



You make **possible**



# Cisco DNA Spaces

Design and use cases of a location enabled  
Wi-Fi network

Christian Gauer, Sr. TME

BRKEWN-2012

**CISCO** *Live!*

Barcelona | January 27-31, 2020



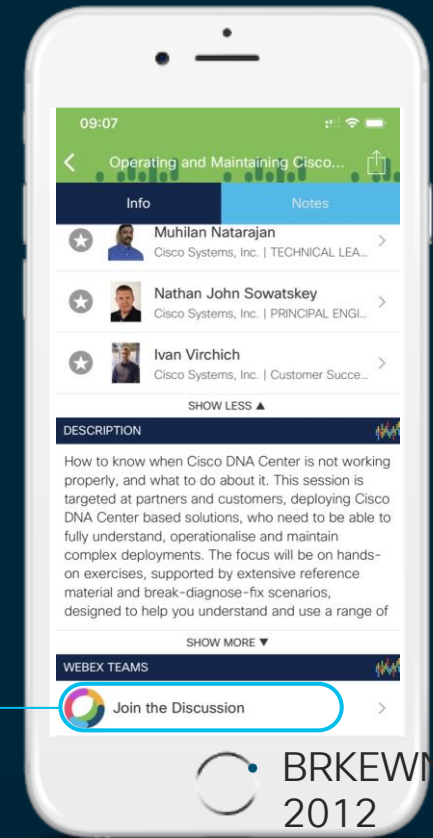
# Cisco Webex Teams

## Questions?

Use Cisco Webex Teams to chat with the speaker after the session

## How

- 1 Find this session in the Cisco Events Mobile App
- 2 Click “Join the Discussion”
- 3 Install Webex Teams or go directly to the team space
- 4 Enter messages/questions in the team space



# Agenda

- Introduction
- Indoor Positioning
- DNA Spaces Architecture
- Migration from MSE / CMX to DNA Spaces
- How to use Location Data in 3rd party applications
  - Connecting 3rd party to Cisco DNA spaces APIs Push/Pull
- Use Cases at Cisco Live
  - Business Insights
  - Wayfinding and Find-my-Friends with Mazemap
  - Open Roaming



Mon



Tue

# MOB

## Mobility Track



Opening Keynote 09:00

LABEWN-2127 Every day  
Walk in Lab:  
Integration of DNA  
Spaces with Aironet  
and Catalyst Based  
wireless networks

PSOEN-2817 14:00  
Cisco DNA Spaces -  
Wi-Fi as a behavior  
sensor enabling  
business outcomes

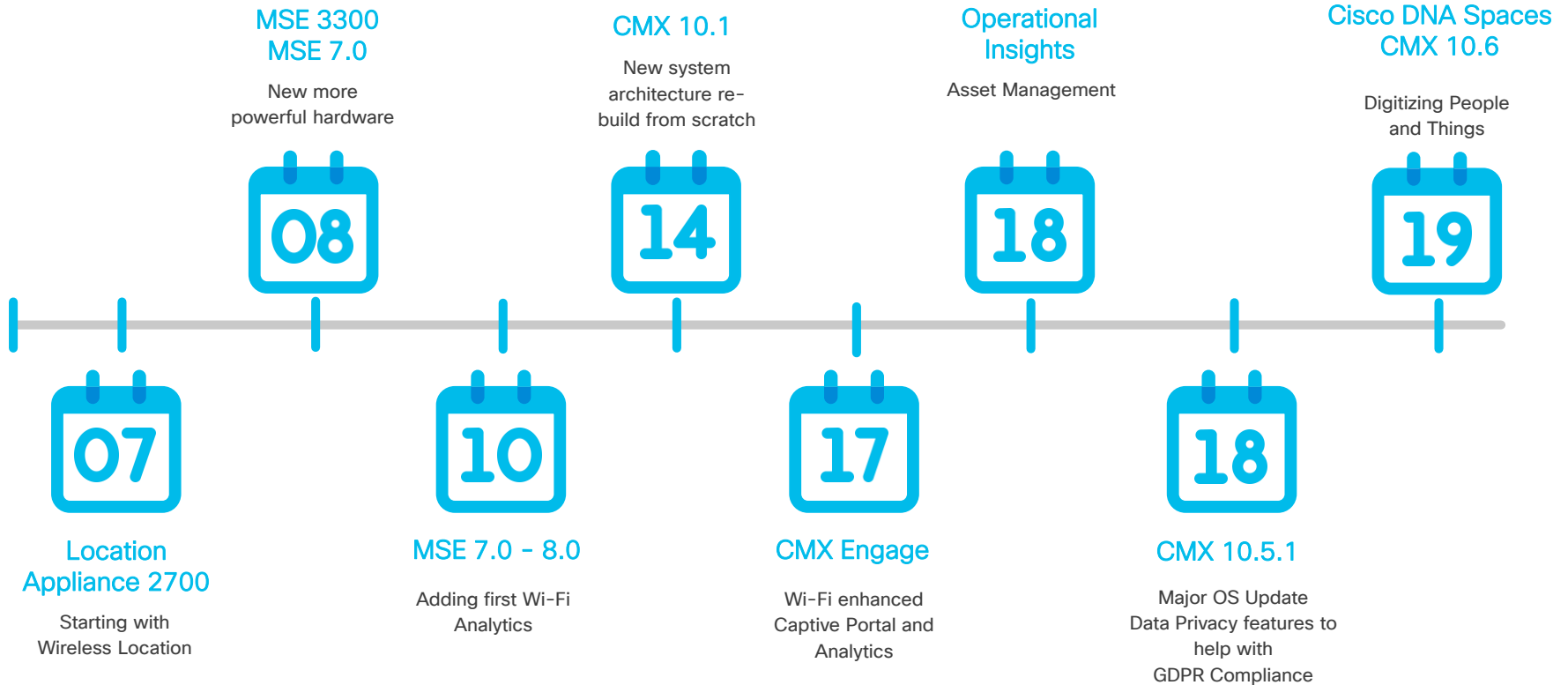
BRKEWN-2012 17:00  
Design and Use  
Cases of a location  
enabled Wi-Fi  
network, supported  
by Cisco DNA Spaces



Services

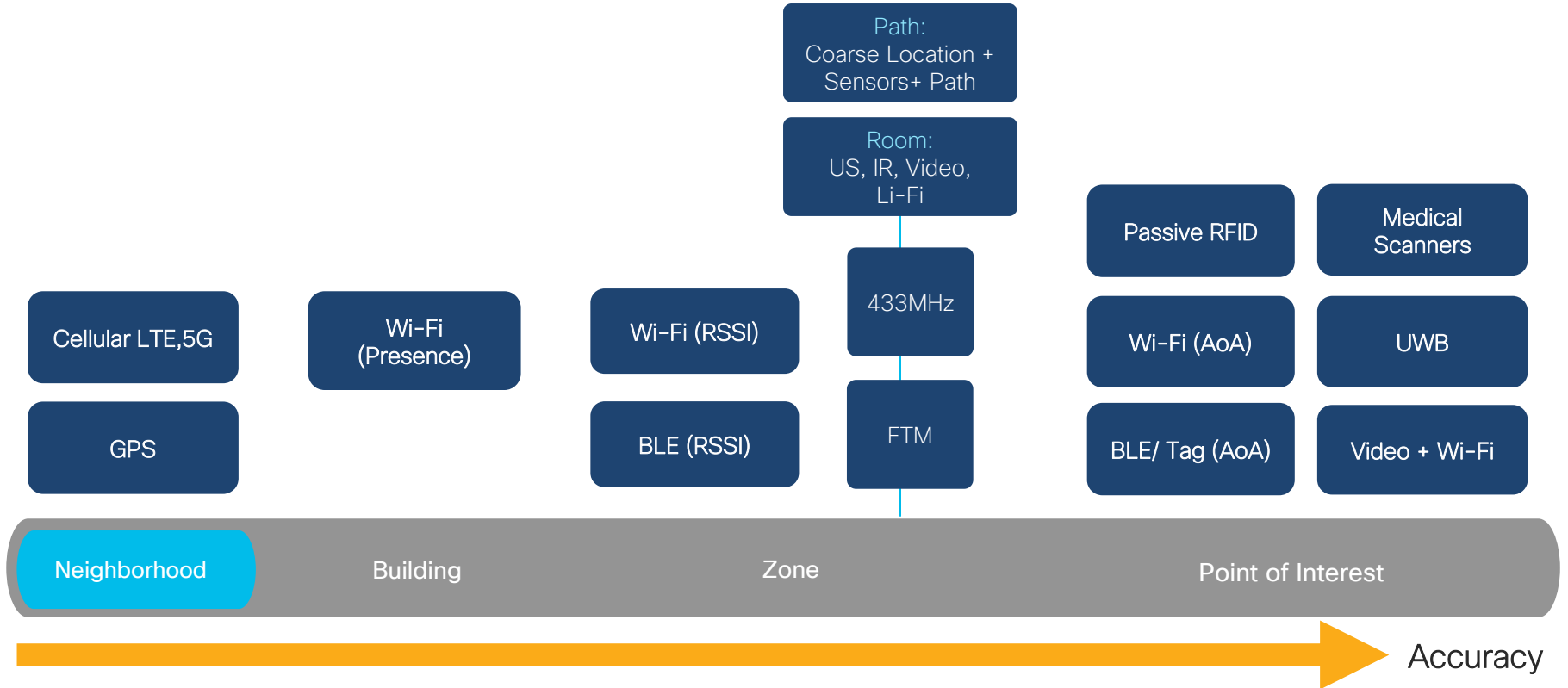


# 13 years of Wi-Fi Location Based Services



# Introduction to Indoor Positioning

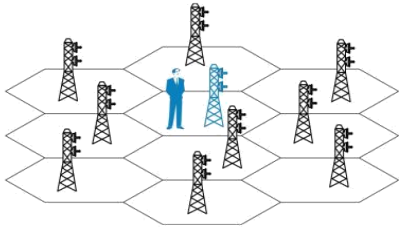
# Location Technology Landscape



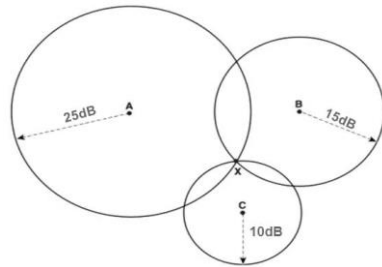


# Location Tracking Approaches

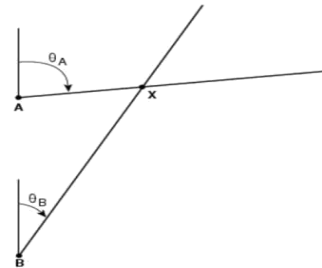
- Real-time location tracking and positioning systems can be classified by the measurement techniques they employ to determine mobile device location
- Approaches differ in terms of the specific technique used to sense and measure the position of the mobile device in the target environment
- Real-Time Location Systems (RTLS) can be grouped into four basic categories of systems that determine position on the basis of the following:



