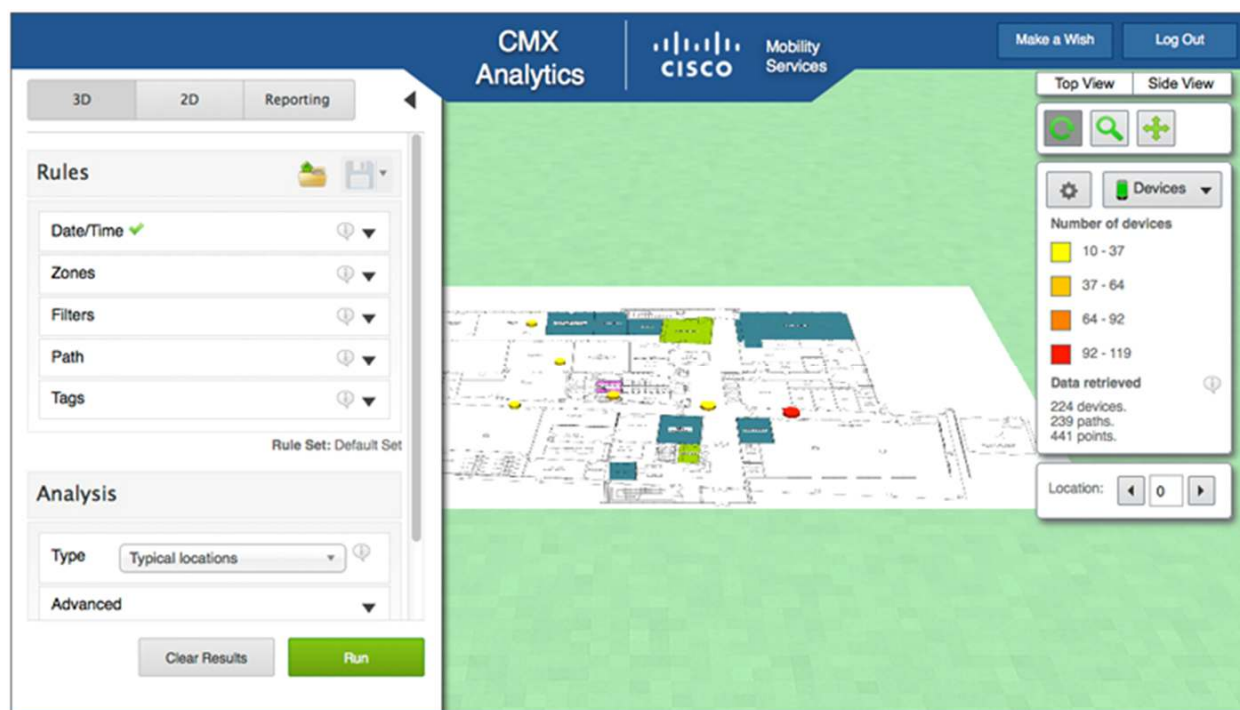# Cisco Connected Mobile Experiences Location Analytics: Deployment Guide for Cisco Mobility Services Engine 7.5

Cisco Connected Mobile Experiences Overview

Cisco[®] Connected Mobile Experiences (CMX) Location Analytics uses the data provided by Cisco MSE to calculate the location of wireless devices that are detected by the access points that support the wireless LAN (WLAN). This information provides visibility into customer movements and behavior throughout the building and throughout the day. Cisco CMX Location Analytics determines device parameters such as dwell time (how long people stay in a specific point), crowding (popular points at which people stay a long time), and path choice (for example, do people usually turn left or right when coming out of an elevator) and aggregates this information for common understanding. Businesses can use this information to better understand how their customers interact with different parts of their buildings or environments.

The Cisco CMX Location Analytics piece of the CMX solution provides venue owners with these benefits:

- Analyze business performance by measuring in-venue actions and improve marketing.
- Document customer movements throughout the venue.
- Increase customer satisfaction through sufficient staffing during peak times.

Cisco CMX Location Analytics helps businesses achieve better facility planning, measure changes in their buildings and improve their interaction with customers.

Cisco CMX Location Analytics provides real-time location details alongside historical trends, enabling greater visibility into customer movements and patterns through data trending. IT can use analytics to identify network utilization, peak use, and the number and types of devices on the network. Lines of business can better understand the ways that customers behave while onsite by tracking Wi-Fi signals in their venues, documenting customer movements throughout facilities, and using this comprehensive, context-aware data to engage with customers more effectively.

The basic data is in the form of MAC addresses, time, coordinates, etc. CMX Location Analytics helps aggregate and visualize this data to help generate insights about the movement and behavior patterns of the people using mobile devices in that building. A "building" can be a shop, mall, airport, or city center, provided that it has a network of wireless access points so that devices moving within that space can be located.

A complete analysis consists of six processes:

- Data cleaning
- Data tagging
- Data filtering
- Data clustering
- Parameter estimation
- Behavior mining

Figure 1 shows a Cisco CMX system.

Figure 1. Cisco CMX System
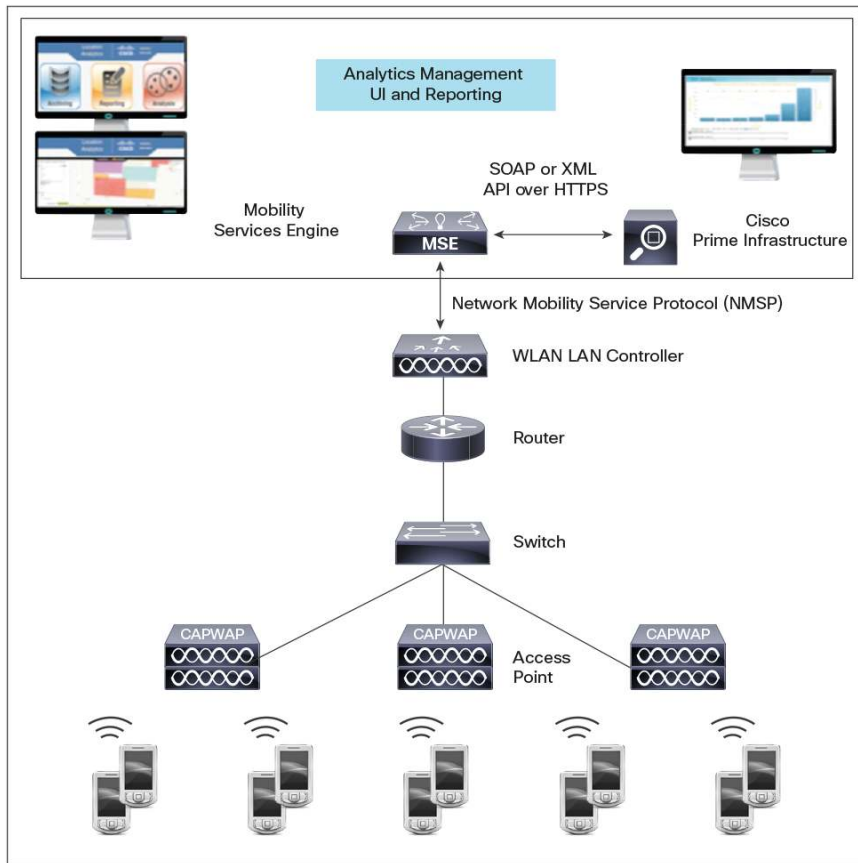
Three Network Deployment Architectures

Figure 2 shows three network deployment architectures.

Figure 2. Three Network Deployment Architectures
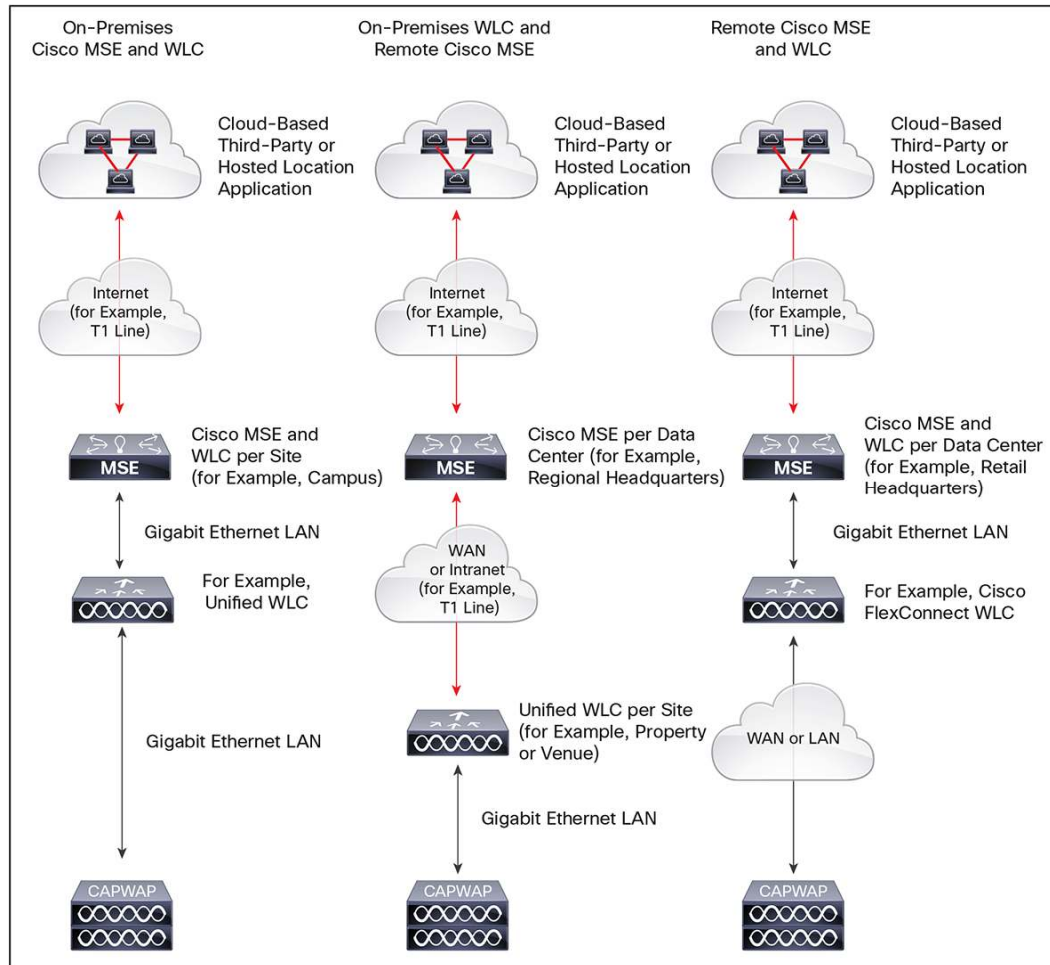
Figure 3 shows the services available in Cisco CMX.

Figure 3. Cisco CMX Services

Admin Status	Name	Version	Service Status	License Type
☑	Context Aware Service	7.5.1.48	Up	Evaluation (358 days left)
☐	WIPS	1.2.6113.0	Down	Evaluation (120 days left)
☐	Mobile Concierge Service	3.0.0.29	Down	Evaluation (120 days left)
☑	CMX Analytics	2.0.0.57	Up	Evaluation (113 days left)
☐	CMX Browser Engage	1.0.0.2	Down	Permanent
☐	HTTP Proxy Service	1.0.0.1	Down	Permanent

- **Context Aware Service (also called Base Location Service):** Calculates the X,Y location coordinates of devices based on antenna patterns and received signal strength indication (RSSI) and enables the Cisco MSE API
- **WIPS:** Provides a wireless intrusion prevention system (WIPS) for wireless-specific network threat detection and mitigation against rogue applications, malicious attacks, and security vulnerabilities
- **CMX Device Engage (also called Mobile Concierge Service):** Enables connectivity with end devices that support Cisco Mobility Services Advertisement Protocol (MSAP)
- **CMX Analytics:** Provides summary information about the movement of devices within the venue
- **CMX Browser Engage:** Enables creation, management, and transmission of content to visitors' web browsers
- **HTTP Proxy Service:** Provisions the HTTP proxy server for the CMX Browser Engage service

These services may be referred to slightly differently in different documentation. Table 1 lists the various names of the processes.

Table 1. Cisco CMX Service Name Variations

Technical or Traditional Name	Cisco CMX Marketing Name	User Interface Name
Context-Aware Service (CAS)	Base Location Service	Base Location (Context Aware Service)
wIPS	wIPS	WIPS
Mobile Concierge Service (MSAP)	CMX Device Engage	CMX Device Engage
Analytics	CMX Location Analytics	CMX Location Analytics
Guest Portal	CMX Connect	CMX Connect requires that the CMX Browser Engage box be selected
Billboard (BBX)	CMX Browser Engage	CMX Browser Engage
BBX Proxy	None	CMX Browser Engage HTTP Proxy Service

Configuring Cisco MSE for Cisco CMX Location Analytics

Cisco CMX Location Analytics uses all input from Cisco MSE. It is installed as part of the Cisco MSE installation, but it needs to be explicitly enabled, by selecting Locational Analytics in the list of enabled services in Cisco Prime™ Infrastructure. If the user wants to use only data from specific parts of a network, then the user needs to edit the mse.properties file (opt/mse/analytics/intellify/tools/MSEclient/mse.properties) to select the network, building, and floor to be analyzed. If the default configuration is used, then the entire network is available for analysis.

Tip: If you have a very large venue and want to reduce CPU load, you can specify fewer areas for analysis by editing the mse.properties file.

Cisco CMX Location Analytics requires both floor plans and coverage areas inserted through Cisco Prime Infrastructure for the visualization and reporting functions to work. For each floor plan, you also need floor numbers. Floors on the same level should have the same number; higher-level floors should have higher numbers. The coverage areas correspond to the zones for which the user wants reports. Therefore, if you want to know what is happening in location A, then you should create an area delineating that location in Cisco Prime Infrastructure and name it as such. Zones, and hence areas, can overlap.

Tip: Plan your zones in advance. Make sure that you have enough zones to identify areas of interest, but do not make your zones too small or they will not contain sufficient data for useful analysis.

Steps for Using Cisco CMX Location Analytics

To use Cisco CMX Location Analytics, you need to do the following:

- Install Cisco Prime Infrastructure with floor maps.

- Create coverage areas and zones.

- Add GPS markers using Cisco Prime Infrastructure.

- Enable Context Aware and Location Analytics Services.

- Set history parameters.

- Check your browser for 3 support.

Install Cisco Prime Infrastructure with Floor Maps

Location analytics requires both floor plans and coverage areas to be defined in the Cisco Infrastructure user interface for location analytics visualization and reporting to function. You need to provide floor numbers for each floor plan. Floors on the same level should have the same number, and floors that are higher should have a higher number. The coverage areas correspond to the zones for which you want reports. If you want to know the details of location A, then you should create an area defining that location in Cisco Prime Infrastructure.

Step 1. Install Cisco Prime Infrastructure with floor maps (Figure 4).

Figure 4. Installing Cisco Prime Infrastructure with Floor Maps
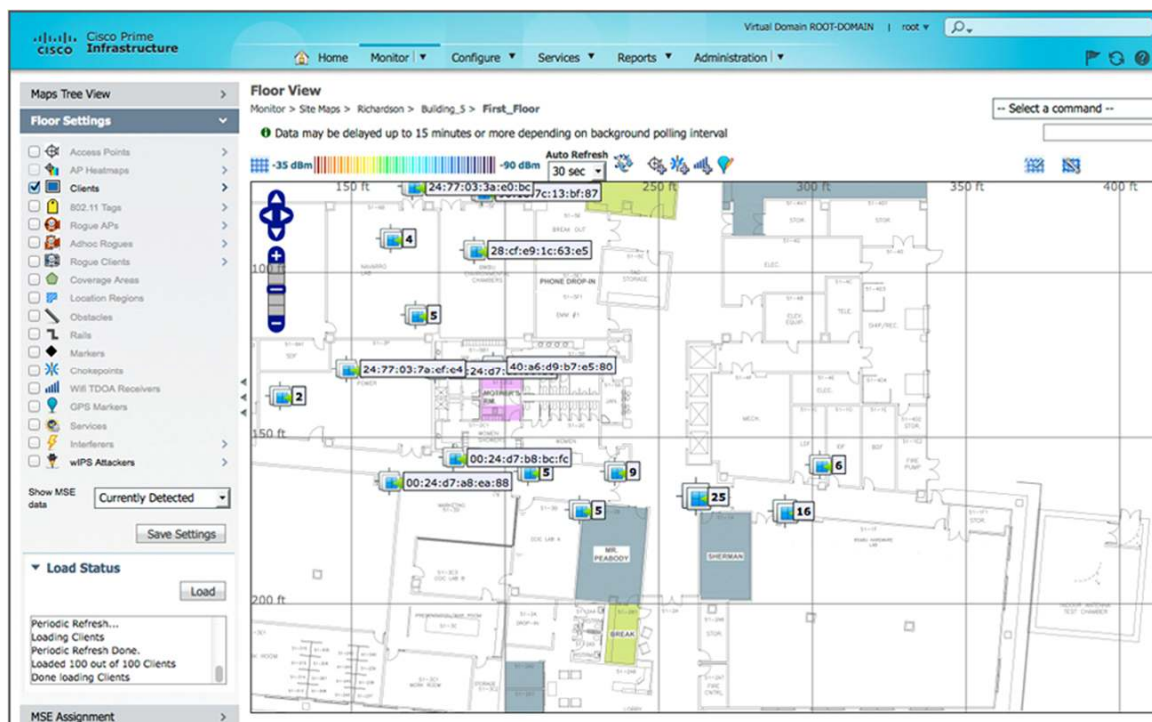
Create Coverage Areas and Zones

Coverage zones provide a means of creating more detailed reports when using Cisco CMX Location Analytics and can be used in defining push notifications

Step 1. Choose Monitor > Site Maps (Figure 5).

