Cisco Connect

Dubai,UAE
February 18-19, 2015

TOMORROW starts here.

Delivering Location Based Services with Cisco Enterprise Mobility Services Platform

Christian Gauer, TME Enterprise Solutions Group

Create Business Impact with Cisco's CMX

Detect

- Presence and location detection
- Visibility

Connect

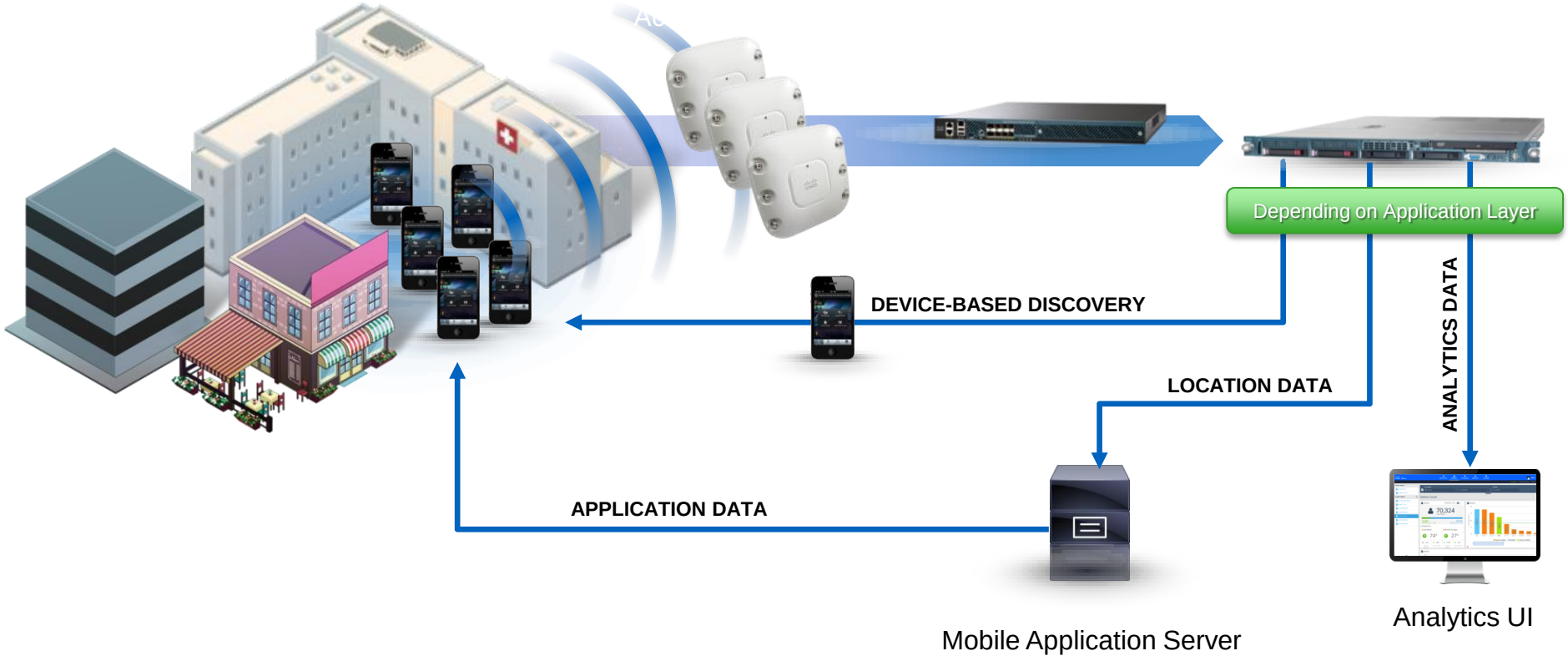
- Easy Wi-Fi login, custom or social
- Zone-based, custom splash pages

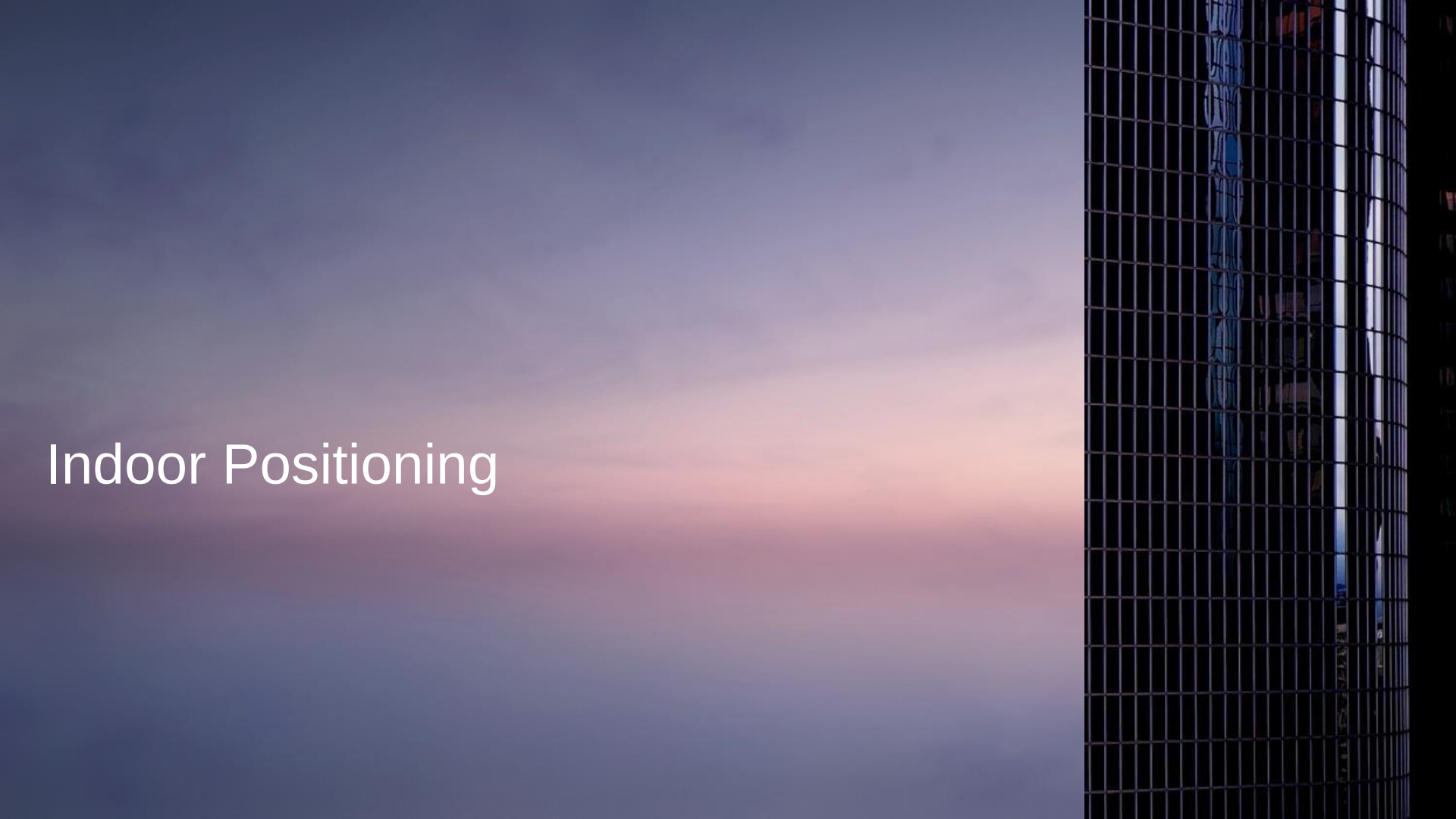
Engage

- App-based mobile engagement
- Context-aware in-venue experiences

Analytics

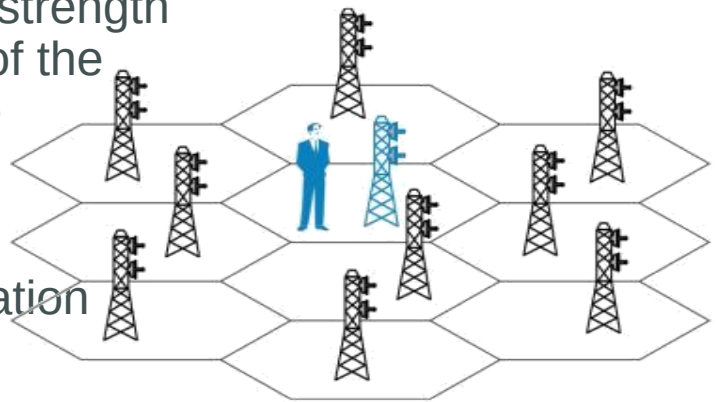
How CMX Works
Built on Cisco Unified Access




Indoor Positioning

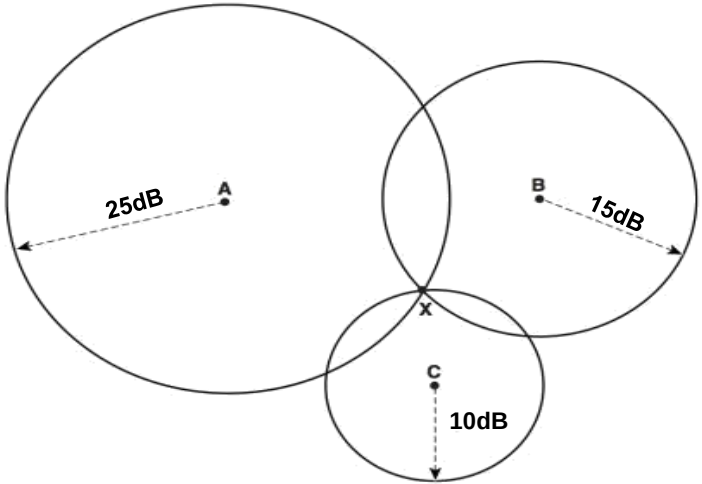
Cell of Origin

- One of the simplest mechanisms of estimating approximate location in any system based on RF cells is the concept of ‘cell of origin’ (or ‘associated access point’ in Wi-Fi 802.11 systems)
- To better determine which areas of the cell possess the highest probability of containing the mobile device, some additional method of resolving location within the cell is usually required.
- When receiving cells, provide received signal strength indication (RSSI) for mobile devices; the use of the highest signal strength technique can improve location granularity over the cell of origin.
- With CMX this level of positioning granularity would only suffice to provide presence information



Distance-Based (Lateration) Techniques
Received Signal Strength (RSS)

- Lateration can be performed by using RSS in place of time (TDOA)
  - Measured by either the mobile device or the receiving sensor
- Path loss represents the level of signal attenuation present in the environment due to the effects of free space propagation, reflection, diffraction, and scattering
  - Path loss exponent indicates the rate at which the path loss increases with distance; the value depends on frequency and environment
  - Is highly dependent on the degree of obstruction (or clutter) present in the environment

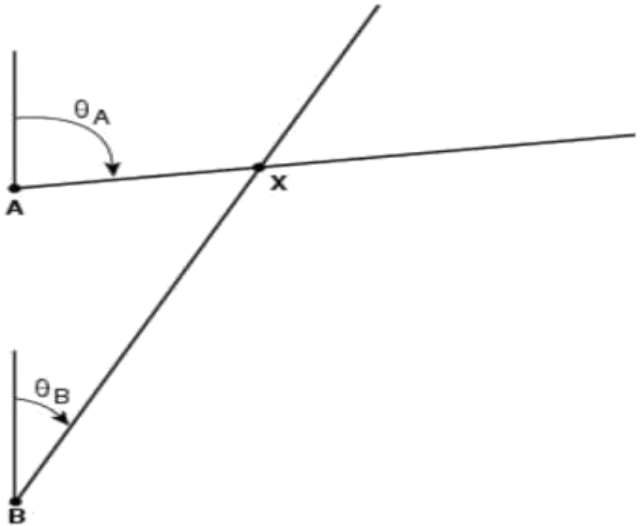


Typical path loss exponent for:

- Indoor office environment - 3.5
- Dense commercial or industrial environment - 3.7 to 4.0
- Dense home environment - as high as 4.5

Angle-Based (Angulation) Techniques
Angle of Arrival (AoA)

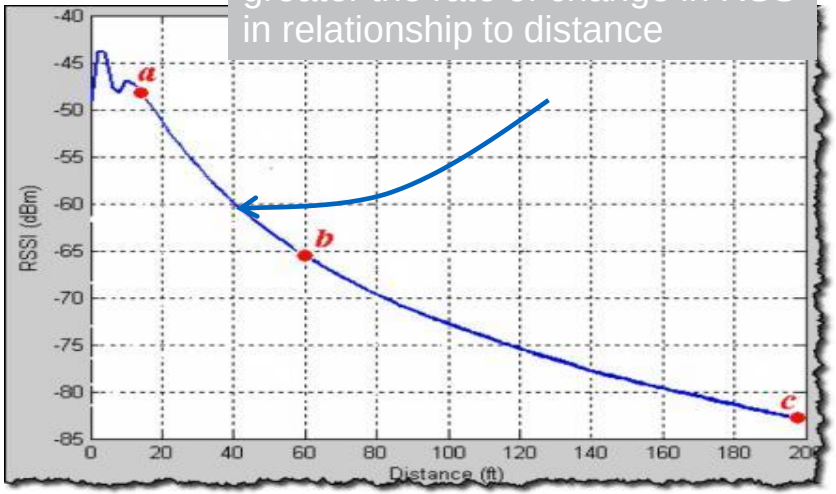
- The AoA locates the mobile station by determining the angle of incidence at which signals arrive at the receiving sensor
- Requires two receiving sensors for location estimation, with improved accuracy coming from at least three or more receiving sensors (triangulation)
- Requires multiple element antenna arrays or mechanically-agile directional antennas
- Works well in situations with direct line of sight, but suffers from decreased accuracy and precision when confronted with signal reflections from surrounding objects
- In dense urban areas, AoA becomes barely usable because line of sight to two or more base stations is seldom present



Relationship Between RSSI & Distance

- RF fingerprinting uses a client's RSS from probe requests to localize a tracked client
- This localization works best when the relationship between the RSS and the distance from the AP poses a clearly monotonic relationship
- Monotonic means Y only moves up or down in relation to X

The closer the distance the greater the rate of change in RSS in relationship to distance

