Cisco Workplace Analytics–Design and Implementation Guide

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Cisco Workplace Analytics is a new solution aimed at the Corporate Real Estate (CRE) Department. Note this group are sometimes referred to as Facilities, Workplace Resources or Estates.The principal value Cisco is bringing is to help them understand the utilization of their buildings. The key term here is utilization: most organizations have a limited view on how buildings are used based on Occupancy and Attendance. This is a very narrow and unreliable view since attendance simply informs entry and sometimes exit from a building/floor/area, and occupancy is often an estimate as to the presence of particular individuals or groups within those areas. Utilization is a blended measure of attendance, occupancy and movement patterns within a building, a far more useful metric. Current data is often gathered from time and attendance systems such as badge readers, secure entry keypads and CCTV. In many cases, CRE will pay a third party to come in and conduct occupancy audits (sometimes referred to as "bed checks"). The auditor will inspect designated areas within the buildings and record occupancy in rooms or at desks. These are expensive, manual checks that only provide a "snapshot in time" and don't reflect the natural habits of the employees and visitors. It is therefore very inefficient and ripe for Digitization.

Cisco has partnered with rifiniti to create a unique and powerful solution to enable CRE with not just the data they need, but a continual monitoring system that is accessible, simple to use and insightful.

The Cisco value add here is to provide additional data into Optimo that greatly enhances the knowledge base. To begin with, this will be based on wifi location data (using Connected Mobile Experiences - CMX) and over time additional data streams will be integrated (such as Bluetooth, Collaboration System, Network Usage and Proximity).

The analytical data that is exposed, such as the utilization of a floor in a building, can be used by CRE to make highly impactful decisions that could save or generate their company huge financial rewards.

The remainder of this document is concerned with the technical details of how to assess, prepare and integrate the Cisco network with rifiniti.

Requirements

Knowledge of Cisco Unified Wireless LAN Solution and basic knowledge of the rifiniti Optimo solution.

Components Used

Cisco Workplace Analytics is available when using Cisco Unified Wireless Network software version 7.6 or later, as well as CMX 10.x or MSE 8.0. This feature is supported on all wireless LAN controllers (WLANs) and newer generation indoor access points (APs). This feature is not available on autonomous access points and outdoor access points. Cisco Prime is a requirement to deploy CMX or MSE in a required network device.
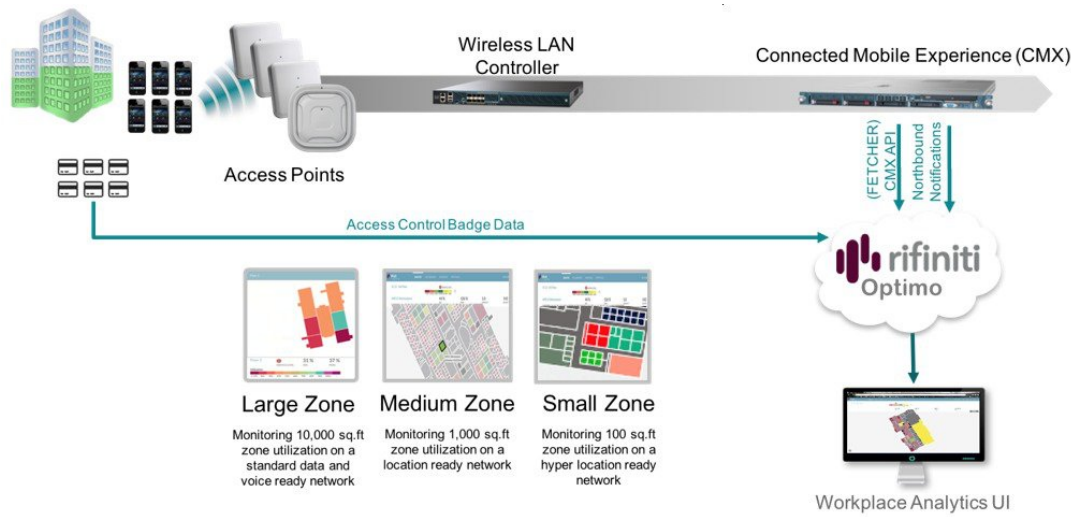
Conventions

Refer to Cisco Technical Tips Conventions for more information on document conventions.