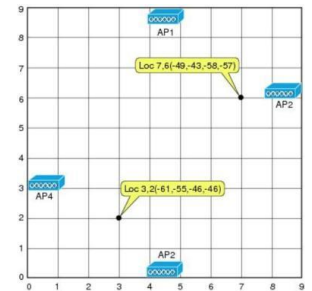
Cell of origin (nearest cell)



Distance based (Lateration)



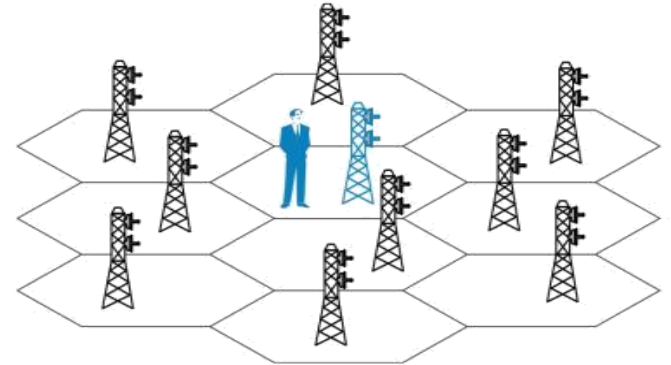
Angle based (Angulation)



Location patterning

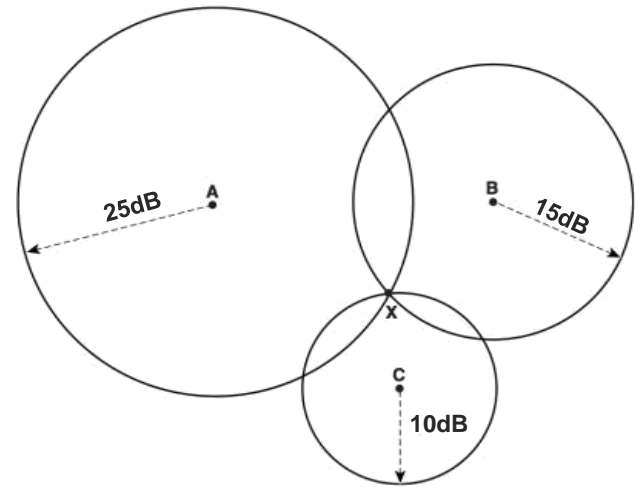
# Cell of Origin

- 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)
- 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.



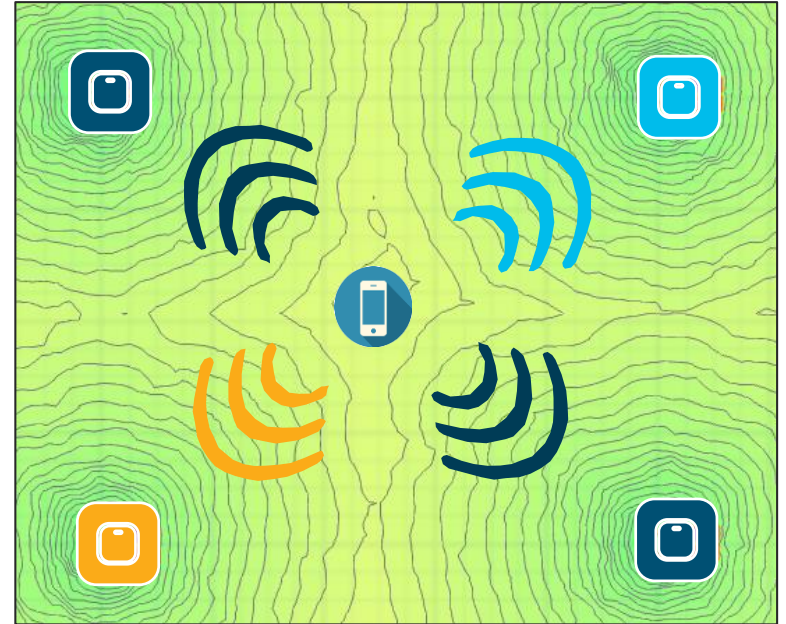
# Distance-Based (Lateration) Techniques

- Lateration can be performed by using
  - Received Signal Strength (RSS)
  - Time of Arrival (ToA)
  - Time Difference of Arrival (TDoA)
- RSS can be measured by either the mobile device or the receiving sensor
- 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



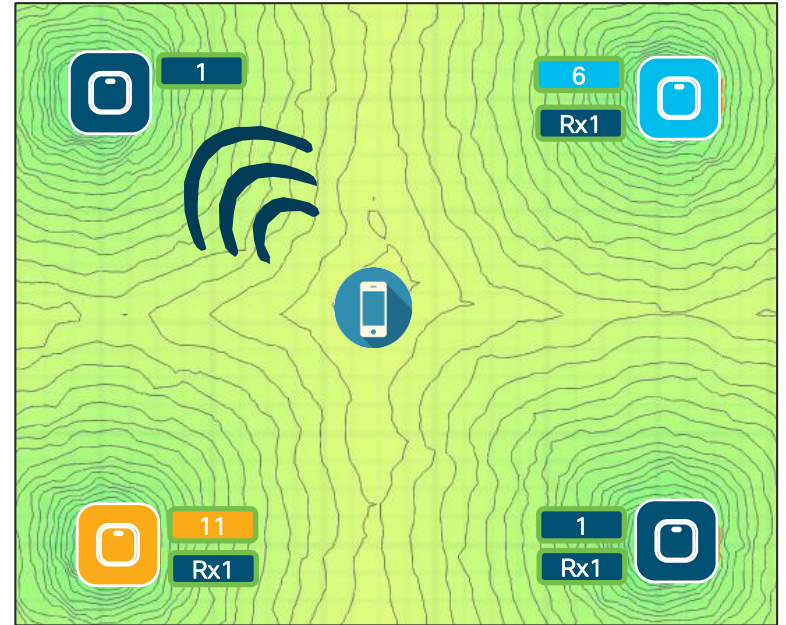
# Probe based location

- Relying purely on Client Probes
- Clients update = probe frequency
  - Between 10s and 5min's
  - Roaming triggers location updates



# FastLocate – Data Packet based location

- Requires APs with an additional radio
- Sync neighbor APs to client channel
- Listen to client packets
  - Use BAR to wake up client
- Update between 10s and 30s
- Works only for connected clients



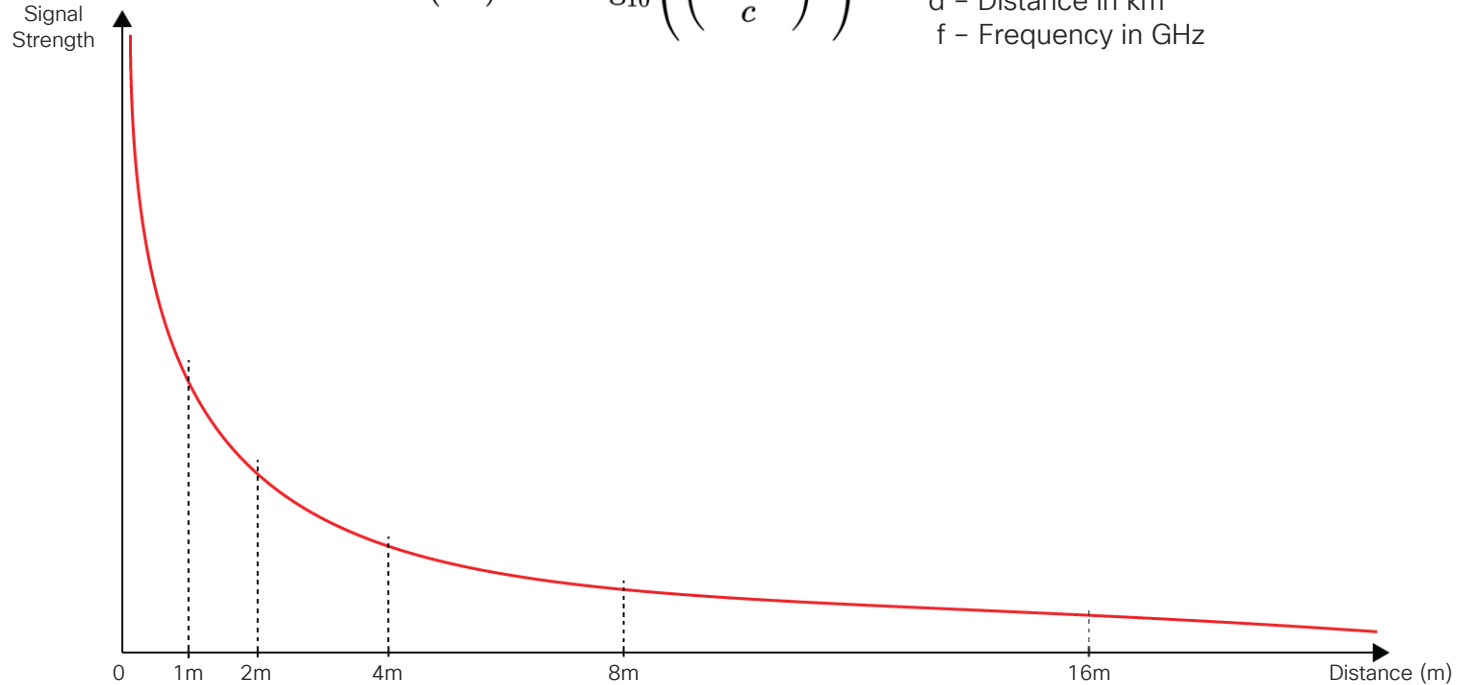
# Why RSSI matters? - Free Space Path Loss

$$\text{FSPL}(\text{dB}) = 10 \log_{10} \left( \left( \frac{4\pi df}{c} \right)^2 \right)$$

$$\text{FSPL}(\text{dB}) = 20 \log_{10}(d) + 20 \log_{10}(f) + 92.45$$

d - Distance in km

f - Frequency in GHz



# Why RSSI matters? -Free Space Path Loss

$$\text{FSPL(dB)} = 10 \log_{10} \left( \left( \frac{4\pi df}{c} \right)^2 \right)$$