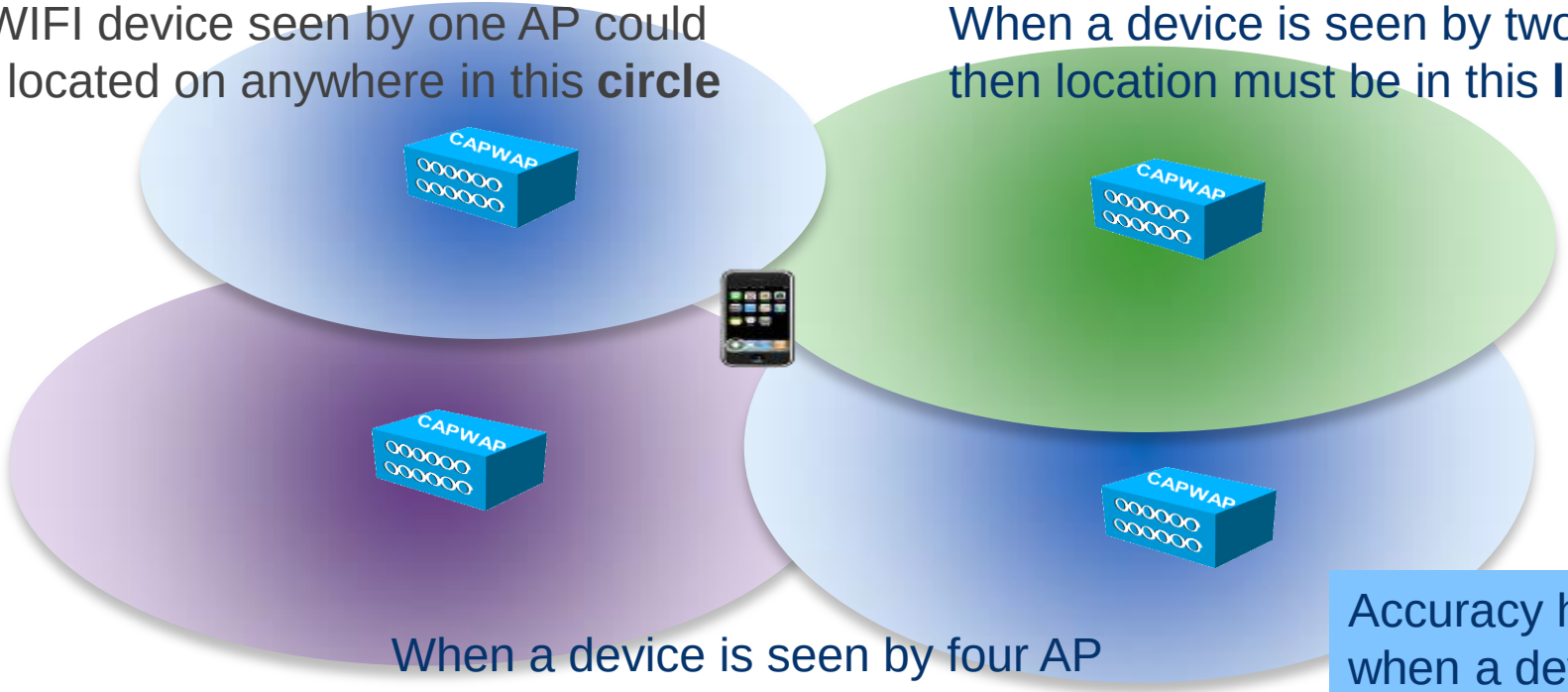


The change in RSS in relationship to distance flattens out at greater distances

WiFi Based Location Calculation Basics (Trilateration)

A WIFI device seen by one AP could be located on anywhere in this **circle**

When a device is seen by two AP then location must be in this **line**



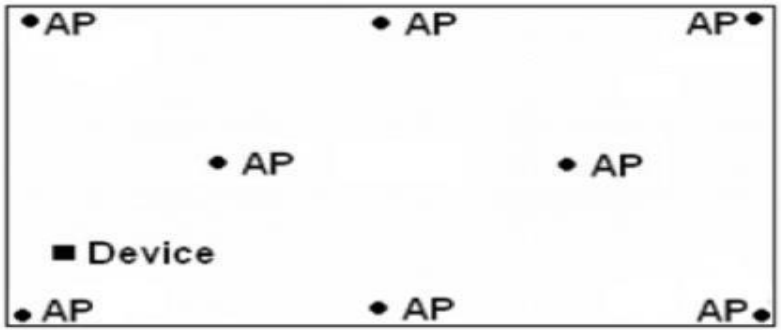
When a device is seen by four AP then location must be at this **point.**

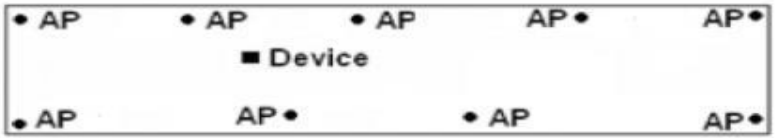
Accuracy highest when a device is seen by at least 4 Access points

Basic Example of Location-Aware Access Point Deployment

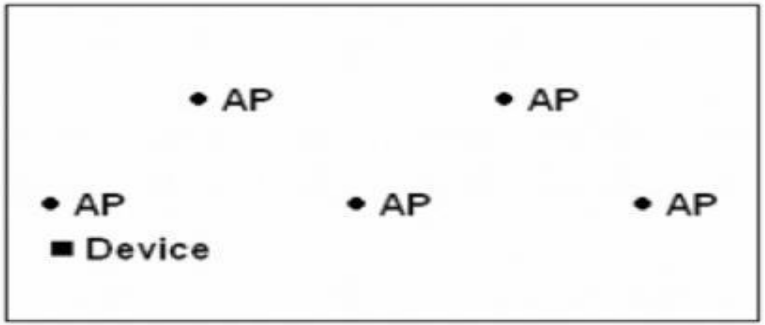
If possible, mount antennas such that they have an unencumbered 360˚view of all areas around them, without being blocked at close range by large objects.

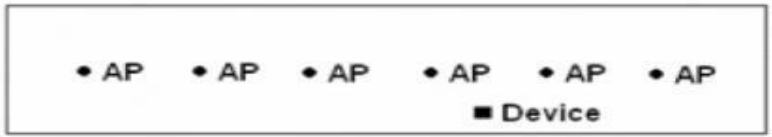
Recommended





Not Recommended





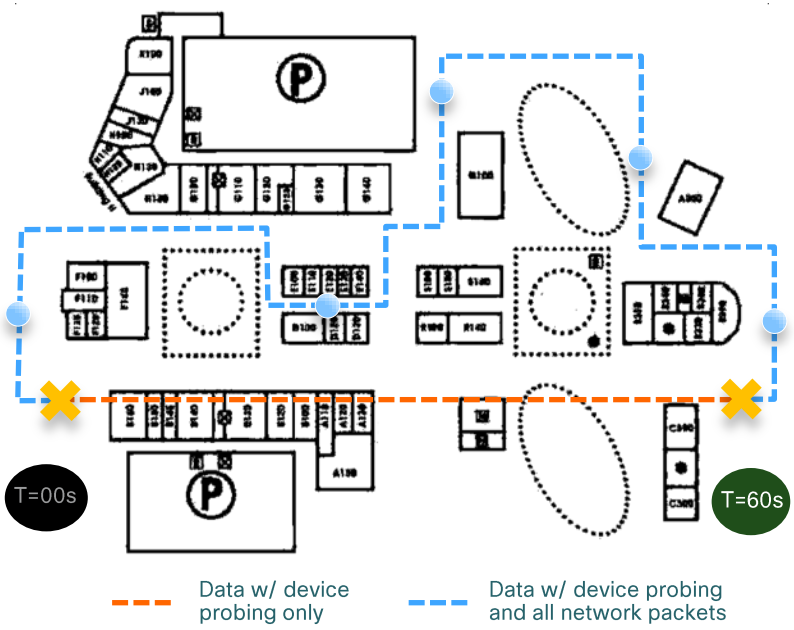
Presence and Location Comparison

- Device is in/out of the store
- Based on distance to an access point

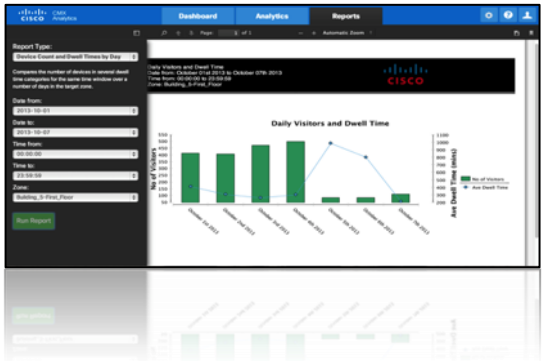
- Device is in a department of the store
- Based on X, Y coordinates

Probe RSSI vs. Data RSSI

Location Resolution is Critical to Actionable Business Intelligence



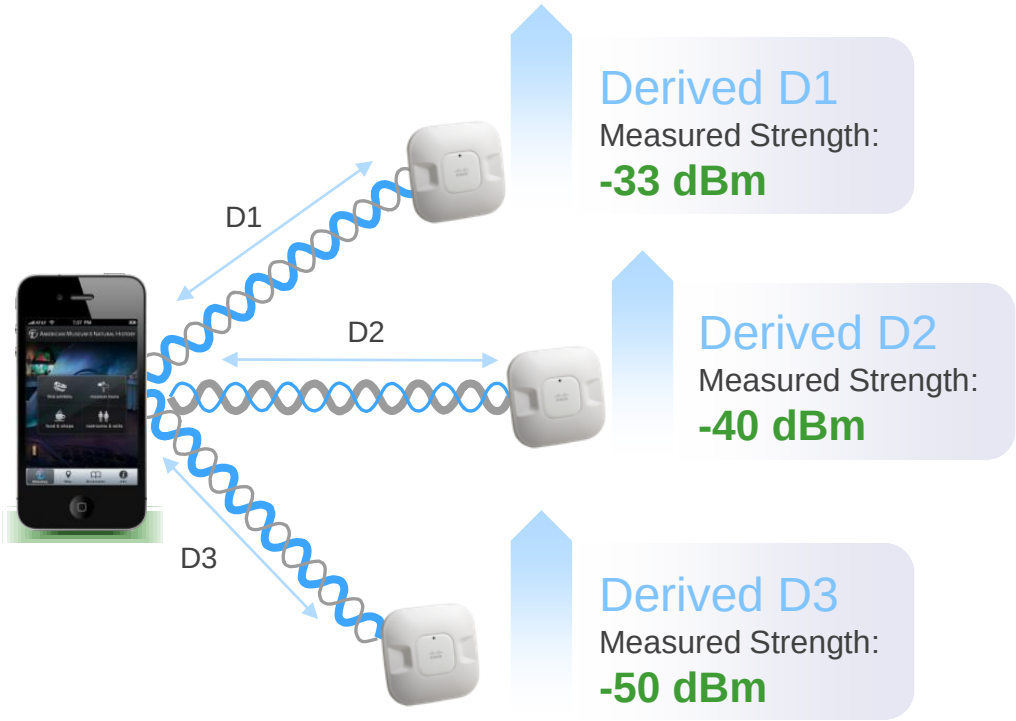
Business Intelligence is Critical to Proper Decision Making…



…And It Needs To Scale

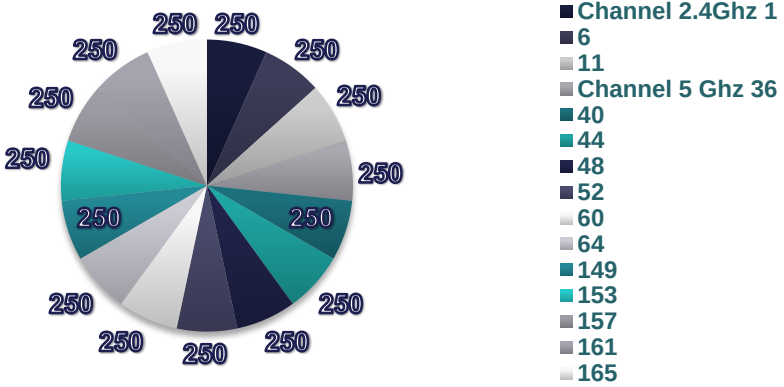
How Location Is Calculated with FastLocate

- Access points detect mobile devices or tag signals and measure RSSI from all frames sent over Wi-Fi.
- Controllers send RSSI information signal to the Cisco MSE for location calculation.
- RF fingerprinting and triangulation, based on signal strengths, are used to calculate device location.
- Out of Data Path for Higher Scalability



WSM Module Listening for ¼ Sec. on Each Channel

Scan Time on Channels (ms)



- When a client is constantly sending packets on a channel, network will get a packet EVERY 4 seconds (250ms x 16 channels) and be able to gather values once every 4 seconds.
- Location is calculated approximately 1 every 8 seconds. (~8 times per Minute)

What is Bluetooth Low Energy (BLE)?

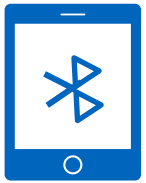
- Bluetooth Low Energy (BLE) is a subset of the Bluetooth 4.0 spec
  - Ultra-low power consumption – run for years on a coin battery
  - Low-cost system-on-chip solutions – proliferate in small devices
  - Simplified communication protocol – easy to implement & extend
- Operates on the 2.4GHz ISM band (2400-2483.5MHz)
  - 40 channels in-between & overlapping WiFi Ch 1,6,11
  - 1 Mbps GFSK, frequency-hopping
  - Reliable signaling up to 100m
- Devices identify themselves with UUIDs
  - Like a MAC address, but also encodes a “profile”
  - Sensors, health monitors, alarms, etc.

What is BLE being used for?

