CMX FastLocate Deployment Guide MSE Release 8.0

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CMX FastLocate Overview

Current WiFi Location technology rely purely on mobile devices sending RSSI/Location information, based on pure probe request messaging, to the Access Points (AP). The information is sent on most channels and received by neighbor APs on different channels, which is good for location estimation.

Device probing frequency is reducing; updates vary from 10 seconds to 5 minutes depending on client, OS, driver, battery, current, and client activity. This results in inadequate data points to represent real-world movement.

With FastLocate, we add the capability to get RSSI/Location information using data packets received by the AP for higher location refresh rates. Using data packet, Location Based Services (LBS) updates are initiated by the network and are available more frequently. This provides more data points to accurately represent end user activity. While it is tempting to think of capturing RSSI from data packets as an incremental improvement over capturing RSSI from probe frames, it is actually a significant step forward. When WiFi mobile devices connect to the AP, neighboring APs are unable to hear the data packets because they are on different channel. This is bad for location estimation. FastLocate technology uses Cisco's modular APs, 3600 and 3700, with Wireless Security Module (WSM). WSM in the associated AP and the neighboring APs scan channels at the same time to get multiple RSSI readings from a data packet transmission and thus locate the mobile device. This can occur without taxing the data serving radios and no performance hit to the data service on the serving radios in 2.4-GHz and 5-GHz band.

Relying on data packets makes the location more consistent across devices. This also works with iOS8 implementations, where a device may randomize their MAC address in probe frames.

Figure 1: The Real impact: More Granular LBS data for business critical information
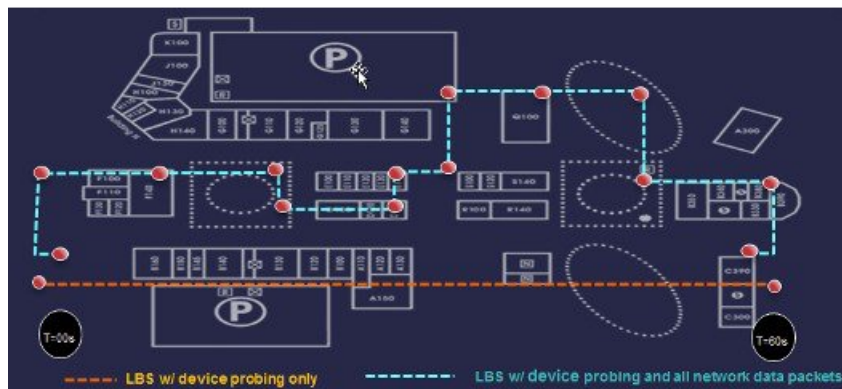
How does it work?

The key characteristics of FastLocate are as follows:

- Get location from all the packets coming from (associated/unassociated) client.

- Try to get the associated clients to send packets regularly, so that you can estimate their location frequently and periodically.

- The WSM modules repeatedly scan different channels by cycling the list of RRM channels to receive the data based RSSI of the client device. The dwell time per channel is 250 msec. The scan cycle time is 250 ms × number of RRM channels on WLC (max. 24). The total time taken to scan is 6 seconds.

- After testing, it is observed that the location refresh rate is between 6 and 15 seconds.

- Location refresh rate is client dependent, and hence it may be missed by the WSM module during its scan cycle.

Requirements and Supported Deployments

- Requires all APs to be 3600 / 3700 with Wireless Security Modules (WSM).

  Note The Wireless Security Module was previously called the Wireless Security and Spectrum Intelligence module.

- FastLocate in Release 8.0 is only supported on 20 MHz BW. FastLocate with Channel bonding (40 and 80 MHz) will be supported in WLC release version 8.1.

- No mixed mode support in FastLocate 8.0 (ALL APs in same zone/floor must be modular with WSM module present).

- POE+/Enhanced POE switching for WSM modules.

- WLC 8.0 and WLC 8.1 for 40 and 80 MHz support.

- MSE 8.0.

- PI 2.1.1 (PI 2.2 if using AP 3700).