Solution Architecture

The Solution Architecture for Workplace Analytics is shown below:

Figure 1: Workplace Analytics Architecture

This is a standard CMX wifi network with the addition of a data stream from security badge readers that are traditionally used to gain access to the buildings, floors or even rooms/areas. The Analytics platform is called Optimo and is cloud hosted, with the end customer consuming the data via a web browser and licensing through subscription.

An example screen is shown below:

Figure 2: Optimo Mobility Screen
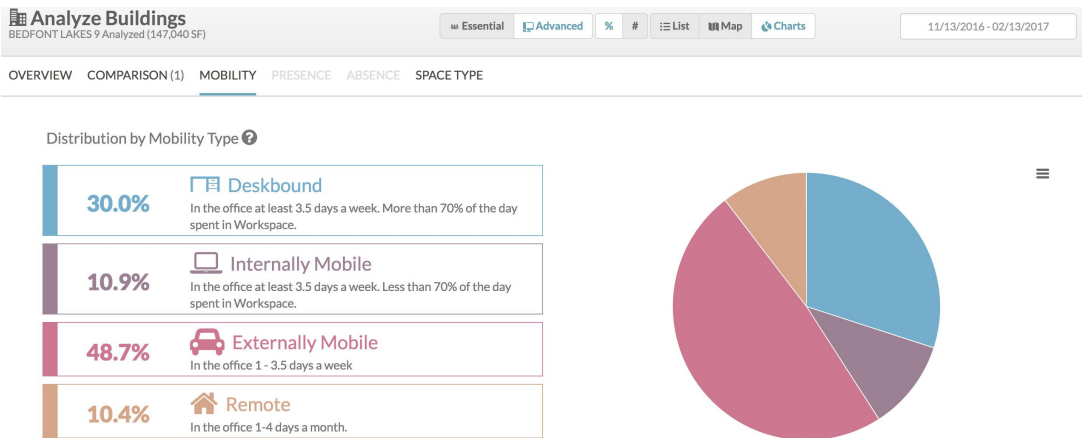
Data from CMX is exported from the Connected Mobile Experience Server (CMX) using the HTTPS northbound notifications. This is the recommended way for analytics applications to consume the near-real time data from CMX. Hence in this initial release it will not be possible to perform retrospective analysis which would require using the fetch (pull) API.

As an alternative, customers with MSE8.0 can utilize a special Optimo provided fetcher that will pull data from MSE into Optimo. This document will focus on how to configure the system with the recommended northbound notification system.

Optimo will analyze these data streams and produce reports based on zones. These are logical divisions of a building and could be a whole floor, a group of meeting rooms or a department. The exact zone design and granularity will be determined by the wifi design and is discussed later in this document.

Pre–requisites for Workplace Analytics

It is imperative that Cisco and their Partners qualify potential customers for suitability with Workplace Analytics.

Suitable workplaces would then be candidates for the Digital Utilization Study or production rollout.

The first criteria is that the Solution will not work with low density wifi networks, or to put another way, with Presence Analytics. Customers should ideally have a location based network that follows Cisco's CMX Validated Design.

A useful summary of these design guidelines are:

Figure 3: Example Prime Location Readiness Test moderate

- Proper placement and density of access points is critical in achieving the quoted location tracking performance
- Original design may have been based on coverage model
- Access Point Density recommendations
    - Use smaller, overlapping cells (lower data rates disabled)
    - For wireless data only deployments: 10% AP cell overlap
    - For wireless data + voice deployments: 20% cell overlap
    - AP density [Cell radius/area] 8m/230m2 – 12m/450m2 (28ft/2500sqft – 40ft/5000sqft)
- Access Points with internal antennas should be oriented horizontally (vs. vertically)
- Antenna diversity should be enabled for legacy 802.11a/b/g Access points (ClientLink not relevant for location)
- For new (greenfield) or wireless re-designs, when performing the predictive site-survey, the following guidelines should be used:
   - Design for 5 GHz

◦ Signal Strength >= -67 dBm

◦ SNR >= 20 dB

◦ Number of APs within range of clients = 3

◦ Packet Loss < 10%

◦ Transmit Power 10mW

• Rule of thumb is 1 AP per:

◦ 460 m2 (5000 sq ft) for Data

◦ 230 m2 (2500 sq ft) for Voice / Location

It is understood that these targets may be unrealistic due to the number of legacy networks existing that were not designed for Location Based Services (LBS).