- Battery operated BLE Beacon and App for management (sometimes crowd sourced)
- Retailers are using this to quickly test drive location based services
- Healthcare facilities are using this to improve patient experience.
- Museums are using this for personalizing tour experience
- Use cases:
  - Target marketing messages and Ads
  - Display patient location and map of the hospital for navigation
  - Gather Analytics

Cisco's BLE Strategy

BLE Aware



- Use CleanAir to detect BLE
- Check Beacon Health
- Track Assets with BLE
- Alert on rogue beacons

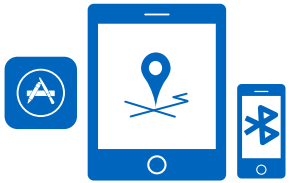
MSE 10.x and WLC 8.0MR1
Q1CY15

BLE Capable

- Integrated BLE radio with Hyperlocation module
- Reduce number of beacons
- Transmit multiple UUIDs

MSE 10.x and WLC 8.1
Q2CY15

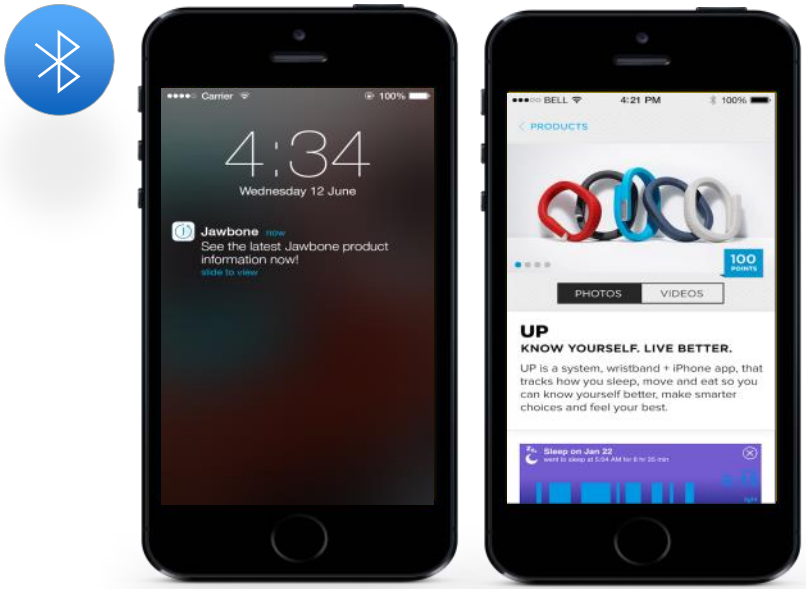
BLE Gateway



- Combined WiFi + BLE Location and Analytics
- Extend CMX SDK to BLE

MSE10.x and WLC 8.x
Q3CY15

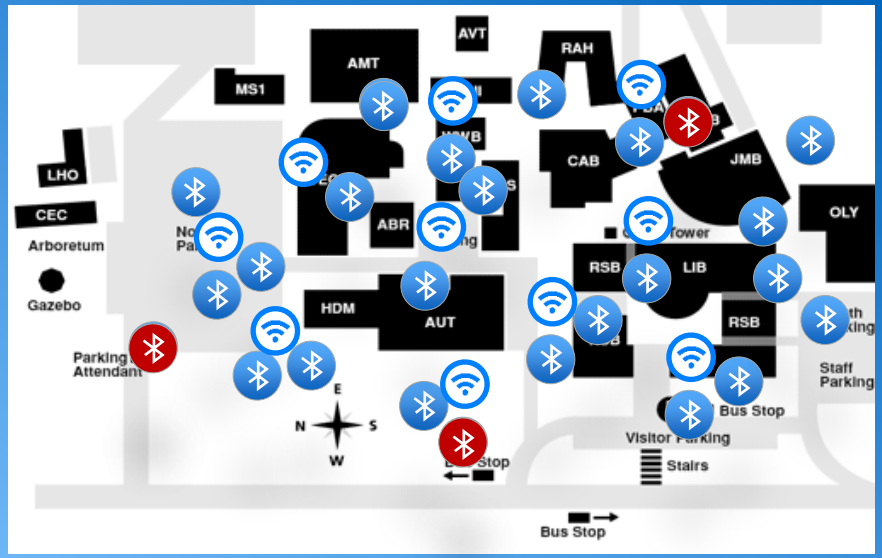
Where does BLE fit in Location strategy



BLE can be part of your location strategy if you already have or will have an App

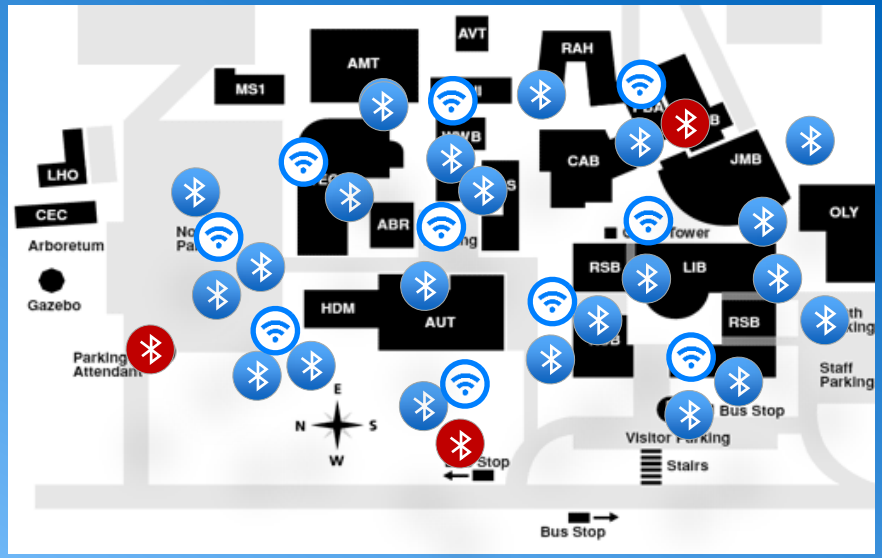
- Opportunities for BLE only
  - Proximity-based messaging
  - Easy to deploy
  - Lower CapEx
- Challenges for BLE only
  - Requires App to be downloaded and running
  - Limited Use Cases if deployed without Wi-Fi
  - Higher OpEx

Beacon and Wi-Fi Location Deployment



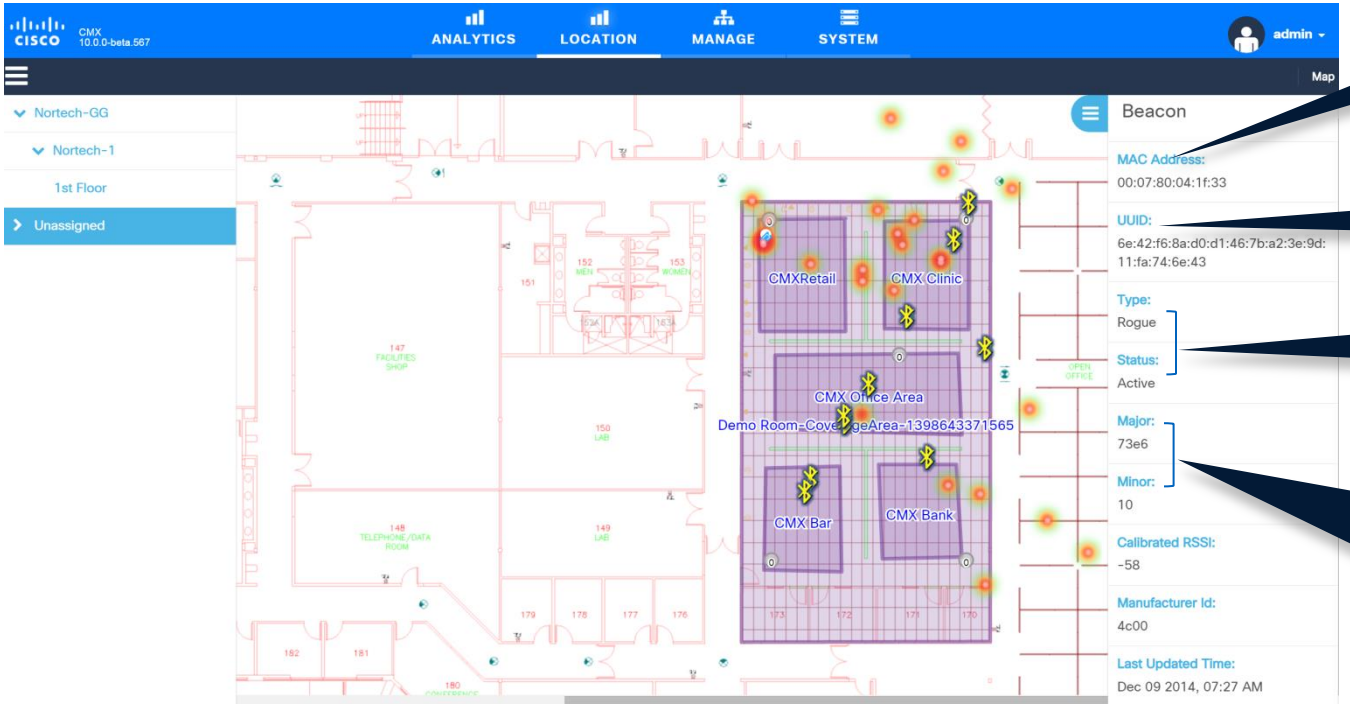
- AP’s for Wi-Fi
- Beacons for Location
- Beacon rogues difficult to detect

Beacon and Wi-Fi Location Deployment

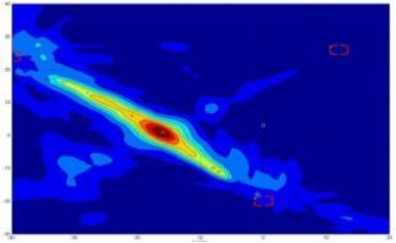


- Hyperlocation - BLE integrated with APs
- Fewer beacons to deploy/track
- Rouges can be detected and removed

BLE Monitoring – Visibility and Alerts



Introducing the Cisco Hyperlocation Module



Angle of Arrival (AoA) Triangulation
1-3 m accuracy, <1m with beacons

Integrated BLE Beacon
Reduce BLE deployment size

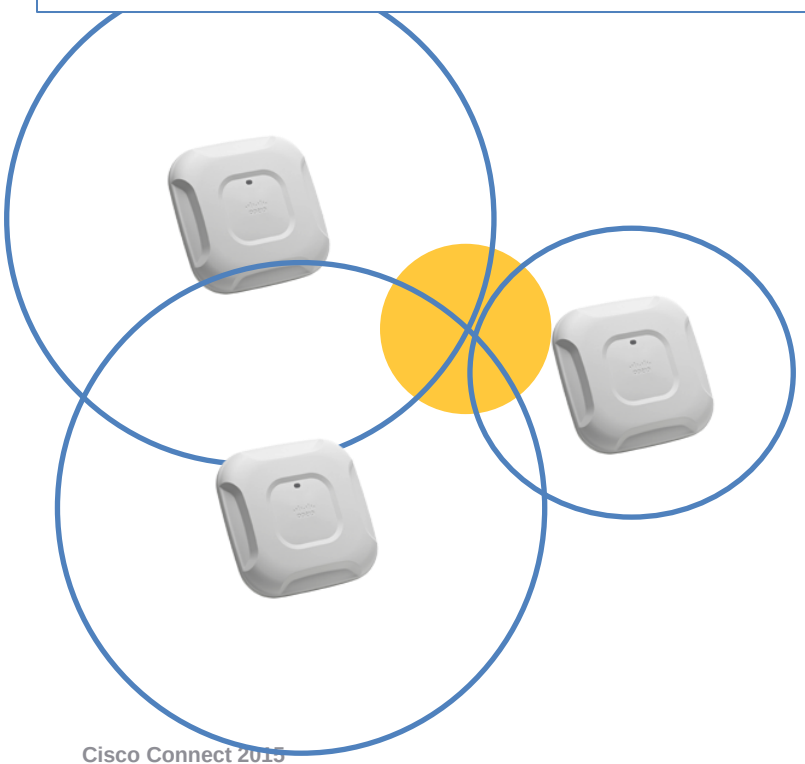
Centralized Management
BLE and Wi-Fi visibility

Enhanced FastLocate
Faster refresh rates

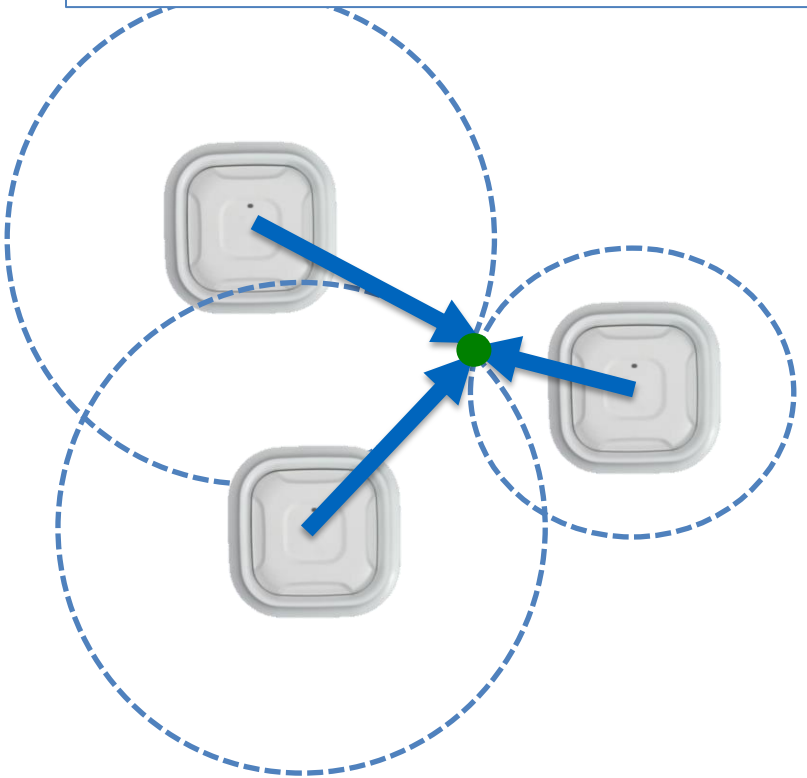
Improved Security Coverage
Integrated Wireless Security Module

Location Accuracy

Today: Approx. distance via RSSI, but no idea which direction → more error in calculation

