restrictions for Configuring Link Latency

- Link latency calculates the Control and Provisioning of Wireless Access Points (CAPWAP) response time between the access point and the switch. It does not measure network latency or ping responses.

Information About Configuring Link Latency

You can configure link latency on the switch to measure the link between an access point and the switch. You can use this feature with all access points that are joined to the switch where the link can be a slow or unreliable WAN connection.

TCP MSS

If the client's maximum segment size (MSS) in a Transmission Control Protocol (TCP) three-way handshake is greater than the maximum transmission unit can handle, the client might experience reduced throughput and the fragmentation of packets. To avoid this problem, you can specify the MSS for all access points that are joined to the switch or for a specific access point.

When you enable this feature, the access point selects the MSS for TCP packets to and from wireless clients in its data path. If the MSS of these packets is greater than the value that you configured or greater than the default value for the CAPWAP tunnel, the access point changes the MSS to the new configured value.

Link Tests

A link test is used to determine the quality of the radio link between two devices. Two types of link-test packets are transmitted during a link test: request and response. Any radio receiving a link-test request packet fills in the appropriate text boxes and echoes the packet back to the sender with the response type set.

The radio link quality in the client-to-access point direction can differ from that in the access point-to-client direction due to the asymmetrical distribution of the transmit power and receive sensitivity on both sides. Two types of link tests can be performed: a ping test and a CCX link test.

With the *ping link test*, the controller can test link quality only in the client-to-access point direction. The RF parameters of the ping reply packets received by the access point are polled by the controller to determine the client-to-access point link quality.

With the *CCX link test*, the switch can also test the link quality in the access point-to-client direction. The switch issues link-test requests to the client, and the client records the RF parameters (received signal strength indicator [RSSI], signal-to-noise ratio [SNR], and so on) of the received request packet in the response packet. Both the link-test requestor and responder roles are implemented on the access point and switch. Not only can the access point or switch initiate a link test to a CCX v4 or v5 client, but a CCX v4 or v5 client can initiate a link test to the access point or switch.

The switch shows the link-quality metrics for CCX link tests in both directions (out— the access point to the client; in— the client to the access point):

- Signal strength in the form of RSSI (minimum, maximum, and average)
- Signal quality in the form of SNR (minimum, maximum, and average)
- Total number of packets that are retried
- Maximum retry count for a single packet
- Number of lost packets
- Data rate of a successfully transmitted packet

The controller shows this metric regardless of direction:

- Link test request/reply round-trip time (minimum, maximum, and average)

The controller software supports CCX versions 1 through 5. CCX support is enabled automatically for every WLAN on the controller and cannot be disabled. The controller stores the CCX version of the client in its client database and uses it to limit the features for this client. If a client does not support CCXv4 or v5, the controller performs a ping link test on the client. If a client supports CCXv4 or v5, the controller performs a CCX link test on the client. If a client times out during a CCX link test, the controller switches to the ping link test automatically.

How to Configure Link Latency

Configuring Link Latency (CLI)

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device# enable`	Enters privileged EXEC mode.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ap link-latency** **Example:** `Device(config)# ap link-latency`	Enables link latency for all access points that are currently associated with the switch. **Note** To disable link latency for all the access points that are associated with the switch, use the **no ap link-latency** command. **Note** These commands enable or disable link latency only for access points that are currently joined to the switch. You have to enable or disable link latency for the access points that join in the future.

	Command or Action	Purpose
		Note To enable or disable link latency for specific access points that are associated with the switch, enter the following commands in Priveleged EXEC mode: • **ap name** *Cisco_AP* **link-latency**—Enables link latency. • **ap name** *Cisco_AP* **no link-latency**—Disables link latency.
Step 4	**ap tcp-adjust-mss size** *size* **Example:** `Device(config)# ap tcp-adjust-mss size 537`	Configures TCP MSS adjust size for all access points. The range is from 536 to 1363.
Step 5	**show ap name** *Cisco_AP* **config general** **Example:** `Device(config)# show ap name AP02 config general`	Displays the general configuration details of the access point. These configuration details contain the link latency results that correspond to the access point that you specify in the command. The output of this command contains the following link latency results: • Current Delay—The current round-trip time (in milliseconds) of CAPWAP heartbeat packets from the access point to the switch and back. • Maximum Delay—Since the time that link latency has been enabled or reset, the maximum round-trip time (in milliseconds) of CAPWAP heartbeat packets from the access point to the switch and back. • Minimum Delay—Since the time that link latency has been enabled or reset, the minimum round-trip time (in milliseconds) of CAPWAP heartbeat packets from the access point to the switch and back.
Step 6	**ap name** *Cisco_AP* **link-latency** [**reset**] **Example:** `Device(config)# ap name AP02 link-latency reset`	Clears the current, minimum, and maximum link latency statistics on the switch for a specific access point.