- Requires valid NTP clock source.

- Security monitoring can be done simultaneously with FastLocate.

  Note MSE treats packet RSSI values the same as probe packet RSSI values.

- FastLocate is supported in Central switch mode.

- FlexConnect Local Switched mode is NOT supported in this release.

- An MSE can support both probe based and FastLocate based RSSI packets.

  Note You can have one floor in a building doing only probe based RSSI (APs without WSM) and another floor doing only FastLocate (APs with WSM module); both floors can be synced to the same MSE.

- Healthcare installations that use tags are not associated to WLC/AP, and will not see location refresh rate improvements from FastLocate. In 8.0 release, this could be data or probe frame RSSI.

- IOS-XE does not support modules (WSM/802.11ac) with AP 3600/3700, and hence FastLocate is not supported with IOS-XE currently.

MSE 8.0 Scaling

When FastLocate is enabled, each FastLocate client device consumes an equivalent of ~5 x the compute requirement then a Probe based client.

Sample configurations:

- Maximum number of devices on a standard MSE supporting probe based location only is 25000 devices. The same standard MSE supporting only FastLocate devices tracks only 5000 devices.

- A venue has a standard MSE with 10K devices, 8K are not associated (probing), and 2K are associated. With FastLocate enabled, the MSE utilization is (8K+(2K*5)=18K devices, well below 25K limit.

- A venue has a standard MSE with 10K devices, 5K are not associated (probing), and 5K are associated. With FastLocate enabled, the MSE utilization is (5K+ (5K*5)=30K devices, and hence this MSE is oversubscribed. A new standard or high end MSE needs to be added to meet capacity.

Verifying WSM Module Operation

Procedure

**Step 1**   Insert WSM in AP and attached to POE+ Switch ports.

Step 2   Use the "show power inline" command to verify whether all APs are operational on the switch port utilizing POE + ~20 W per port.

```
3560-X#sh power inline
Available:847.0(w)  Used:338.4(w)  Remaining:508.6(w)

Interface Admin  Oper      Power    Device                  Class Max
                           (Watts)
--------- -----  ----      -------  -------------------     ----- ----
Gi0/1     auto   on        19.0     AIR-CAP3602I-A-K9       4     60.0
Gi0/2     auto   on        19.0     AIR-CAP3602I-A-K9       4     60.0
Gi0/3     auto   on        19.0     AIR-CAP3602I-A-K9       4     60.0
Gi0/4     auto   on        19.0     AIR-CAP3602I-A-K9       4     60.0
Gi0/5     auto   on        19.0     AIR-CAP3602I-A-K9       4     60.0
Gi0/6     auto   on        19.0     AIR-CAP3602I-A-K9       4     60.0
Gi0/7     auto   on        19.0     AIR-CAP3602I-A-K9       4     60.0
```

Refer the installation guide for WSM: http://www.cisco.com/c/en/us/support/docs/wireless/aironet-3600-series/115612-Aironet-Access-Point-Module-for-WSSI-Guide-00.html

Step 3   From the WLC GUI main menu, choose **Wireless > Access Points > Radios > Dual-Band Radios**, and verify that the WSM module is operational. The Admin Status is "Enable" and the Operational Status is "UP".
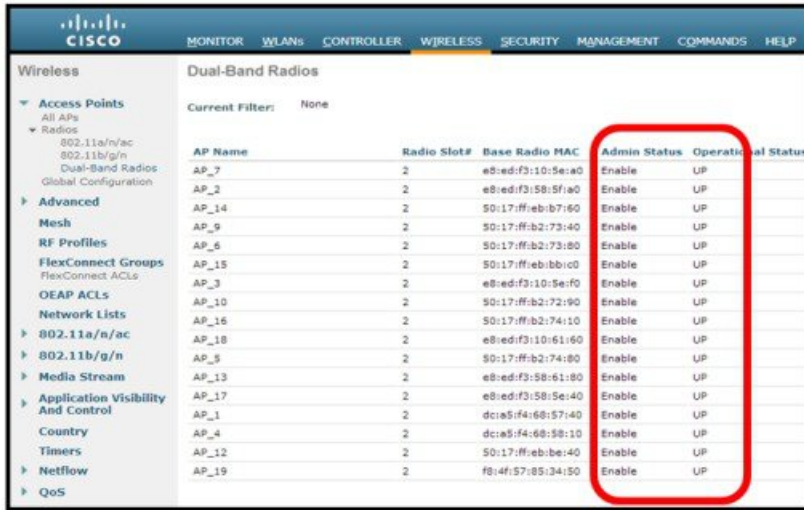
Once the above steps are completed, you can enable the FastLocate feature from the WLC or Prime Infrastructure.