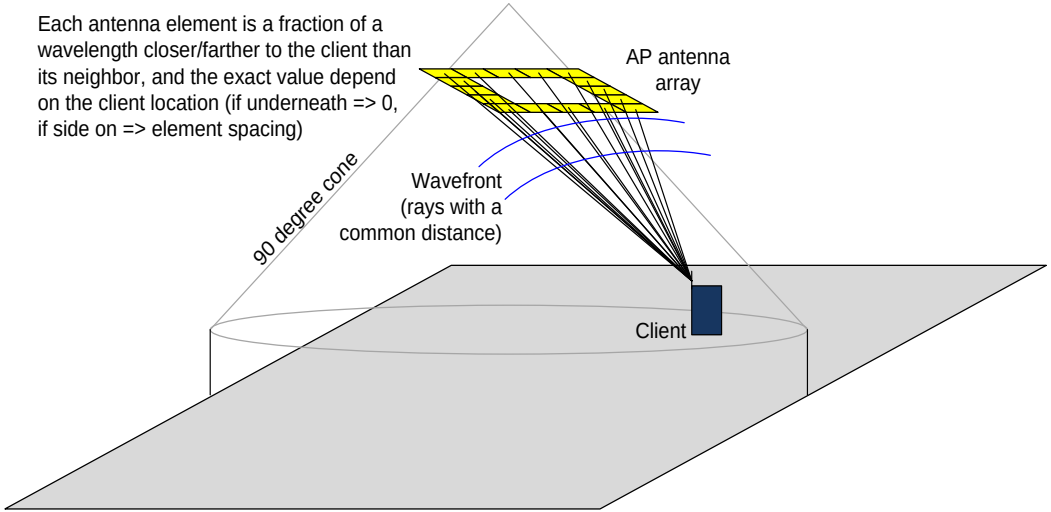


Solution: Determine direction to client in addition to distance → dramatic error reduction



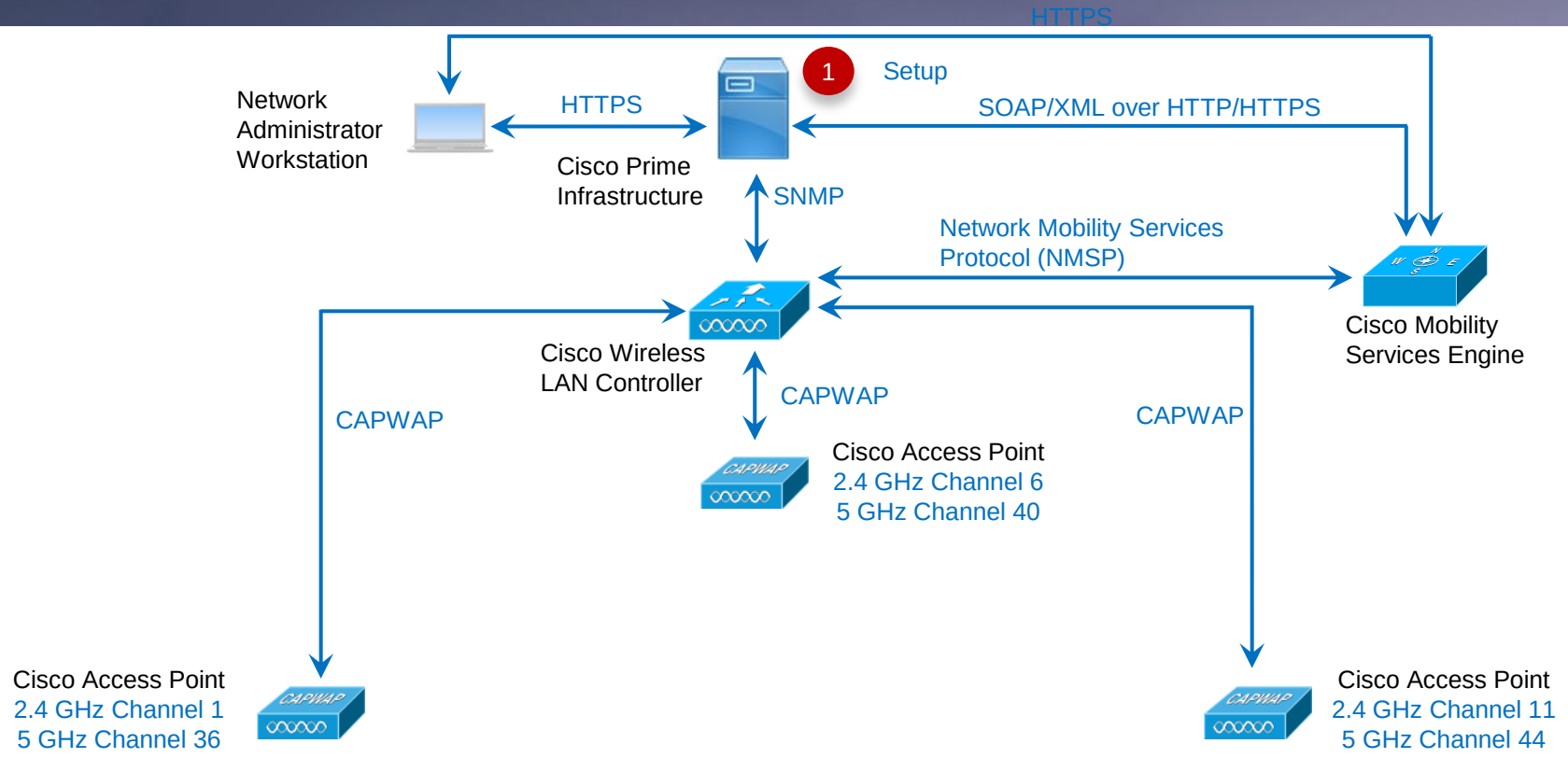
Innovation: Angle of Arrival(AOA) = ~meter accuracy

- Different antenna elements hear the signal a little earlier/later than others, measured by the phase of the signal
- Favors line-of-sight with stellar accuracy in cone under AP

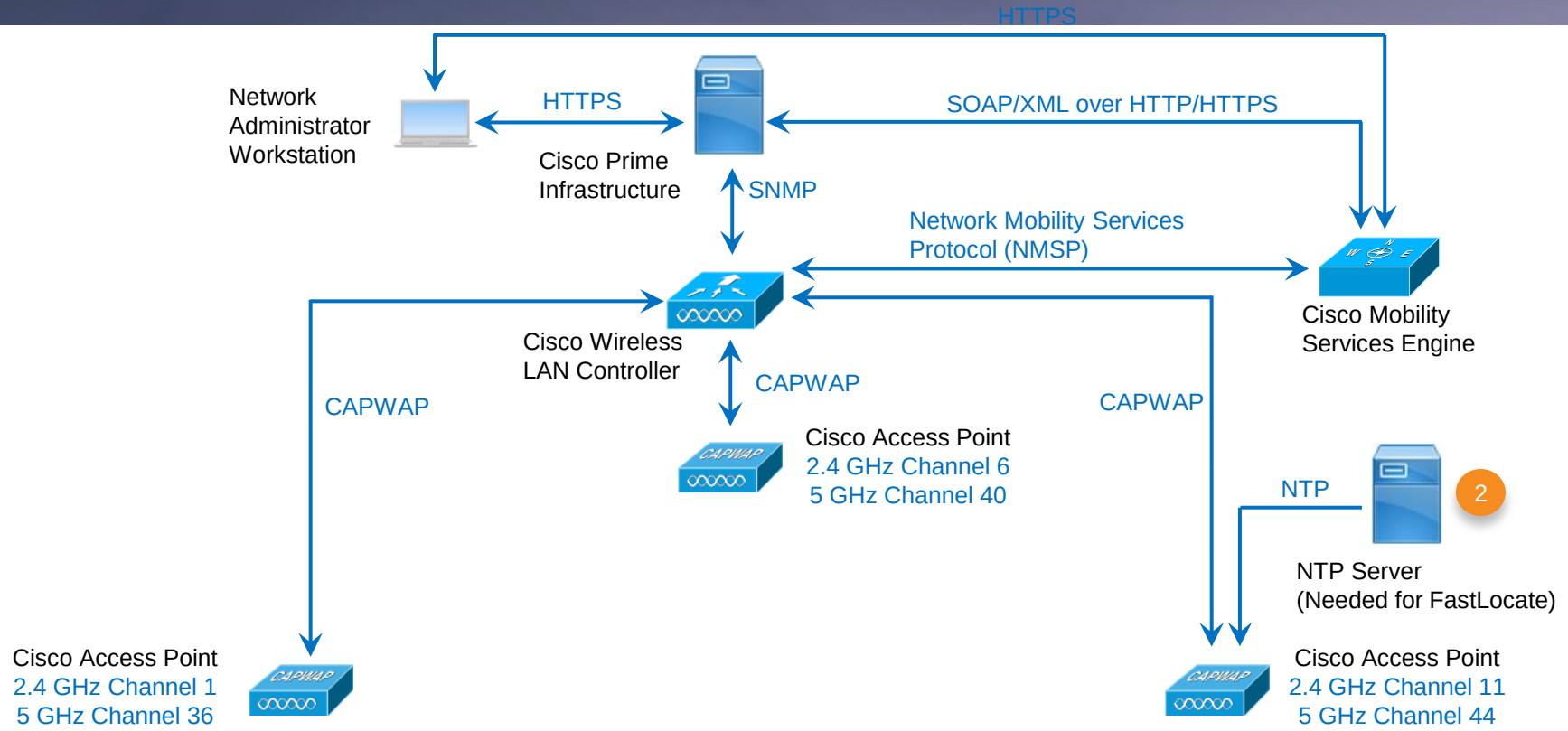


Context Aware Services Architecture

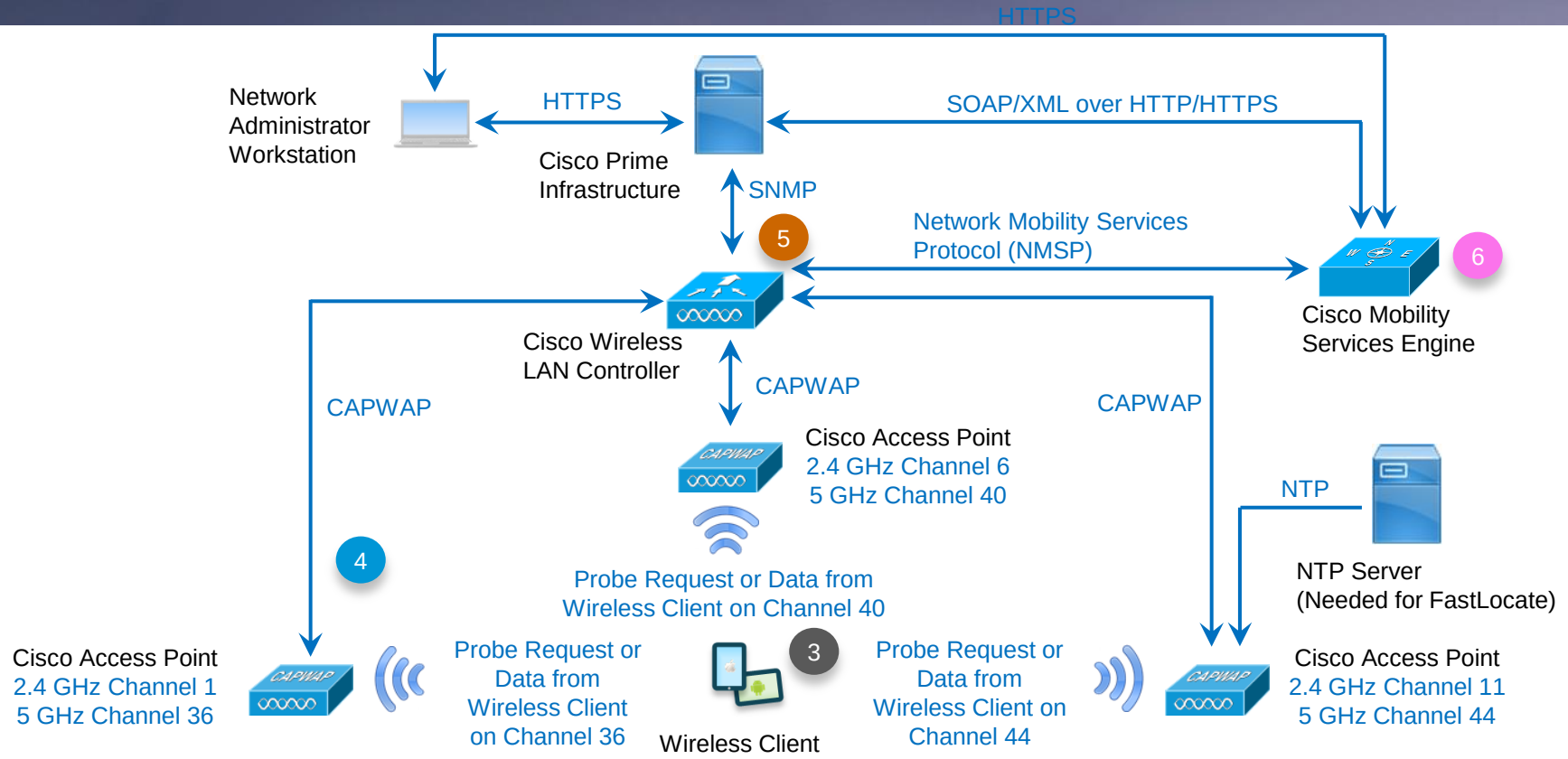
Context Aware Service (CAS) Hardware and Data Flows