$$\text{FSPL(dB)} = 20 \log_{10}(d) + 20 \log_{10}(f) + 92.45$$

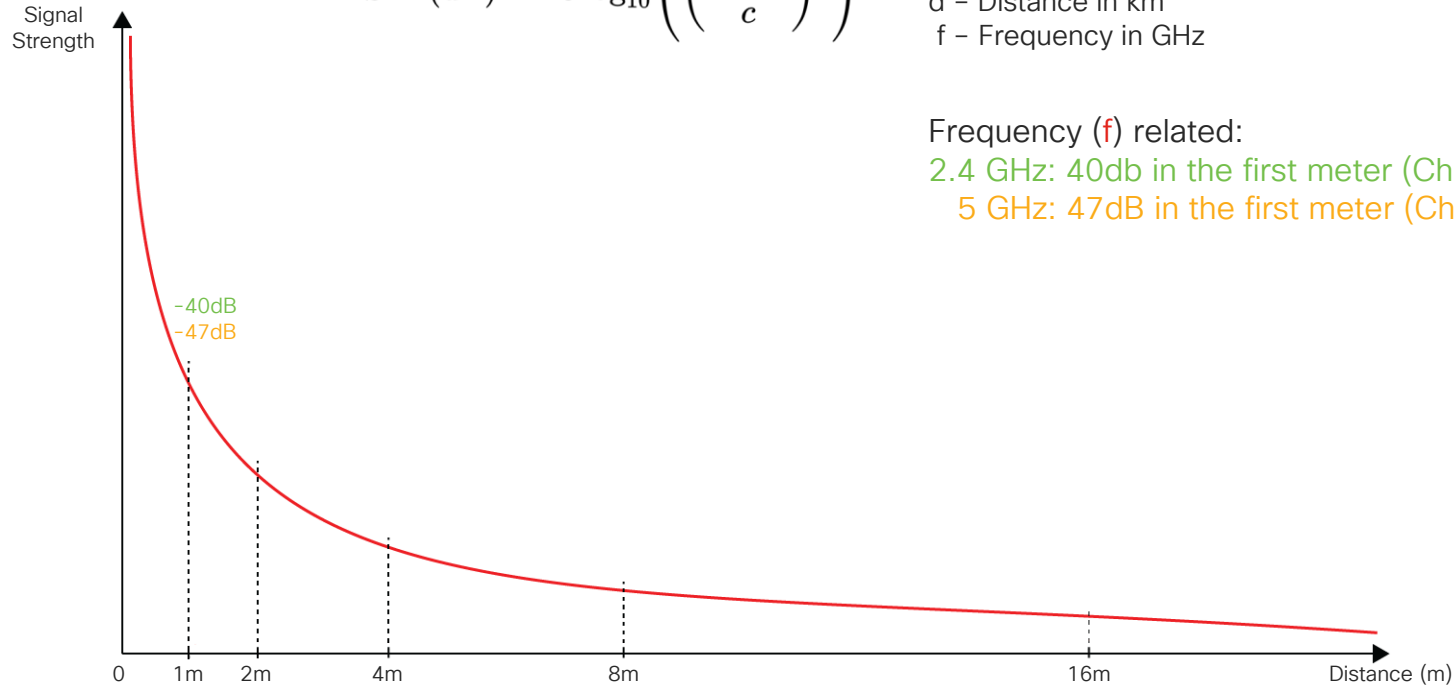
d - Distance in km

f - Frequency in GHz

Frequency (f) related:

2.4 GHz: 40dB in the first meter (Ch1)

5 GHz: 47dB in the first meter (Ch100)



# Why RSSI matters? – Free Space Path Loss

$$\text{FSPL}(\text{dB}) = 10 \log_{10} \left( \left( \frac{4\pi d f}{c} \right)^2 \right)$$

$$\text{FSPL}(\text{dB}) = 20 \log_{10}(d) + 20 \log_{10}(f) + 92.45$$

d – Distance in km

f – Frequency in GHz

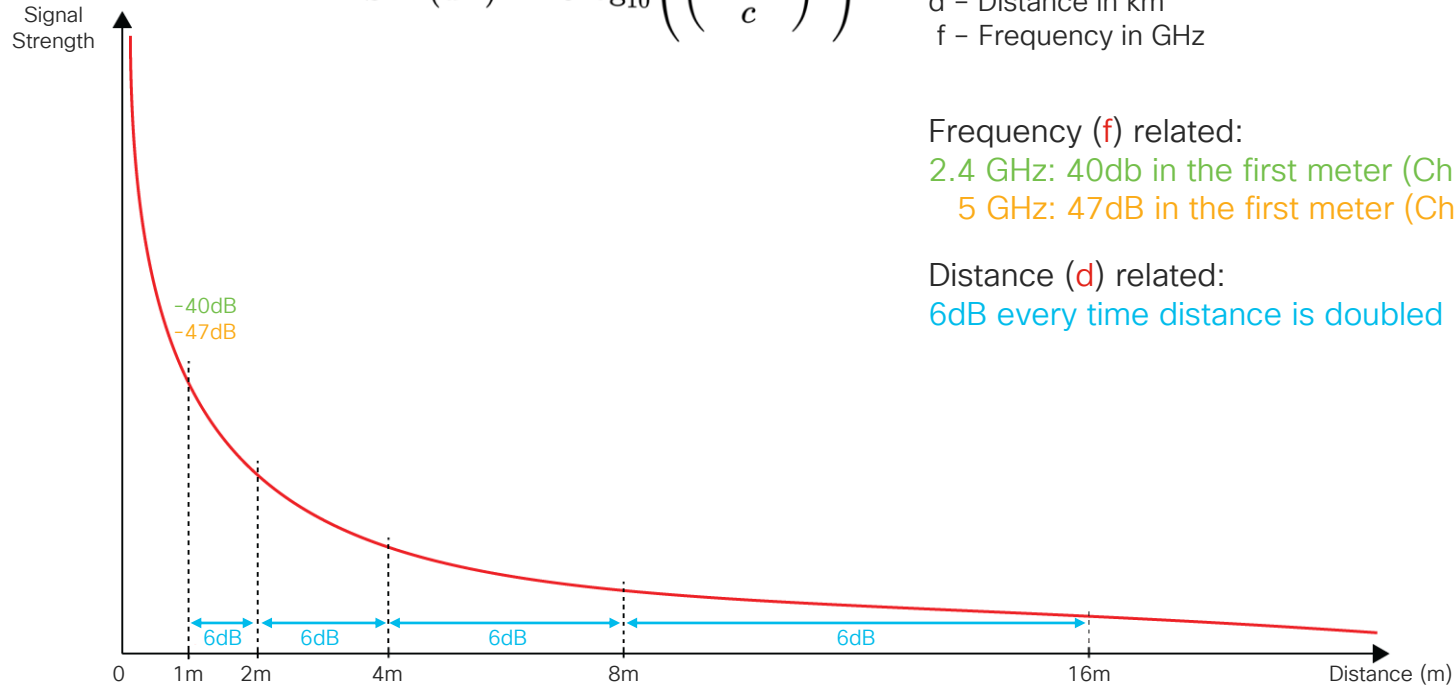
Frequency (f) related:

2.4 GHz: 40dB in the first meter (Ch1)

5 GHz: 47dB in the first meter (Ch100)

Distance (d) related:

6dB every time distance is doubled





# Why RSSI matters? – Free Space Path Loss

$$\text{FSPL(dB)} = 10 \log_{10} \left( \left( \frac{4\pi d f}{c} \right)^2 \right)$$

$$\text{FSPL(dB)} = 20 \log_{10}(d) + 20 \log_{10}(f) + 92.45$$

d – Distance in km

f – Frequency in GHz

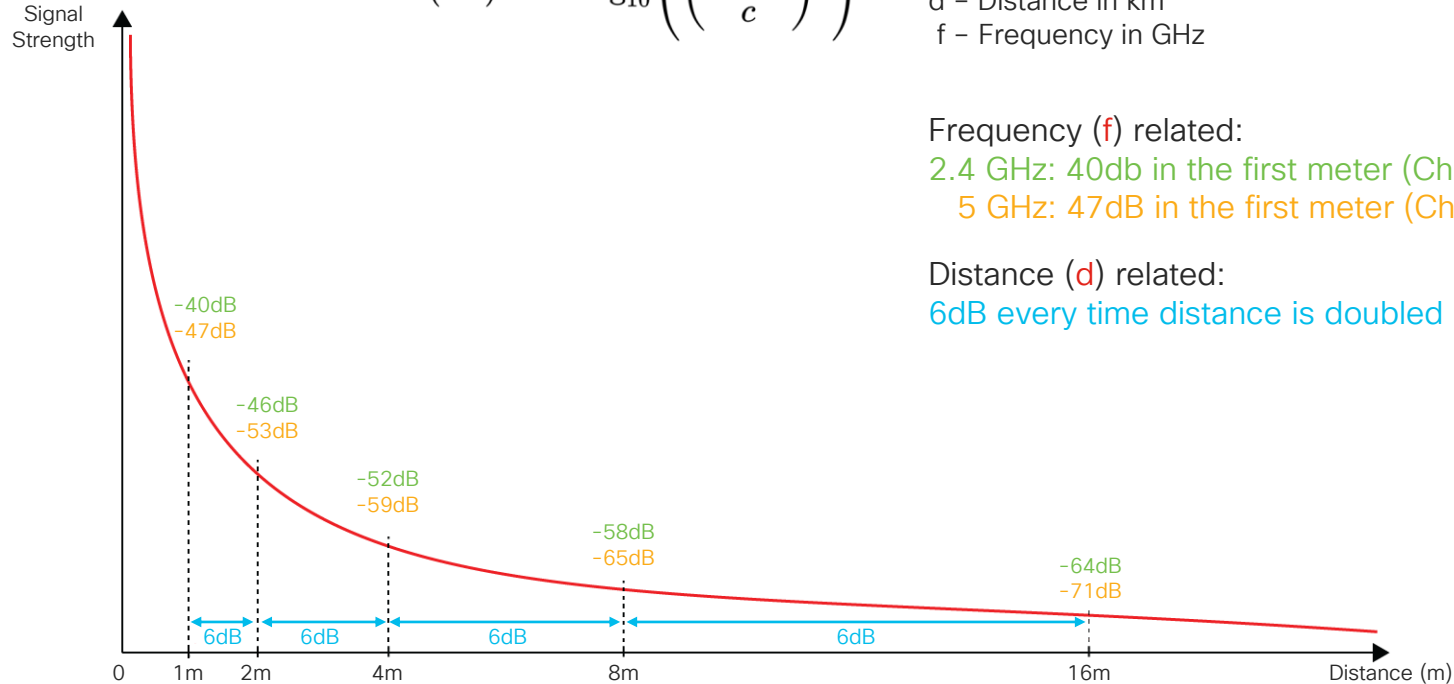
Frequency (f) related:

2.4 GHz: 40dB in the first meter (Ch1)

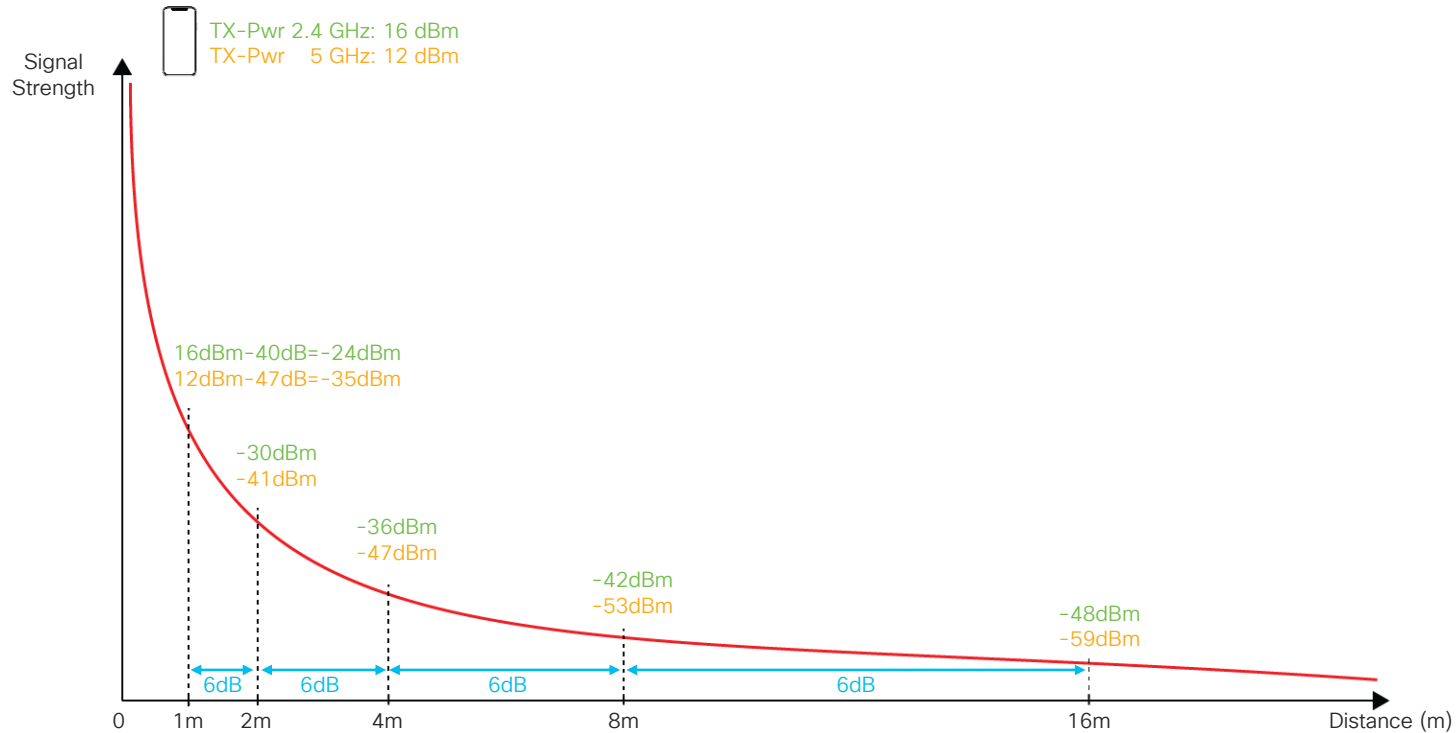
5 GHz: 47dB in the first meter (Ch100)

Distance (d) related:

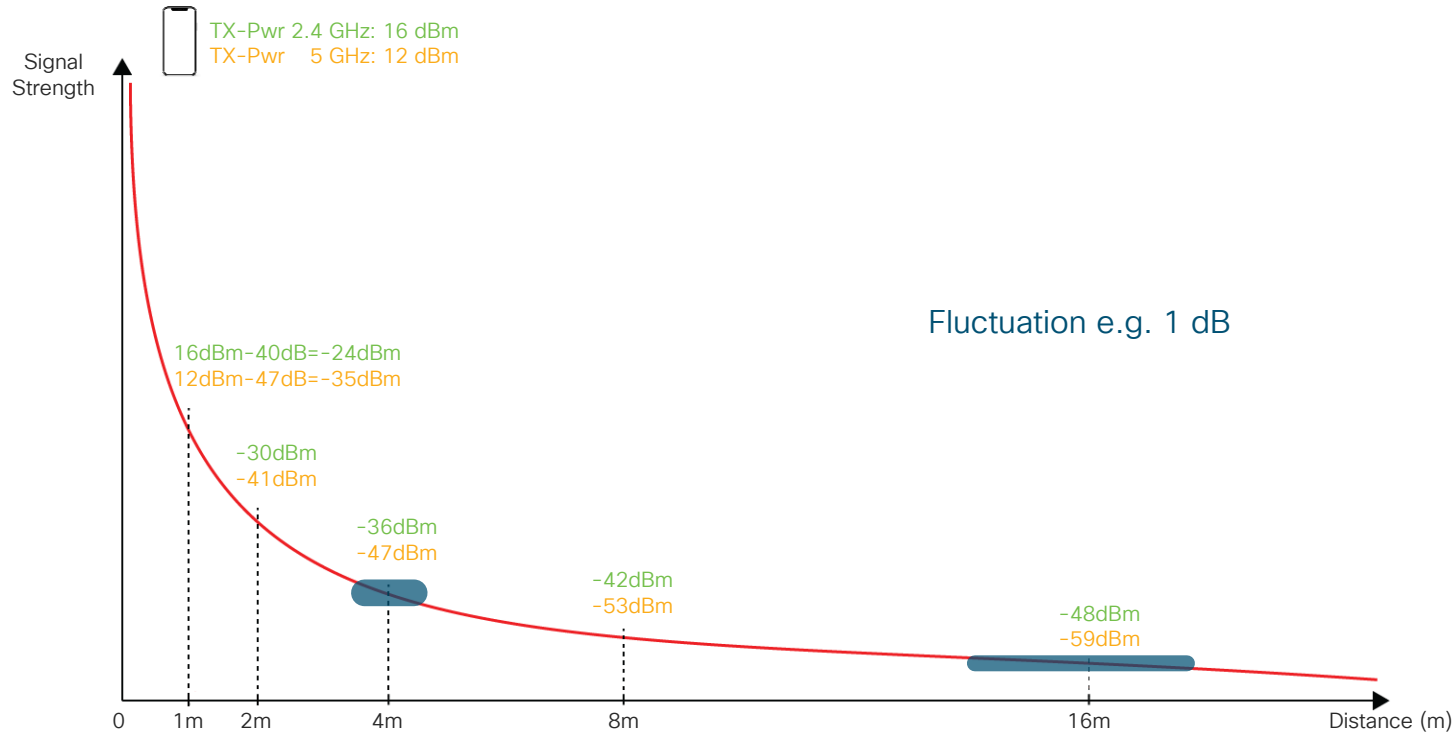
6dB every time distance is doubled



# Why RSSI matters? - Free Space Path Loss

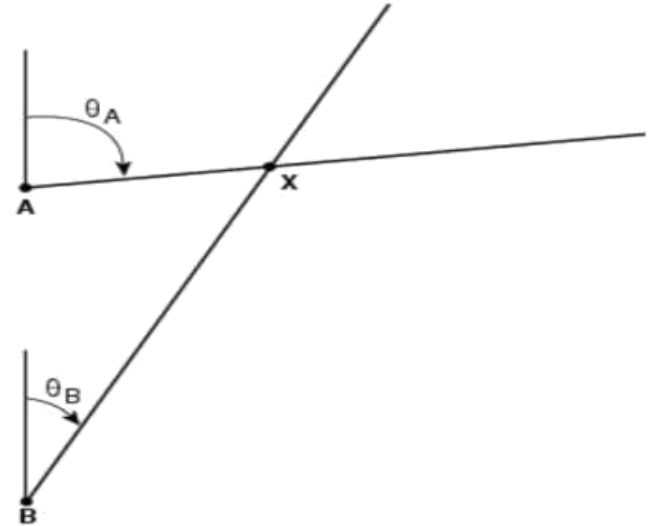


# Why RSSI matters? - Free Space Path Loss

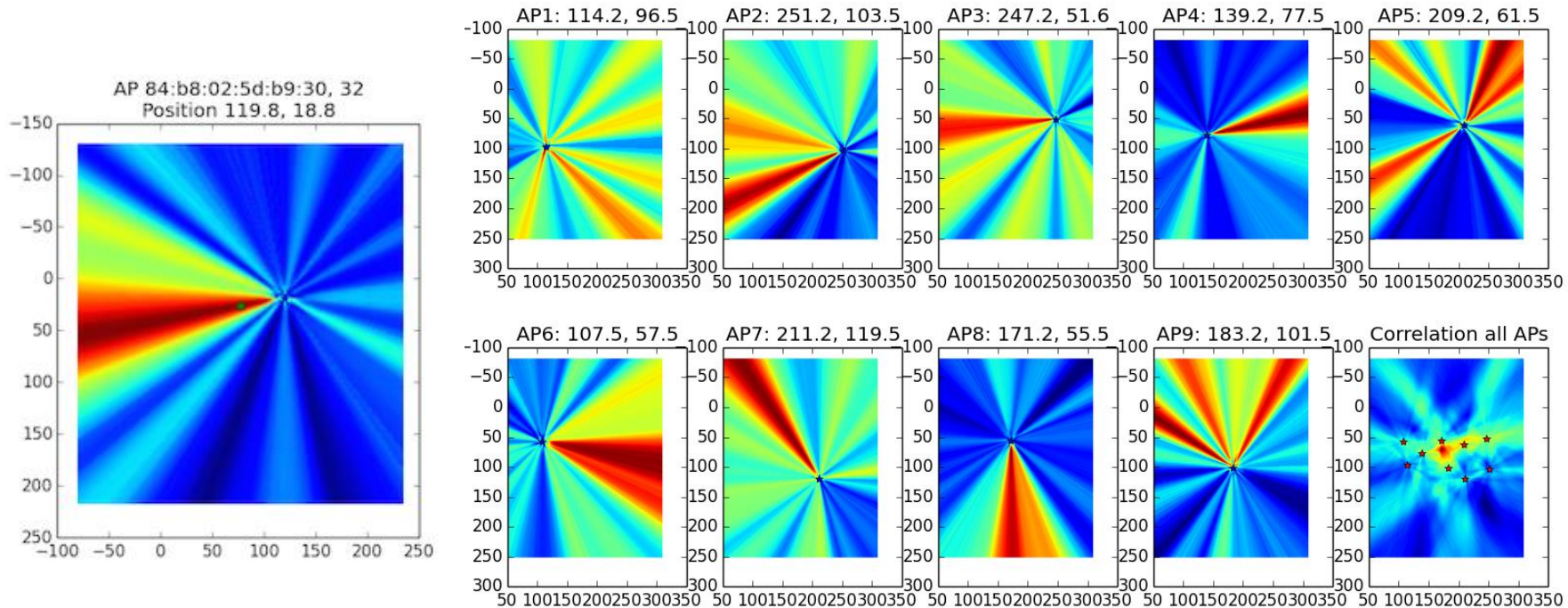


# Angle-Based (Angulation) Techniques

- 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)