One immediate "litmus test" for compatibility is to use Cisco Prime. In fact, Cisco Prime is itself a pre-requisite for Workplace Analytics. In particular, Prime should be updated with all floor plans and Access Points accurately represented and positioned on them, ideally using laser measurement devices for co-ordinates and height.

Within Cisco Prime, navigate to the Maps view and run the Location Accuracy Test for each floor. This will produce a heatmap showing an estimate of location suitability. The ideal output is a predominantly green overlay, although a combination of green/orange would also qualify. Examples are shown in above figures.

Figure 4: : Location Readiness Test – Good
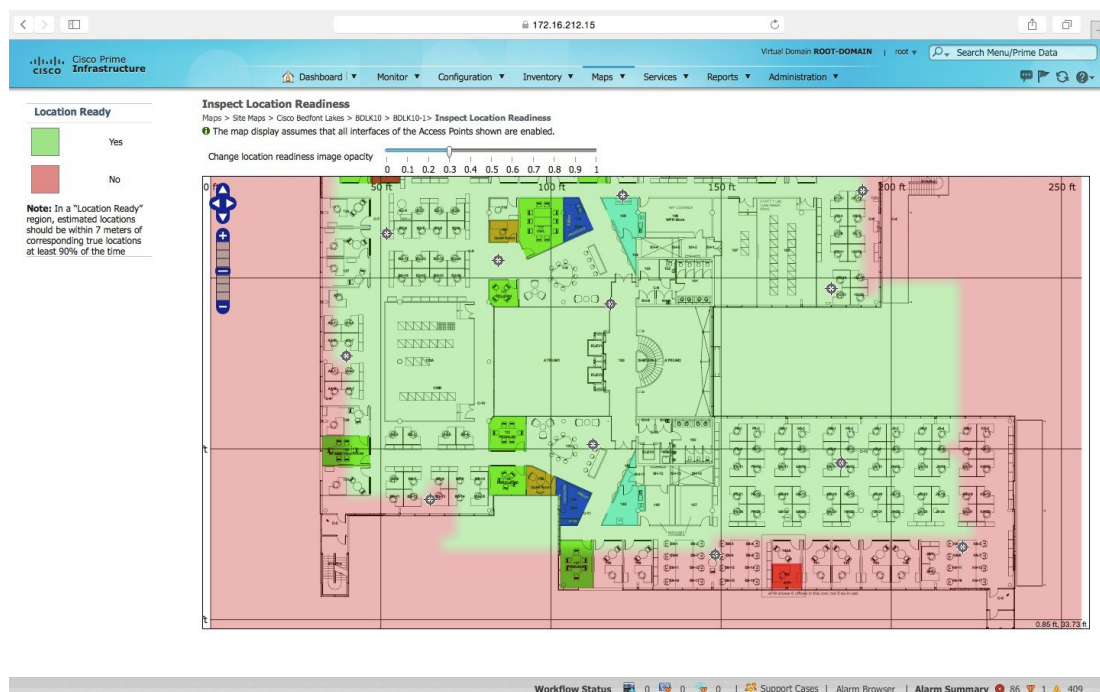
Assuming these initial tests are passed, an additional set of infrastructure checks should be made. These Primarily consist of validating compatibility and software versions on Access Points, Controller, CMX (if in use) and Prime.

This is all documented at: http://www.cisco.com/c/en/us/td/docs/wireless/compatibility/matrix/compatibility-matrix.html#pgfId-147162

✎
Note   If compatibility is not achieved here, this need not prevent either the Digital Utilization Study or production roll out from proceeding.

For example, the customer may decide to update the non-compatible part of the network (such as Access Point density), or deploy Workplace Analytics in a specific segment/area that is compatible (such as in one building with the right wifi coverage).

CMX Deployment and Configuration

If CMX is not already being used, then it should be deployed, configured and tested. This task is typically administered by a Cisco Channel Partner, though Customer may choose to do it themselves.