Context Aware Service (CAS) Hardware and Data Flows

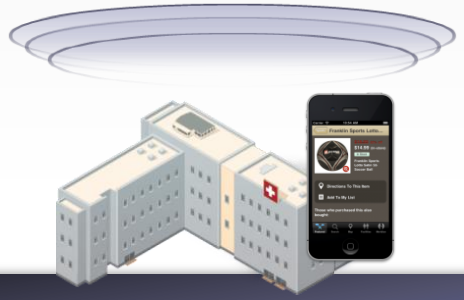


Context Aware Service (CAS) Hardware and Data Flows



Detect – CMX Analytics

Create Connected Experiences with Cisco's CMX



Presence & Analytics

- Presence detection
- On-premise visibility

Visitor Connect

- Easy Wi-Fi login, custom or social
- Zone-based, custom splash pages

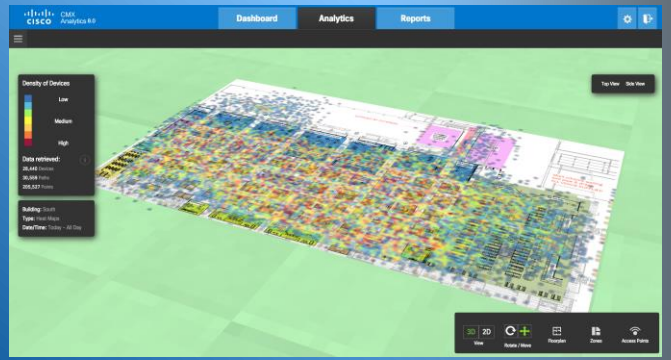
Contextual Experience

- Location-based push notifications
- App-based mobile engagement

Analytics

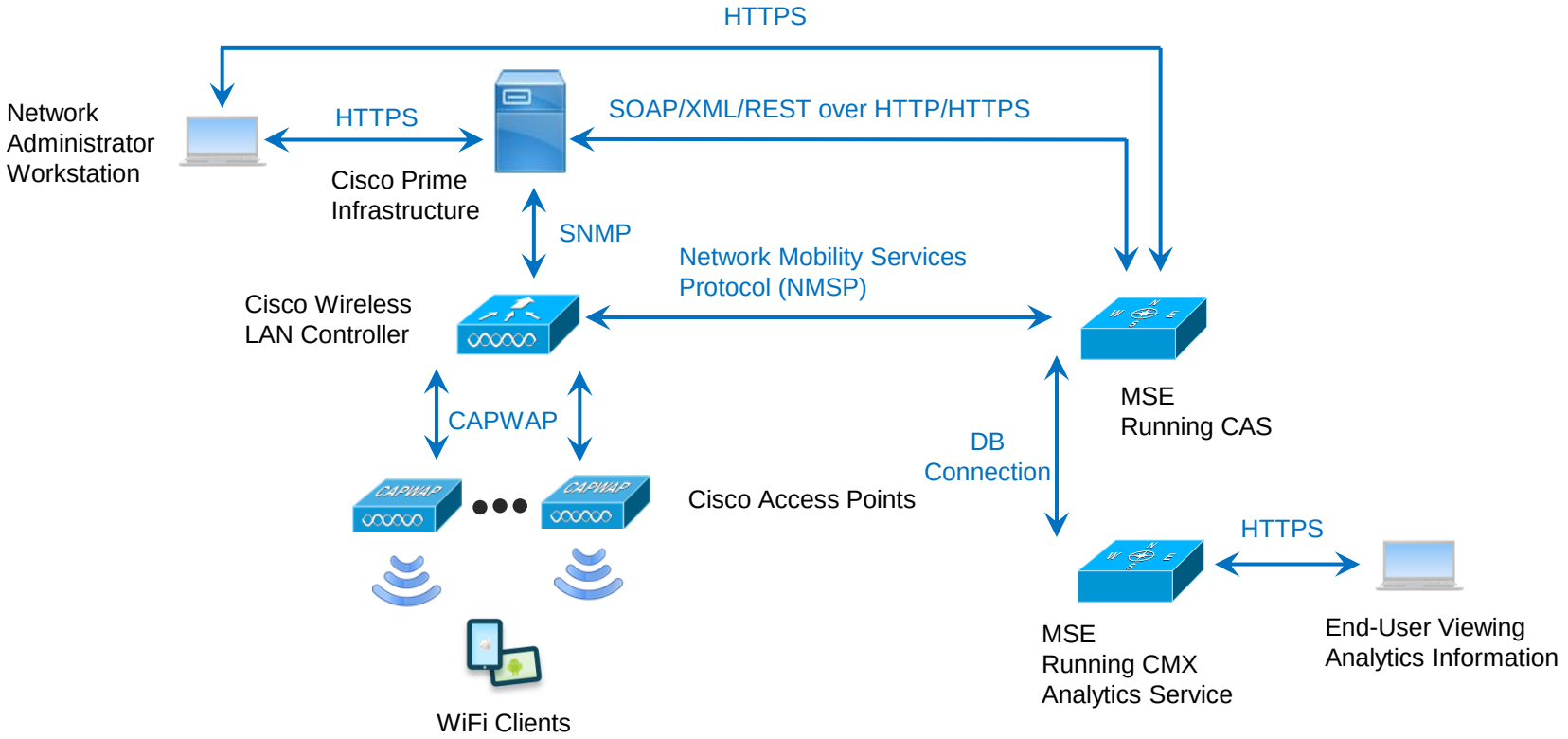
Understand How People Interact in the Location

Detect

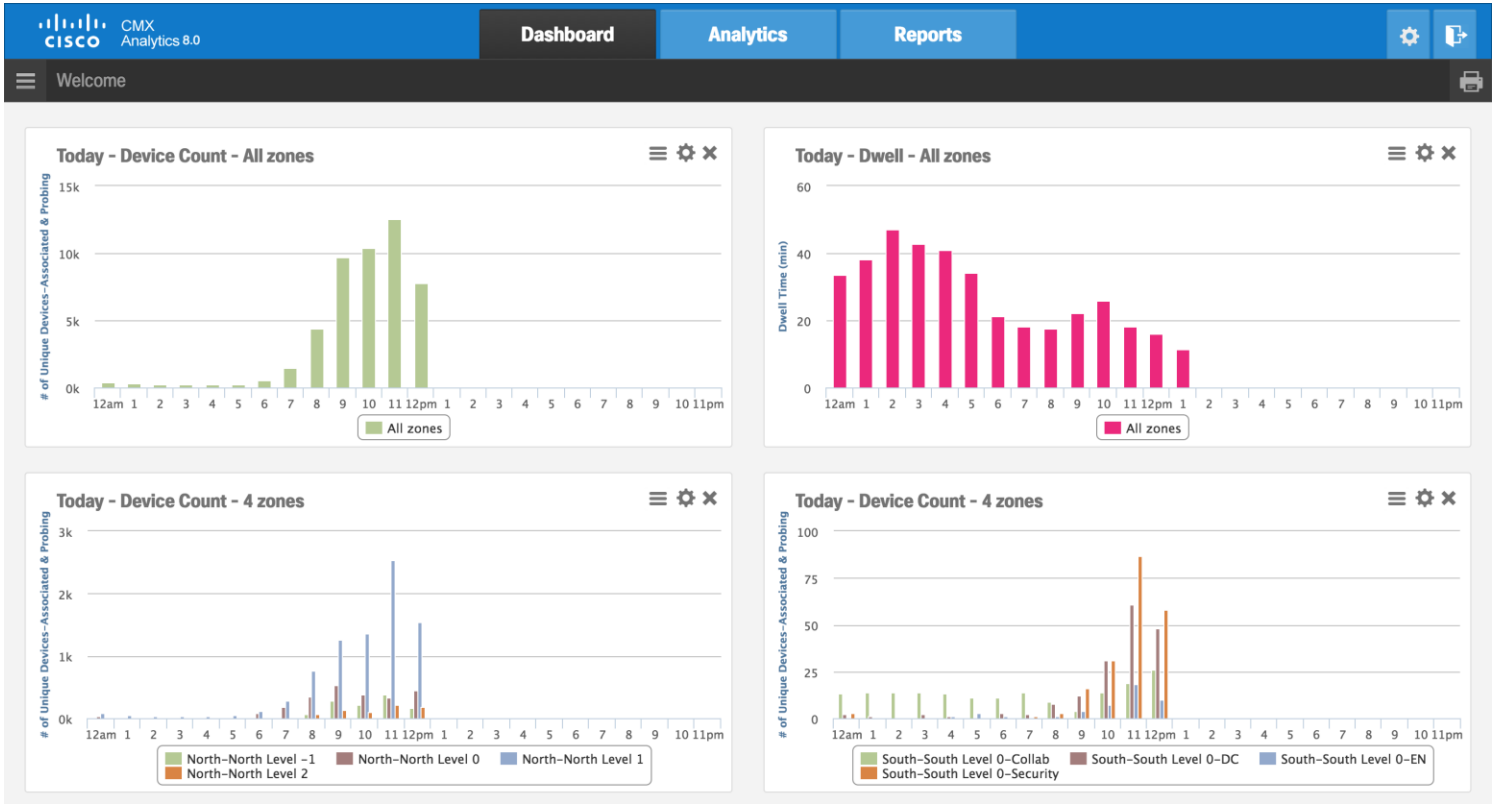


- Number people by venue and zones
- Peak time in venue
- New compared to repeat visitors
- Common traffic patterns
- Where people spend time

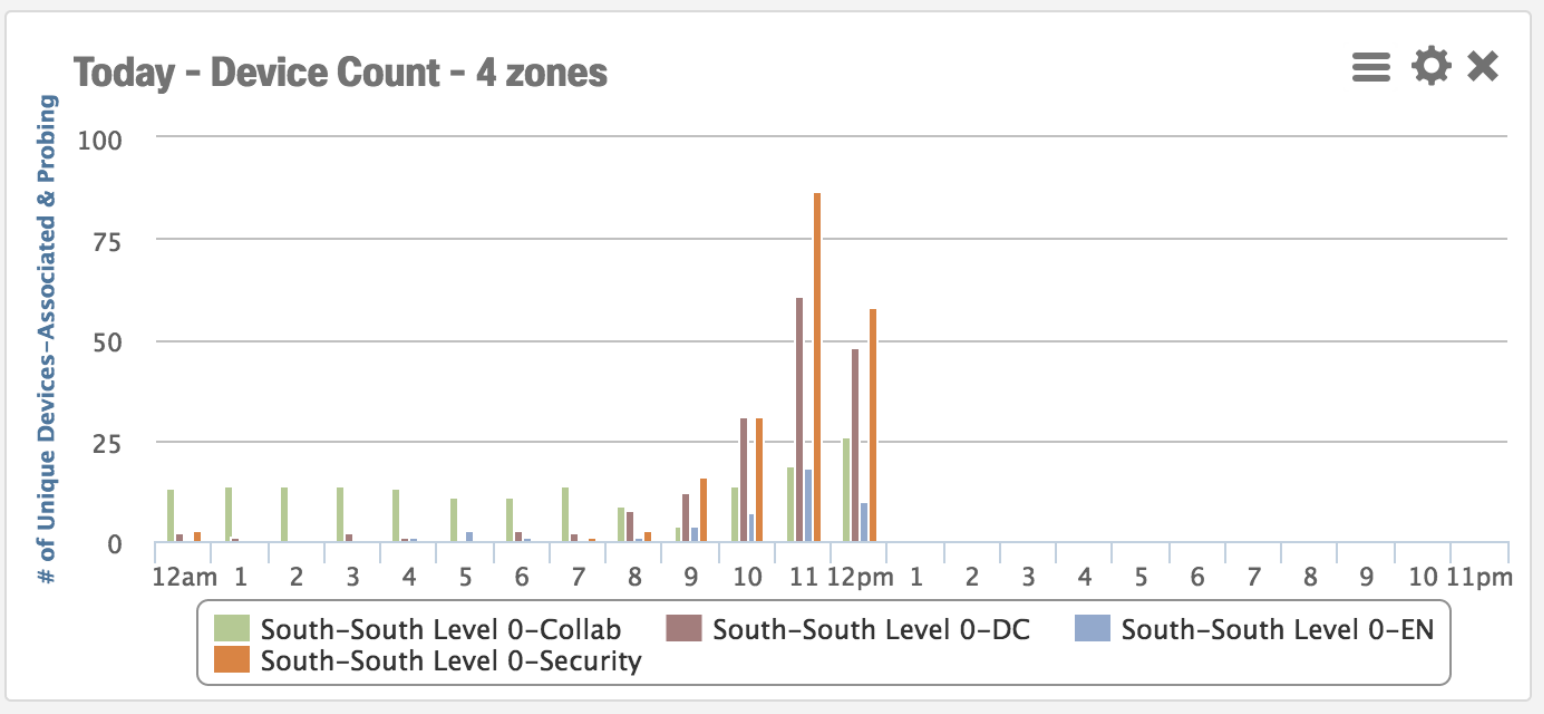
High-level overview of Hardware and Information Flows for CMX Location Analytics