Figure 5. Choosing Site Maps
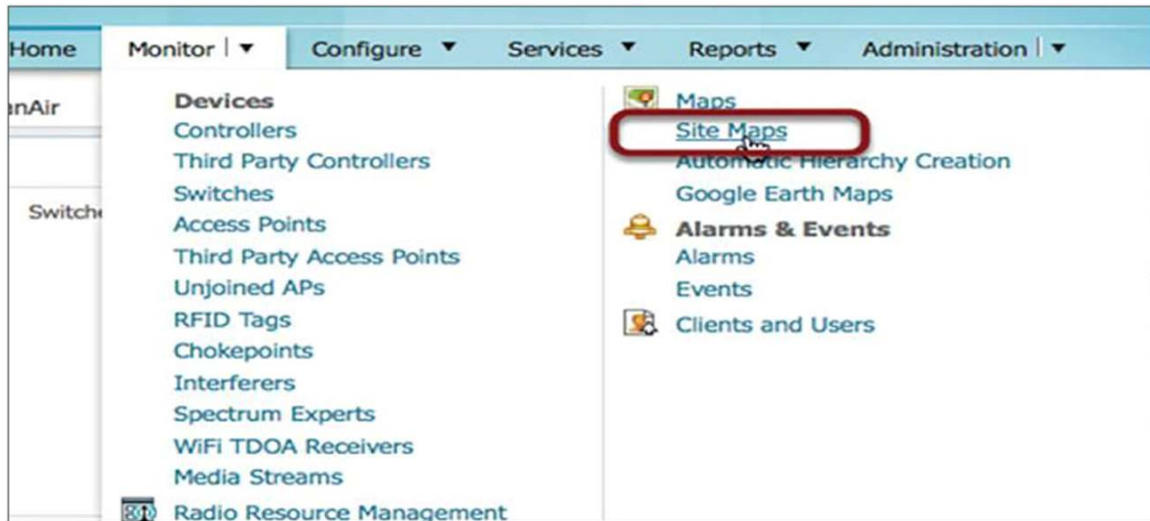
Step 2. Click the floor on which you want to draw the zone and coverage area (Figure 6).

Figure 6. Selecting the Floor
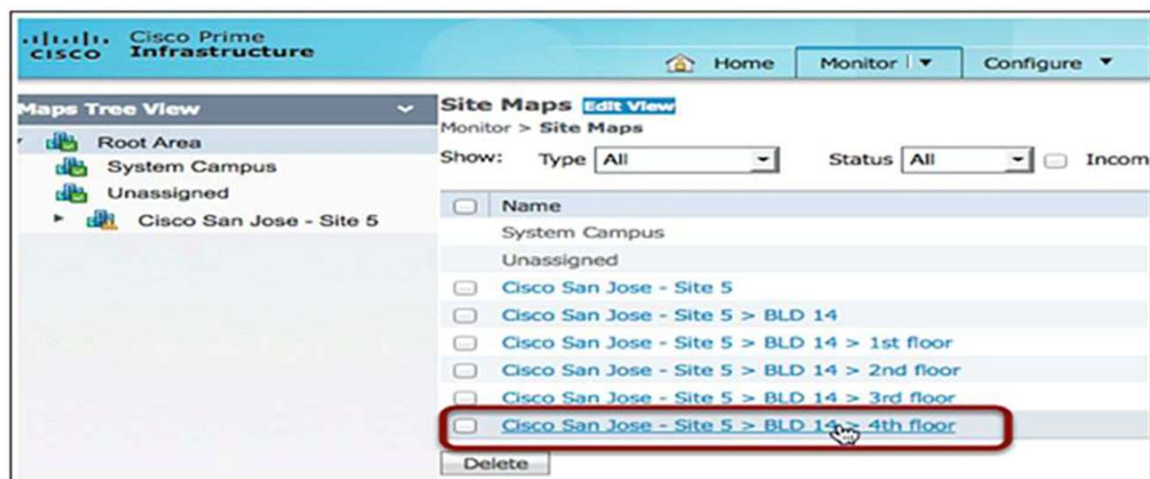
Step 3. Click Map Editor in the Floor View toolbar (Figure 7).

Figure 7. Selecting Map Editor
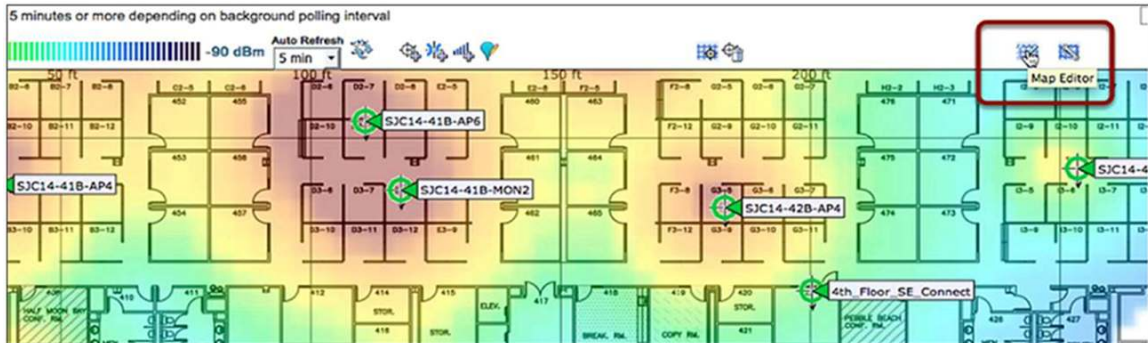
Step 4. After the Map Editor loads, select Coverage Areas under Floor Settings at the left to enable coverage areas (Figure 8).

Figure 8. Selecting Coverage Areas
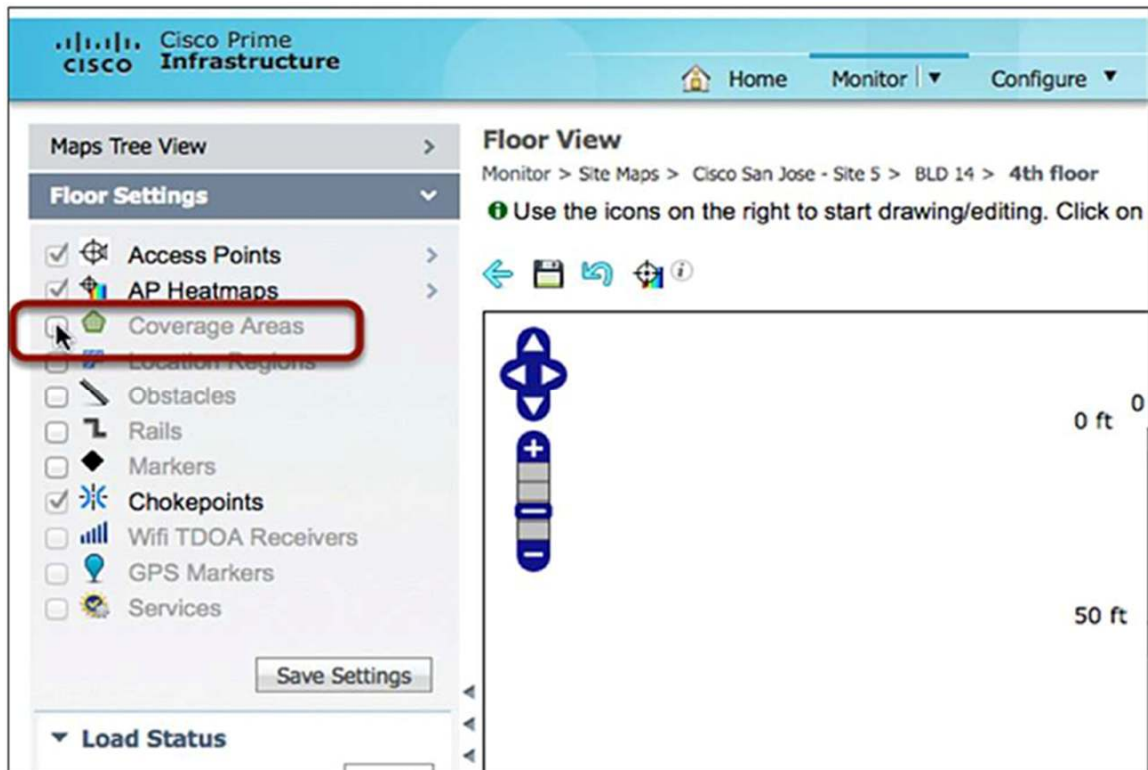
Step 5. Click the Draw Coverage Area icon in the Map Editor toolbar (Figure 9).

Figure 9. Selecting Draw Coverage Area
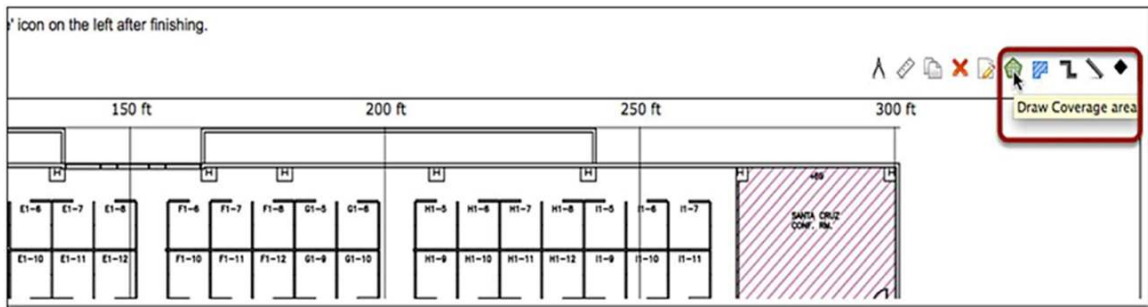
Step 6. Type a name for the coverage area (Figure 10).

Figure 10. Naming the Coverage Area
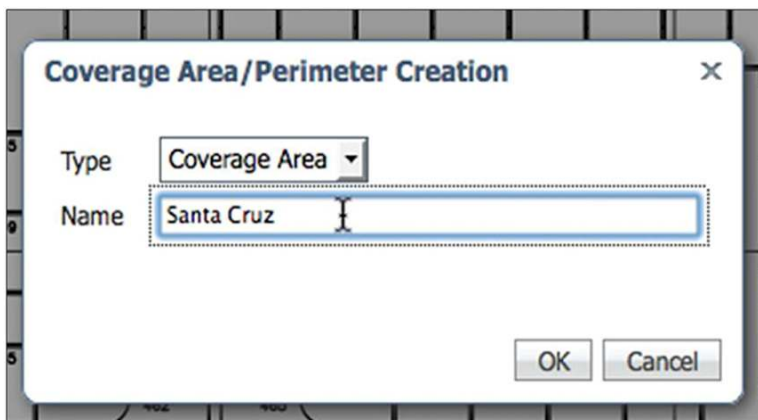
Step 7. After you enter a name, click OK (Figure 11).

Figure 11. Clicking OK to Name the Coverage Area
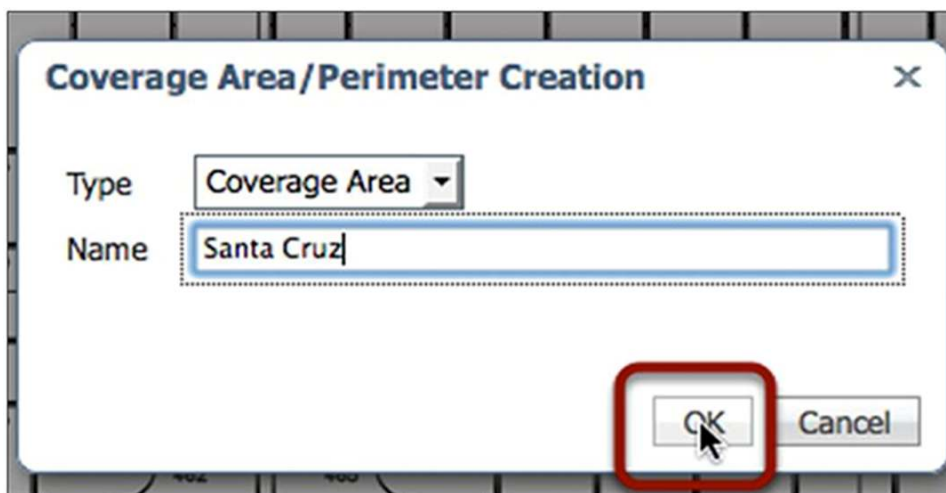
Step 8. Start drawing the coverage area by clicking a point at the corner of a coverage area (Figure 12).

Figure 12. Clicking the First Point in the Coverage Area
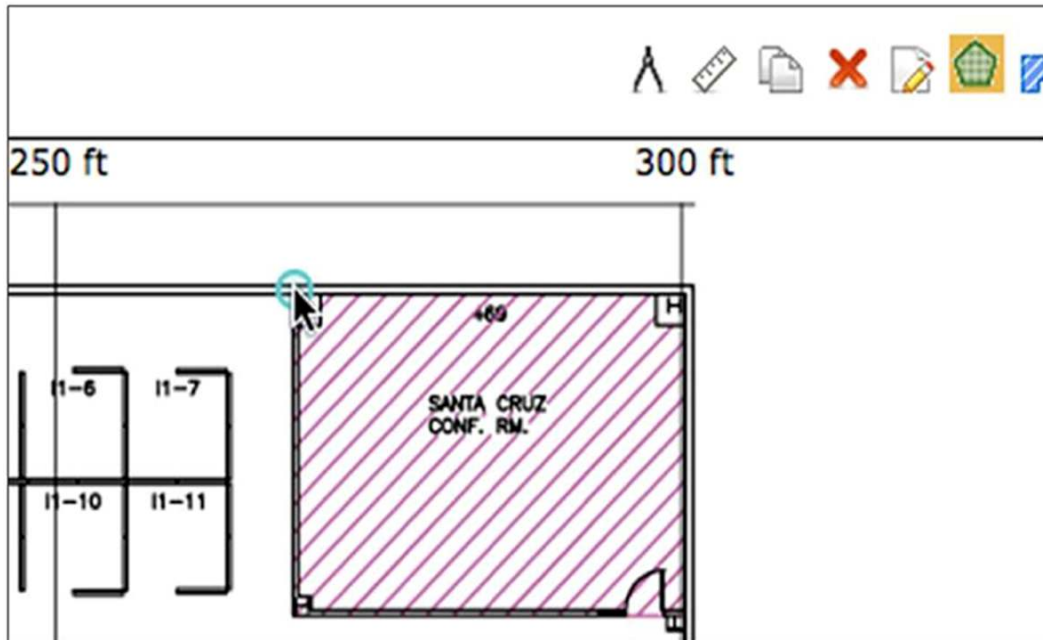
Step 9. Click each corner of the area (Figure 13).

Figure 13. Clicking Each Point in the Coverage Area
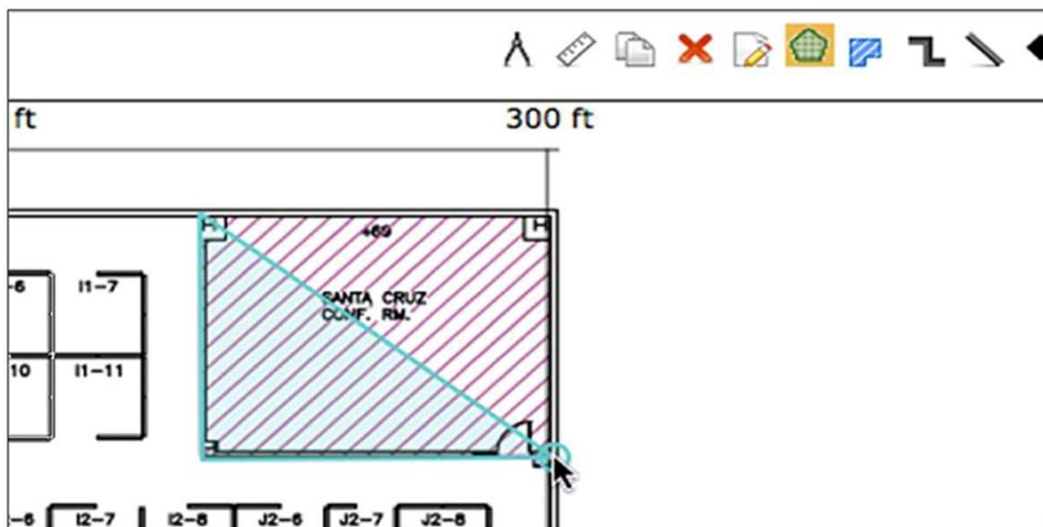
Step 10. When you are finished, double-click the last corner (Figure 14).

Figure 14. Double-Clicking the Last Point in the Coverage Area
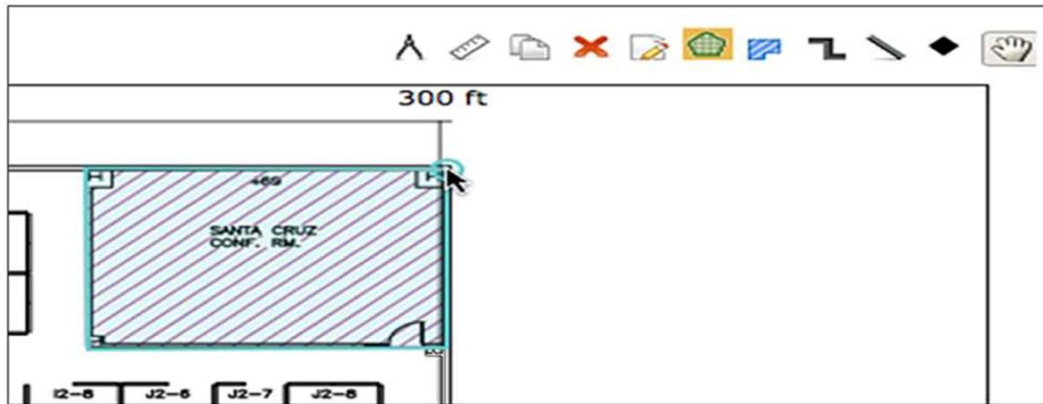
Step 11. The coverage area is created (Figure 15).

Figure 15. Creating the Coverage Area
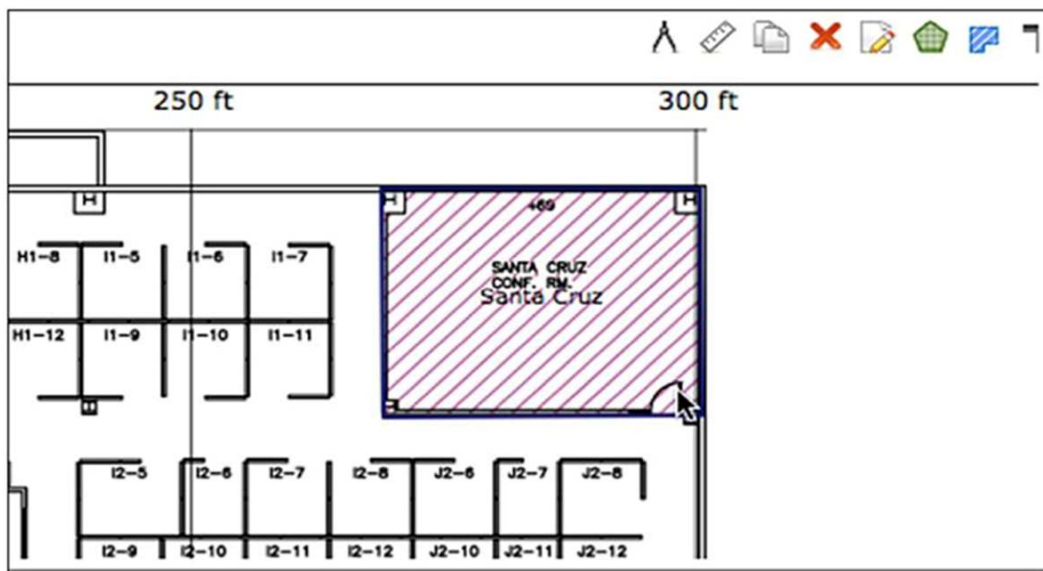
Step 12. Click Save to save the coverage area (Figure 16).