Enabling FastLocate Feature on MSE

To enable the FastLocate feature on MSE:

1. Enter the provided MSE CLI - CMD shell commands in root mode.

2. Enable FastLocate from WLC GUI, CLI, or PI.

Enabling FastLocate Using MSE CLI commands

To increase or tune the location accuracy with FastLocate enabled, enable the following commands from MSE console.

Procedure

Step 1	Login to MSE console as a root user.
Step 2	Type the following command to invoke cmdshell.
	`cmdshell`
Step 3	Type the following command for "Do not limit the RSSI numbers".
	cmd>`config max-per-node-rssi-entries 16`
Step 4	Type the following command for "Use the new aggregation algorithm".
	cmd>`config use-new-location-algorithm enable`
Step 5	Type the following command for exiting cmdshell.

```
cmd>exit
```

```
[root@mse ~]# cmdshell

[cmd> config max-per-node-rssi-entries 16
invoke command: com.aes.server.cli.CmdSetServerConfigParameter
AesLog queue high mark: 50000
AesLog queue low mark: 500
Parameter max-per-node-rssi-entries was successfully modified

cmd> config use-new-location-algorithm enable
invoke command: com.aes.server.cli.CmdSetServerConfigParameter
Parameter use-new-location-algorithm was successfully modified

[cmd> exit
```

Enabling FastLocate Through WLC GUI

Procedure

Step 1   Go to **Wireless > Access Points > Global Configuration**.

Step 2   Enable the **Packet RSSI Location Config Parameters** feature:

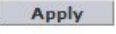   a) Enter the valid NTP server IP address.

        This IP address is used by all APs for time synchronization.

    b) Check the **Enable Packet RSSI Location** check box.

    c) Adjust the **Packet Detection RSSI minimum (dBm)** if required.

        Adjust this value to filter out weak RSSI readings from location calculation. Consider only strong RSSI value for FastLocate location calculation.

    d) Leave **Scan Count Threshold for Idle Client Detection** at default value.

    e) Click the **Apply** button at top right corner of the page to enable the service.
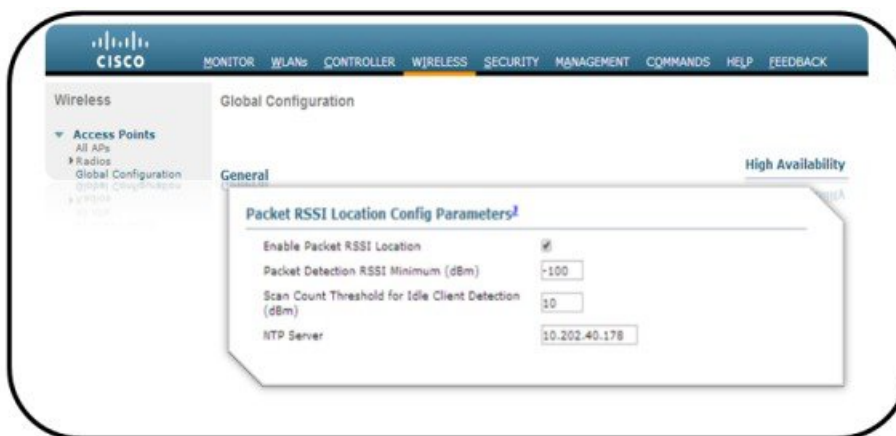
Enabling FastLocate Service Through WLC CLI