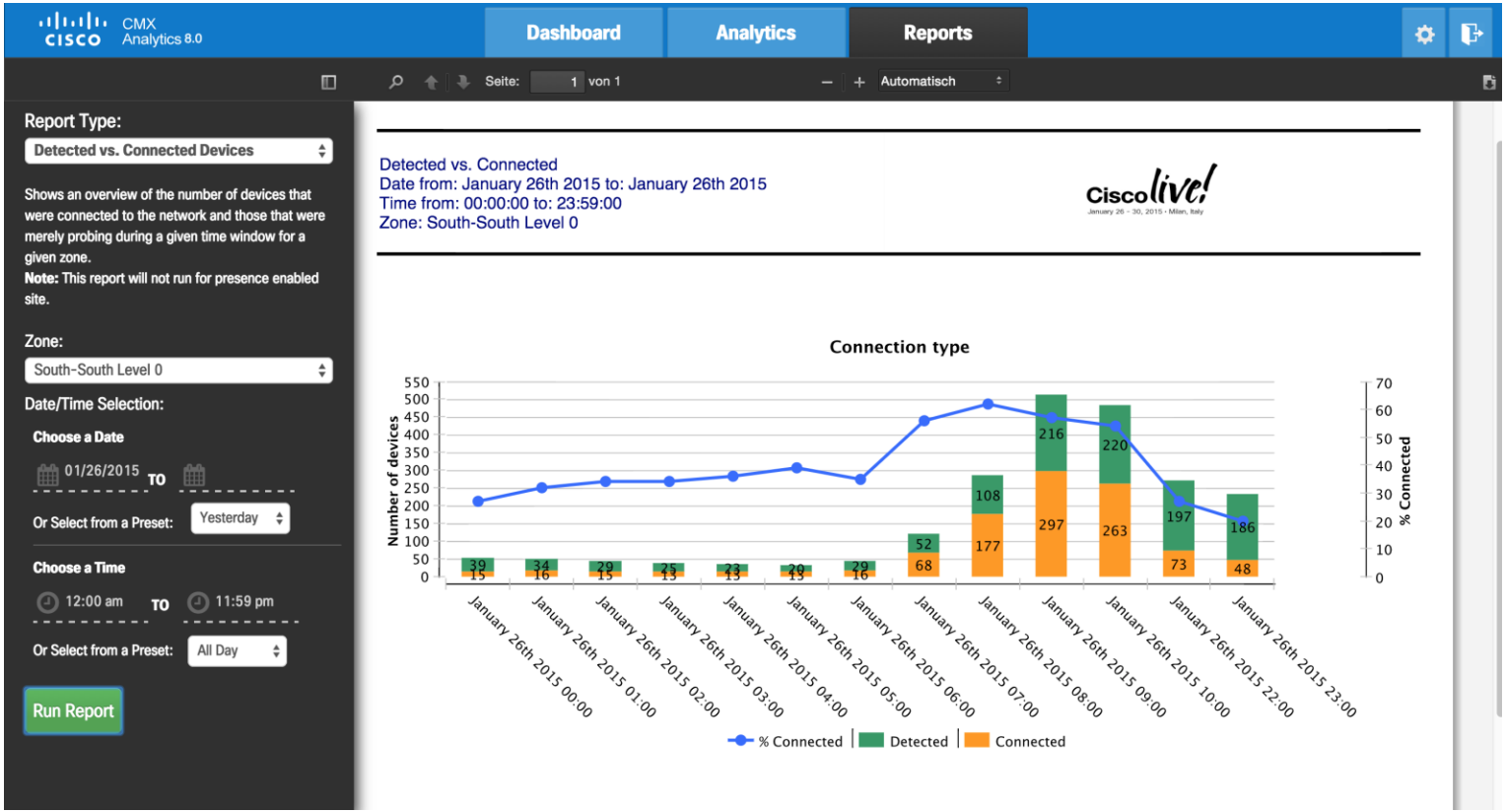
CMX Analytics Dashboard



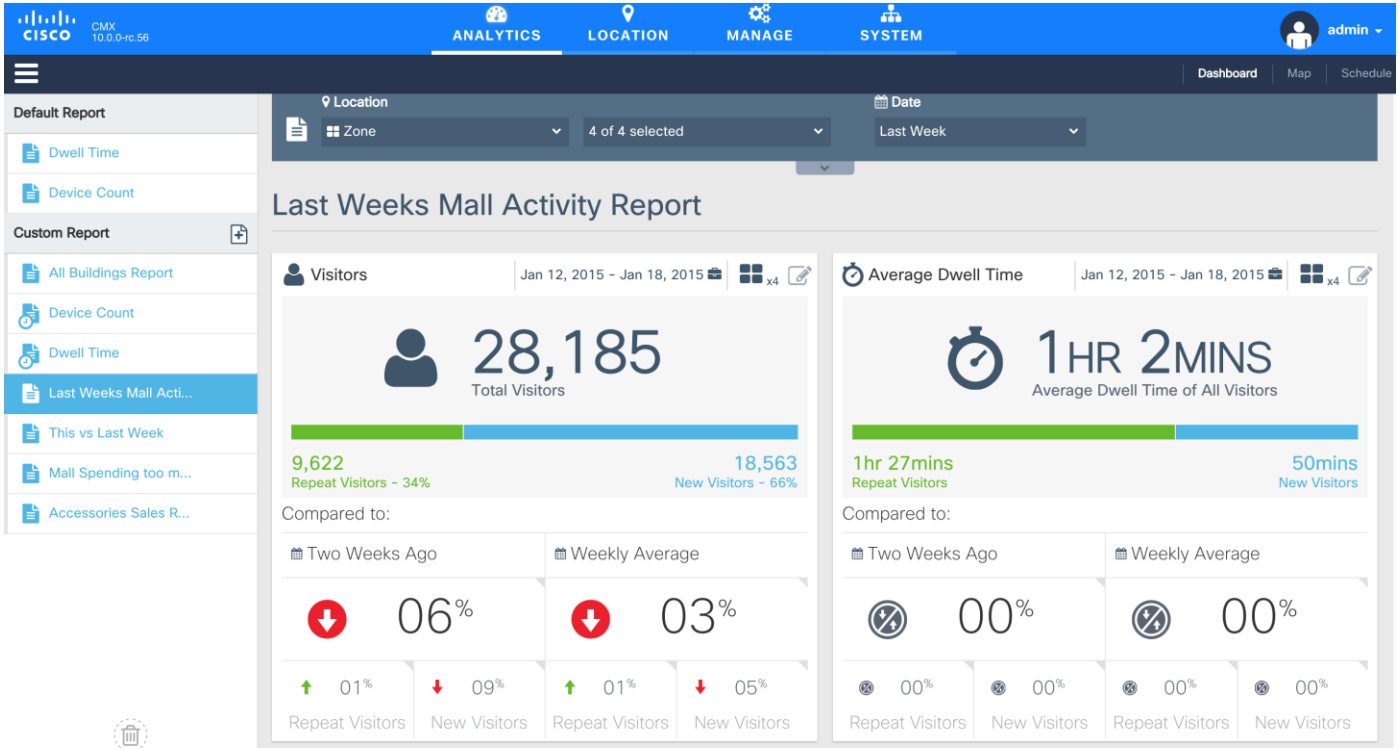
Multiple Zones Comparison in Dashboard



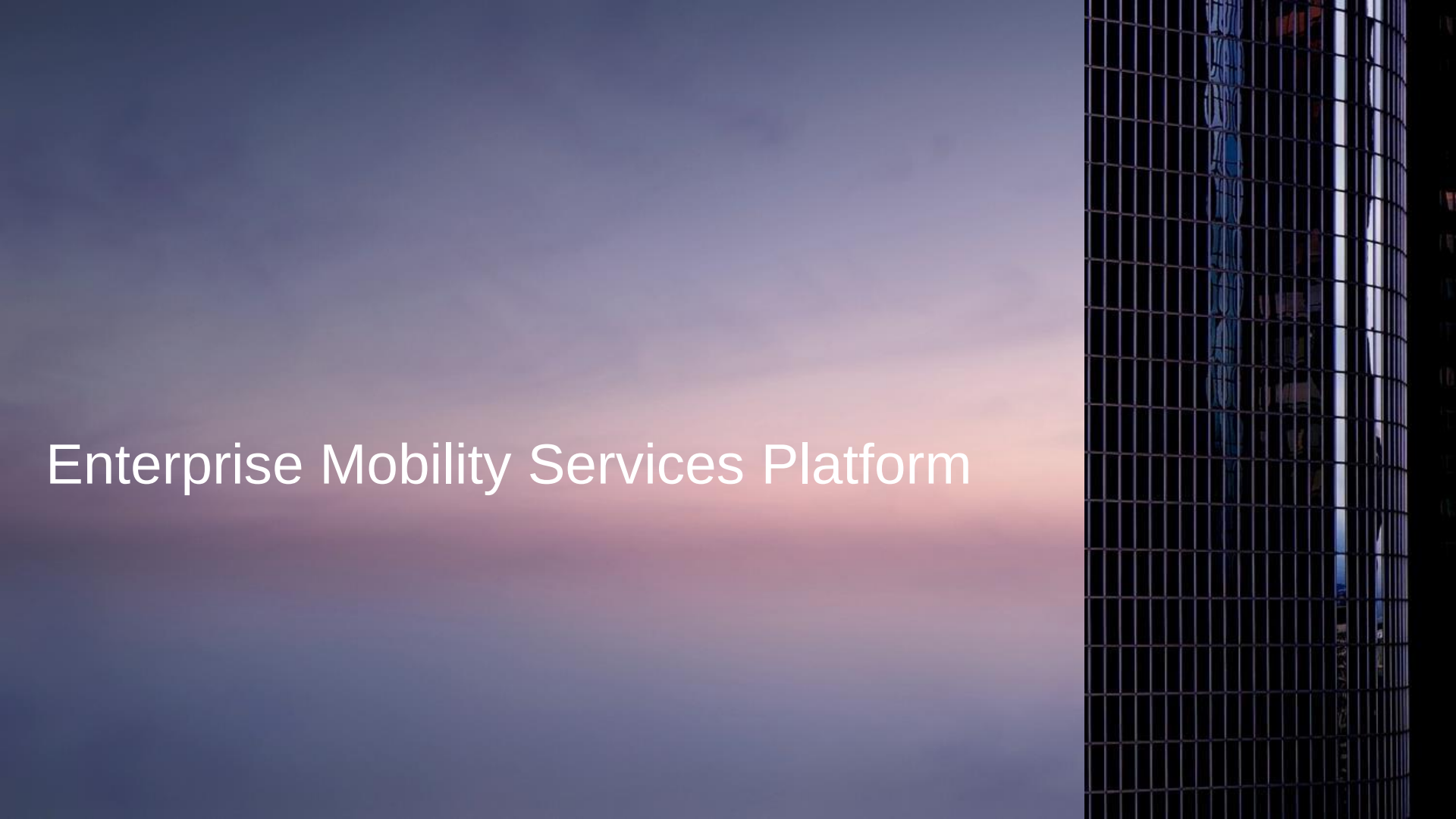
Report: Detected vs. Connected Devices



Preview - Analytics MSE 10



Enterprise Mobility Services Platform



Challenge for Today's Enterprise

Line of Business Challenges

- Delivering personalized content to drive sales and loyalty
- Incorporating existing application functionality into mobile apps
- Being able to get the application built quickly and affordably

IT is challenged delivering on the LOB needs and timelines….

Multiple Devices and Platforms to Support

Resource Intensive Development

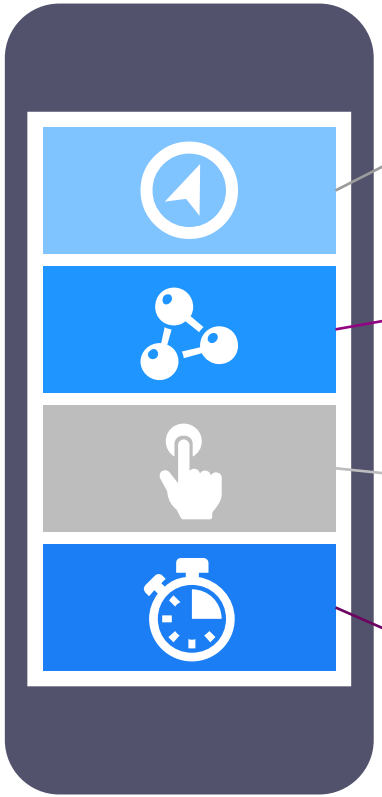
Scale Across Locations, People Environments

Deliver Highly Secure Solutions

What Is Cisco EMSP?

The Cisco Enterprise Mobility Services Platform enables the rapid delivery of context-aware mobile experiences that exceed business and customer expectation. It binds Cisco network infrastructure capabilities with enterprise and open cloud systems, creating ready-to-use modules for mobile, web and native applications.

EMSP Delivers New Experiences



Gives applications context awareness, allowing customer engagement like never before

Prebuilt integration to infrastructure, applications and cloud services

Robust analytics and admin consoles that empower business users to manage content

Leverages real-time data to influence and drive behavior

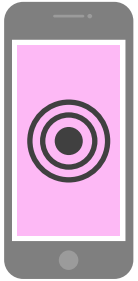
Finding and Engaging Loyal Customers
Cisco EMSP in Retail

- Engage with shoppers when in store
- Differentiation between retail locations
- Flexibility for store manager to make updates to mobile experience/content

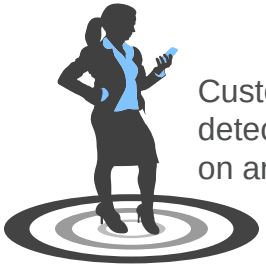
Finding and Engaging Loyal Customers
Cisco EMSP in Retail

Proposed Solution (Workflow Enabled)

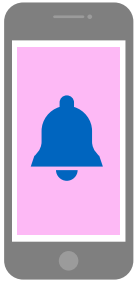
Store manager identifies excess inventory of Bedding



Using the management control app, store manager updates and pushes a targeted ad for Bedding



Customer detected on arrival



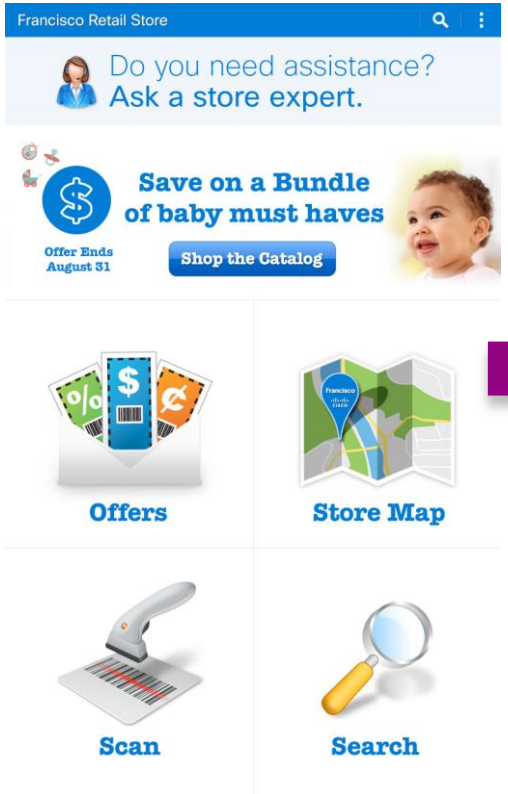
Welcome notification encouraging customer to open store app

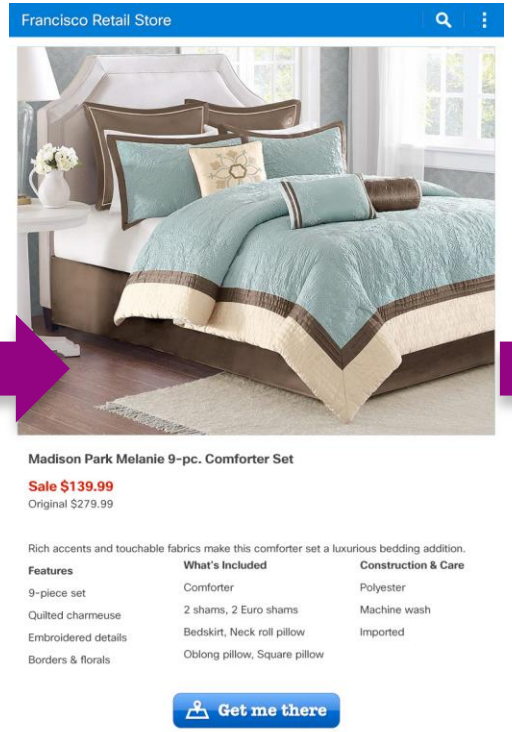
Personalized promotion of the day via wayfinding, push ads, etc.