Figure 16. Saving the Coverage Area
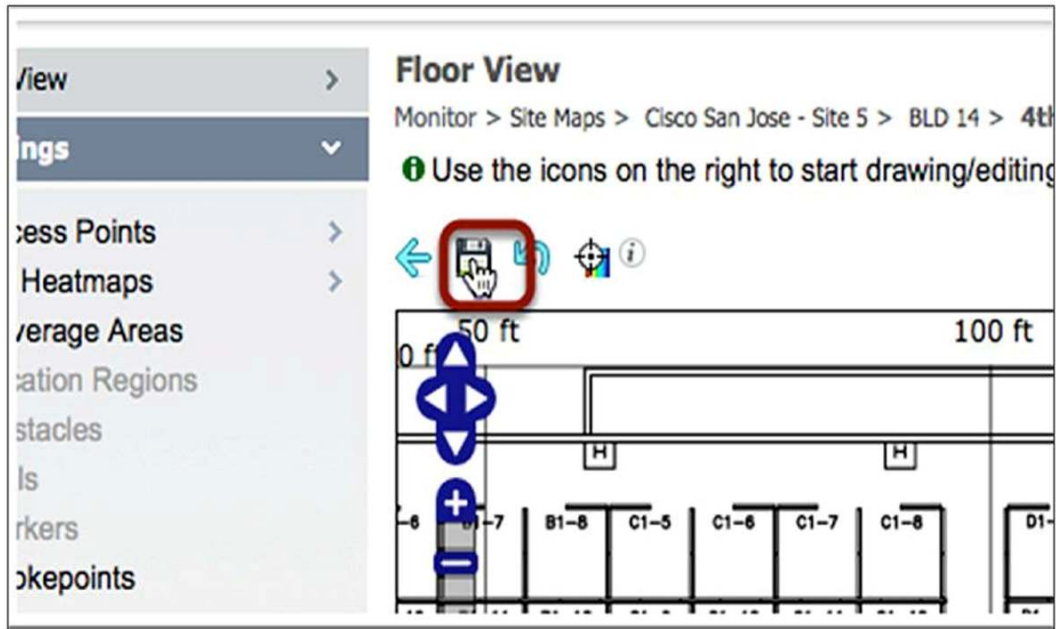
Tip: Create coverage areas for important parts of your venue for which you want to generate reports.

A recommended procedure or "best practice" when defining the zones on the first floor of a venue is to make sure that the map has white space outside the venue for which you want to create a report, and that a zone called Perimeter outlines the physical venue, with white space outside this zone. To do this, delete the inclusion zone in Cisco Prime Infrastructure (Figure 17).

Figure 17. Deleting the Inclusion Zone
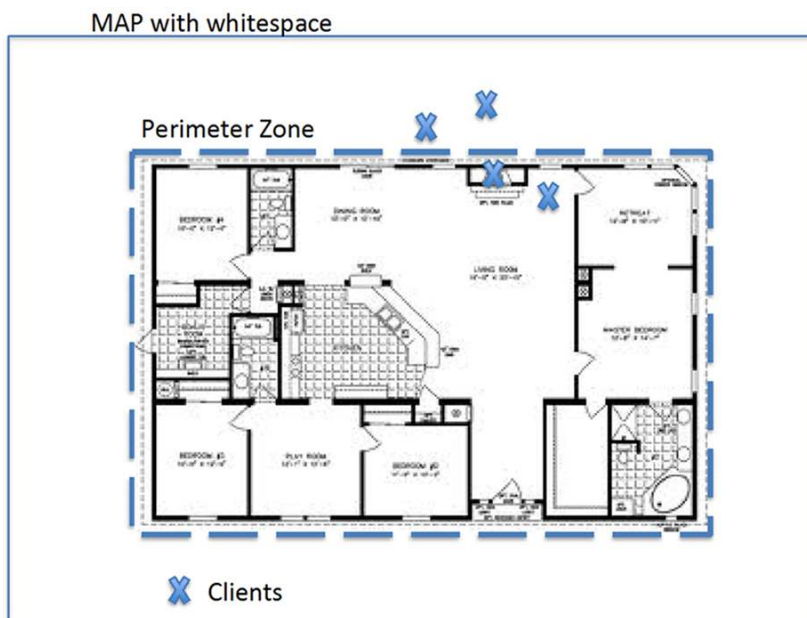
For customers who want to locate all visitors in their venue for accurate location analytics, you should create an inclusion zone that is the perimeter of the building on the first floor (Figure 18).

Figure 18.   Including an Inclusion Zone
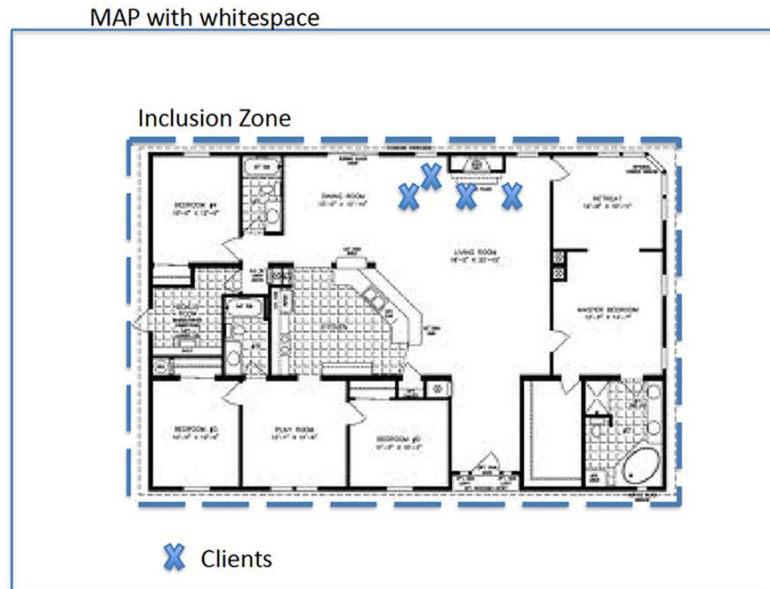
Add GPS Markers Using Cisco Prime Infrastructure

Step 1. Add GPS markers using Cisco Prime Infrastructure (Figure 19).

- Choose Monitor > Site Maps to display the Maps page.
- Choose Campus Name > Building Name > Floor Name.

  From the menu at the top left, choose Add/Edit GPS Markers Information to open the Add/Edit GPS page. A GPS Marker icon appears on the top-left corner of the map (X=0 Y=0).

- Either drag the GPS Marker icon and place it in the desired location on the map or enter the X and Y position values in the GPS Marker Details table in the menu at the left to move the marker to the desired position.
- In the menu at the left, enter the latitude and longitude values for the selected GPS Marker icon.
- Click Save.
- Click Apply to Other Floors of Building to copy GPS markers on one floor of a building to all the remaining floors of that building.

Figure 19. Adding GPS Markers

Tip: GPS markers are not required if you do not intend to use 2D reports.

Step 2. Synchronize Cisco MSE to map using Cisco Prime Infrastructure (Figure 20).

Figure 20. Synchronizing Cisco MSE with Cisco Prime Infrastructure
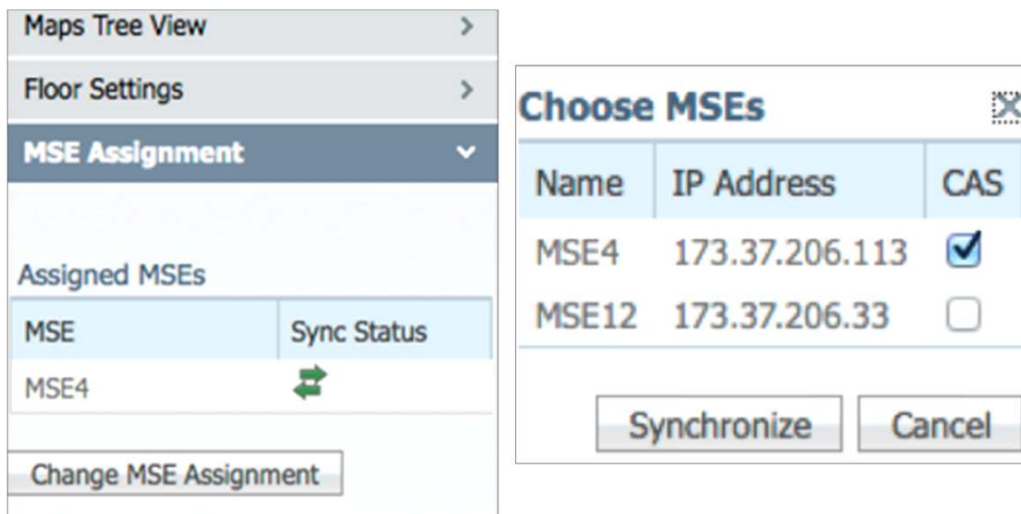
Tip: Synchronizing Cisco MSE to maps in Cisco Prime Infrastructure takes the map data that is defined in Cisco Prime Infrastructure and pushes it to Cisco MSE for use in subsequent calculations. When you update a map in Cisco Prime Infrastructure, you can view the synchronization status indicator to see whether changes made in Cisco Prime Infrastructure maps are used for location calculations performed by Cisco MSE.

Enable Context Aware and Location Analytics Services

In order to start using CMX Location Analytics, you must first enable two mobility services through Prime Infrastructure: Context-Aware Services and Location Analytics Services.

Step 1. In Prime Infrastructure, select the dropdown Services > Mobility Services Engines (Figure 21).

Figure 21. Choosing Mobility Services Engines
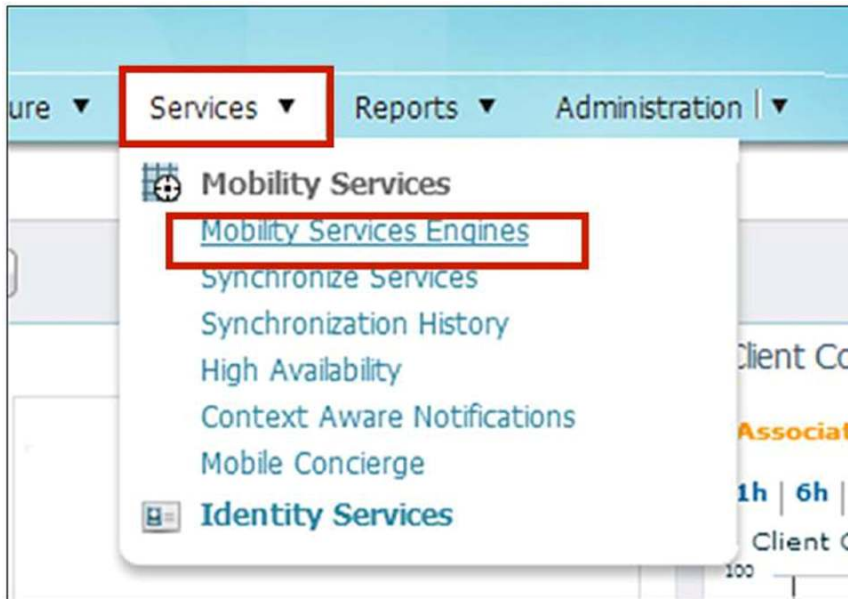
Step 2. Under Device Name, select MSE (Figure 22).

Figure 22. Selecting Cisco MSE

Step 3. Select Context-Aware Service and CMX Analytics Service to enable Cisco CMX Location Analytics; then click Save to save your configuration (Figure 23).

Figure 23. Selecting Cisco Context-Aware Service and Location Analytics Service

Admin Status	Name	Version	Service Status	License Type
☑	Context Aware Service	7.5.1.48	Up	Evaluation (358 days left)
☐	WIPS	1.2.6113.0	Down	Evaluation (120 days left)
☐	Mobile Concierge Service	3.0.0.29	Down	Evaluation (120 days left)
☑	CMX Analytics	2.0.0.57	Up	Evaluation (113 days left)
☐	CMX Browser Engage	1.0.0.2	Down	Permanent
☐	HTTP Proxy Service	1.0.0.1	Down	Permanent

Step 4. Select the client to be tracked using Cisco Prime Infrastructure (Figure 24).

Figure 24. Selecting the Client to Track

Tip: In certain circumstances - for instance, if a location has both indoor and outdoor access points and you want to track only associated users - you can use the Tracking Parameters setting to limit tracking to certain devices.

Set History Parameters

Step 1. Set the history parameters for Cisco MSE using Cisco Prime Infrastructure (Figure 25). This is done by checking the box labeled CLIENT STATIONS in the "Enable History Logging for Locations Transactions for" in PI

Figure 25. Setting the History Parameters

Tip: Be sure to enable database pruning because if the database becomes too large, it will fail to track new activity and you will then need to prune it manually to reenable tracking of new activity.

Check Browser for 3D Support

Cisco CMX Location Analytics supports 3D building representations using Web Graphics Library (WebGL). This advanced feature requires graphics capabilities. Cisco CMX Location Analytics also supports 2D views based on OpenStreetMaps.

Not all browsers support WebGL on all devices. Check devices and browsers by following the setup suggestions presented here.

Step 1. Test your browser for suitability at http://get.webgl.org/. If the test is successful, you should see a WebGL rotating cube. If the test is not successful, you may be able to update your video driver.

- For Chrome, see
  http://support.google.com/chrome/bin/answer.py?hl=en&answer=1220892.
- For Firefox, follow these steps to enable WebGL:
  - Download the latest build of Firefox browser and launch Firefox on your computer.
  - In the browser address line, enter **about: config**.
  - In the Search text box, enter **webgl** to filter the settings.
  - Double-click **webgl.enabled_for_all_sites**.
  - Set **webgl.enabled_for_all_sites=true.**

- For Safari, follow these steps to enable WebGL
    ◦ Download the latest build of Safari browser.
    ◦ Enable the Develop menu by choosing Safari > Preferences.
    ◦ Click the Advanced tab.
    ◦ Select the Show Develop Menu in Menu Bar check box.
    ◦ From the Develop menu, choose Enable WebGL.
- Other web browsers such as Maxthon have also been successful in running WebGL.

Ideally, the hardware should have a 3D graphics card to help ensure compatibly with WebGL. Most current Macs have graphics cards sufficiently configured to work with Safari or Firefox. On PCs, the Chrome browser has been the most successful.

License Implications

The previous licensing model supported WIPS based on WIPS access points; support for context-aware services was based on tracked devices. Cisco MSE Release 7.4 and later is based on supported access points. Several license upgrade scenarios are presented here.

For more information, see the Cisco Mobility Services ordering and licensing guide at http://www.cisco.com/en/US/prod/collateral/wireless/ps9733/ps9742/data_sheet_c07-473865.html.

Example 1: Customer with Cisco 3355 MSE Release 7.3 and a 25,000-seat CAS license with a 1000-access point deployment upgrading to Cisco MSE 7.5 with Base Location Service with Cisco Prime Infrastructure 1.4

- A 500-access point Base Location license will automatically be generated, and there will be no access point license enforcement. The customer can use Cisco MSE for a 1000-access point deployment.
- In Cisco MSE 7.5 with Cisco Prime Infrastructure 1.4, the 500-access point Base Location license will be upgraded to a 1000-access point Base Location license.

Example 2: Customer with Cisco 3355 MSE Release 7.3 and a 15,000-seat CAS license with a 1000-access point deployment upgrading to Cisco MSE 7.4 Base Location Service with Cisco Prime Infrastructure 1.3

- A 300-access point Base Location license will automatically be generated, and there will be no access point license enforcement. The customer can use Cisco MSE for a 1000-access point deployment.
- The account team should submit a request to the Cisco Wireless Business Unit (WNBU) on the customer's behalf for a 200-access point Base Location license (visit http://wnbu-press.cisco.com/licensing-requests/mse-license-request/).

    Tip: This is a Cisco internal website and needs to be accessed by a Cisco employee.
- In Cisco MSE 7.5 with Cisco Prime Infrastructure 1.4, the 500-access point Base Location license will be upgraded to a 1000-access point Base Location license.

Example 3: Customer with Cisco 3355 MSE Release 7.3 and a 25,000-seat CAS license with a 1000-access point deployment upgrading to Cisco MSE 7.5 Advanced Location Services

- A 500-access point Base Location license will automatically be generated for the existing Cisco MSE.
- The customer should purchase a second Cisco MSE and request a 500-access point Base Location license.

- The Customer must purchase two 500-access point upgrade licenses (L-UPG-LS-100AP) to enable Advanced Location Services on both Cisco MSEs.

Example 4: Customer with Cisco 3355 MSE Release 7.3 and a 15,000-seat CAS license with a 1000-access point deployment upgrading to Cisco MSE 7.4 Advanced Location Services

- A 300-access point Base Location license will automatically be generated for the existing Cisco MSE.

- The customer should purchase a second Cisco MSE and request a 500-access point Base Location license.

- The customer must purchase two 500-access point upgrade licenses (L-UPG-LS-100AP) to enable Advanced Location Services on both Cisco MSEs.

Hardware Requirements

The minimum hardware requirements are listed here.

- VMware ESX or ESXi Version 4.1 or 5.0 (current versions of VMware ESX are recommended; end-of-live versions such as VMware ESX 4.1 are not recommended)

- Cisco MSE low-end virtual appliance (Note: A low-end virtual appliance can be used only for Base Location or WIPS services.)

  ◦ Minimum RAM: 8 GB

  ◦ Minimum hard disk space allocation: 250 GB with SAS drives and 900 I/O operations per second (IOPS)

  ◦ Processors: 4 virtual CPUs (vCPUs) at 2.0 GHz or faster and a passmark (cpubenchmark.net) of no less than 4000

  ◦ Cisco Unified Computing System™ (Cisco UCS®) reference:

    http://www.cisco.com/en/US/prod/collateral/ps10265/ps10493/C240M3_SFF_SpecSheet.pdf .