To enable the FastLocate Service through WLC CLI:

Procedure

Step 1   Type the following commands at the WLC CLI:

```
(Cisco Controller) >config advanced 802.11-abgn pak-rssi-location ?

enable          enable pak-rssi-location on all APs.

disable         disable pak-rssi-location on all APs.

threshold       PRL threshold in dbm valid range -50 to -100.

trigger-threshold PRL trigger threshold in dbm valid range 1 to 100.

reset-threshold PRL reset threshold in dbm valid range 0 to (trigger-threshold-1).

ntp             PRL NTP Server IP address.
```

Step 2   To verify that the FastLocate service is enabled via the GUI, type the following command at the WLC CLI:

```
(Cisco Controller) >show advanced 802.11-abgn pak-rssi-location

  Packet RSSI Location Mode....................... Enabled
  Threshold....................................... -100
  Trigger Threshold............................... 10
  Reset Threshold................................. 8
  NTP Server...................................... 10.202.40.178

(Cisco Controller) >
```
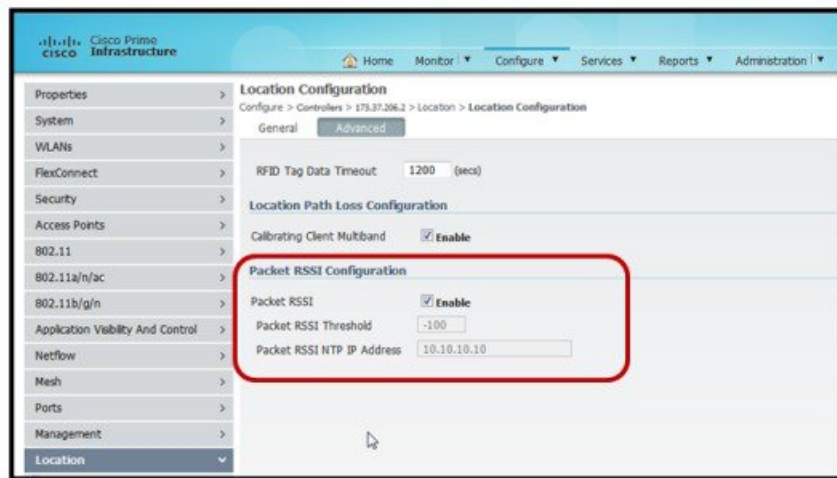
Enabling FastLocate service Through Prime Infrastructure

Procedure

Step 1   Go to **Configure > Controllers > *WLC_IP_Address* > Location > Location Configuration**.

Step 2   Click the **Advanced** tab.

Step 3   Provide the NTP server information and check the **Enable** check box.

Step 4   Click **Save**.

Note To enable the FastLocate feature on several WLCs, you can create a Location Controller template and apply it to all the WLCs in your network.

Verifying and Troubleshooting FastLocate Operation

Verifying FastLocate Service Through WLC GUI

To verify that the FastLocate service is utilized, type the following debug command at the WLC CLI:

```
Debug client <mac-addr>
```

The client MAC address that you want to debug. This is recommended as console will be flooded if no client MAC filter is set.

```
Debug dot11 probe error enable/disable
```

```
Debug disable-all
```

This command disables all debugging.

Note You may need to input the commands several times as the WLC console is pretty busy with data output, when above debugs are enabled.

The output should look as follows:

```
apfProbeThread: Jun 27 10:38:13.456: b4:b6:76:a0:1f:5e probing client, ver=1, slot=2, wlan=0, snr=0, tx_pwr=0,
chan=36, reg_class=0, ts_diff=195ms, seq_num=0, ant_cnt=2, rssi[0]=189, rssi[1]=128 ,subType = 2
```

- **b4:b6:76:a0:1f:5e**—MAC address that is being debugged.
- **Slot=2**—Using the WSM module.
- **SubType=2**—Utilizing FastLocate RSSI; SubTypye=1—Utilizing Pobe RSSI.