The deployment guide for CMX can be found at http://www.cisco.com/c/en/us/td/docs/wireless/mse/10-3/cmx_config/b_cg_cmx103.html

If the customer knows in advance that high accuracy is required, Hyperlocation will factor into the CMX design. The deployment guide for Hyperlocation can be found at http://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-1/Halo-DG/b_hyperlocation-deployment-guide.pdf Extreme care should be taken when deploying Hyperlocation as there are several important caveats and dependencies.

Once deployed, CMX should be validated. A critical part of this is an Accuracy Test. This will indicate the likely accuracy to be expected, but more importantly will determine the Workplace Zone design. Instructions for applying the Accuracy Test are in the previous document. Customer or Partner should create multiple tests per floor: round the perimeter and in the interior to get a better average error figure.

An example of an Accuracy Test Report is as shown below:

Figure 5: Example CMX Accuracy Test Report

Test	Name	Status	Mac Address	Floor	Start Time	Location Computation Frequency (s)	Measurements on Correct Floor (%)	10m Accuracy (%)	Average Error Distance (m)	90% Error Distance (m)	75% Error Distance (m)	50% Error Distance (m)	
↻⬇✉	Test	finished	cc:44:63:c6:7d:28	UK - Bedfont Lakes Campus > BDLK09-G Building 9 > BLDK09-G-Groundfloor	2017-01-25 01:34am	3.3	100	100.0	0.69	0.72	0.71	0.69	✕
↻⬇✉	UK EBC: b8:78:2e:3e:0a: 18	finished	b8:78:2e:3e:0a:18	UK - Bedfont Lakes Campus > BDLK09-G Building 9 > BLDK09-G-Groundfloor	2017-01-19 01:45am	5.6	100	100.0	2.54	2.73	2.56	2.44	✕

Location Accuracy Test
Show 8 entries   Search:
Showing 1 to 2 of 2 entries   Previous 1 Next
Close

The critical part here is the 90% Error Distance Figure. Think of this as the radius of the smallest zone that could be created for that floor.

Figure 6: CMX Zone Design

- Size and Separation should match accuracy (90% accuracy distance)

- Not possible to suggest absolute sizes and distances

- Absolute numbers depend on achieved location accuracy
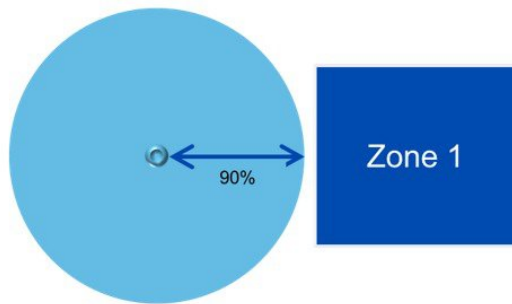
If it makes logical sense, then the floor should be updated with zones according to these guidelines. Sometimes, it may not be applicable, for example a floor used for one purpose where there are uniform rows of desks. In that scenario, there would be little value in sub-dividing into smaller zones. If however there are different workgroups or functional areas such as meeting rooms, café, gym etc then value would be obtained by using zones.

Figure 7: CMX Zone Example
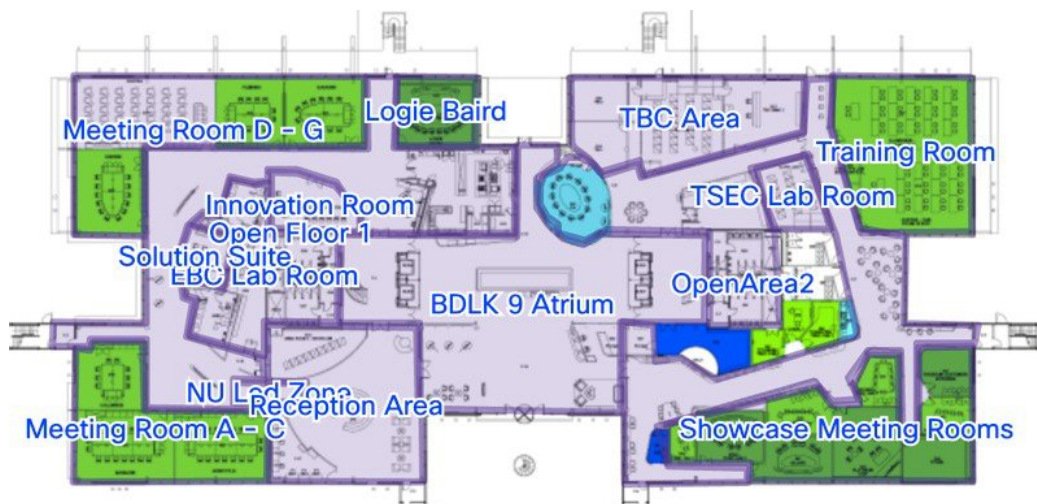
At this stage it is possible to explain to the Customer, in particular Corporate Real Estate, the Workplace Analytics zones that will be capable of being measured by the system. In Workplace Analytics, there is the concept of small, medium and large zones. These map approximately onto the CMX capability spectrum as illustrated in Figure 3.