- Cisco MSE standard virtual appliance

  ◦ Minimum RAM: 16 GB

  ◦ Minimum hard disk space allocation: 500 GB with SAS drives and 1000 IOPS

  ◦ Processors: 8 vCPUs at 2.0 GHz or faster and a passmark (cpubenchmark.net) of no less than 4000

  ◦ Cisco UCS reference (Cisco UCS C240 M3 Rack Server):

    http://www.cisco.com/en/US/prod/collateral/ps10265/ps10493/C240M3_SFF_SpecSheet.pdf.

- Cisco MSE high-end virtual appliance

  ◦ Minimum RAM: 24 GB

  ◦ Minimum hard disk space allocation: 500 GB with SAS drives and 1600 IOPS

  ◦ Processors: 16 vCPUs at 2.0 GHz or faster and a passmark (cpubenchmark.net) of no less than 4000

  ◦ Cisco UCS reference (Cisco UCS C240 M3 Rack Server or C460 M2 High-Performance Rack Server):

    http://www.cisco.com/en/US/prod/collateral/ps10265/ps10493/C240M3_SFF_SpecSheet.pdf.

    http://www.cisco.com/en/US/prod/collateral/ps10265/ps10493/ps11587/spec_sheet_c17-662220.pdf.

Table 2 shows Cisco UCS configurations that match the minimum requirements.

Table 2. Reference Configurations

	Low-End Virtual Appliance	**Standard Virtual Appliance**	**High-End Virtual Appliance**
Processor	UCS-CPU-E5-2609 (quantity: 1)	UCS-CPU-E5-2660 (quantity: 1)	UCS-CPU-E5-2660 (quantity: 2)
RAM	UCS-MR-1X082RX-A (quantity: 1) 8 GB	UCS-MR-1X082RX-A (quantity: 2) 16 GB	UCS-MR-1X082RX-A (quantity: 4) 24 GB
Disk	A03-D300GA2 (quantity: 2, in RAID 10 configuration)	A03-D300GA2 (quantity: 4, in RAID 10 configuration)	A03-D300GA2 (quantity: 4, in RAID 10 configuration)
RAID	UCS-RAID-9266CV	UCS-RAID-9266CV	UCS-RAID-9266CV

Accessing and Interacting with the Cisco CMX Location Analytics User Interface

Logging into the Cisco CMX Location Analytics User Interface
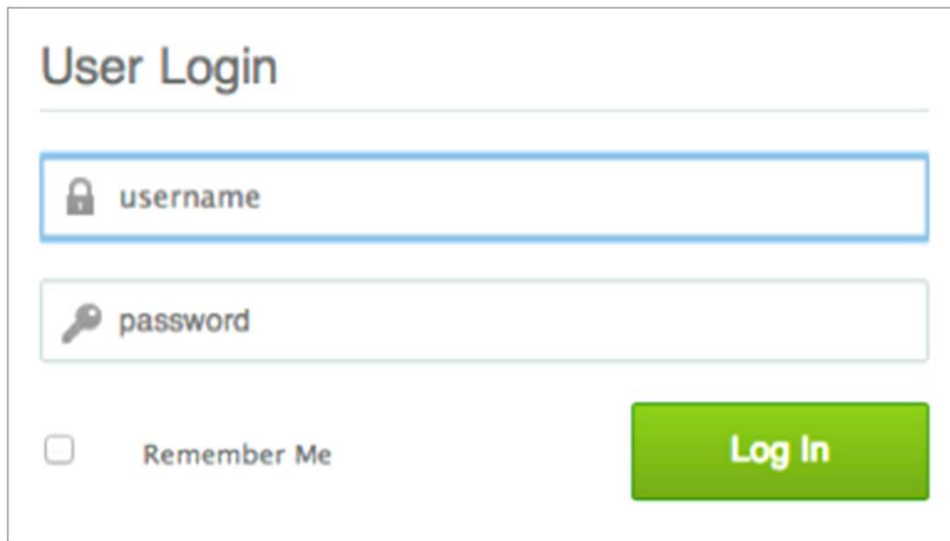
To log into the Cisco CMX user interface through a web browser, follow the steps presented here.

Step 1. In the address line of browser, enter location-analytics-ip-address:8080/ui, where location-analytics-ip-address is the IP address of the Cisco CMX server. For example, enter http://xxx.xx.xxx.xx:8080/ui/.

The Cisco CMX user interface displays the User Login page (Figure 26).
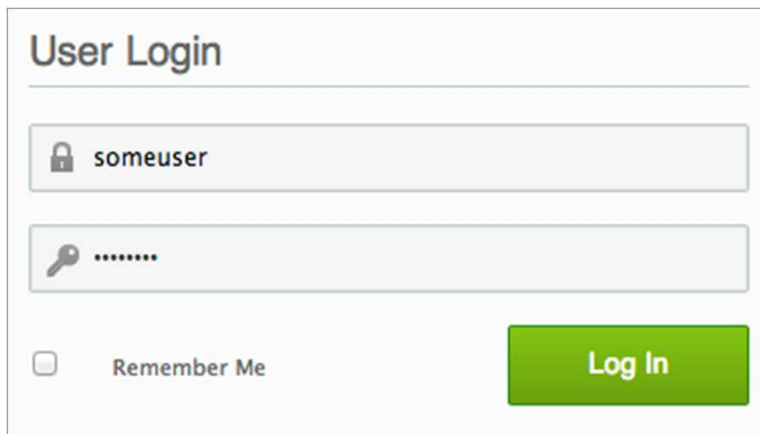
Tip: Bookmark the site for easy access. When it is bookmarked, the site may appear with the title "Cisco CMX Location Analytics."

Figure 26. User Login Page

Step 2. Enter your username and password (Figure 27).

Figure 27. User Login Information

Step 3. Click Log In to log into Cisco CMX.

Cisco CMX Location Analytics Homepage

The Cisco CMX homepage (Figure 28) contains the following:

- 3D analytics tab
- 2D analytics tab
- Reporting tab
- Rules box
- Analysis box

The right side of the homepage contains:

- Visualization pane
- Auxiliary information dashlet

Figure 28.   Cisco CMX Homepage
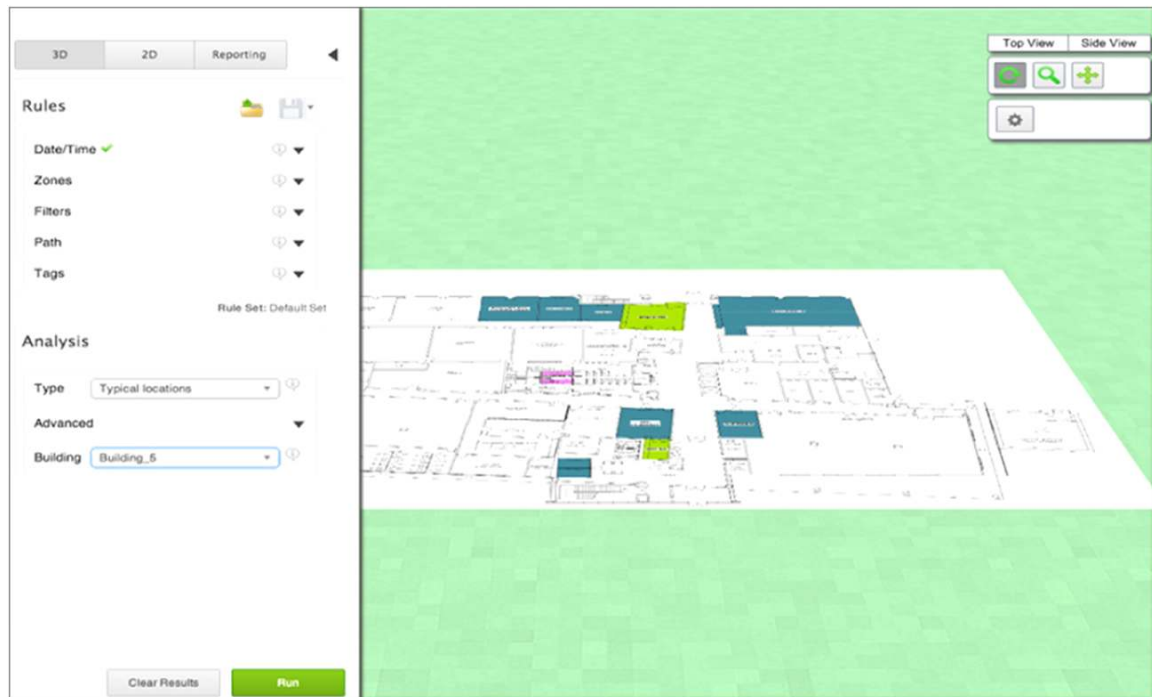
3D Analytics Tab

The Cisco CMX Location Analytics system provides the capability to view the analytics results in a 3D environment. This view provides a better understanding of results on multiple floor paths or when the dwell time is calculated for the multistory building.

Tip: When a single access point in a single band (for example, 5 MHz) in a single channel detects an endpoint, the X,Y location calculated for that endpoint will be the X,Y location of the access point. This behavior can explain some anomalies when very high counts of endpoints are reported at certain locations.

Before you can view Cisco CMX Location Analytics in 3D, you must do the following:

- Set up the Cisco CMX Location Analytics system. See Cisco Location Analytics Service Configuration Guide for more information.
- Be sure that your browser supports 3D. Cisco CMX supports a 3D representation of analytics using WebGL.
- Make sure that sufficient points or devices are present in the device or in the path database.
- Add floor plans to either a campus building or standalone building in the Cisco Prime Infrastructure user interface.
- Define coverage areas using Cisco Prime Infrastructure and be sure that the zones have been defined and overlays are supplied.

To view the analytics results in the 3D environment, do the following:

1. In the Rules box, set rule types to specify the devices that you want considered for analysis based on the specified rule parameters.

2. In the Analysis box, specify the analyses you want performed on devices that pass through a building or environment.

3. Click Run.

4. Click 3D Analytics to view the results in the 3D environment. The results are displayed in the right pane.

5. Click the navigation buttons available in the auxiliary information window to see various overlays of the building and various views of the floors. The 3D environment provides the capability to switch floors on and off.

2D Analytics Tab

To view the analytics results in the 2D environment, do the following:

1. In the Rules box, set rule types to specify the devices that you want considered for analysis based on the specified rule parameters.

2. In the Analysis box, specify the analyses that you want performed on devices that passes through a building or environment.

3. Click Run.

4. Click 2D Analytics to view the results in the 2D environment. The result is displayed in the right pane.

Rules Box

The Rules box allows you to identify the specific set of devices for which you want analytics applied. The Rules box displays the following:

- Date/Time: The Date/Time rule allows you to select a specific date or range of dates and time or time period for which you want the analytics to be applied. Click the black inverted triangle to see all available dates and configure the date and time.

  Select the Date check box to enable the Date, and click the Date text box to open the calendar and to specify the following:

  ◦ Specific Date: Select this option if you want the analytics to be applied based on the specific date.

  ◦ All Dates Before: If you select this option, all dates before the selected date are considered for analysis.

  ◦ All Dates After: If you select this option, all dates after the selected date are considered for analysis.

  ◦ Date Range: If you select this option, the analytics will be applied between the selected start date and end date.

- Zones: Click the black inverted triangle to configure the following:

  ◦ Restrict to Zones: Select the Restrict to Zones check box and choose one or multiple zones from the Restrict to Zones drop-down list to restrict your analysis to selected zones. If want to analyze only a certain part of the building, then information about the selected part is displayed.

- Filters: Click the black inverted triangle to configure constraints on the points with different dwell times. This option allows you to select the data for analysis based on quantitative constraints on paths. The quantitative constraints that you can use on paths from the path filters are:

- Length: Length restricts the analysis to those paths within the sum of the straight-line distances between the points.
- Duration: Duration restricts the analysis to the total duration between the first and the last time points on the path.
- Hops: Hops is the measure of the number of location observations made on that path.
- Path: Click the black inverted triangle to open the Path window. This window allows you to select for analysis those devices that have followed a particular path through the predefined zones. The options are:
  - Starts In: Select the zone in which the wireless device was first detected from the Starts In drop-down list.
  - Visits: Select the intermediate zone through which the device passed from the Visits drop-down list.
  - Ends In: Select the zone in which the device was last detected from the Ends In drop-down list.
- Tags: Tags are specific to asset Tag tracking and not used in most deployments

Load Ruleset   Save Ruleset

Click to load a rule set.

This option allows you to load the predefined rules. You can create multiple different rules and load them. A collection of rules together creates a rule set.

Click to save the rule set.

After creating rules, you can save them and load the rule when you require them.

Groups of rules can also be saved as rule sets. This is accomplished by having multiple criteria in your rules when you save the rule set.

Analysis Box

The Analysis box allows you to perform different analysis on devices that are passing through a building or environment. The Analysis box displays the following:

- Type: Select the type of analyses you want to perform from the Type drop-down list. The choices are:
  - Typical Locations
  - Most Popular Paths
  - Alternate Path Analysis
  - Heat Maps

- Advanced: Click the black inverted triangle to configure the number of locations that you want to include in the analysis. Selecting a large number of locations will result in a breakdown of the building into many areas.
  - Number of Locations: Enter the number of locations or paths that you want to include in the analysis. Selecting a large number of locations for the typical location analysis results in a dense concentration of markers across an area.
  - Optimal: Select this check box if you want the number of locations to be determined mathematically according to the locations that best represent the distribution of points in the building.
- Building: Select the location from the Building drop-down list.

Tip: The Heat Map is a popular report and is a good initial report to view to see the data that exists in Cisco MSE.

Reporting Tab

Cisco CMX Location Analytics reports are necessary to monitor common behavioral patterns over time. You can generate a number of reports, which provide a more standardized and task-oriented set of information. Cisco CMX reports provide deep analytic insight. Cisco CMX provides some flexibility in the types of reports that are generated.

Visualization Pane

You can view the following in the visualization pane:

- Analytics results for a 2D or 3D environment
- Report results

Auxiliary Information Dashlet

You can access the auxiliary information dashlet at the top-right corner of the right pane. The auxiliary information menu provides access to the 3D navigation tools and visible overlays for the building or area when you are in the 3D environment. Click the icon in the right pane and choose additional information about the building or area for analysis. You can switch floors on and off and see the layout of access points, any point of interest, or the actual cluster area.

Typical Locations Analysis

Typical Locations analysis analyzes various areas of the building and measures the movement of people within the building. The location analysis provides a way of segmenting all points detected into representative areas for which parameters are calculated.

The location analysis process starts by clustering all devices into areas determined by the geographical layout of observations. Each point is allocated to a particular area, and each area is represented by a center point. After the set of areas is established, all parameters associated with each area are calculated, which reflects the movement of people through that part of the building.

The result of location analysis is a set of areas represented by center points indicating the spread of device parameters over the Wi-Fi detected area.

Tip: Typical Locations analysis may not seem intuitive at first because the locations are based on averages of information from many points in the database and use the calculated center point. Note that the Typical Location feature may not provide an exact representation of the locations in which people are congregating, but should instead be used as a general guide.

Areas and Zones

Areas and zones are different, but they work together. You need to consider the following when defining areas and zones:

- A zone is a user-defined space with a name, and it is used for reporting or for path rule purposes. Zones can be overlapping and need not cover all the building.
- Areas are defined by mathematical clustering on the visible Wi-Fi points.
- Cluster areas are used when no known zones are established. Cluster areas also are used to help ensure that all parts of the location space are taken into account.
- Each area is associated with a set of behavior parameters that are represented by icons.

The following behavior measurements are available:

- Dwell Time: Dwell time, or wait time, is an estimate of the amount of time that people spend in an area as they move through the building. Dwell times are color coded as follows:
  - Yellow: Indicates areas of low dwell time in which people movement is fast.
  - Red: Indicates areas of high dwell time in which people movement is slow.
- Crowding: Crowding is measured by the density of people within a particular area over a specified time period. The measure is derived from the number of observed devices in a particular area compared to the size of the area.
- Number of Devices Passing: This measure indicates the number of unique MAC addresses identified in a particular area and is defined based on filtered conditions. If a device reappears in the same area after a specified elapsed time, then it is counted as a second visit.

Tip: The Number of Devices Passing value may not exactly match the number of devices that pass an access point in a controlled short test. Usually, any discrepancy in the number of devices occurs because data is sent from the WLC to Cisco MSE every 15 minutes, and while data is in the CAS analytics engine, it may take a while for a device to be recorded as away from an area. Therefore, the device counts in the measure may not exactly match the actual count.

Figure 29 shows the distribution of a number of devices across one floor.

Figure 29. Distribution of Multiple Devices Across One Floor

Figure 30 shows the distribution of median dwell times in a 2D map.

Figure 30. Distribution of Median Dwell Times (2D Map)

Most Popular Paths Analysis

Most Popular Paths analysis analyses the behavior of devices or people as they move through the building. This analysis provides a set of typical paths taken by devices, for example, across a shopping mall on a particular day and time.

This analysis is performed using mathematical path clustering, which aggregates paths into sets that are equivalent. Each resulting set is represented by an actual path and is shown graphically by a set of observed points linked by a straight line. The clustering allows you to identify the common routes that people usually take.

Figures 31 and 32 show the most popular paths across a shopping mall on a particular day and time in a 2D environment.