Verifying FastLocate Service Through Prime Infrastructure (PI) and MSE

To verify that LBS is utilizing FastLocate service through Prime Infrastructure (PI) and MSE:

1. Log into PI and go to the MSE running the Context Aware Service (CAS).

2. Click the **Logs** tab.

3. Under **Logging Options**, check the following check boxes:

    • **General**

    • **MSE/Location Servers**

    • **NMSP Protocol**

4. Under **Advance Parameters**, check the **Advanced Debug** check box.

5. Under **MAC Address Based Logging Parameters**, do the following:

    a. Check the **MAC Address Logging** check box.

    b. Add the MAC addresses of the devices for which you want to capture the logs (maximum 5).
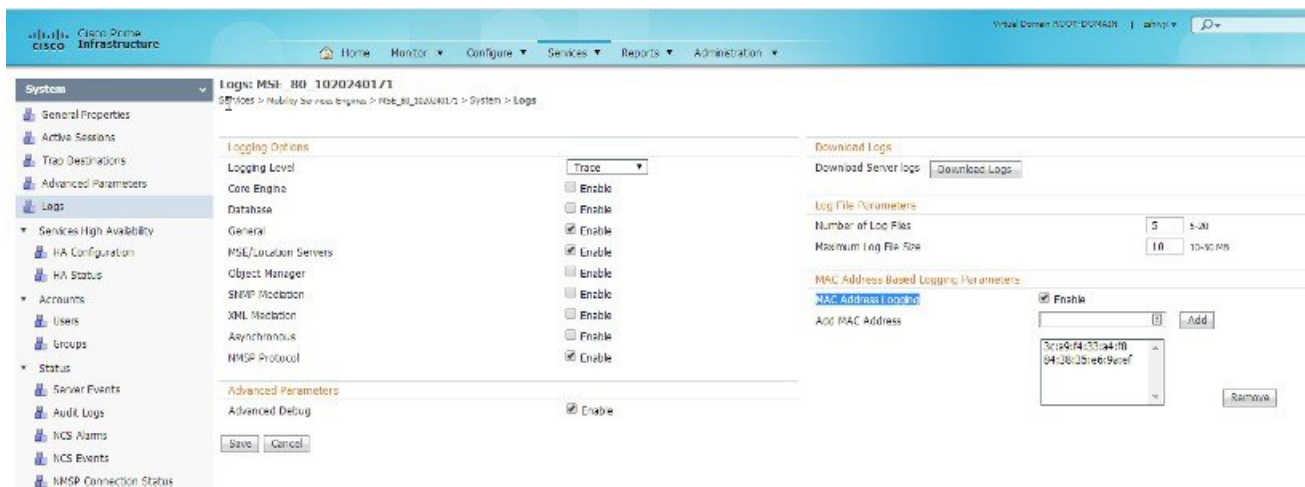
Once the MAC Address logging is enabled, you will find all the entered MAC address debug files in the MSE, under **/opt/mse/logs/locserver**.

You can download these files and verify that the client device is utilizing FastLocate for LBS.