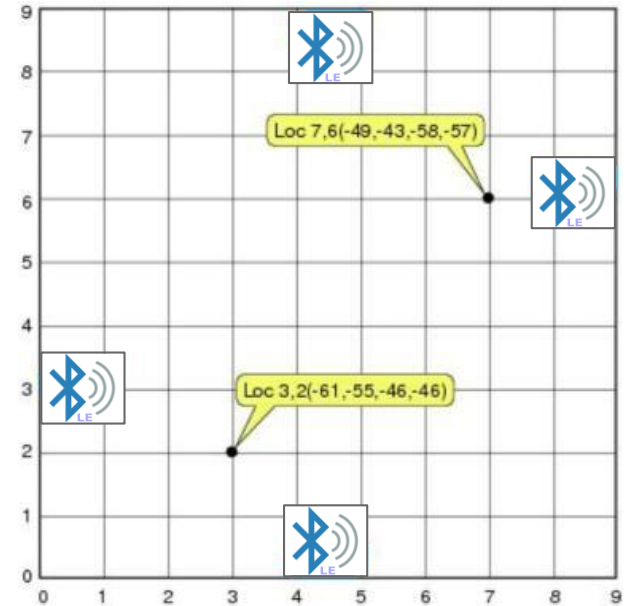


# How do we calculate X,Y with Hyperlocation? Heatmaps



# Location Patterning (Fingerprinting)

- Location patterning is based on the sampling and recording of radio signal behavior patterns in specific environments
- Each potential device location ideally possesses a distinctly unique RF "signature"



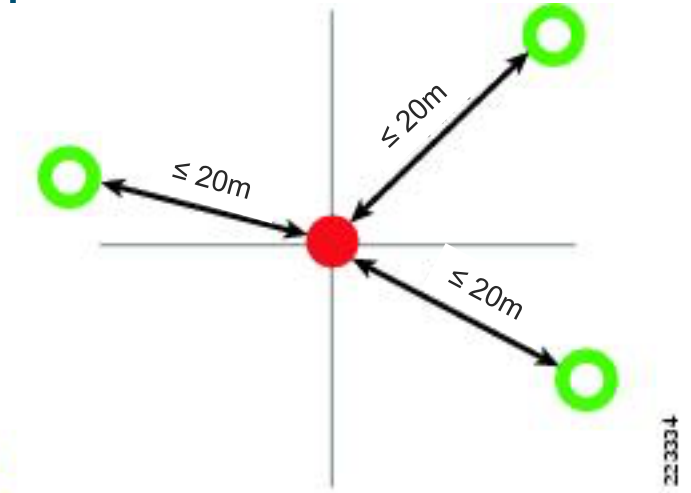
Because of fading and other phenomena, the observed signal strength of a mobile device at a particular location is not static but is seen to vary over time. As a result, calibration phase software typically records many samples of signal strength for a mobile device during the actual sampling process.

# What to expect from Wi-Fi location?

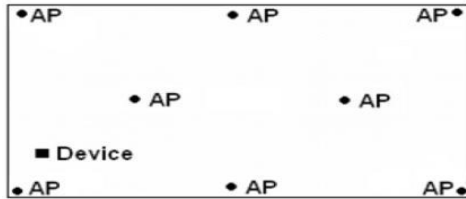
- General accuracy
  - RSSI based: 5m – 10m
  - With optimized RFID tags: 3m – 5m
  - Hyperlocation: 1m – 3m
- Update Rate
  - Probe based:
    - 1 – 2 updates per minute
    - Roaming triggers updates
  - Data Packet based: up to 10s update rate
  - RFID tags:
    - depends on configuration, typically 5min update rate for static tags, 1min for moving
    - Button push immediately (about 1s until CMX sends notification)

# Basic Rules – often not follow

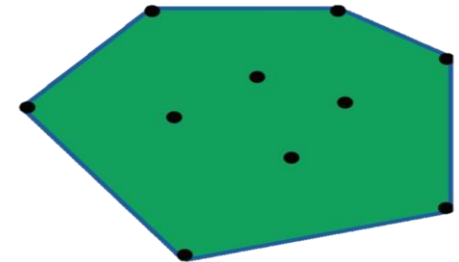
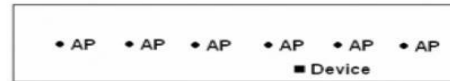
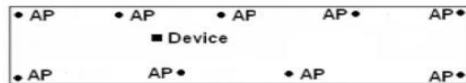
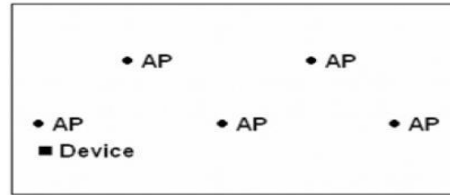
- Deploy minimum of 4 APs per floor
- One AP around client in each quadrant
- -75 dBm Client RSSI on 3 APs
- Create a convex hull around location area



## Recommended



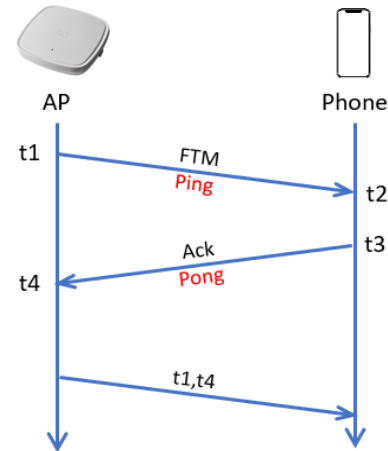
## Not Recommended





# 802.11mc – FTM Wi-Fi certified location

- 802.11mc (802.11-2016) specifies the Fine Timing Measurement (FTM) protocol for device ranging
  - Function already supported by some chipsets
  - not widely used currently
- Uses cases
  - Proximity services
  - Locate the device if we know the distance between the device and more than 3 APs
- Time stamps in ns accuracy
  - 3 ns translate to 1 meter
  - Device clock needs to have ns granularity
  - No clock synchronization needed (drift estimate helpful)
- Accuracy:
  - @80 MHz wide channel about 1m
  - @20 MHz wide channel about 4m

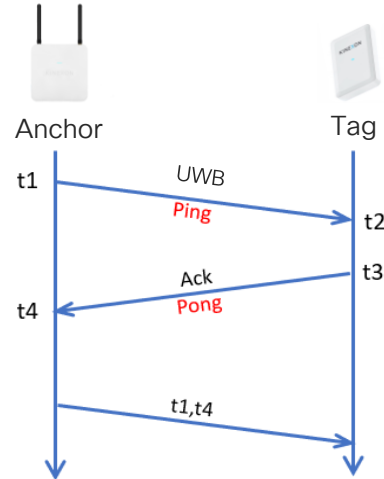


$$\text{Distance} = \frac{((t4-t1) - (t3-t2))}{2} * c$$

round trip time      turnaround time

# Location using Ultra Wide Band

- Round trip time + TDOA
- Anchor sends packet
- Tag returns the packet, distance is calculated by RTT
- Packet is received by multiple anchors, distance is calculated by TDOA
- 6 GHz with 500 MHz channel width
- not sensitive to noise and reflections: pulse
- IEEE 802.15.4-2011
- Update rate 1 – 5 updates per second
- Accuracy sub 1m, up to 10-15 cm in optimal conditions
- 3D (X,Y,Z) possible



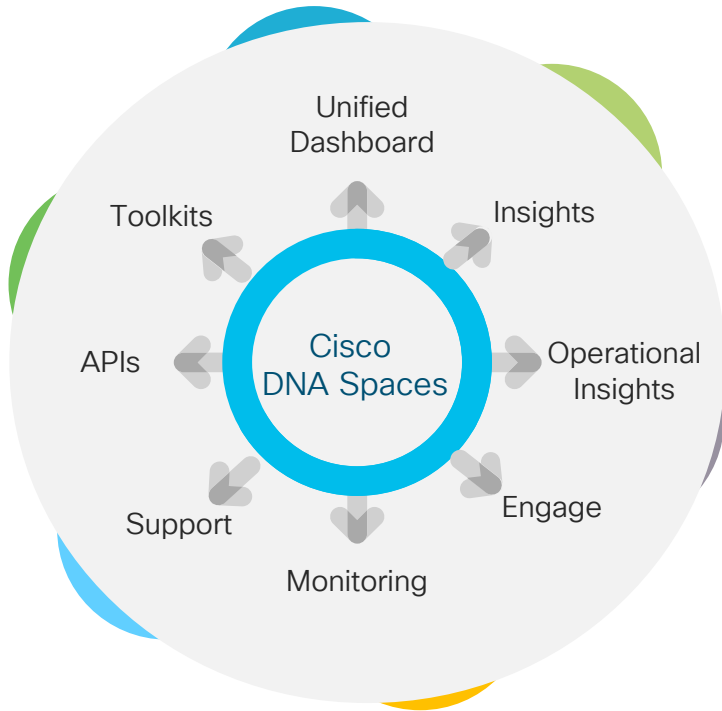
$$\text{Distance} = \frac{((t4-t1) - (t3-t2))}{2} * c$$

round trip time

turnaround time

# DNA Spaces

# Cisco DNA Spaces



## Simplifying the way customers consume location based services

Bringing all location services offerings together onto a single cloud platform that is extensible, scalable and reliable.

## Compatibility and Interoperability across Cisco hardware (Catalyst, Aironet & Meraki) and software

Support across both next gen and previous gen wireless stack. Integration with DNA-C

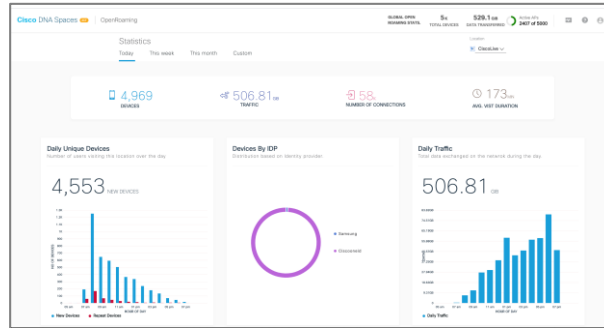
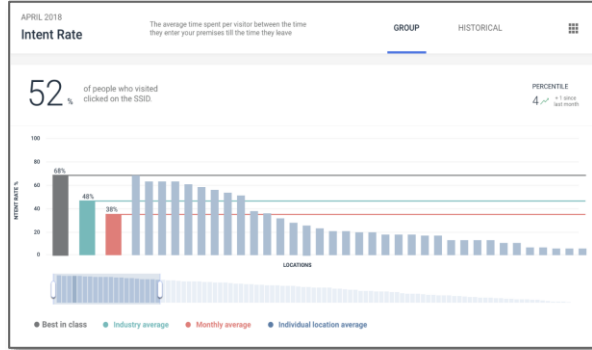
## Simplified Offer Structure, with a comprehensive feature set

Three subscription SKUs, making it easy to purchase

## Enterprise class reliability

24 X 7 Deep Monitoring & End-to-End SLA

# Cisco DNA Spaces: SEE



## DNA Spaces Cloud

- Behavior metrics
- Right now metrics
- Location hierarchy
- Cloud Detect & Locate (Base)
- Location Analytics (Base)
- Report Export