Figure 31.   Most Popular Path Across One Floor (2D Environment
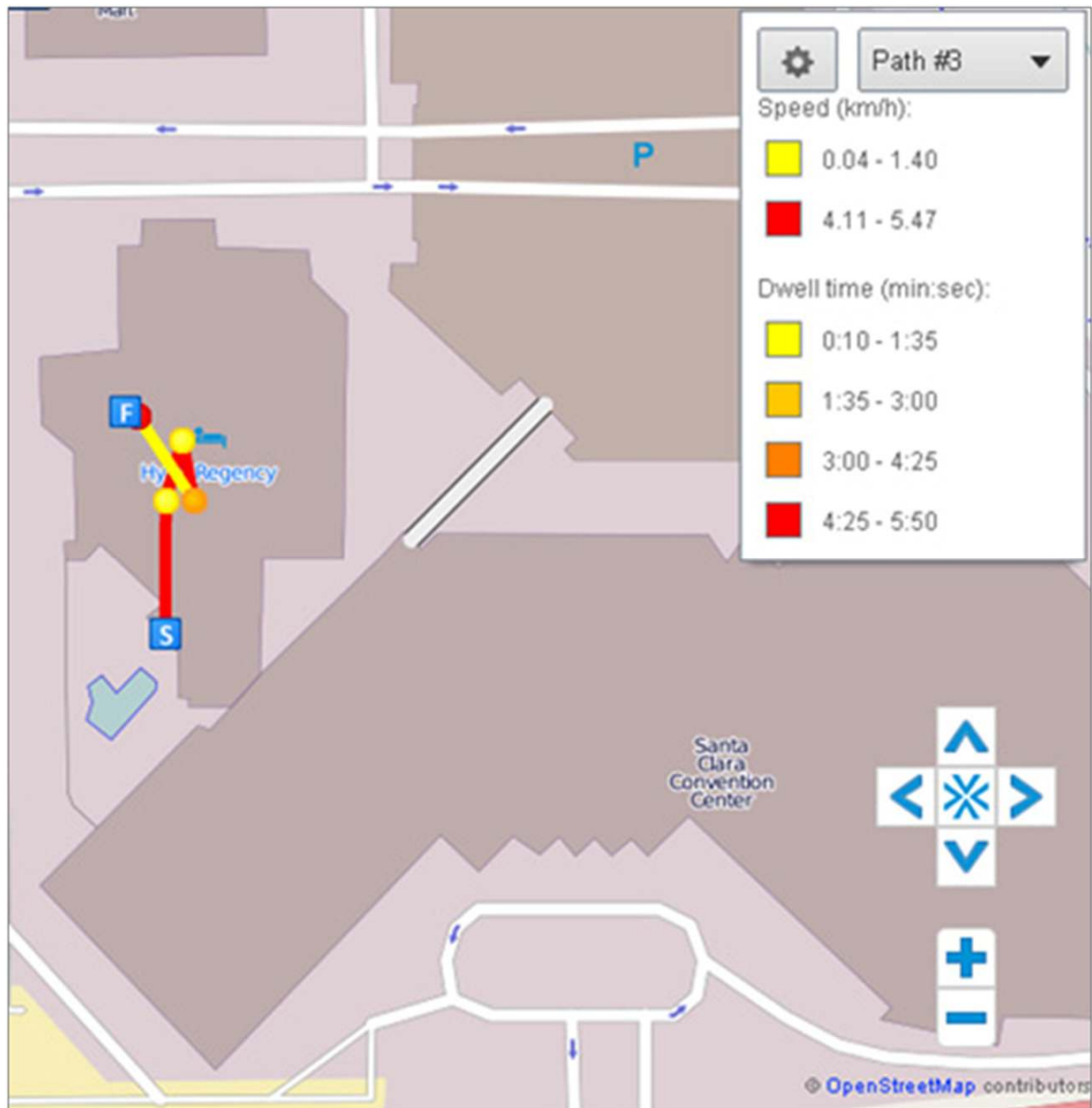
Figure 32.   Most Popular Path Between Floors
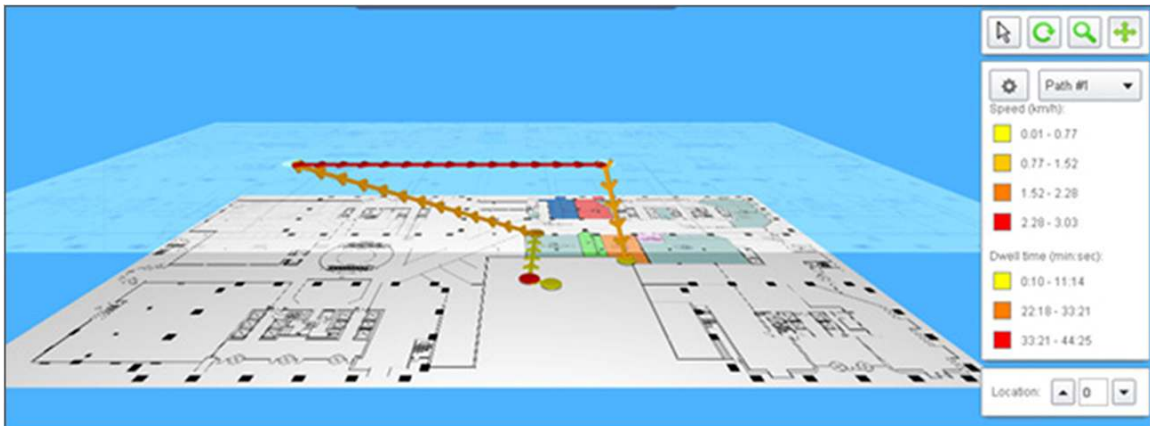
To obtain information associated with a parameter, click the node or use the location selector in the auxiliary information dashlet (Figures 33 through 36).

Figure 33.   Path Parameters at Start Node
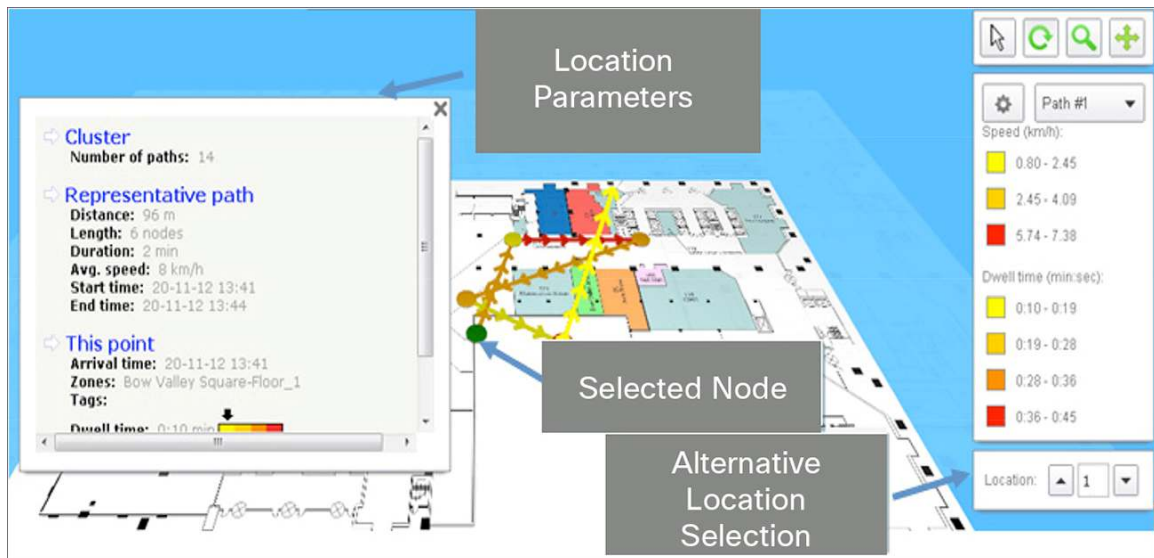
Figure 34.   Path Parameters at Intermediate Node
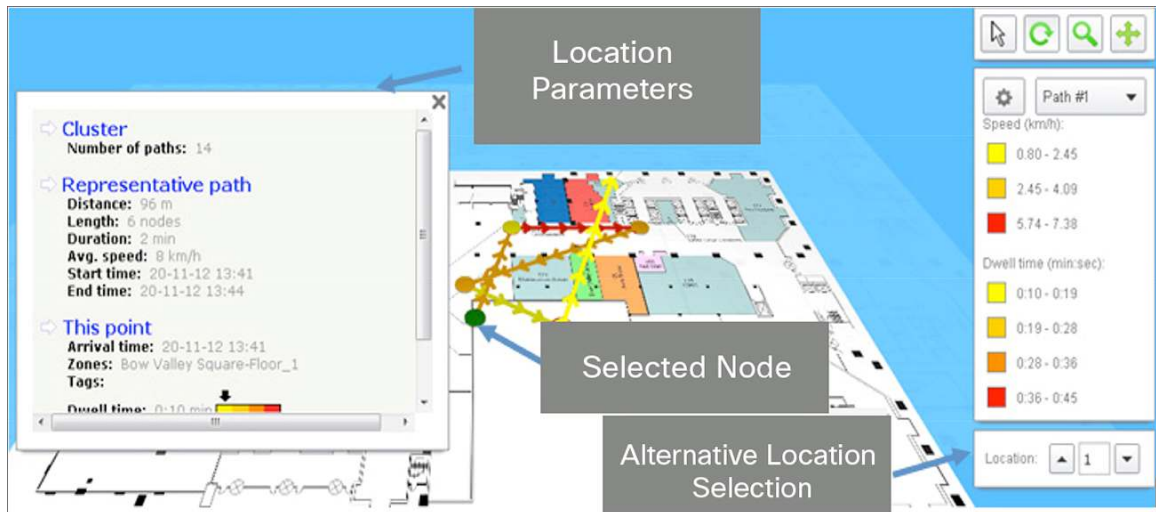
Figure 35.   Path Parameters at Intermediate Node
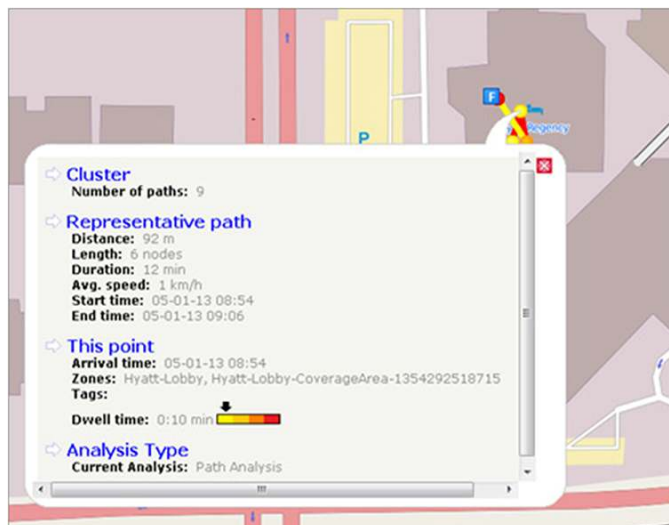
Figure 36.   Path Parameters at Edge Node
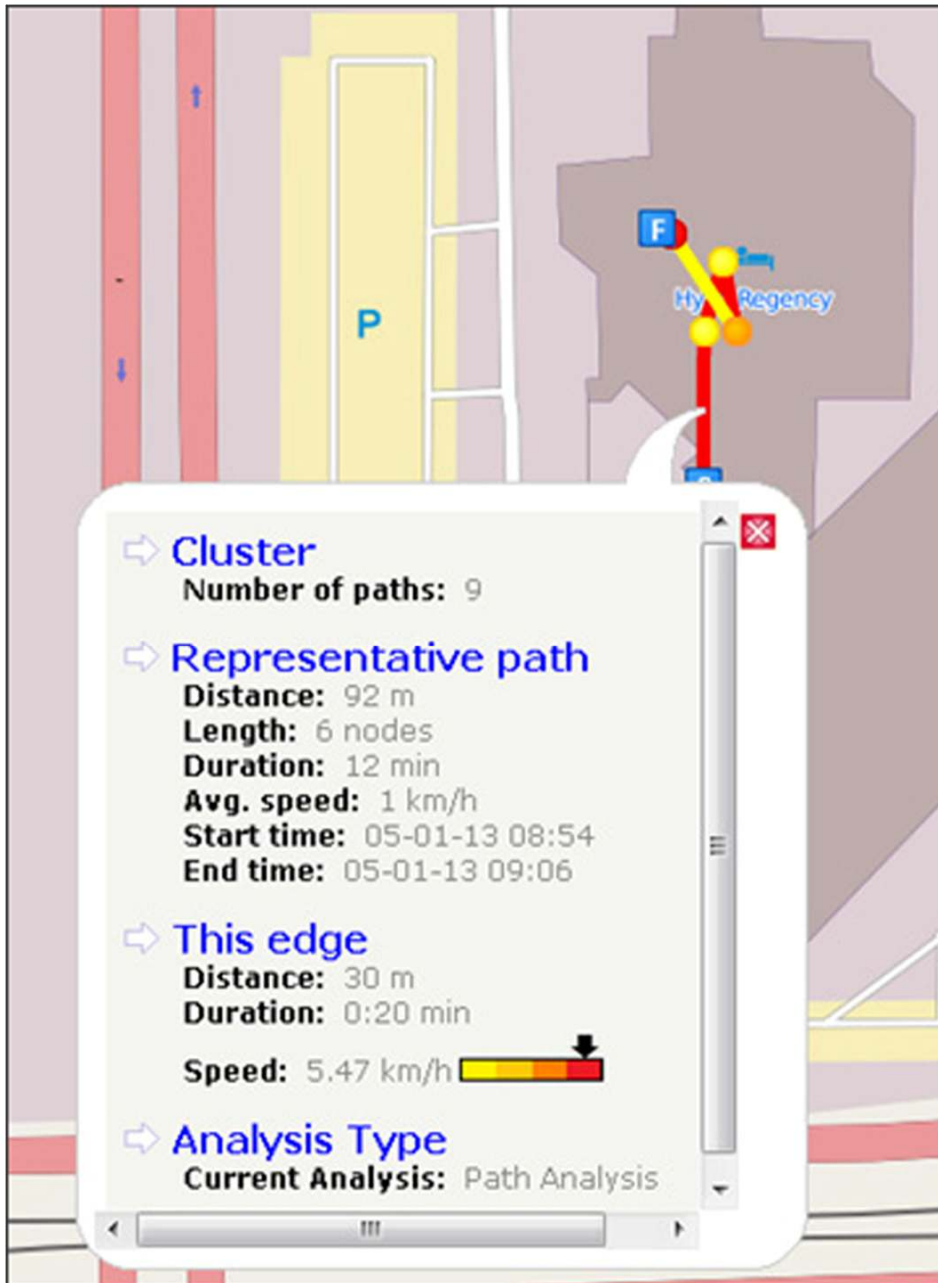
The following information is displayed when you click a particular node:

- Number of paths in the cluster
- Overall distance traveled
- Number of point observations recorded along the path
- Time taken to complete the particular path

- Average speed along the path (kilometers per hour [km/hr])
- Date and time of the first and the last recorded point on the path

The following are the parameters displayed for a particular point:

- Arrival date and time
- Zones located on map
- Any tags associated with this point

The following are the parameters displayed for a particular edge:

- Straight-line distance between the two points it joins
- Difference in time between two points
- Estimated speed between the two points

Analyzing Areas of the Building Using the Most Popular Paths Analysis

To analyze different areas of the building using the Most Popular Paths analysis, follow these steps:

1. In the Analysis box, in the Type drop-down list, choose Most Popular Paths.
2. Click the black inverted triangle next to the Advanced option to configure the number of paths that you want to include in the analysis.
   a. In the Number of Paths text box, enter the number of paths that you want to display in the analysis results.
   b. From the Method drop-down list, choose the method that you want to represent the paths before you select the most popular path. The possible values are Markers and Actual.
3. From the Building drop-down list, select the building for which you want to conduct this analysis.
4. In the Rules box, apply the parameterized rules to your analysis.
5. Click Run.
6. Click 3D Analytics to view the results in a 3D environment or 2D to view the results in a 2D environment.

The Most Popular Path analysis presents a set of paths taken and the parameters associated with them in the right pane.

Alternative Path Analysis

Alternative Path analysis allows you to determine the device flow between different points in the building. This analysis helps you to understand the different paths that people take while leaving one point to go to another point. This analysis allows you to set up arbitrary areas and estimate the time it takes to move between those areas. This analysis starts by identifying all paths passing within a certain radius of a circle whose center is the source point.

Alternative Path analysis is available only in a 2D environment.

Figure 37 shows three beacon points placed within a building. The figure shows one source node and two possible destination nodes.

Figure 37.   Specifying Beacon Points for Alternative Path Analysis
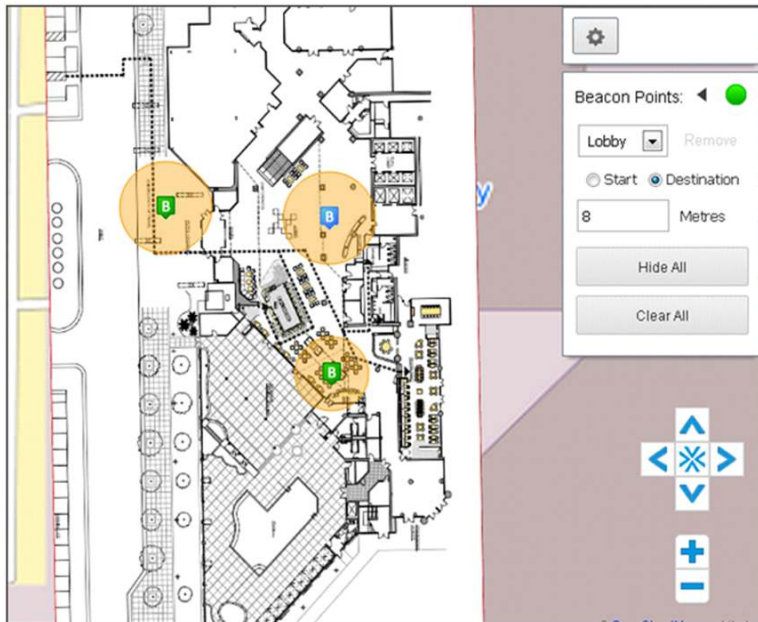
Figure 38 shows the breakout or flow of passengers from a point outside the security area to each of the main three portions of an airport.

Figure 38.   Breakout from Security Area to Terminals

Figure 39 shows the dominant directions of flow from a train station.