	Command or Action	Purpose
Step 7	**show ap name** *Cisco_AP* **config general** **Example:** `Device(config)# show ap name AP02 config general`	Displays the general configuration details of the access point. Use this command to see the result of the reset operation.

Configuring Link Latency (GUI)

Procedure

Step 1 Choose **Configuration** > **Wireless** > **Access Points** > **All APs**.

The **All APs** page appears with a list of access points.

Step 2 Click the name of the access point.

The **AP > Edit** page appears.

Step 3 Click the **Advanced** tab.

Step 4 In the **Link Latency** area, select or unselect the **Enable Link Latency** check box.

Note You can select the **Enable Link Latency** check box to enable link latency for this access point or unselect it to prevent the access point from sending the round-trip time to the switch after every echo response is received. The default state is unselected.

Step 5 Click **Apply**.

Step 6 When a message box appears that indicates that AP Parameters are modified successfully, click **OK**.

Step 7 When the **All APs** page is displayed, click the access point that you have modified earlier.

The **AP > Edit** page appears.

Step 8 Click the **Advanced** tab.

In the **Link Latency** area, the following link latency and data latency results are displayed:

- **Current(mSec)**—The current round-trip time (in milliseconds) of CAPWAP heartbeat packets or data packets from the access point to the switch and back.
- **Minimum(mSec)**—Since the time that link latency has been enabled or reset, the minimum round-trip time (in milliseconds) of CAPWAP heartbeat packets or data packets from the access point to the switch and back.
- **Maximum(mSec)**—Since the time that link latency has been enabled or reset, the maximum round-trip time (in milliseconds) of CAPWAP heartbeat packets or data packets from the access point to the switch and back.

Step 9 Click **Reset Link Latency** to clear the current, minimum, and maximum link latency and data latency statistics on the switch for this access point.

Note After the page refreshes and the **All APs** page is displayed again, click the **Advanced** tab. The updated statistics appear in the **Minimum** and **Maximum** text boxes.

How to Configure TCP MSS

Configuring TCP MSS (CLI)

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**ap tcp-adjust-mss size** *size_value* **Example:** `Device(config)# ap tcp-adjust-mss size 537`	Enables the TCP MSS on the particular access point that you specify. **Note** To enable TCP MSS on all the access points that are associated with the switch, enter the **ap tcp-adjust-mss size** *size_value* command, where the size parameter is from 536 to 1363 bytes. The default value varies for different clients.
Step 3	**reload** **Example:** `Device# reload`	Reboots the switch in order for your change to take effect.
Step 4	**show ap tcp-adjust-mss** **Example:** `Device# show ap tcp-adjust-mss`	Displays the current TCP MSS setting for all the access points that are associated with the switch. **Note** To display the TCP MSS settings that correspond to a specific access point, enter the **show ap name** *Cisco_AP* **tcp-adjust-mss** command.

Configuring TCP MSS (GUI)

Procedure

Step 1 Choose **Configuration** > **Wireless** > **Access Points** > **Global AP Configuration**.

The **Global Configuration** page is displayed.

Step 2 In the **TCP MSS** area, select the **Global TCP Adjust MSS** check box and set the MSS for all access points that are associated with the switch. The valid range is from 536 to 1363 bytes.

Step 3 Click **Apply**.

Step 4 Click **Save Configuration**.

Performing a Link Test (CLI)

Note The procedure to perform this task using the switch GUI is not currently available.

Procedure

	Command or Action	Purpose
Step 1	**test wireless linktest** *mac_address* **Example:** `Device# test wireless linktest 00:0d:88:c5:8a:d1`	Runs a link test.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**wireless linktest frame-size** *frame_size* **Example:** `Device(config)# wireless linktest frame-size 41`	Configures the link test frame size for each packet.
Step 4	**wireless linktest number-of-frames** *number_of_frames* **Example:** `Device(config)# wireless linktest number-of-frames 50`	Configures the number of frames to send for the link test.

	Command or Action	Purpose
Step 5	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.