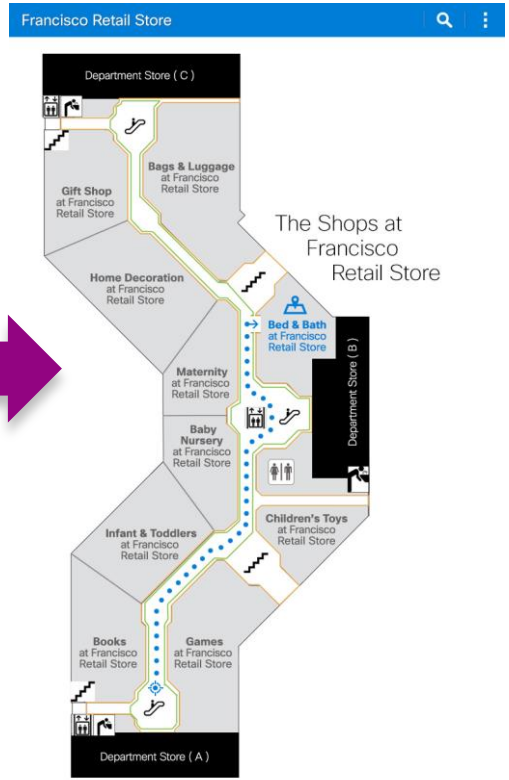
Benefits

- **Superior customer experience:** Engage shoppers with experiences unique to that store
- **Successful targeted advertisement:** Notify shoppers of any relevant promotions, promotion of the day, etc., when in store, to influence buying patterns

Targeted Offers Delivered to your Application







EMSP Location Services

GPS

Geo Location

- Devise GPS via WiFi or cellular connectivity

Premise

Premise

- WiFi Access Point association

Zone

Zone (x,y,z)

- WiFi Triangulation
- BLE

Infra Requirements

Context Aware Mobile Experiences For The Hybrid Enterprise

Enterprise Service Mobility Platform delivers context aware mobile experiences by bringing together infrastructure, enterprise apps, and cloud services

Network Enriched Engaging Experiences

Leverage intelligent network services to deliver engaging context aware mobile experiences

Expose Cloud and App Services

Integrate, expose and mobilize business intelligence, cloud services, and enterprise app services

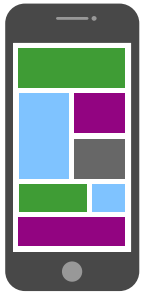
Operational Efficiencies

Pre-built, ready-to-use, and device agnostic application experiences to meet industry and LoB needs

Cisco EMSP Application Development

Native Application Development:

- Use EMSP Studio and app builder to develop iOS or Android native applications
- Leverage hundreds of pre-built experiences for rapid app development



Hybrid Application Development:

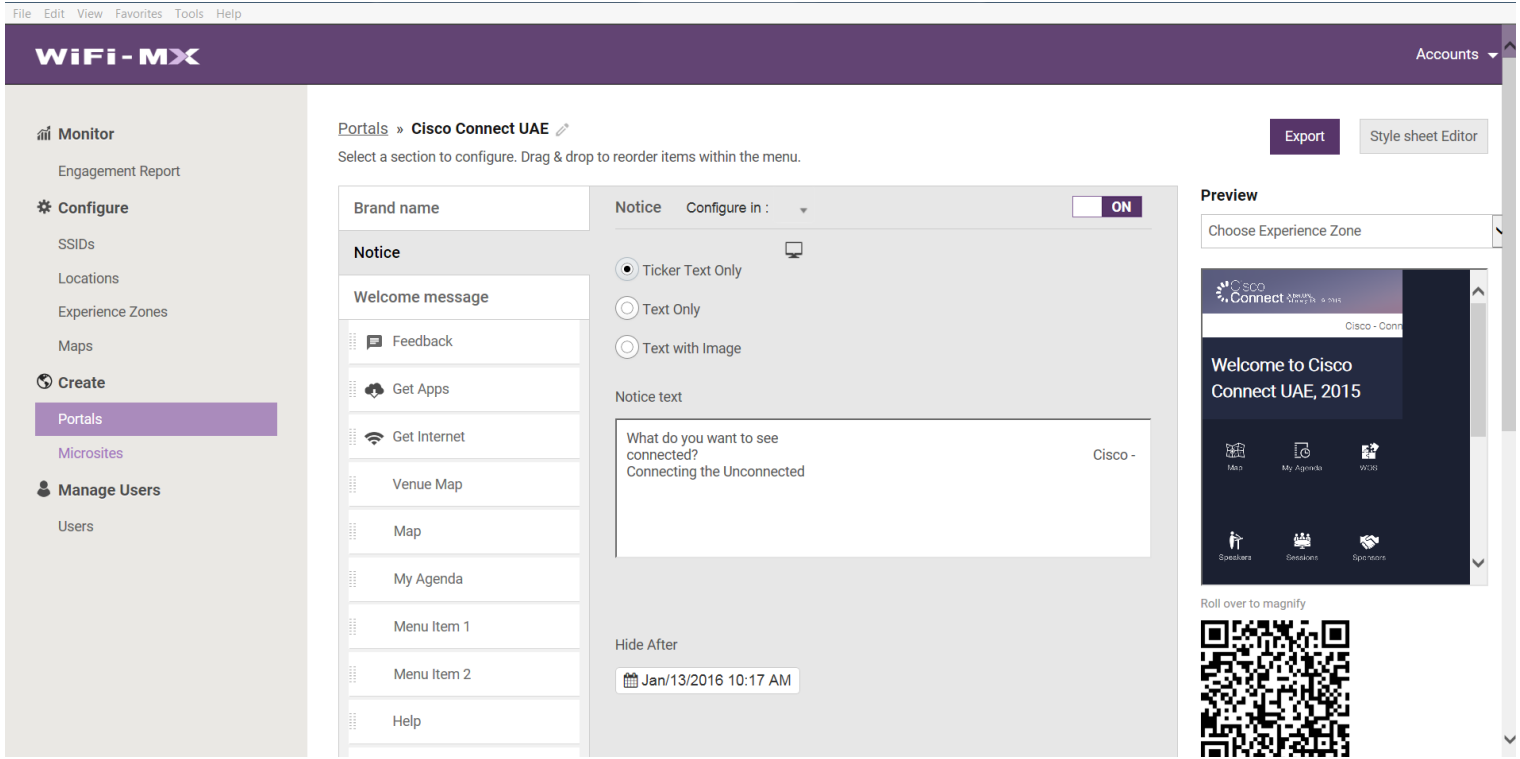
- Use the EMSP AppX SDK and Studio to provide feature rich hybrid application experiences embedded within your native application

Web Application Development:

- Use the EMSP Studio to rapidly build, host, and update web-based applications
- Primary vehicle to deliver context experiences

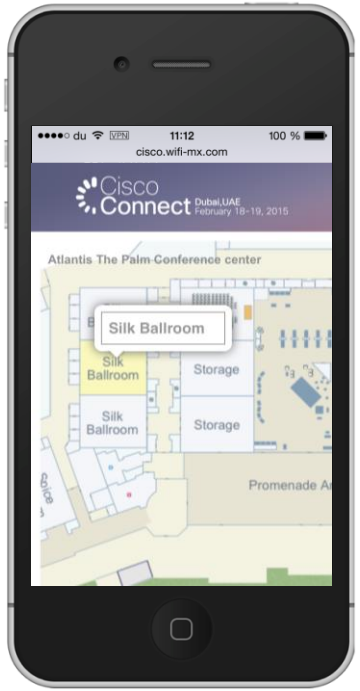
EMSP WiFi MX Demo

EMSP Dashboard



EMSP Demo

- Connect to SSID
- Login with your E-Mail
  - Subscribe to SMS Service



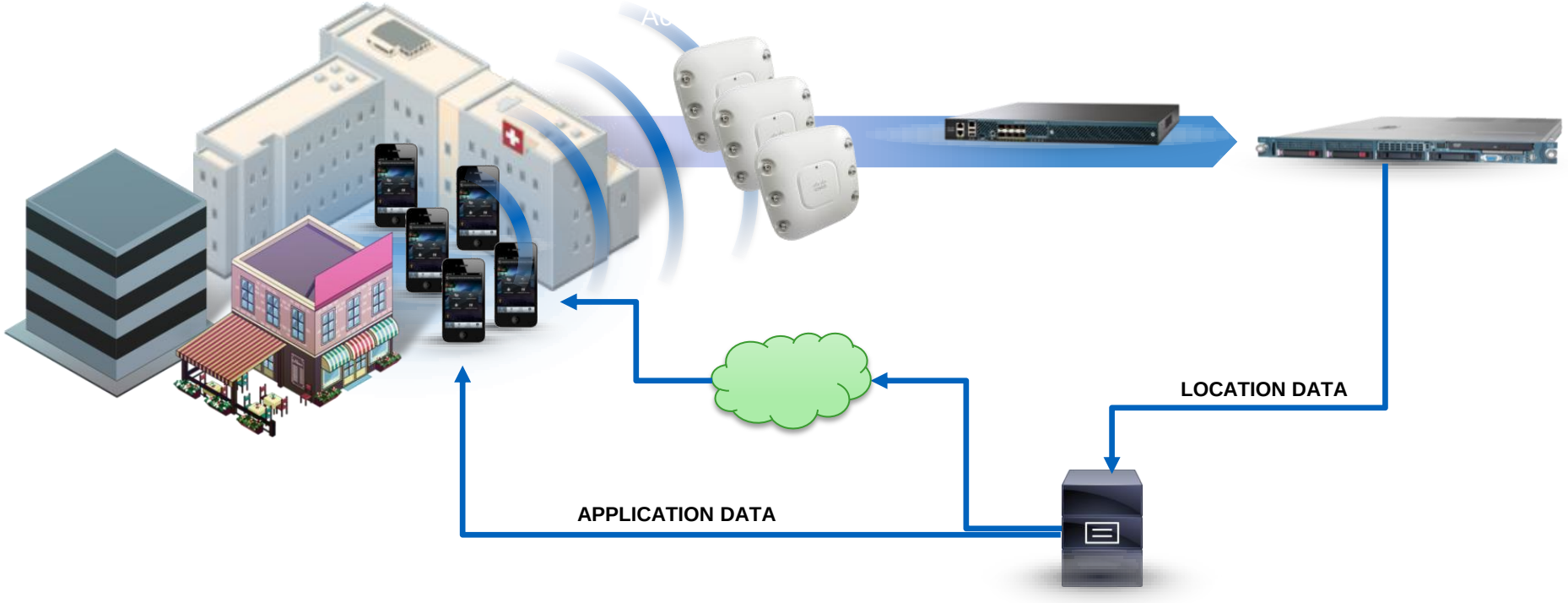
For more details visit the
Enterprise Networks Demo Booth

Mobility Services API

Mobility Services API and CMX App SDK

- Supports SOAP/XML and REST (new)
- Exposes current and historical location information for tracked devices
- Enables numerous use cases – apps, analytics, equipment tracking, etc.
- Offers a pull model: XML or JSON, based on the requesting client
- Offers a push model: XML, JSON, and protocol buffer formats Can be streamed over HTTP, HTTPs, or TCP

Mobility Services SDK

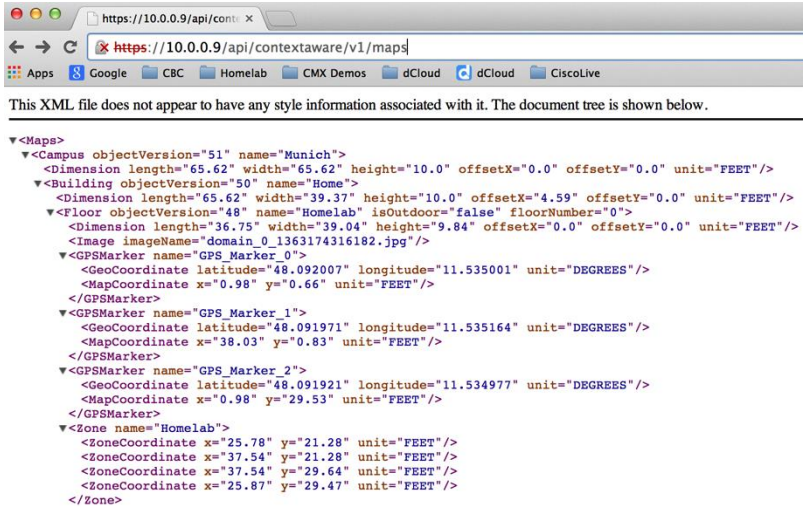


CMX Mobile Application Server

CMX Tools: API

REST API - Examples

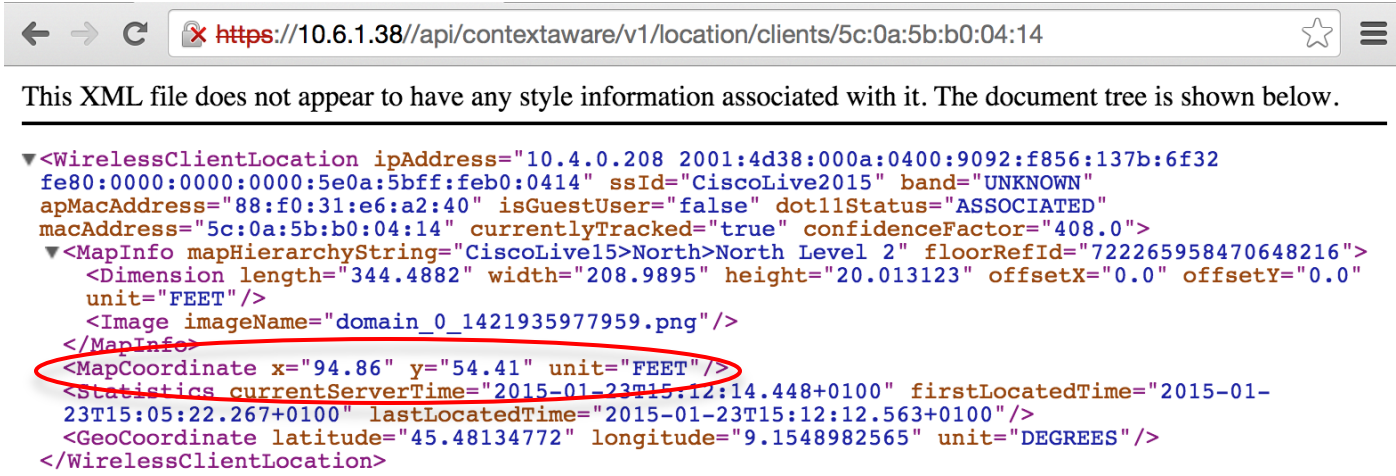
- Just use your Webrowser to:
  - Get Maps Information:
  - https://MSE-IP/api/contextaware/v1/maps