Figure 39. Dominant Directions of Flow from Train Station
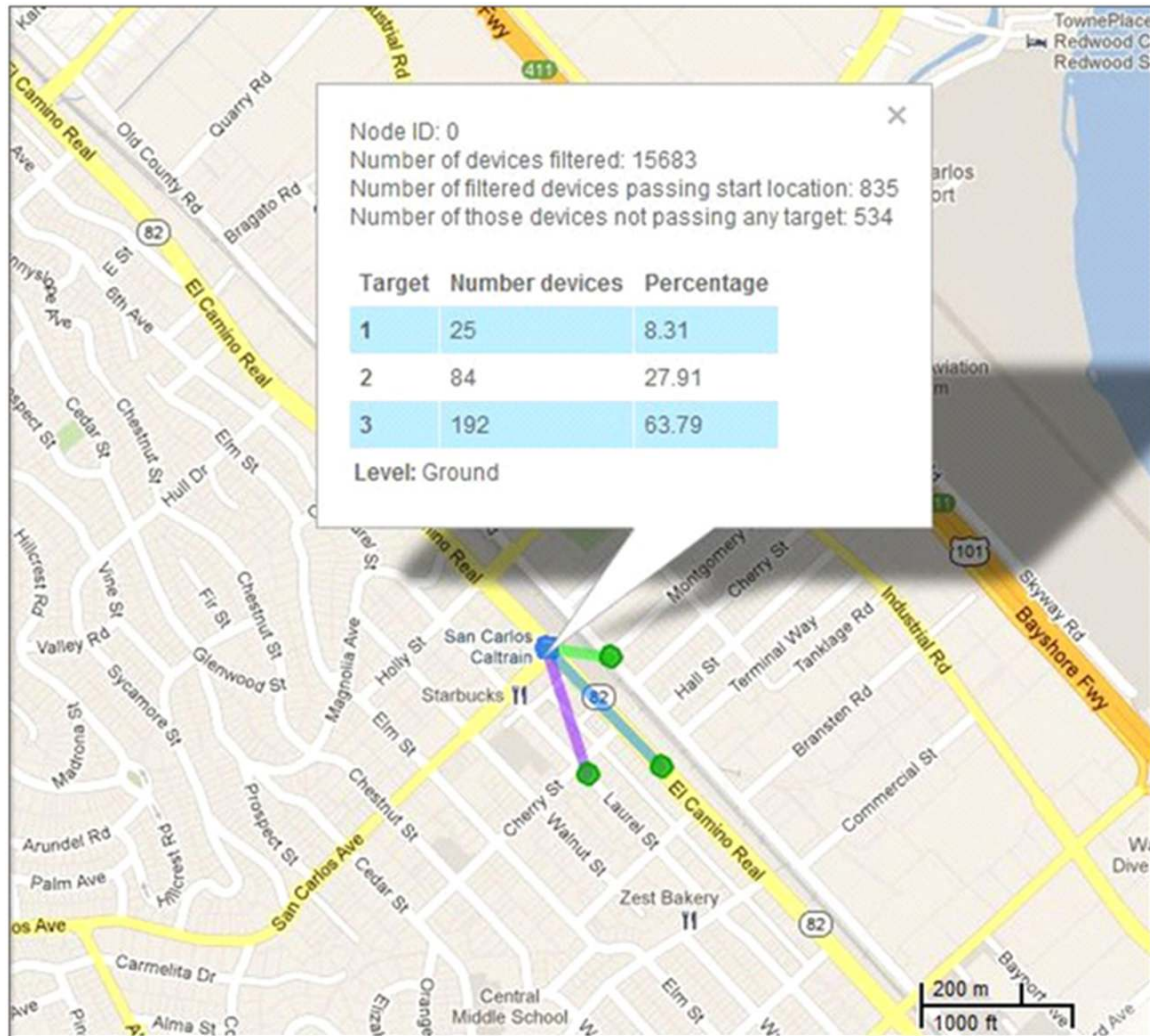
Heat Maps

A heat map is a graphical representation of data and allows you to view all the selected data on the map (Figure 40). The areas for which there is a greater presence of data are represented in darker colors. These patterns also help to indicate the real coverage of the access points across a region.

Figure 40.   Heat Map Showing the Distribution of Points
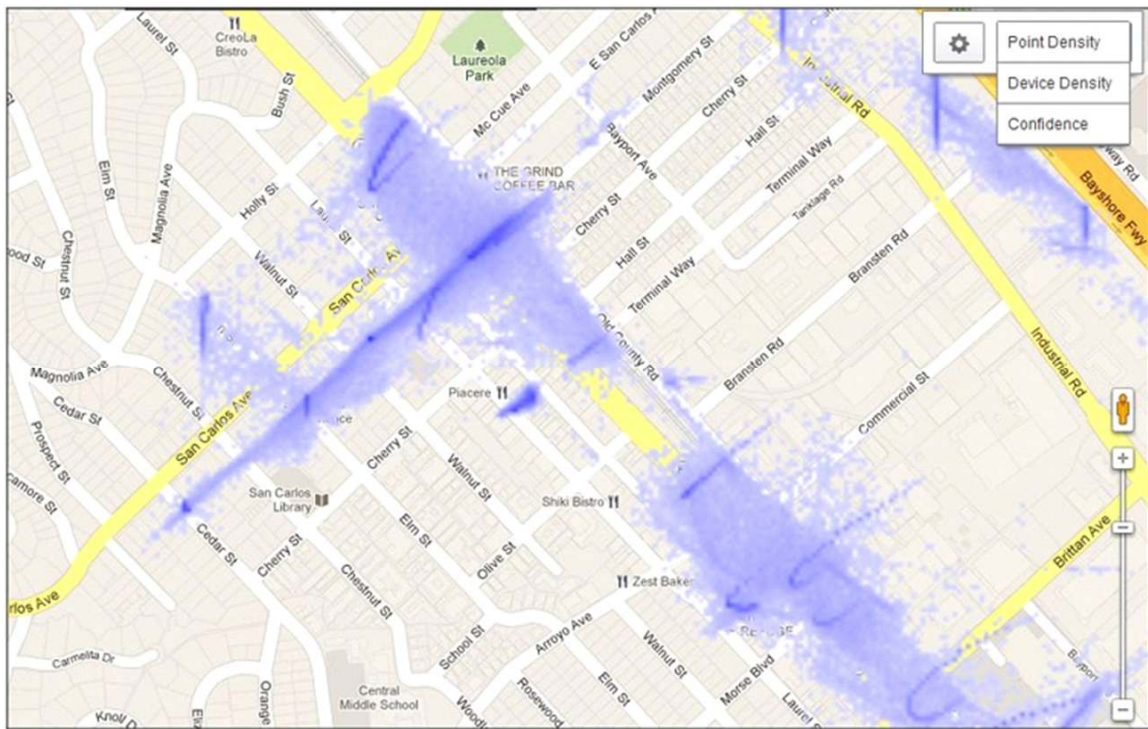
Using Reports

The reporting facility in Cisco CMX provides a more standardized, management-oriented set of information than the online analytics. Typically, the online analytics provides the mechanism for comprehensive impromptu investigation of behavior patterns, and reports are used for common, repeated analyses. For instance, an operator or planner might use the information provided by the online analytics to investigate special circumstances. The manager would expect only higher-level information in an easily viewable format daily or weekly, for example. Reporting nevertheless provides comprehensive analytic insight and provides some flexibility regarding the types of parameters used in the reports. The report generator used in this release is Birt.

The reporting function can be accessed through the top-level icons or through the Reporting tab in the online analytics view. Five report templates are available in this release.

Report Types

The report types include the following:

- Associated/Probing Devices
- Daily Device/Time Window (Number of Devices and Dwell)
- Daily Devices and Dwell Times
- Device Snapshot (Fixed Windows)
- Dwell Times
- Top N Frequency Visits

- Movement - All Zones
- Movement - First, Intermediate, and Final
- Movement - First and Last on Path
- Repeat Visitors

Tip: A Top-10 Repeat Visitors report and the Associated/Probing Devices report are good initial reports to use and understand.

Associated/Probing Devices

The Associated/Probing Devices report provides counts for associated and probing clients in a selected zone over a specified time period (Figure 41). This report shows the counts in a time series chart and also shows the distribution of clients on the floor. The output of this report contains the following:

- Time series chart showing probing and associated client counts in the selected area
- Distribution image showing the distribution of clients on the floor

Follow these steps to generate the report:

1. From the Select Report Type drop-down list, choose Associated/Probing Devices.
2. From the Start Time drop-down list, choose the start time.
3. From the End Time drop-down list, choose the end time.
4. From the Date drop-down list, choose a start date.
5. From the Date To drop-down list, choose the end date.
6. From the Zone drop-down list, choose the zone on which you want to report.
7. Click Run Report.

Tip: When you have a Cisco MSE that reports on devices that are outside the building (perhaps because of the existence of external access points), then you should create one or more explicit capture zones outside the building. Without such zones, the devices outside the venue (which may be devices possessed by people walking or driving by the venue) will be snapped into the closest zone in the venue if you have an inclusion zone defined for the perimeter of the building. Creating these zones will eliminate the inclusion of external points and provide more accurate data.

Figure 41. Number of Devices Associated and Probing
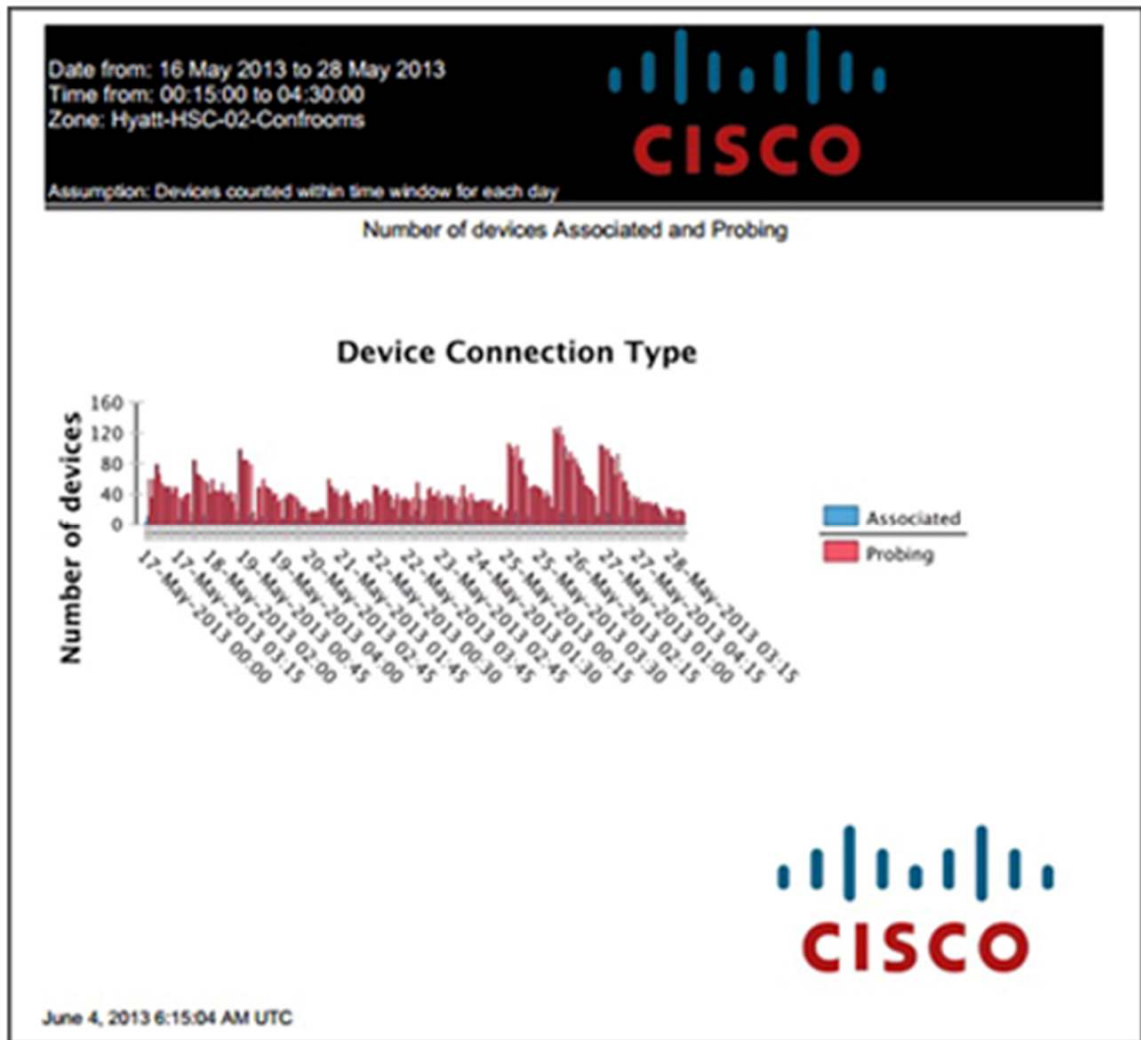
Number of Devices and Dwell

The Number of Devices and Dwell reports (ie allows the user to compare the same time window across consecutive days for a particular zone in terms of number of devices, categorized by dwell time (Figure 42). The dwell-time ranges provided in this report template are:

- Less than 5 minutes (passing through)
- 5 to 45 minutes (short-term customers)
- 45 minutes to 2 hours (long-term customers)
- Greater than 2 hours (staff)
- All devices detected

The ranges are meant to reflect the different levels of interaction by the customers in that zone.

Follow these steps to generate the report:

1. From the Select Report Type drop-down list, choose Daily Devices and Dwell Times.
2. From the Date From drop-down list, choose a start date. The report shows the number of devices categorized by dwell time from the selected date onward.
3. From the Date To drop-down list, choose the end date. The report shows the number of devices categorized by dwell time up to the selected date.
4. From the Time drop-down list, choose the time period for which you want to generate the report. The result shows the comparison of the same time period across consecutive days for a particular zone.
5. From the Focus Zone drop-down list, choose the zone you want to reference as the zone of interest.

Figure 42. Number of Devices and Dwell Report
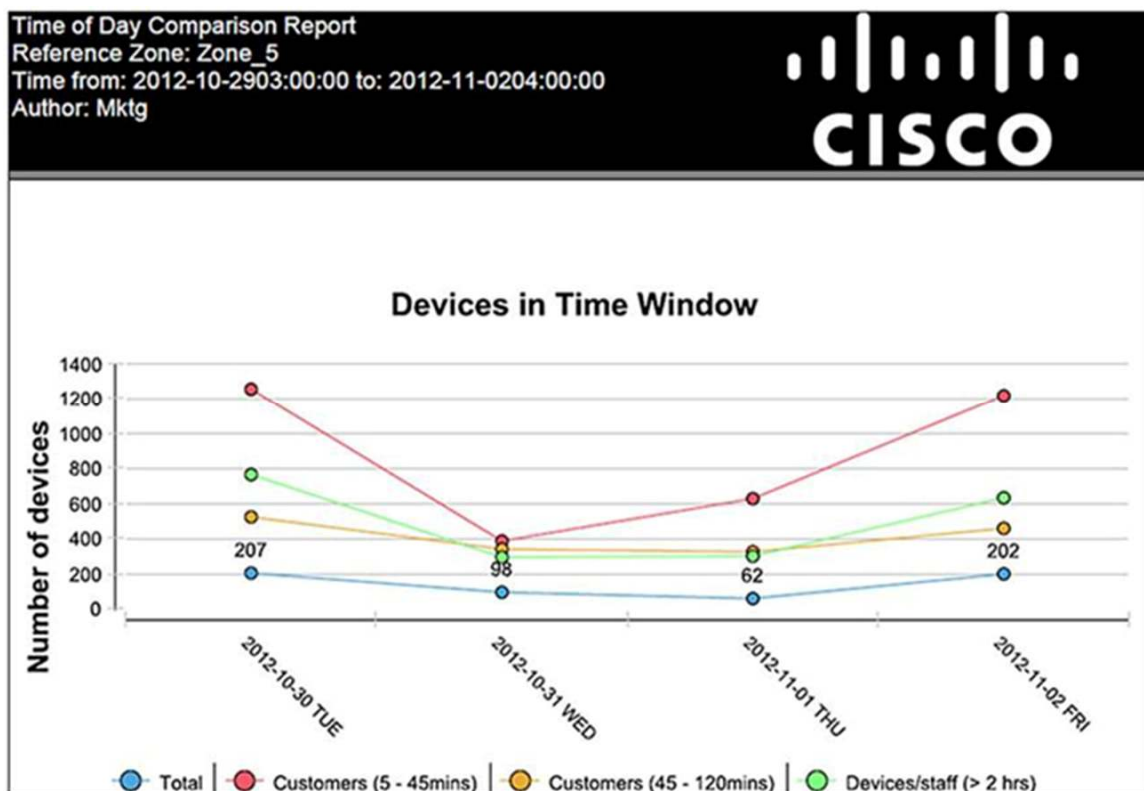
Tip: The Number of Devices and Dwell report is meant to be used to compare different days to see if some activity, such as a sale or store reconfiguration, has resulted in a detectable change in dwell times. For some venues, such as a retail store, high dwell times are good; for other venues, such as airport screening lines, high dwell times are undesirable.

Daily Dwell Time

The Daily Dwell Time report provides the average dwell time in 15-minute segments for any time window for a specified day and a specified zone (Figure 43). This report template filters out devices with very short dwell times (for example, people passing through the zone in less than 5 minutes) and very long dwell times (for example, people actually working in that zone).

Figure 43. Daily Dwell Time Report (15 Minutes)
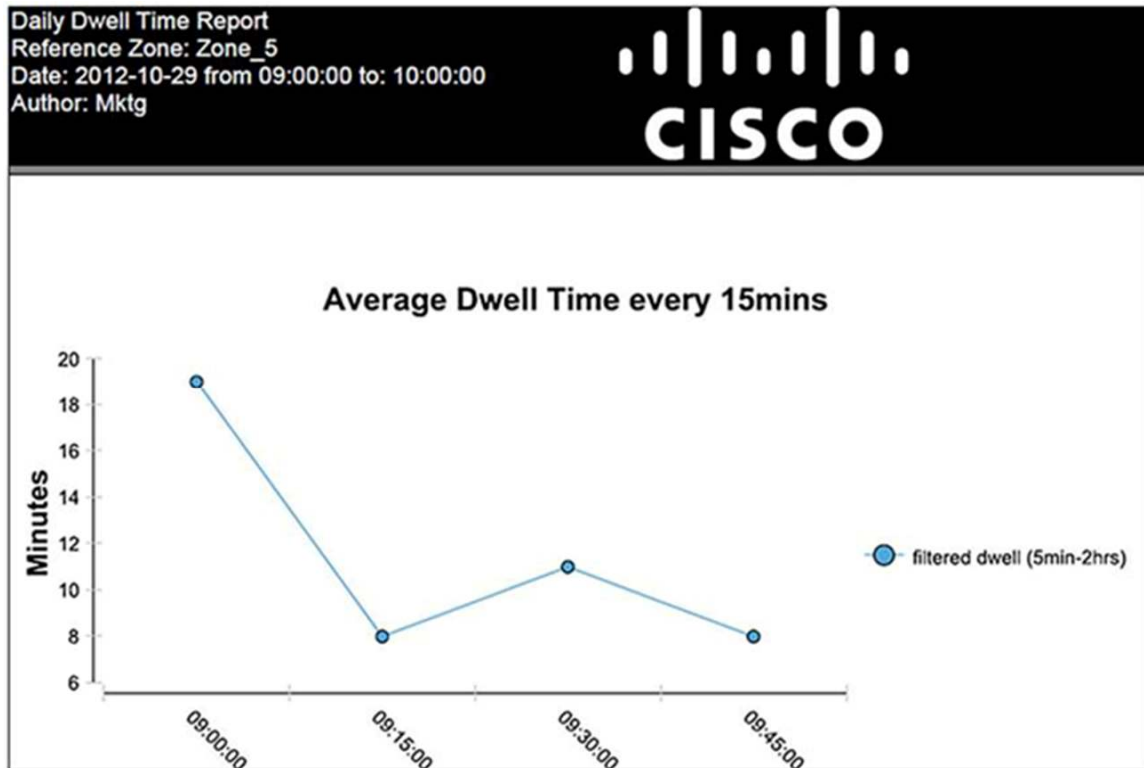
Device Snapshot (Fixed Windows)

The Device Snapshot report divides the selected day into predefined time periods (Figure 44). Each period shows the number of devices observed in a particular zone of the building. In this report, each device is separated according to its dwell time. This report shows people passing through and those staying for a significant amount of time in the zone.