Configuration Examples for Configuring Link Latency

Running a Link Test: Example

This example shows how to run a link test:

```
Device# test wireless linktest 00:0d:88:c5:8a:d1

When CCX v4 or later releases is enabled on both the controller and the client being tested,
 information similar to the following appears:
CCX Link Test to 00:0d:88:c5:8a:d1.
Link Test Packets Sent..................................... 20
Link Test Packets Received................................. 10
Link Test Packets Lost (Total/AP to Client/Client to AP).... 10/5/5
Link Test Packets round trip time (min/max/average)........ 5ms/20ms/15ms
RSSI at AP (min/max/average)............................... -60dBm/-50dBm/-55dBm
RSSI at Client (min/max/average)........................... -50dBm/-40dBm/-45dBm
SNR at AP (min/max/average)................................ 40dB/30dB/35dB
SNR at Client (min/max/average)............................ 40dB/30dB/35dB
Transmit Retries at AP (Total/Maximum)..................... 5/3
Transmit Retries at Client (Total/Maximum).................. 4/2
Transmit rate: 1M 2M 5.5M 6M 9M 11M 12M 18M 24M 36M 48M 54M 108M
Packet Count: 0 0 0 0 0 0 0 0 0 2 0 18 0
Transmit rate: 1M 2M 5.5M 6M 9M 11M 12M 18M 24M 36M 48M 54M 108M
Packet Count: 0 0 0 0 0 0 0 0 0 2 0 8 0

When CCX v4 or later releases is not enabled on either the controller or the client being
tested, fewer details appear:
Ping Link Test to 00:0d:88:c5:8a:d1.
Link Test Packets Sent..................... 20
Link Test Packets Received................. 20
Local Signal Strength...................... -49dBm
Local Signal to Noise Ratio................ 39dB
```

Displaying Link Latency Information: Example

This example shows how to display general configuration details of the access point. These configuration details contain the link latency results that correspond to the access point that you specify in the command.

```
Device# show ap name AP01 config general

Cisco AP Name                                  : AP01
Cisco AP Identifier                            : 55
Country Code                                   : US  - United States
Regulatory Domain Allowed by Country           : 802.11bg:-A     802.11a:-A
AP Country Code                                : US  - United States
AP Regulatory Domain                           : Unconfigured
Switch Port Number                             : Te1/0/1
MAC Address                                    : 0000.2000.03f0
IP Address Configuration                       : Static IP assigned
```

```
IP Address                                      : 9.9.9.16
IP Netmask                                      : 255.255.0.0
Gateway IP Address                              : 9.9.9.2
Fallback IP Address Being Used                  : 9.9.9.16
Domain                                          : Cisco
Name Server                                     : 0.0.0.0
CAPWAP Path MTU                                 : 1485
Telnet State                                    : Enabled
SSH State                                       : Disabled
Cisco AP Location                               : default-location
Cisco AP Group Name                             : default-group
Primary Cisco Controller Name                   : CAPWAP Controller
Primary Cisco Controller IP Address             : 9.9.9.2
Secondary Cisco Controller Name                 :
Secondary Cisco Controller IP Address           : Not Configured
Tertiary Cisco Controller Name                  :
Tertiary Cisco Controller IP Address            : Not Configured
Administrative State                            : Enabled
Operation State                                 : Registered
AP Mode                                         : Local
AP Submode                                      : Not Configured
Remote AP Debug                                 : Disabled
Logging Trap Severity Level                     : informational
Software Version                                : 7.4.0.5
Boot Version                                    : 7.4.0.5
Stats Reporting Period                          : 180
LED State                                       : Enabled
PoE Pre-Standard Switch                         : Disabled
PoE Power Injector MAC Address                  : Disabled
Power Type/Mode                                 : Power Injector/Normal Mode
Number of Slots                                 : 2
AP Model                                        : 3502E
AP Image                                        : C3500-K9W8-M
IOS Version                                     :
Reset Button                                    :
AP Serial Number                                : SIM1140K002
AP Certificate Type                             : Manufacture Installed
Management Frame Protection Validation          : Disabled
AP User Mode                                    : Customized
AP User Name                                    : Not Configured
AP 802.1X User Mode                             : Not Configured
AP 802.1X User Name                             : Not Configured
Cisco AP System Logging Host                    : 255.255.255.255
AP Up Time                                      : 16 days 3 hours 14 minutes 1 s
econd
AP CAPWAP Up Time                               : 33 minutes 15 seconds
Join Date and Time                              : 01/02/2013 22:41:47
Join Taken Time                                 : 16 days 2 hours 40 minutes 45
seconds
Join Priority                                   : 1
Ethernet Port Duplex                            : Auto
Ethernet Port Speed                             : Auto
AP Link Latency                                 : Enabled
Current Delay                                   : 0
Maximum Delay                                   : 0
Minimum Delay                                   : 0
Last Updated (based on AP up time)              : 0 seconds
Rogue Detection                                 : Disabled
AP TCP MSS Adjust                               : Disabled
AP TCP MSS Size                                 : 536
```

Displaying TCP MSS Settings: Example

This example shows how to display the current TCP MSS setting for all the access points that are associated with the switch:

```
Device# show ap tcp-adjust-mss

AP Name                    TCP State        MSS Size
-----------------------------------------------------
AP01                       Disabled         6146
AP02                       Disabled         536
AP03                       Disabled         6146
AP04                       Disabled         6146
AP05                       Disabled         6146
```