## Open Roaming

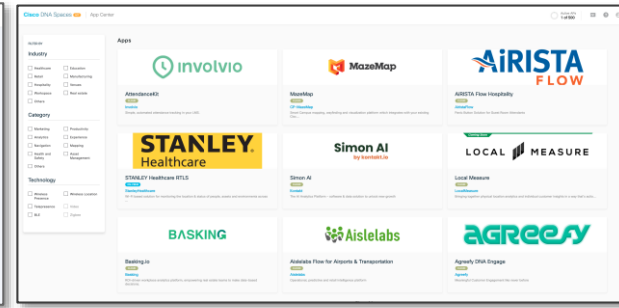
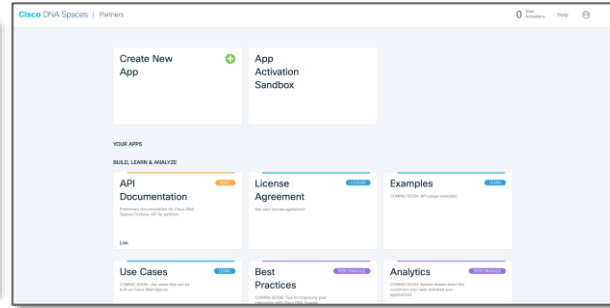
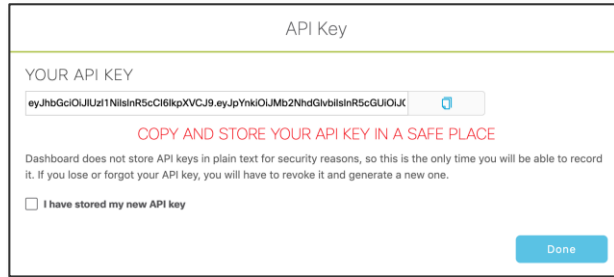
- Auto Onboarding to Guest Wi-Fi
- Improved Guest Wi-Fi Experience

## Cisco DNA Center Integration



- Client Location
- Intelligent Capture
- Assurance
- Rogue Location

# Cisco DNA Spaces: EXTEND



## Customer

- On-prem and cloud APIs
- Customer Firehose
- Streaming Data Export

## Enterprise Software

Extend location data into enterprise software platforms such as CRMs, Data hubs, Analytics Platforms, Marketing clouds, etc.

## Partner

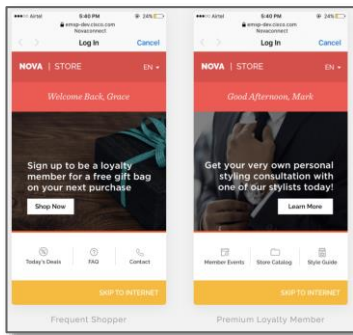
- Partner Dashboard
- Partner Stream (e.g. for Stanley)
- Partner Firehose
- SLA & Monitoring for APIs

## App Center

- Advanced Analytics
- Indoor Mapping and Wayfinding
- Digital Signage
- Asset Management
- Productivity

And many more

# Cisco DNA Spaces: ACT



## Captive Portal

- Acquire & identify visitors and map to enterprise identity



## Cloud Detect & Locate (enhanced)

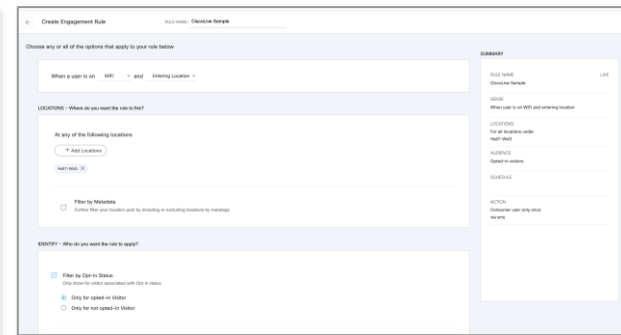
- RSSI location in Cloud
- Cloud Location APIs
- Cloud Location History (Coming Soon)*

## Hyperlocation

- 1-3m accuracy with AP4800

## Location Analytics (Advanced)

- Zone based (Coming Soon)*



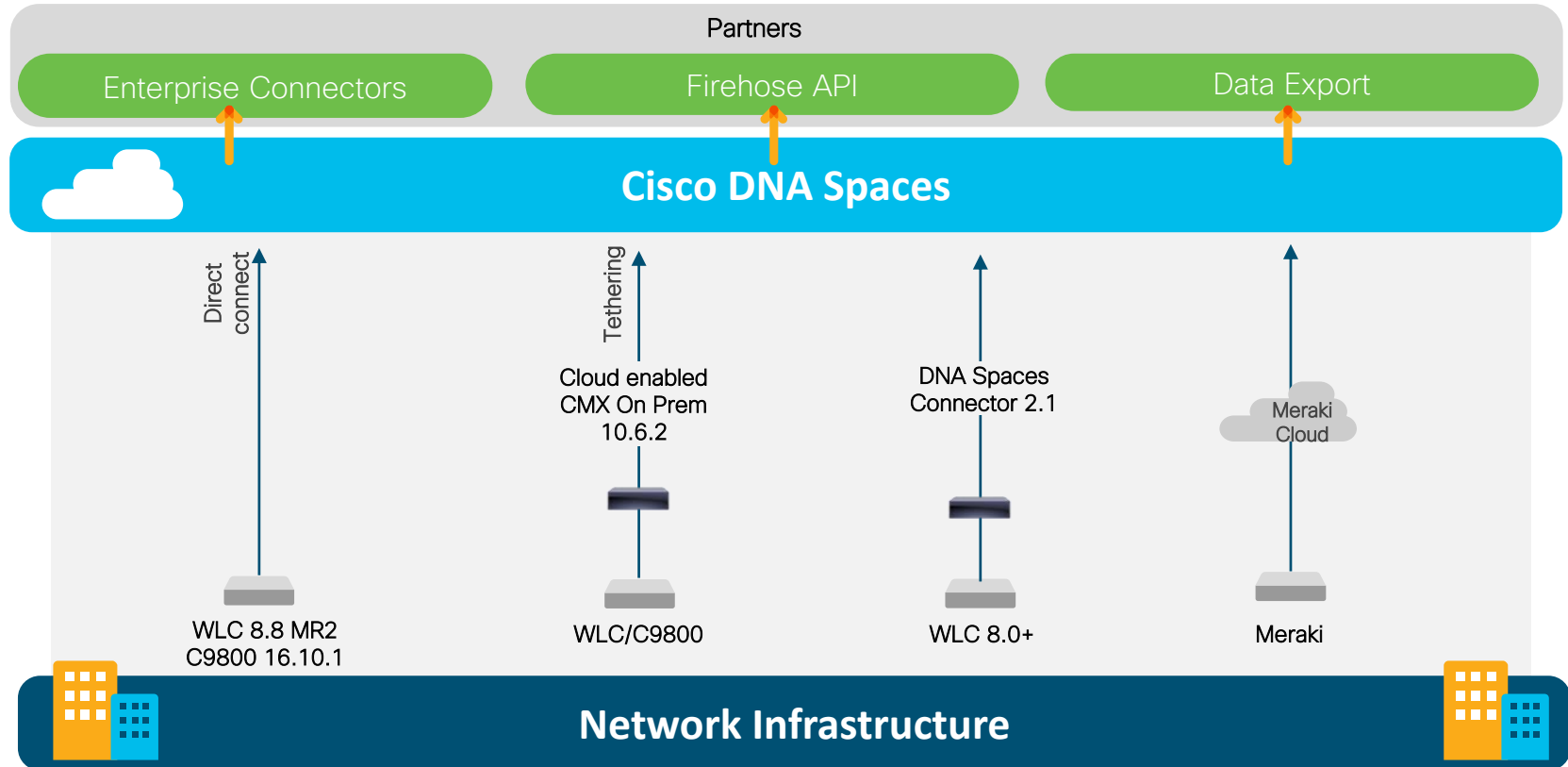
## Applications

- Location Personas** : Profile and segment visitors based on at-location behavior
- Engagement Rules**: Trigger notifications to visitors & employees via multiple channels
- DNA Spaces SDK: Coming Soon*
- Edge Device Manager: Coming Soon*