Follow these steps to generate the report:

1. From the Select Report Type drop-down list, choose Device Snapshot.
2. From the Date drop-down list, choose the date for which you want the report to be generated.
3. Click Run Report

Figure 44. Device Snapshot Report
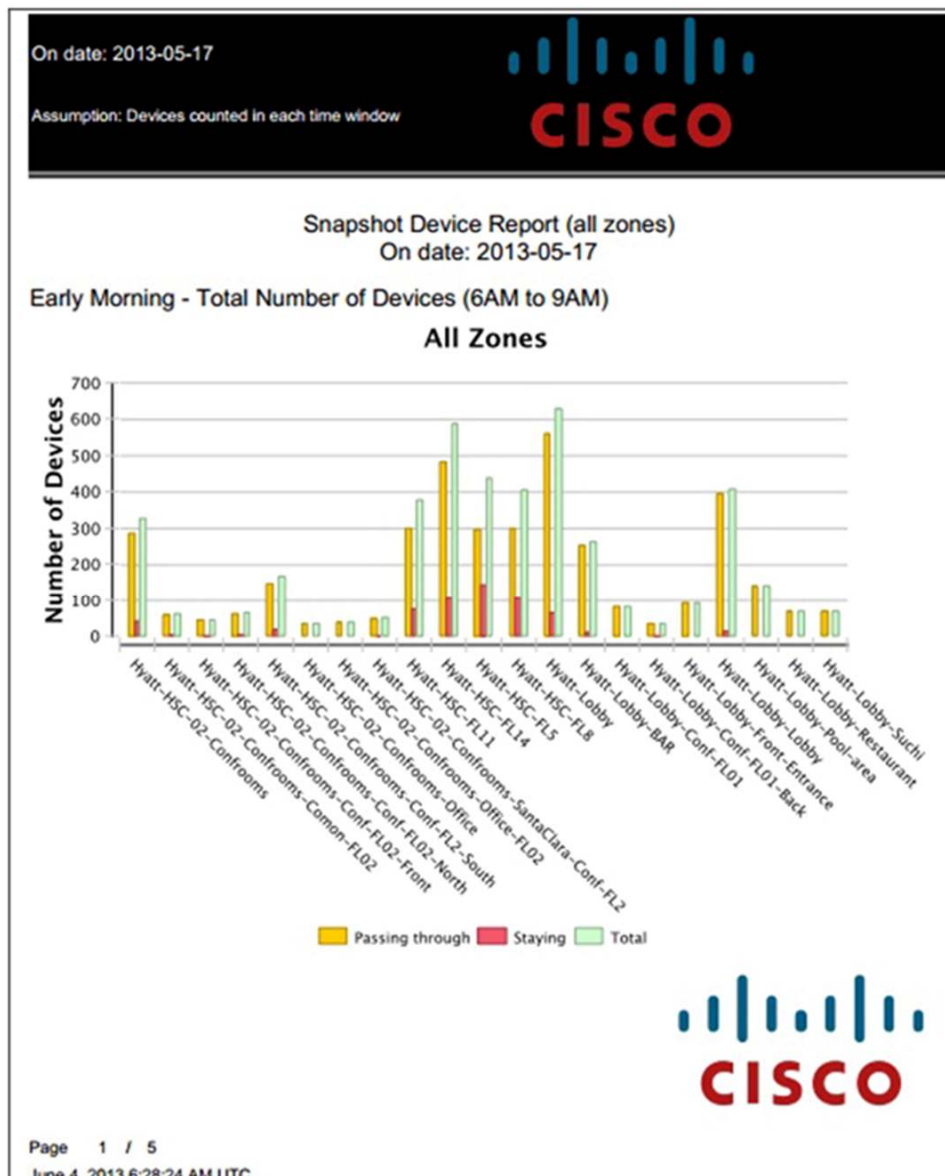
Dwell Times

The Dwell Times report shows how long clients have remained at a specific zone across a time period (Figure 45). The duration is measured every 15 minutes and the average is taken. This report excluded extremely short or long dwell time to give more balanced result.

Steps to Generate the Report

- From the Select Report Type drop-down list, choose Dwell Times.
- From the Date From drop-down list, choose a start date.
- From the Start Time drop-down list, choose a start time.
- From the End Time drop-down list, choose an end time.

- From the Focus Zone drop-down list, choose a zone.
- Click Run Report.

Figure 45.   Dwell Times Report
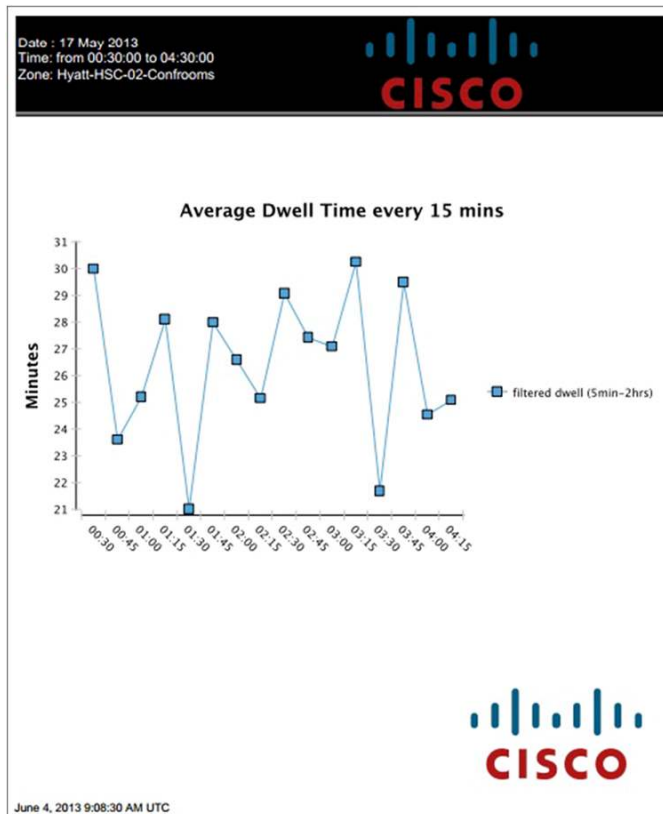
Top N Frequency Visits

The Top N Frequency Visits report shows the number of devices that frequently visit the selected area within the selected time period (Figure 46). The result shows frequently seen devices in the building along with the frequency distribution for those devices.

Follow these steps to generate the report:

1. From the Select Report Type drop-down list, choose Frequent Devices.

2. In the Top Devices text box, enter the number of frequently seen devices for which you want a report during a particular time and date in the building. For example, if you want to see the top 10 devices during a particular time period, enter 10 in the Top Devices text box.

3. From the Time drop-down list, choose the time period for which you want to generate the report. The results show the top N frequently seen devices in the building during the selected time. The possible options are All Day, Morning, Afternoon, Evening, Night, and explicit 3-hour time periods.

4. From the Date From drop-down list, choose a start date. The report will show the top-N frequently seen devices from the selected date onward.

5. From the Date To drop-down list, choose the end date. The report will show the top-N frequently seen devices up to the selected date.

6. Click Run Report.

Figure 46. Top N Frequency Visits Report
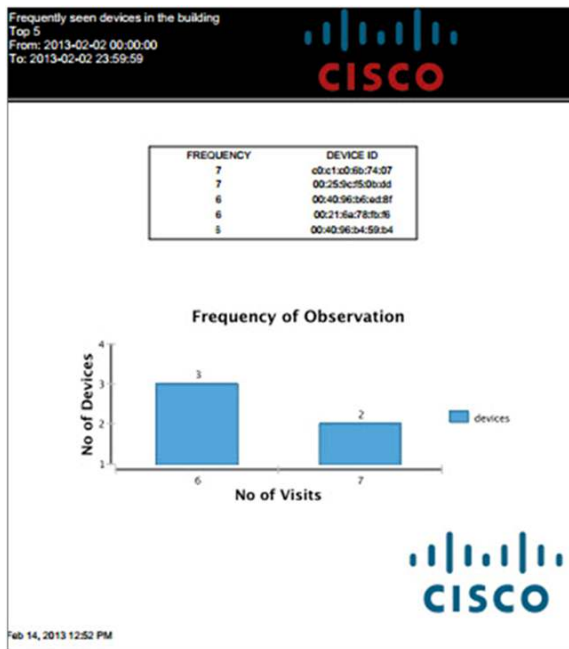
Movement Between Zones

The Movement Between Zones report allows you to identify a zone of interest (Figure 47). The report provides you with information about the number of devices moving to and away from that zone to and from other zones within a specified time period across a continuous set of days.

As a device passes to or from the zone of interest, it may pass through multiple zones. Each zone it passes through is counted toward the zone movement total. Therefore, devices likely are counted multiple times.

Follow these steps to generate the report:

1. From the Select Report Type drop-down list, choose Movement Between Zones.

2. From the Time drop-down list, choose the time period for which you want to generate the report. The result shows movement between zones within the building during the selected time. The possible options are All Day, Morning, Afternoon, Evening, Night, and explicit 3-hour time periods.

3. From the Date From drop-down list, choose a start date. The report shows the movement between zones to a focus zone within the building from the selected date onward.

4. From the Date To drop-down list, choose the end date. The report shows the movement between zones to a focus zone within the building up to the selected date.

5. From the Focus Zone drop-down list, choose the zone you want to reference as a zone of interest.

6. Click Run Report.

Figure 47.   Movement Between Zones Report
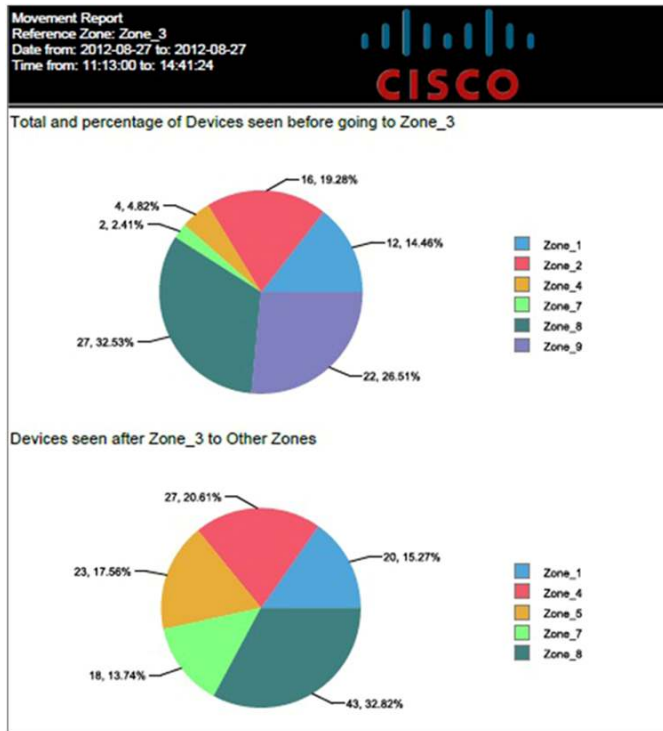
Tip: Getting good data in the Movement Between Zones report depends on setting up a good set of zones in the initial Cisco Prime Infrastructure installation. For a store, different departments may be different zones; for a venue such as a stadium, different seating areas may be different zones.

Movement - All Zones

The Movement - All Zones report provides information about zones that were visited by the devices before the devices visited the focus zone, or the zones that the devices visited after leaving the focus zone (Figure 48). This report provides information about the route taken by the people to reach to the focus zone. This report allows venue owners to direct their marketing efforts in areas that are underrepresented.

Follow these steps to generate the report:

1. From the Select Report Type drop-down list, choose Movement - All Zones.
2. From the Date From drop-down list, choose a start date. The report shows the movement between zones to a focus zone within the building from the selected date onward.
3. From the Date To drop-down list, choose the end date. The report shows the movement between zones to a focus zone within the building up to the selected date.
4. From the Start Time drop-down list, choose the start time period for which you want to generate the report. The result shows movement between zones within the building during the selected time.
5. From the End Time drop-down list, choose the time period for which you want to generate the report. The result shows movement between zones within the building during the selected time.
6. From the Focus Zone drop-down list, choose the zone you want to reference as a focus zone.
7. Click Run Report.

Zones Visited Any Time Before

Figure 48.   Zones Visited Any Time Before
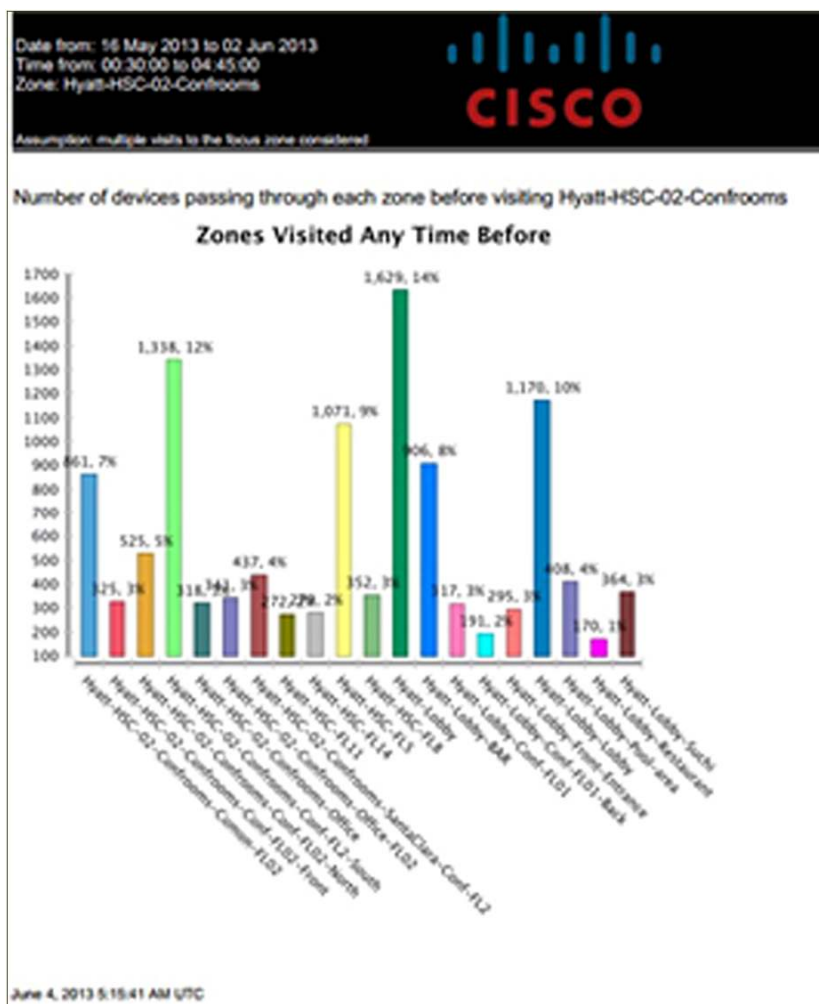
Movement - First, Intermediate, and Final

The Movement - First, Intermediate, and Final report provides a breakdown of all zones at specific points as a device passes to and from the focus zone. This report provides the following information:

- The zone in which the device was first detected
- The intermediate zone through which the device passed
- The zone in which the device was last detected

Movement - First and Last on Path

The Movement - First and Last on Path report considers the focus zone to be either the first or the last zone on the path and then counts the other zones that devices pass through on that path (Figure 49). For example, an organization can better understand how a building is used by viewing movement from any entrance or exit zone.

Figure 49. Starts at the Focus Zone
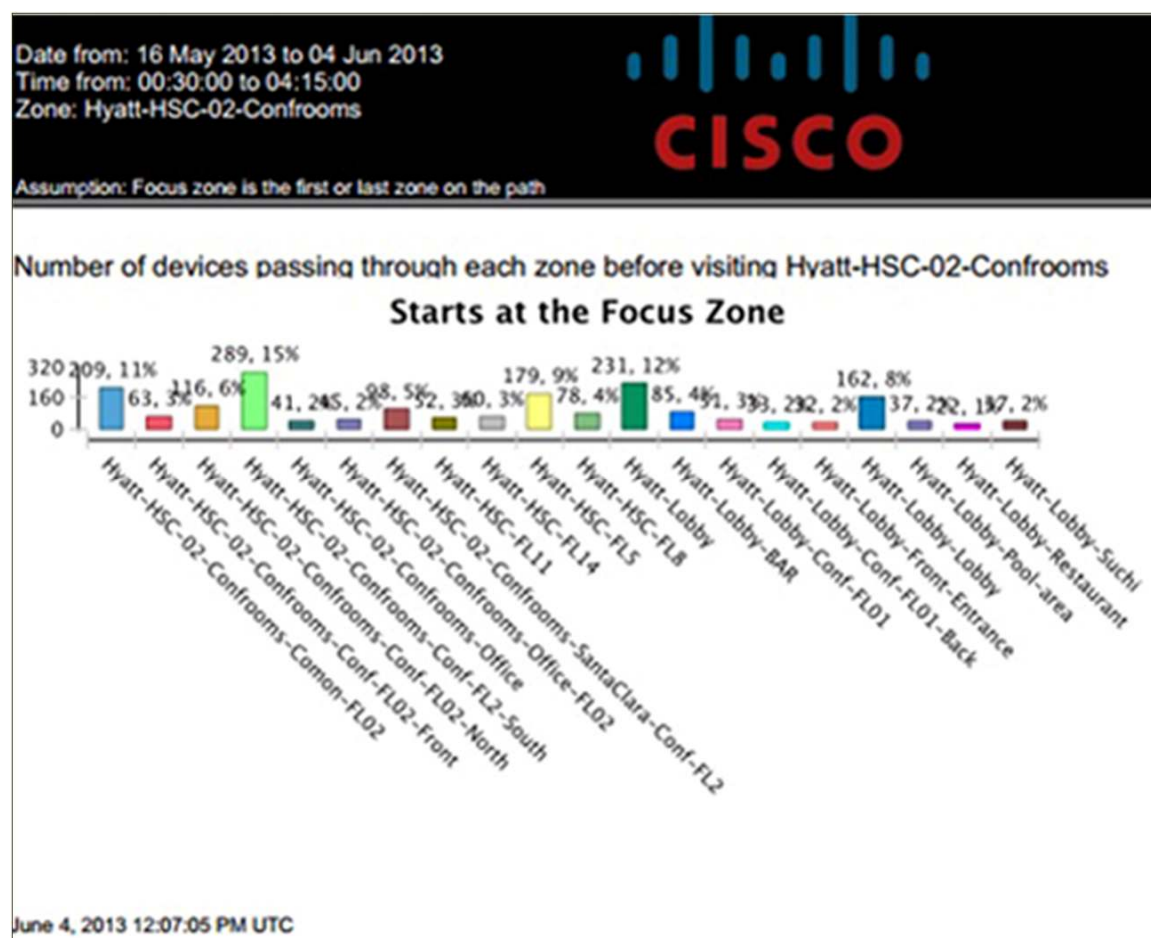
Tip: The Movement - First and Last on Path report can help you determine where customers enter and where they exit a venue. You should set up your zones by creating a zone at the typical entrance points and exit points. In a venue with a single set of doors, the first and last zones will likely be the same.