Following is a sample output from the file.

```
Measurement notification@1744422740
Measurement notification.State = null
Measurement notification.MacAddress = 84:38:35:e6:9a:ef
Measurement notification.RssiSource@1731390584
Measurement notification.RssiSource.RssiSource = PKT
Measurement notification.DeviceCategory@794394593
Measurement notification.DeviceCategory.BlockSize = 0
Measurement notification.DeviceCategory.DeviceClass = STATIONS
Measurement notification.ApRssiMeasurements@147675452
Measurement notification.ApRssiMeasurements.Entries@1637709479
Measurement notification.ApRssiMeasurements.Entries.0@685309954
Measurement notification.ApRssiMeasurements.Entries.0.Timestamp = 269
Measurement notification.ApRssiMeasurements.Entries.0.IfSlotId = 2
Measurement notification.ApRssiMeasurements.Entries.0.RssiSource = 6
Measurement notification.ApRssiMeasurements.Entries.0.BandId = 0
Measurement notification.ApRssiMeasurements.Entries.0.Rssi = -56
Measurement notification.ApRssiMeasurements.Entries.0.ApMacAddress = 50:17:ff:eb:b7:60
Measurement notification.ApRssiMeasurements.Entries.0.AntennaId = 0
Measurement notification.ApRssiMeasurements.Entries.1@1740649232
Measurement notification.ApRssiMeasurements.Entries.1.Timestamp = 1066
Measurement notification.ApRssiMeasurements.Entries.1.IfSlotId = 2
Measurement notification.ApRssiMeasurements.Entries.1.RssiSource = 6
Measurement notification.ApRssiMeasurements.Entries.1.BandId = 0
Measurement notification.ApRssiMeasurements.Entries.1.Rssi = -57
Measurement notification.ApRssiMeasurements.Entries.1.ApMacAddress = e8:ed:f3:58:61:80
Measurement notification.ApRssiMeasurements.Entries.1.AntennaId = 0
Measurement notification.ApRssiMeasurements.Entries.2@1955028365
Measurement notification.ApRssiMeasurements.Entries.2.Timestamp = 247
Measurement notification.ApRssiMeasurements.Entries.2.IfSlotId = 2
Measurement notification.ApRssiMeasurements.Entries.2.RssiSource = 6
Measurement notification.ApRssiMeasurements.Entries.2.BandId = 0
Measurement notification.ApRssiMeasurements.Entries.2.Rssi = -41
```

IfSlotId = 2 → WSM module being used.

RssiSource = 6 → Data RSSI PKT being used.

Additional Optional Changes to Reduce Total System Latency

Note These changes should be tested in a POC, non-production environment as it could impact MSE scalability.

From MSE CLI

Procedure

Step 1 Type the following command in the cmdshell:

cmd>**config use-new-location-algorithm enable**

Step 2 Type the following command for "Reduce aggregation time":

cmd>**config nmsp-rssi-aggregation-window-milli-seconds 1000 (default 4000)**

Step 3 Type the following command for exiting cmdshell:

cmd>**exit**

From WLC CLI

Procedure

Step 1   Telnet to the controller.

Step 2   Change the aggregation time using the following command:

```
(Cisco Controller)>config nmsp notification interval rssi clients 1
```

Step 3   Save the setting using the following command:

```
(Cisco Controller)>save config
```

Step 4   Type the following command to exit:

```
(Cisco Controller)>logout
```

From WLC GUI

Procedure

Step 1   Scan fewer channels where possible under:
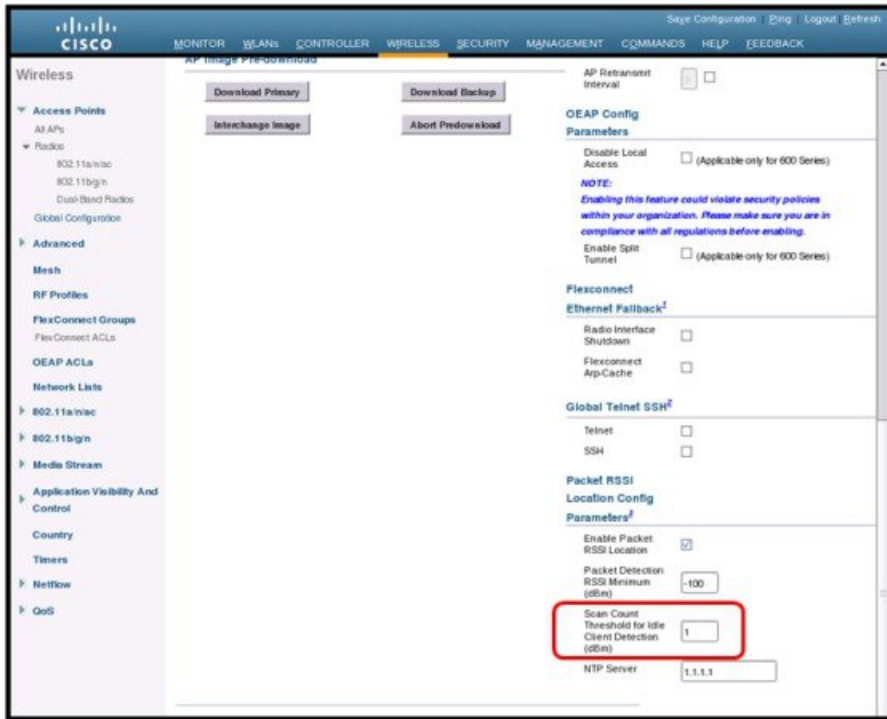
RRM > Dynamic Channel Assignment (DCA)