Figure 8: The Location Accuracy Spectrum
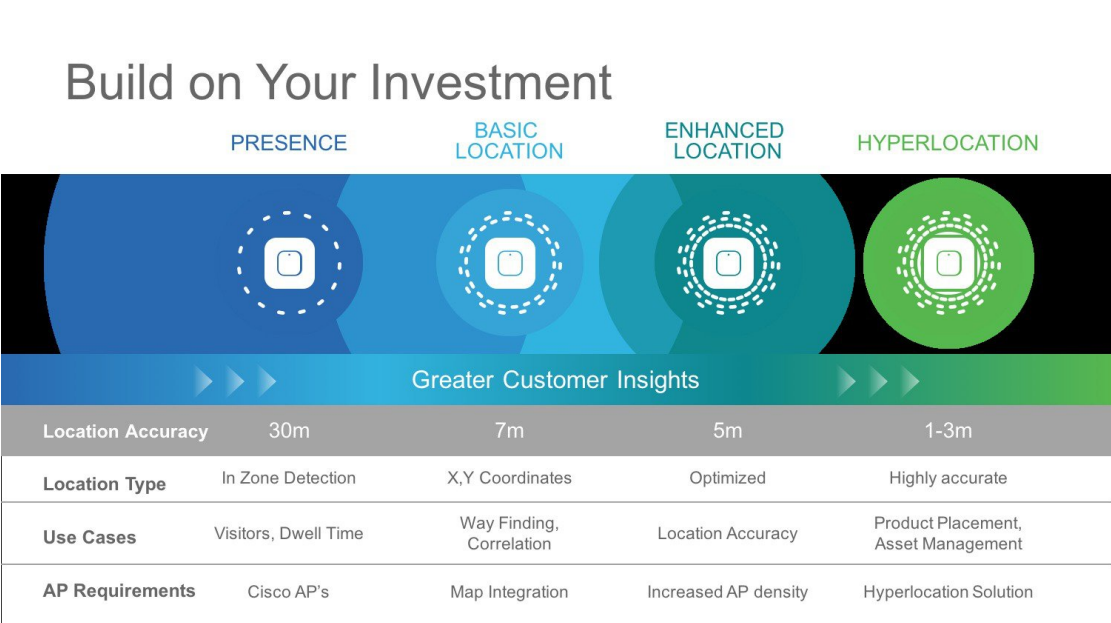
Presence will not be supported in Workplace Analytics. Thereafter, customer networks will fall into one of the remaining categories, each of which maps onto the concept of small, medium and large zones as per Table 1.

Table 1: Workplace Zones and CMX Capability

Workplace Zone	CMX Capability	Definition	Example
Large	Basic Location	1000 - 10000 square feet (approx. 100 - 1000 square metres)	Floor of a building
Medium	Enhanced Location	100 - 1000 square feet (approx. 10 - 100 square metres)	Co-located Department or Workgroup
Small	Hyperlocation	10 - 100 square feet (approx. 1 - 10 square metres)	Meeting Room(s)*

As shown, to achieve Small Zone monitoring, Hyperlocation needs to be employed, taking great care to follow guidelines for successful use of this technology as mentioned previously.

It should also be stressed that to achieve meeting room level accuracy, especially for small to medium sized rooms, Optimo is required to provide the additional accuracy. This is because CMX cannot guarantee to place a wifi client inside a meeting room. Event with Hyperlocation, a wifi client could be physically located near a wall in the room and CMX may place that client in the adjacent room

or in the corridor outside. Furthermore, it is unlikely and in most cases impractical to place three Hyperlocation Access Points in meeting rooms.