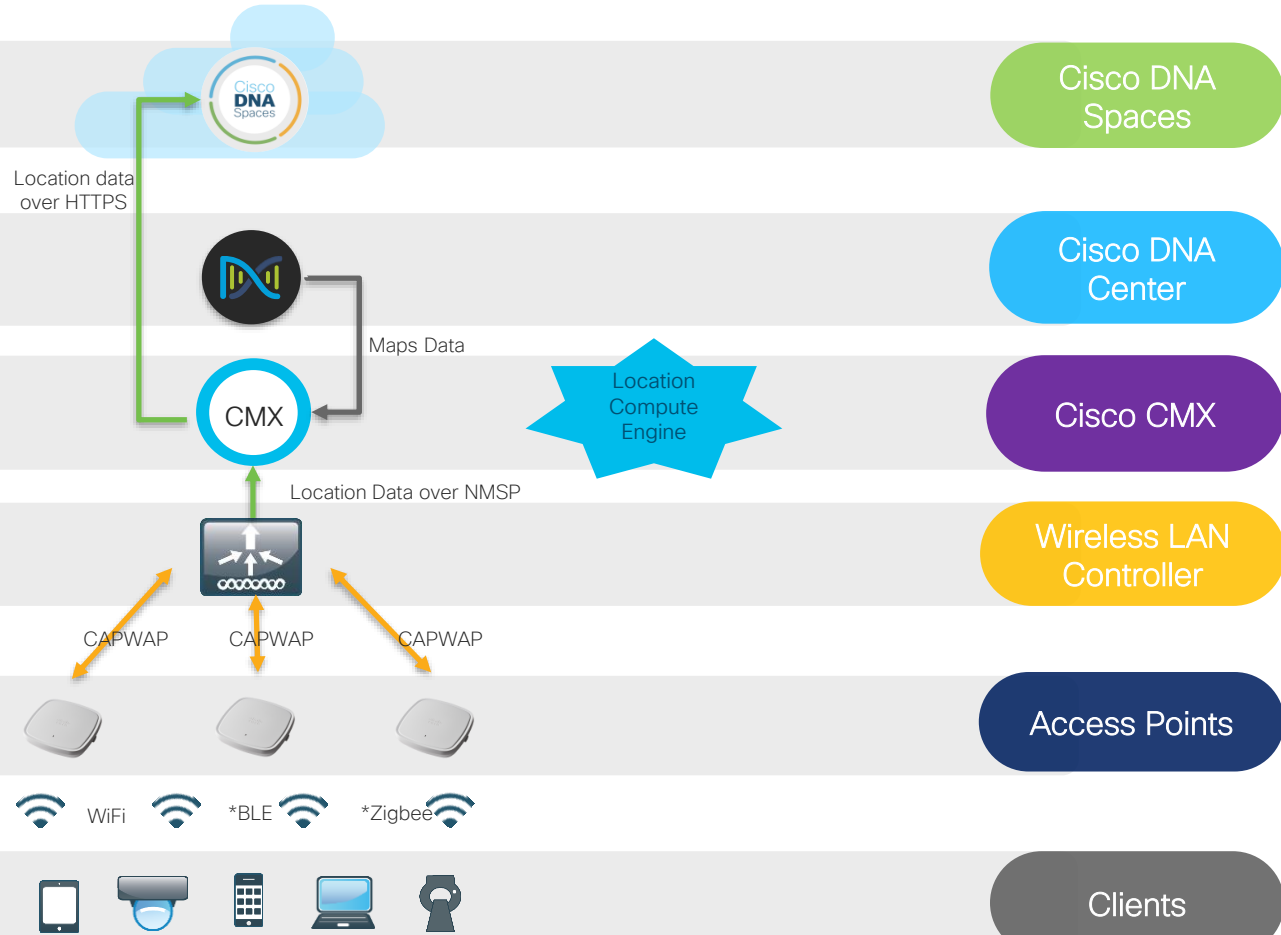
# Architecture



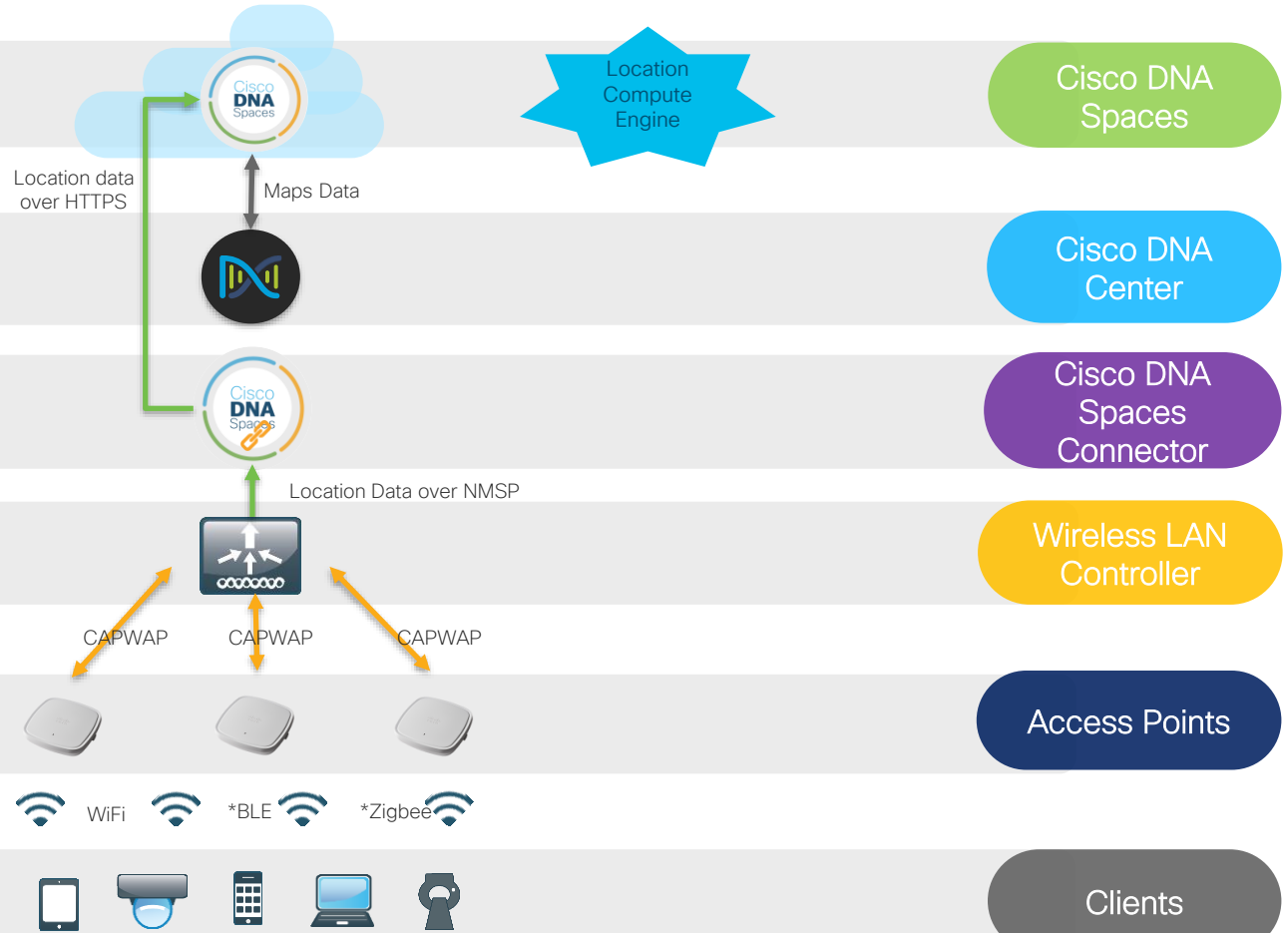
# Supports all Cisco Wireless Topologies



# Location compute models – On-prem Model

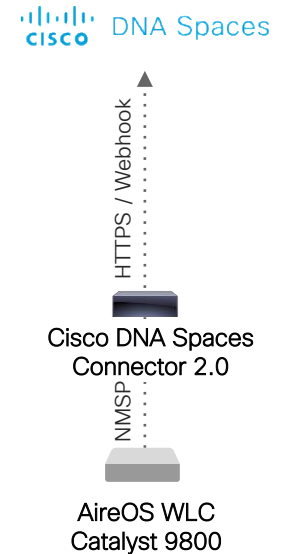


# Location compute models – Cloud Model



# Cisco DNA Spaces Connector 2.0

- Recommended for AireOS
  - if X/Y is not needed or
  - if cloud location is used
- One Connector can support multiple WLCs
- HA support with active / active
- System Requirements
  - 2 vCPU
  - 4 GB RAM
  - 60 GB Hard Disk
- Scale
  - Up to 10,000 APs
  - Up to 350,000 Devices



# When is on premise CMX Location Required ?

- Hyperlocation

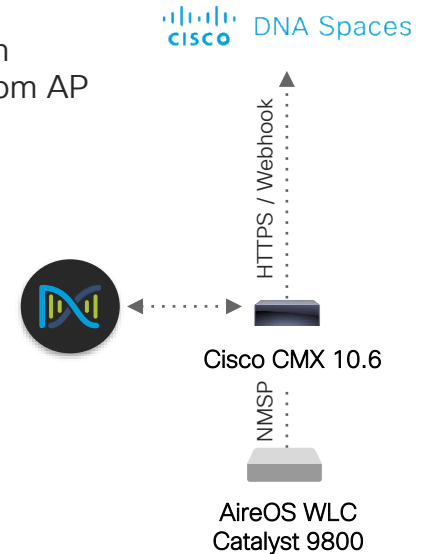
- To use the AP4800 or AP3700 with HL antenna or use FASTPATH on all AP on on premises CMX server is required to receive FASTPATH UDP data on port 2003 from AP and use in CMX for location calculations.

- Location for Prime Infrastructure

- Clients, Rogues, etc.

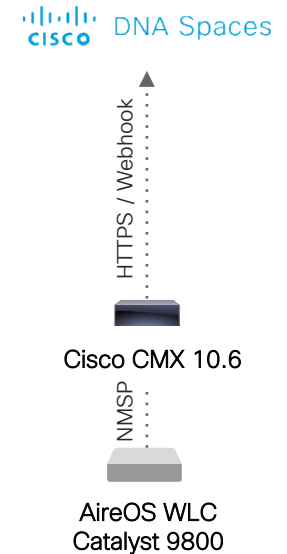
- Location for Cisco DNA Center

- Clients, Rogues\*, etc.
- Assurance
- Intelligent Capture



# Cisco CMX On-prem 10.6

- CMX 3375 HW-Appliance Scale:
  - RSSI: Up to 100k unique MACs tracked devices per day
  - Hyperlocation / FastLocate: Up to 10k unique MACs per day
  - Up to 2500 NMSP messages per second
- Supports multiple WLCs
- High Availability
- Tethering of On-prem and cloud
  - Display location in cloud of multiple CMX
  - Cloud API



# Cisco DNA Spaces Connector: Data Privacy



Reference

The screenshot shows the Cisco DNA Spaces Connector web interface. The main configuration area includes fields for Username (cmxadmin), Hostname (CL-DNA-SPACES-2), Tenant ID (11462), IP Address (10.100.254.63), and DNS Server (10.100.254.6). A modal dialog box titled 'Configure Privacy Settings' is open, showing input fields for MAC Salt and Username Salt. A red box highlights the 'Configure Privacy Settings' option in the right-hand menu.

Control Channel	Data Channel	Controller Details
Connected At: Sat Jan 25 2020 15:21:38 GMT+0100 (Central European Standard Time)	Connected At: Fri Jan 24 2020 21:50:37 GMT+0100 (Central European Standard Time)	IP Address   Connected At   Msg Rate   Status
Status: Connected	Status: Connected	10.130.0.9   Sat, Jan 25th, 2020   151   ACTIVE
		10.130.0.5   Fri, Jan 24th, 2020   43   ACTIVE
		10.130.0.8   Sat, Jan 25th, 2020   ---   ACTIVE
		10.130.0.1   Fri, Jan 24th, 2020   7   ACTIVE
		10.130.0.3   Sat, Jan 25th, 2020   0   ACTIVE