Cisco MSE API

Cisco MSE Context Aware Service can detect and track the location of wireless devices. As long as Wi-Fi is turned on in a wireless device, Cisco MSE can detect the device (even if the device is not associated with a wireless network). Cisco MSE has an open API to collect location and history information for different wireless devices and to configure various parameters on Cisco MSE.

An important API feature of Cisco MSE is its capability to broadcast a real-time stream of events to a destination. Cisco MSE can generate and send multiple types of events, but for the purposes of this document, the events of interest are:

- Location update events
- Containment events
- Generic northbound notifications

Location Update Events

Location update events are configurable events that can direct Cisco MSE to generate notifications whenever a wireless device moves a certain distance. This feature can be enabled using the API and requires the following information:

- URL of the event receiver
- Movement distance
- Message protocol: XML or text
- Destination type: Simple Object Access Protocol (SOAP), Simple Network Management Protocol (SNMP), or syslog
- Device type: client, rogue, tag, or interferer
- MAC address filter

Containment Events

Every containment event that is sent by Cisco MSE includes the MAC address of the device, the zone or area in which the device was detected, and information indicating whether the device was inside or outside the zone.

Generic Northbound Notifications

Cisco MSE can send a real-time stream of all the activity for all clients to a destination (Figure 50). These notifications are a superset of the location update events. This feature can be enabled using the API and requires the following information:

- URL of the event receiver
- Device type: client
- Trigger type: location change or presence
- Notification contents: location, custom key-value pair, and secure system ID (SSID)

Figure 50.   Generic Northbound Notifications
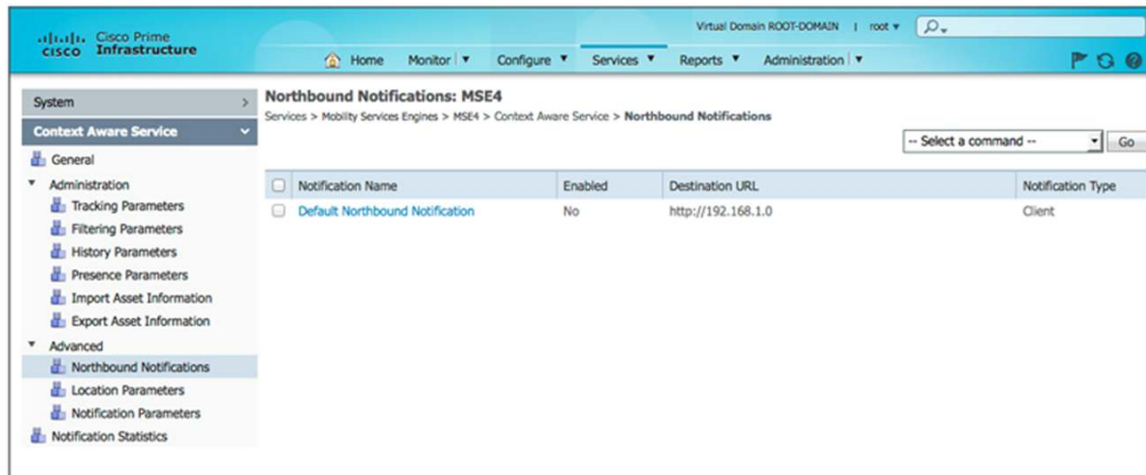
Representation State Transfer API Support

Cisco MSE provides public SOAP APIs for interaction with Cisco MSE collected data. The SOAP API has the following characteristics:

- The API is heavyweight; all data is wrapped in a SOAP envelope.
- SOAP can be hard to use on mobile devices. There is no native library.
- The API supports only the XML data format. It can be difficult to parse on the client side directly and the syntax for elements is verbose. Parsing is expensive on mobile devices.
- The data model is bloated. It includes a lot of unnecessary parameters that cannot be removed because doing so may break existing applications.
- The client needs to understand the object and database hierarchy to get the correct response.
- Data for some devices is split across different APIs.
- The API is session oriented. API users have to manually embed the session ID in all API requests.
- API developers must learn an old technology.

Cisco MSE 7.5 adds support for Representational State Transfer (REST) APIs. REST APIs simplify API use and are lightweight for direct use from mobile devices. The advantages of REST APIs include the following:

- They are based on the stateless REST architecture.
- The information is delivered over the well-understood HTTP and HTTPS protocols.
- They have a simplified design and easy-to-understand resource URIs, which usually are self-explanatory.
- Standardized libraries allow content negotiation capabilities by automatically sending the response in the user-requested format.
- They allow developers to simplify their data models, deprecate older nonscalable APIs, remove hierarchy dependency, and add other enhancements.

Cisco MSE provides updated documents specific to the REST API (Figure 51). The documents can be found at the following location on the server: https://address-of-mse/docs/.

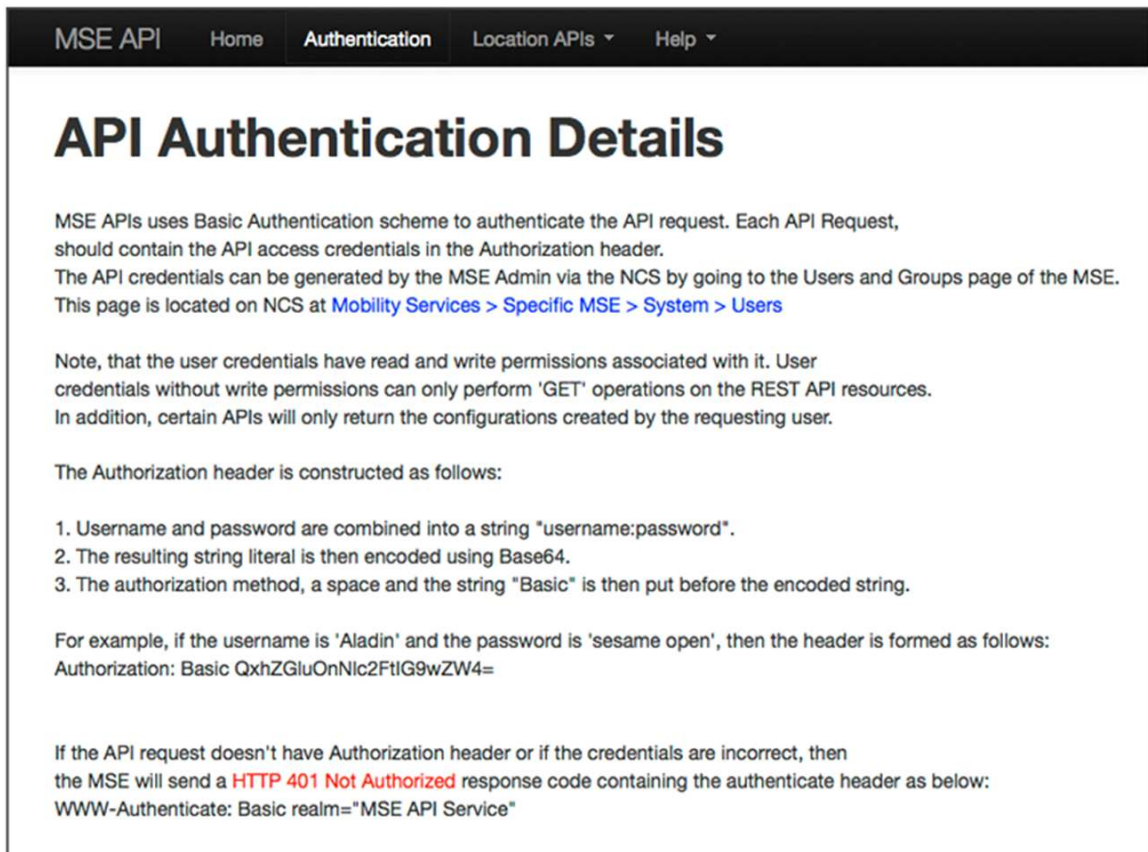**Figure 51.**   Cisco MSE API Documentation
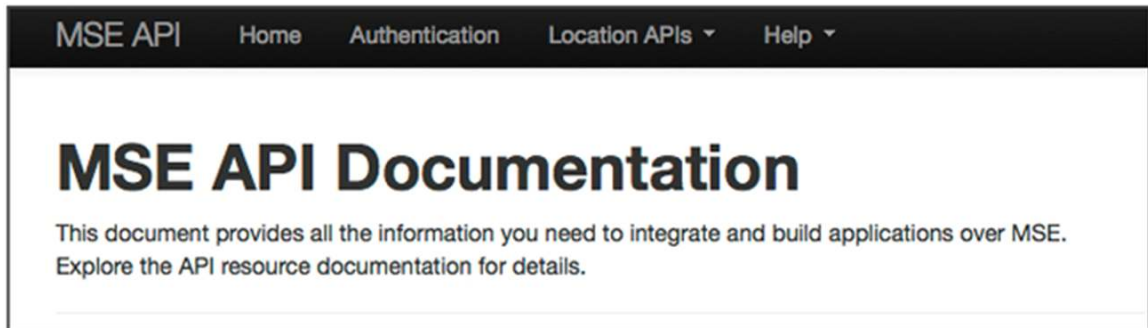
REST endpoints (clients) send requests to the authentication module using an address specific to each service you want to reach (Figure 52).

Figure 52.   API Authentication Details

Credentials are created on Cisco MSE through Cisco Prime Infrastructure:

- Requests are sent, after authentication, using GET and the resource needed.
- Authentication can be sent from the client side before the request, using the Authorization header.
- The username and password are combined into the string **username: password**.
- The resulting string literal is then encoded using Base64.
- The authorization method, a space, and the string **Basic** is then inserted before the encoded string.

For example, if the user agent uses **Aladin** as the username and **sesame open** as the password, the header is formed as follows:

```
Authorization: Basic QxhZGluOnNlc2FtIG9wZW4=
```

- Authentication can be requested from the server, using the HTTP 401 Not Authorized response code containing a WWW-Authenticate HTTP header.
- The header for basic authentication is constructed as follows:
  ```
  WWW-Authenticate: Basic realm="MSE API Service"
  ```
- Authentication is sent to the root URI to be reached (for example, https://<mseip>/api/contextaware).
- From the main URI, GET is used to obtain information about a specific object: network design, location, or notification resources.
- In this release, CAS resources start with v1; for example:
  ```
  GET /v1/location/{deviceType}/{id}
  ```

Tip: Joining the Cisco Developer Network will give you the best support for creating applications that access the Cisco MSE REST API. Check out http://developer.cisco.com/web/mobility-services.

Troubleshooting the Analytics Environment

To accurate produce results in Cisco CMX Location Analytics, a valid chain of processes has to be set up to deliver the right data to the analytics engine to generate results. Every part of the chain needs to be set up correctly to work (see Cisco Location Analytics Service Configuration Guide).

Figure 53 shows the main data flows necessary to deliver results, and Figure 54 shows the elements that need to be in place or checked to help ensure that these flows occur.

Figure 53. Data Flow in Cisco CMX Location Analytics

Figure 54. Monitors for Helping Ensure Data Flow (Red Arrows Show Main Links)

Any problem should be identified and traced back to its origin. A problem in analytics may reflect a misconfiguration in Cisco Prime Infrastructure. Most problems can be traced back to a malfunctioning of one of the links.

Common Questions and Starting Points for Resolution

This section presents a set of known problems people have encountered in configuring and running Cisco CMX Location Analytics. The section lists the high-level observation of the problem and then suggests possible causes and ways to check or validate these possibilities.

Problem: No User Interface Is Available

This problem generally occurs because the Cisco CMX Location Analytics application is not up and running.

- Verify that the analytics application is running from Cisco Prime Infrastructure.
- If it is not running, then enable it in Cisco Prime Infrastructure.
- If the analytics application cannot be enabled using Cisco Prime Infrastructure, go to the command-line interface (CLI) and stop and start the application and look for any error messages:

```
/opt/mse/analytics/bin/analyticsServiceManager.sh stop
/opt/mse/analytics/bin/analyticsServiceManager.sh start
chown –R nobody:nobody /opt/mse/analytics" after every start
```

- Check update.log.0 for error messages related to preparation of the user interface content.

Problem: Cannot Log into Application

- Verify that the Oracle database is running:

```
ps ax| grep oracle
```

- If the database is running, verify that the username and password are set correctly in Cisco Prime Infrastructure.

Problem: No Data Is Available

- This problem can occur because one of the links in the chain is not working. Check all links in order.
- Verify that history is enabled.
- If yes, verify that the analytics application is running.
- If yes, verify that tracking is enabled in Cisco Prime Infrastructure.
- If yes, verify that clients are being seen through Cisco Prime Infrastructure for the building and floors expected.
- If yes, verify that the mse.log.0 file is current and contains paths written to the database from the Cisco MSE download:

```
/opt/mse/logs/analytics/mse.log.0
```

Problem: Floors Are Seen, but Are Black

- This problem may occur if the floor image size is too large for the application to handle. Typically, images larger than 1 MB can cause problems.
- Check image sizes. Images are stored in /opt/mse/analytics/jboss-as-7.1.1.Final/images/. To check the size, enter the following command to list the images with their sizes:

```
ls –la /opt/mse/analytics/jboss-as-7.1.1.Final/images/*.jpg
```

If the image size is too large, you can change the maximum pixel dimension of any image in the mse.properties file. This file is located at /opt/mse/analytics/intellify/tools/MSEclient.

Problem: No Floors Appear in 3D

- Check that the mse.properties file has not restricted the floors being downloaded:
`/opt/mse/analytics/intelligy/tools/MSEclient/mse.properties`

- Verify that the floor is synchronized between the controller and Cisco MSE.

- Check whether the image files are being accessed through updater.log:
`/opt/mse/analytics/logs/update.log`

- Check the size of the image files, if an image may be larger than 1 MB.

Problem: Buildings Are Missing from the Menu

- Check that the mse.properties file has not restricted the buildings being downloaded:
`/opt/mse/analytics/intellify/tools/MSEclient/mse.properties`

- Verify that the building is synchronized between the controller and Cisco MSE.

Problem: Zones Do Not Appear

Zones are created as coverage areas in Cisco Prime Infrastructure.

- Verify that the zones are turned on for the building and floor. Note that by default, a floor is designated as a zone.

- Check update.log.0 to see if the zone updates are being uploaded:
`/opt/mse/analytics/logs/update.log`

- If zones are being uploaded, have you waited long enough? Please wait at least 15 minutes after zones are changed in PI before running reports in MSE using these zones.

Problem: There Is No 2D Image

This problem occurs when no GPS markers have been assigned to each floor. A building will be shown only after all the floors have GPS markers on them.

- Make sure that GPS markers are set (on the map in Cisco Prime Infrastructure).
- Make sure that GPS markers have the correct dimensions set for the building in Cisco Prime Infrastructure.

Problem: Analytics Processes Take Too Long to Run

This problem occurs when Cisco MSE is busy, usually with other location services.

- At the CLI, check the running processes to see if any is consuming more than 100 percent of the resources.
- If yes, identify the process and stop or move them.

On Cisco MSE with many clients, the workload can be quite high, so that also processing analytics can be problematic. The solution can be to move analytics processing to a separate Cisco MSE with fewer services or less location traffic.

Problem: Points Outside the Floor Are Detected

Points may be expected outside the building for the ground floor because the access points may detect points there. This behavior is not necessarily a problem. For an upper floor, however, the points may have been inaccurately placed.

- Are the outside points on the ground level?
- If yes, then either create an outside zone or create an inclusion area.
- If the points are on higher floors, then create an inclusion zone for that floor so that points are pushed back inside.

Problem: Result Locations Are Not Where Expected

- Verify that the locations are set correctly in Cisco Prime Infrastructure by viewing the placement of the clients.
- Are points shown outside the building where the floor is above ground level?
- If yes, consider adding an inclusion zone through Cisco Prime Infrastructure.
- If no, are the devices also shown outside the building through Cisco Prime Infrastructure?
- If yes, then you must recalibrate the map using Cisco Prime Infrastructure.

Expected Time for Changes to Propagate

When analytics processes are configured or changes made to the network, there is often an elapsed time before the end results can be seen. Many of the processes for updating are on timers, so it is not always apparent how long propagation of changes will take. Table 3 provides some guidance on how long to wait for changes to propagate or other events to complete.

Table 3. Expected Wait Times

Change or Event	Time to See Change or Event Reflected in User Interface	Comments
Startup with no data	Less than 1 hour and 15 minutes	One path needs to be complete and written to the database and then reflected in the user interface.
Startup with restored database	Immediate	
Addition of GPS markers	Less than 15 minutes	The analytics application polls Cisco MSE every 15 minutes for data. A new transition matrix appears and 2D is enabled and shows all historical results.
Addition of new coverage areas	About 90 minutes	The earliest that data is written is after 60 minutes, plus 15 minutes polling time, plus 15 minutes for refreshing the server-side cache with building parameters. **Note:** The old coverage areas will remain in the menus as long as they are referenced in the database. Currently, you can only delete data to get rid of them.
Addition of new floor	About 90 minutes, or 5 hours and 30 minutes	If you restart the analytics service, it will refetch the building parameters and take 90 minutes to display the new data. Otherwise, the system reloads the building parameters every 4 hours.
Change to maximum dimension in mse.properties	Immediate	Changes apply immediately after file is changed and MSE is restarted.
Data retrieved from Cisco MSE database	Every 15 minutes	This is the default and can be set in the mse.properties file.
Building characteristics refreshed for user interface	Every 15 minutes	This is the default

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