  - Get Map Image:
  - https://MSE-IP/api/contextaware/v1/maps/imagesource/domain_0_1363174316182.jpg

REST API - Examples

- Get Client Location by MAC Address:
- https://MSE-IP/api/contextaware/v1/location/clients/5c:0a:5b:b0:04:14



CISCO

Cisco Connect

Dubai,UAE
February 18-19, 2015

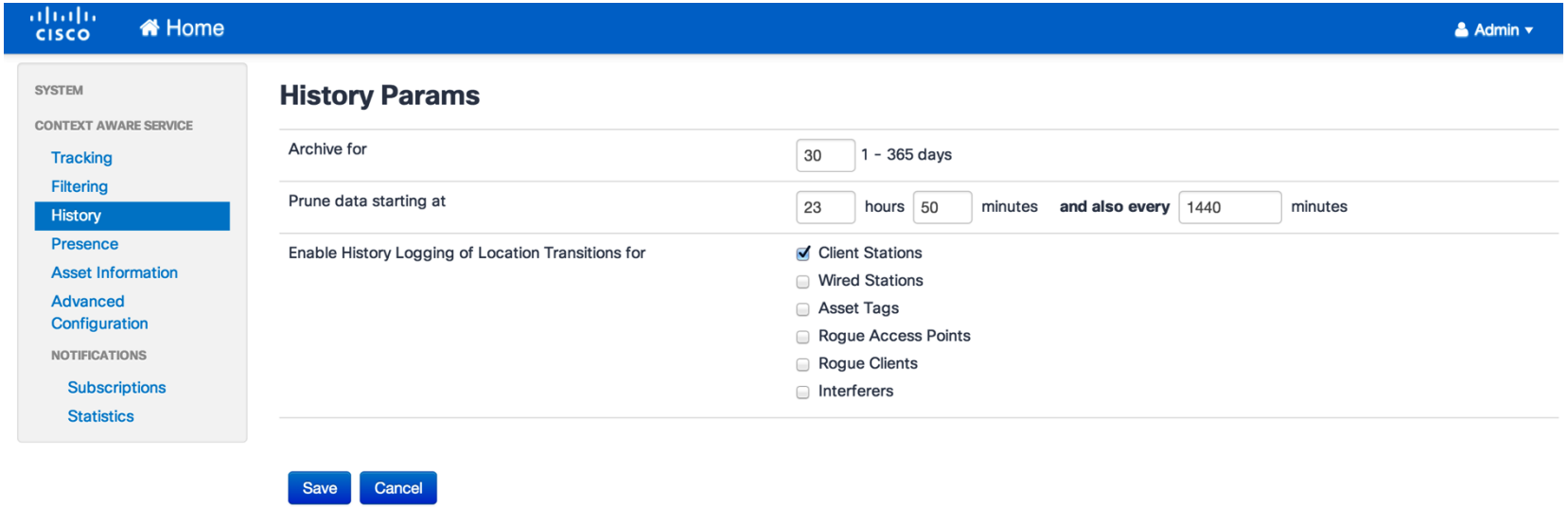
TOMORROW starts here.

HALO Module is a Mainstream AoA Solution

- Halo module wraps around AP
- 32 extra antennas to turbo-charge Angle of Arrival
- The Halo module will include Bluetooth capability as well

Analytics Configuration

- Enable History Logging for Client Stations on Context Aware MSE



Fan Wifi On-boarding In-Stadium

Business Problem

- Mode to publish Mobile apps to non-frequent fans In- Stadium
- Capture new fans coming into the Stadium
- Visibility to In-Stadium activity

Fan connects on SSID and opens browser

WLC re-directs the https session to EMSP web portal

The user to the device mapping is noted on EMSP

Stadiums can track Fan activity when In-Stadiums moving forward

Solution Pre-requisites

- Cisco WLAN Infrastructure Design for Location Capability
- CMX provides location info
- CRM with fan history Dbs w/API Integration capability

Business Outcomes

- Personalized experience – Based on Profile and Likes
- In-Stadium Analytics- Track behavior and actions

EMSP Cisco Infrastructure Requirements

Feature	Infrastructure Requirements
Mobile Application Development (Native, Hybrid, Web)	N/A, infra independent
WiFi Engage Portal w/ Location based web experience*	Meraki: • Wirless LAN Cloud Controller • Minimum of 1 AP (MR12, MR18, MR26, MR34, MR62, MR66) Cisco: • Wireless LAN Controller • Minimum of 1 AP (Aironet 700, 1700, 2700, 3700) • MSE 7.6 or 8.0 (highly recommended)
Location Services API's ('where am I', POI, etc)	Cisco: • Wireless LAN Controller • Minimum of 4 (high density) AP's (Aironet 1700, 2700, 3700) w/ Fast Locate Modules/WSM • MSE 8.0

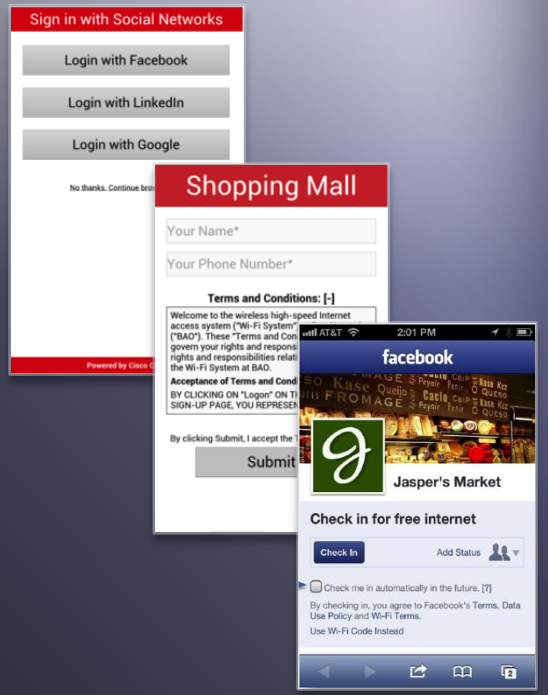
*The minimum bandwidth cap we recommend is 5mbps per user to ensure the initial page load experience is acceptable. With a 1:3 sharing, 50mbps can support ~30 users connecting simultaneously

EMSP Deployment Requirements

Tool	Requirements	
EMSP Studio	Operating System	MAC OS 10.6 and above (64 bit) Microsoft Windows XP and above (32bit)
	RAM	2GB
	Other	Adobe Air v15
		Adobe Flash v15
EMSP Development Studio	Operating Systems	MAC OS 10.6 and above (64bit) Microsoft Windows XP and above (32bit)
	RAM	2 GB
	Java Environment	Java Development Kit 1.6.x
	Database	MySQL 5.5 and above
WiFi Engage Portal	N/A, full cloud hosted solution	
Location Services API's	N/A, full cloud hosted solution	
Cisco Integration Platform – ESB	Hardware Requirements	• 2GHz, dual-core CPU, or 2 virtual CPUs in virtualized environments • 2GB of RAM • 4GB of storage
	Java Runtime Environments	• Oracle Java 1.6 • Oracle Java 1.7 • IBM Java 1.6
	Operating Systems	Windows (32- and 64-bit) 2003, 2008, Windows 7, Windows 2012 Mac OS 10.7, 10.8 Linux RHEL (64-bit) 5.3, 6.1 Ubuntu Server 12.04 (64-bit) Solaris OS 10 HP-UX 11i V3 AIX V7.1

CMX Connect

Location-Specific Guest Access



Simplify Access with User Opt-In

Offer Clear Terms and Conditions

Multiple Access Methods

Custom or Social Media

Customized Access and Promotion

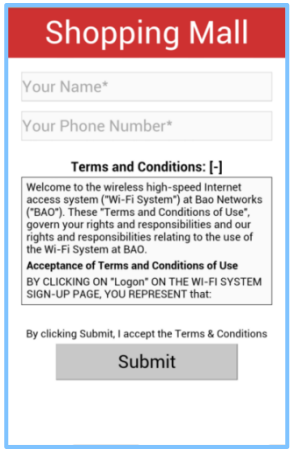
Proximity-Based Landing Pages and Video

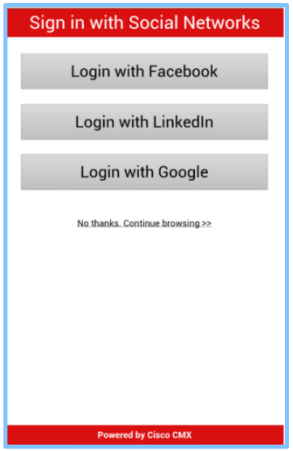
Understand Who Is in Your Location

Enhanced Analytics

Location-Specific Guest Access – Cisco CMX Connect

- Customize the Wi-Fi guest access experience
- Gain valuable analytics about who is in venue
- Simplify the user experience while offering clear terms and conditions





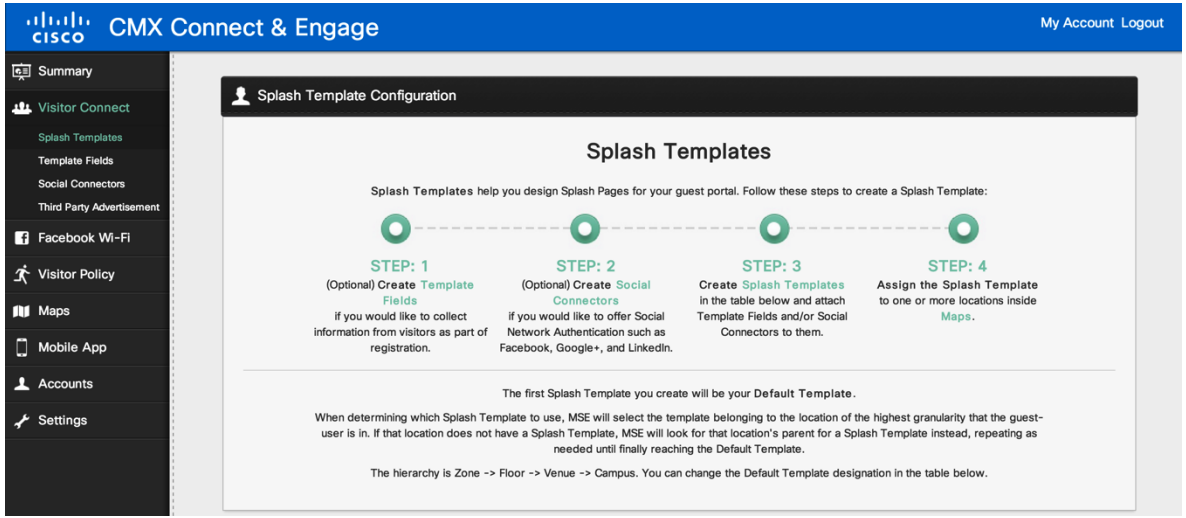
Registration, Terms, and Conditions

Custom Landing Page/Video

Simplified Login

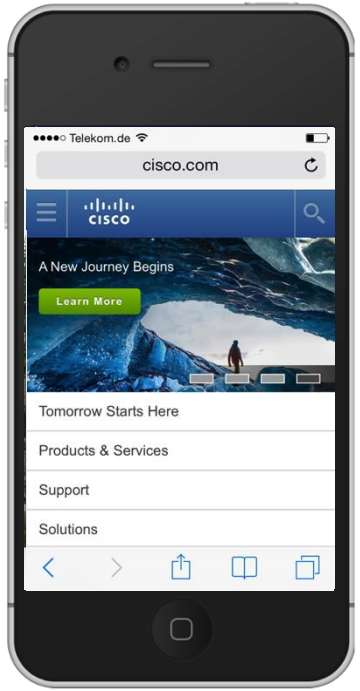
Captive Portal Configuration

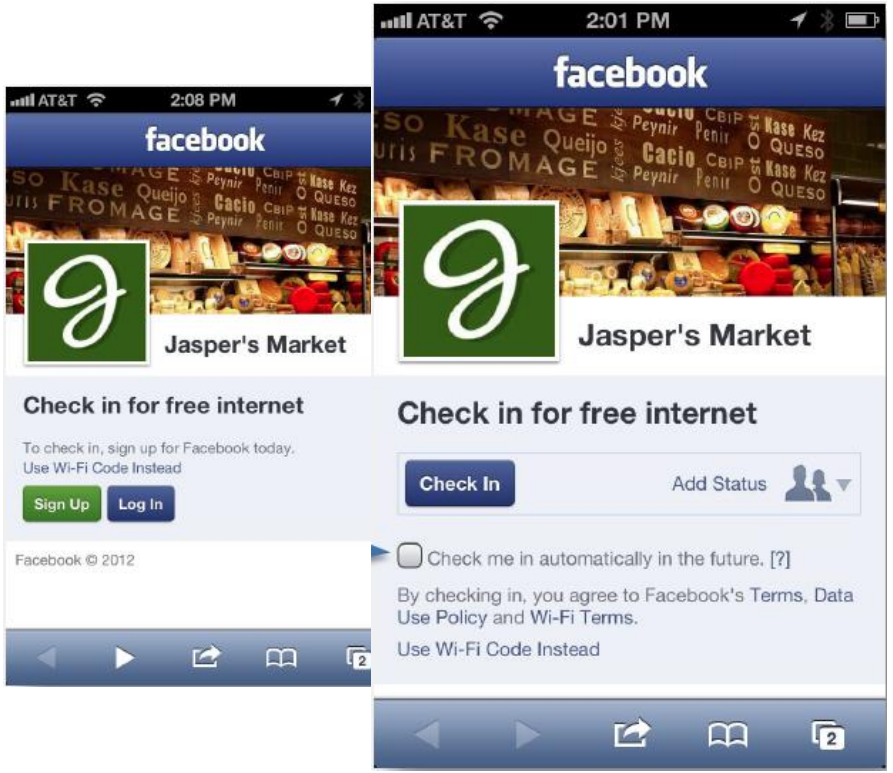
- Login to: https://mse/dashboard/



Login Procedure – First Login

- User connects to SSID
- User opens Safari
- Redirect to Captive Portal
  - User enters E-Mail etc.
- Play Advertisement Video
  - User can skip after 10sec
- Select Social Login and enter credentials
- Redirect to original page or Redirect URL



Guest Access – Cisco CMX for Facebook Wi-Fi

- Increase brand recognition and gain insights through Facebook Wi-Fi.
- User connects to Wi-Fi, opens browser, and checks in.
- Venue gains exposure through news feeds, notifying friends.