Step 2   Reduce the scan count threshold to 0 or 1 from WLC GUI.

Step 3   Click the **WIRELESS** tab and then click the **Global Configuration** from the left hand menu.

**Step 4**   Change **Scan Count Threshold for Idle Client Detection** to 1.

Step 5   Click the **APPLY** button to save the settings.

Changing the RSSI Threshold to 0

Procedure

Step 1   Go to **Services > Mobility Services > Mobility Services Engines**.
The **Mobility Services Engines** page appears.

Step 2   Click the MSE name in the list to open the required MSE page.

Step 3   In the left pane, navigate to **Context Aware Service > Advanced > Location Parameters**.

Step 4   In the **Movement Detection** area, change **Individual RSSI change threshold** and **Aggregate RSSI change threshold** to 0.

Step 5   Click **Save**.
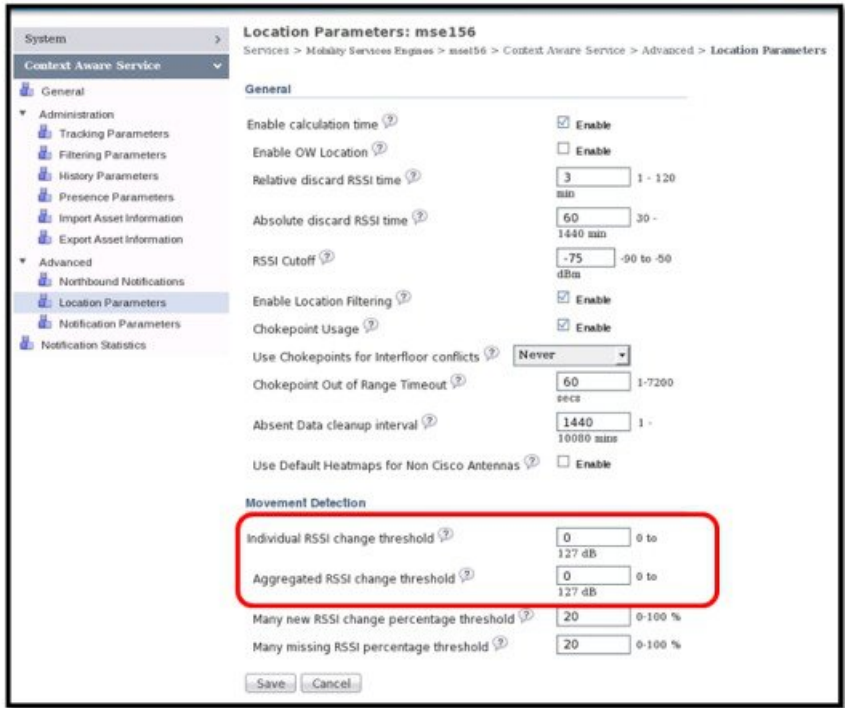
Conclusion

In release 8.0, CMX FastLocate technology uses the MSE, WLAN controllers, and modular Cisco access points (AP 3600 and AP 3700 with Wireless Security Module (WSM)) to build a foundation for collecting more data points for a granular location data set. Enterprises can use Connected Mobile Experiences (CMX) Analytics to translate location data into business metrics displayed on charts. They can offer location based guest access with CMX Connect or meaningfully engage the users by capturing context from the location data.