Optimo uses special machine learning in conjunction with room booking data to provide enhanced statistical accuracy over a period of several weeks to achieve this.

Integration with rifiniti Optimo

As mentioned in the Architecture section, Optimo integrates with CMX through Northbound Notifications. These are listed in Table 3.

CMX Notifications Required for Optimo

Notification	Parameters	Destination
Location Update	Device Type = Client	https://DEFINEDBYRIFINITI:PORT

The largest amount and most important data that is sent from CMX to rifiniti is the LOCATION UPDATE notification. One important consideration is that all of the notifications from CMX to rifiniti have MAC Hashing enabled and use the same key. This protects all of the privacy of the individuals, but still allows for the aggregation on the information by rifiniti.

The following is how the MOVEMENT notification should be configured.

Figure 9: Optimo Movement Notifcation Configuration in CMX

Collaborative Spaces

Conference rooms and other collaborative spaces such as huddle rooms, informal seating, etc., have taken on particular importance for corporate end users seeking to rationalize space use, due to their shared nature, their high per-seat costs to build and maintain compared to workstations, and increasing demand. Depending on available data and the customer's need for accuracy, Optimo can determine the utilization of such spaces using various combinations of data.

Using only badge data and meeting invitation data from MS Exchange, Office 365 or Google Calendar, Optimo compares who was invited to a meeting with who actually badged in, and determines the maximum number of probable attendees in managed spaces.

Using the rudimentary data sources as above but combining these with room occupancy sensor (or smart lighting occupancy sensor) data, Optimo can determine which spaces were used as booked and also determine when spaces are being 'squatted' (ie use without a booking), but cannot report on detailed utilization of unmanaged spaces such as informal seating. Where other sensors-such as desk sensors, door/people counters, and image processors--are available, Optimo can report on utilization.

Using the same data sources as above but combining these with WiFi triangulation data, Optimo not only achieves greater accuracy in determining the number of attendees in managed spaces, but can also determine 'squatting' (ie use without a booking) in such spaces as well as utilization of unmanaged spaces such as informal seating. The accuracy of such calculations is a function of the accuracy of the WiFi triangulation data.

When one or more sensor data sources are added to the other data sources for Optimo above, Optimo, can report results in detail for all monitored areas.

Resolving Multiple WiFi devices per Person

In the office environment, it's common for occupants to carry more than one WiFi-device, such as a cellphone, laptop and tablet. To determine the correct number of occupants, Optimo uses machine learning algorithms on data over time to learn by clustering the devices belonging to one person. This is done continuously, so as new occupants join the population or as occupants change devices, the clustering is adjusted. Furthermore, when occupants leave a device in one place and go to another place, there may be uncertainty about which space they are occupying. Optimo is able to discern which is the ocupant's 'primary' device (usually the most mobile one) and use that to assign utilization.

Verifying Interaction between CMX and Optimo

CMX will send northbound notifications at a rate that is dependent on the number of devices on a floor. A rate of less then 500 notifications per second is supported with CMX.

To verify the number of notifications per second, you can select a notification and view the details. The Latency should be less then 1000ms and the Failure Percentage less then 5%. In some cases no notification ACKs are sent, but this does not mean that Optimo is not receiving them.

Figure 10: CMX Northbound Notification Statistics Details

DETALS   ×

Name	Notification Receiver	Total Sent	Acknowledged Count	Unacknowledged Count	Success Percent	Failure Percent	Send Rate(per sec)	Latency(in ms)	Actions
RifinitiLocUpdMTV	https://northbound.rifiniti.com:7445	219572850	218989675	583486	99.73%	0.27%	266.35	288	Reset

Close

Additional Information on Badge Readers

One important area that needs to be configured is badge readers. This dataset and how they need to be configured to send to Optimo can be determined by sending an email to "support@rifiniti.com" and requesting the more detailed design guides around badge reader integration.

Conclusions

Cisco WorkPlace Analytics can provide a great set of benefits to real estate professional and configuration at Cisco is minimal. Primarily you need to ensure that there is a location ready WIFI network and that northbound notifications are sent to rifiniti. The web GUI provided by rifiniti is referred to as Optimo and displays the utilization information that is most relevant to real estate professionals.