CISCO DNA Spaces

HTTPS / Webhook

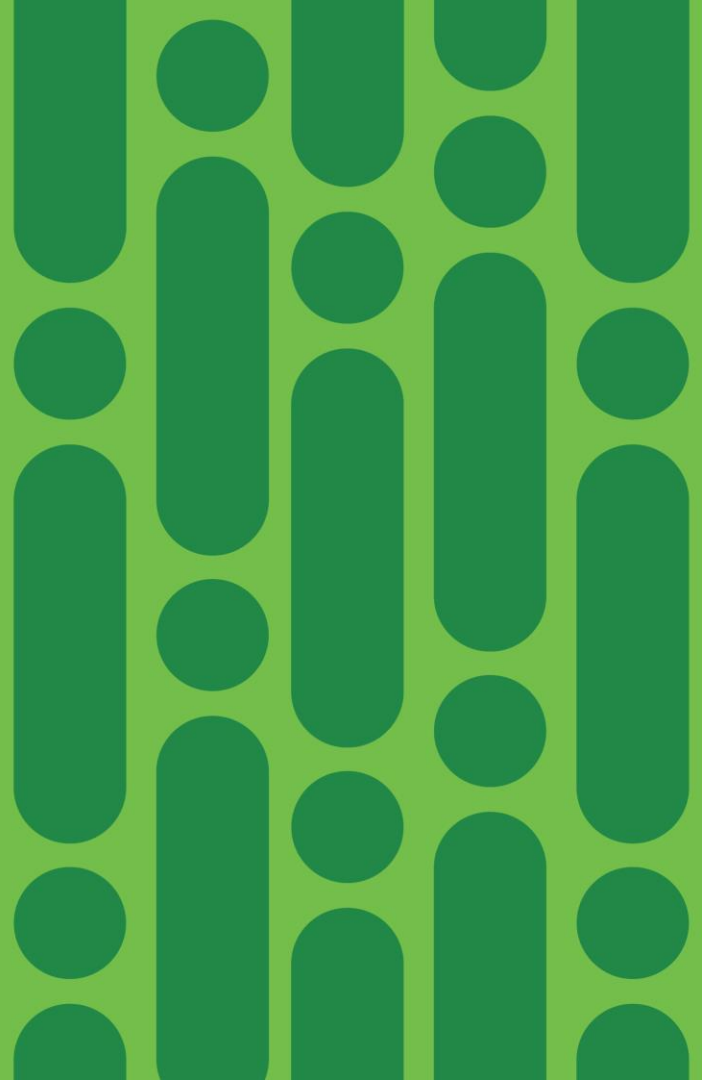
Cisco DNA Spaces Connector 2.0

NMSP

AireOS WLC Catalyst 9800



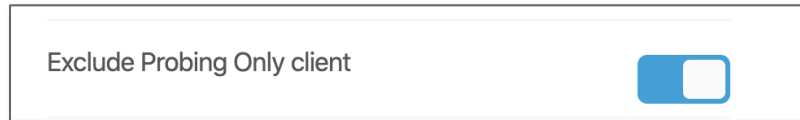
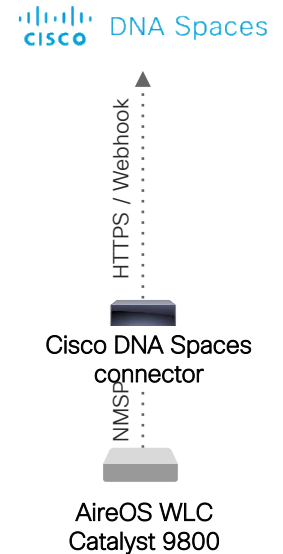
# Frequent Question: Large Scale





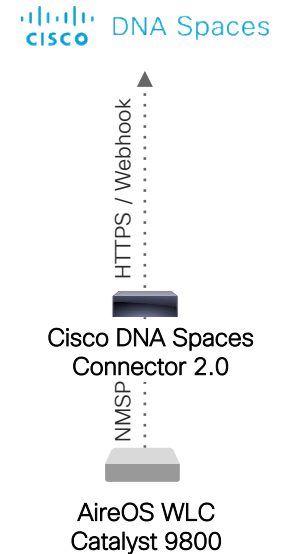
# Options for large scale wireless deployments

- Cloud Based Cisco DNA Spaces can support an unlimited size of deployments with Cisco resolving issues with respect to scale
- Cisco DNA Spaces can consume data from multiple CMX or Connectors.
- 3rd Party should integrate with cloud APIs or partner APIs
- To scale with an CMX on-prem, each CMX on-prem will support a maximum number of devices (90,000 unique MACs per day) and design would have to break up network to handle this.
- Exclude Probing Clients to ensure best set of data and improve scale.



# Large Scale with Connector

- Cloud is doing location calculation and analytics
- Single Connector can support 10,000 APs
  - Large scale Wireless Controllers
  - Multiple Wireless Controllers
- Multiple Connectors can report into a single account
- Unlimited Support for number of elements in Location Hierarchy for Analytics
- Unlimited Support for number of MAC devices that location can be calculated for per day



# Scaling numbers compared



Reference

Appliance	RSSI APs	RSSI MACs tracked per day	Hyperlocation APs	Hyperlocation MACs tracked per day	Analytics Zones	Movement: Number of NMSP messages per second
CMX 3375	10,000	100,000	1,000	10,000	1,000	2,500
High-end virtual CMX	10,000	90,000	1,000	10,000	1,000	2,500
DNA Spaces Connector	10,000	350,000 / Unlimited	Coming Soon	Coming Soon	Unlimited	10,000

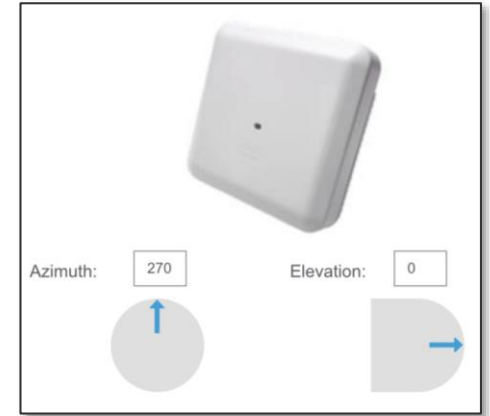


Recommended for Scale

# Frequent Question: Maps Workflow

# Location requires maps

- X/Y can only be calculated if there are maps
- APs need to be positioned accurately
  - Azimuth and Elevation for each radio and antenna
- Hyperlocation requires AP orientation
  
- Only one AP position possible
  - Dual-5GHz with two external antennas: Try not separate more than 1m / 3ft



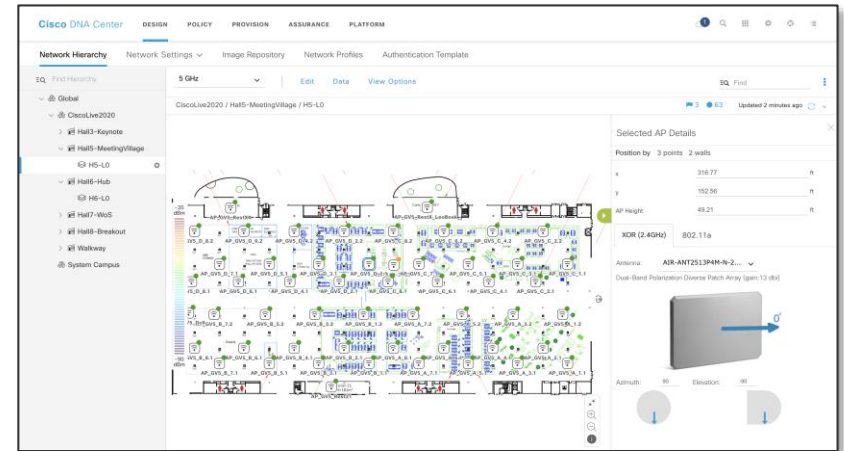
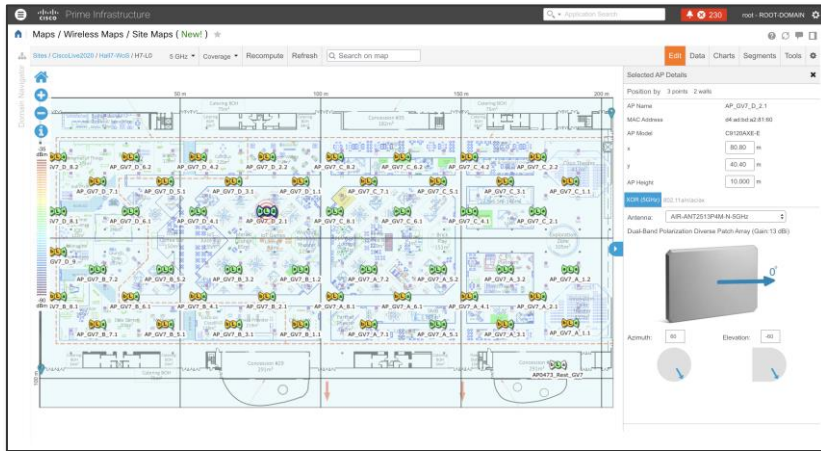
# How to get maps into DNA Spaces

Maps need to be created in

Prime Infrastructure

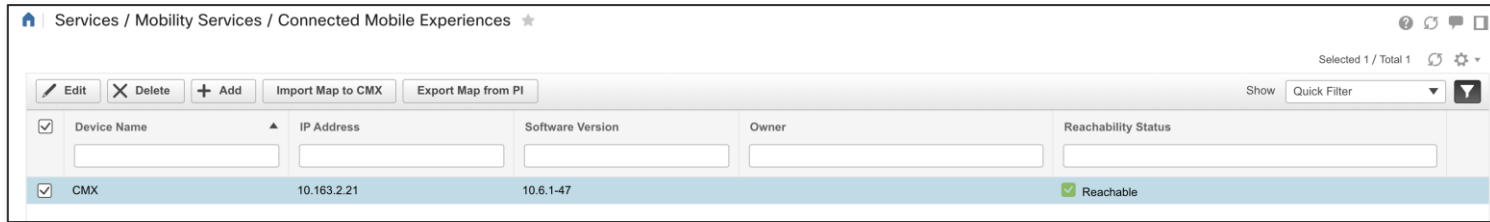
or

DNA Center



# Prime Infrastructure to CMX

- CMX workflow in PI GUI

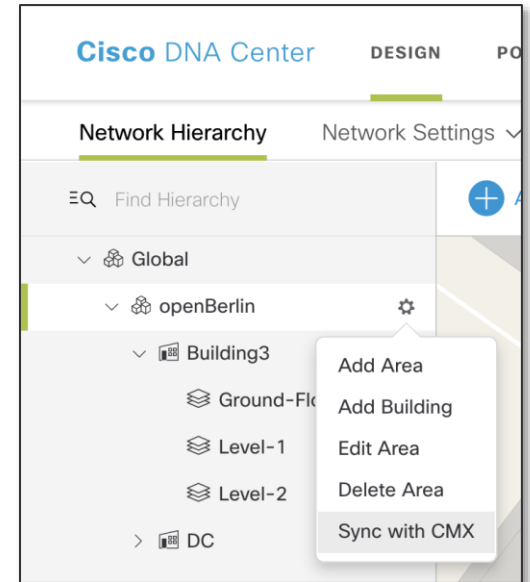


- Manual Export to file



# DNA Center to CMX

- Maps can be IMPORTED from PI
- DNA Center syncs the maps to CMX
  - Full hierarchy support with CMX 10.6.2
  - Limited hierarchy support till CMX 10.6.1:  
Global - Campus - Building - Floor
- For DNA Spaces Cloud location maps can be exported via script from DNA Center 1.3.1 and later
- *Native Connection from DNA Center to Cisco DNA Spaces Cloud coming soon.*





# DNA Spaces – manual import

- Upload maps exported from PI or DNA Center manually to DNA Spaces

The screenshot displays the Cisco DNA Spaces web interface. On the left, a dark sidebar contains the 'Cisco DNA Spaces' logo and a navigation menu with the following items: Home, Location Hierarchy, Monitoring & Support, Admin Management, and Setup. The 'Setup' menu is expanded, showing sub-options: Wireless Networks, Map Service, and Meraki Camera. The main content area is titled 'Cisco DNA Spaces | Map Service' and shows a list of 'Campuses' with a count of 5. The list includes 'CiscoLive2020' and several other event locations. A map of the 'EL GORNAL' area is displayed, featuring a blue highlighted region with several labeled hall locations: Hall7-WoS, Hall5-MeetingVillage, Walkway, Hall8-Breakout, Hall3-Keynote, and Hall6-Hub. The map also shows surrounding streets and landmarks like 'Europa-Fira' and 'Hotel Porta Fira'.

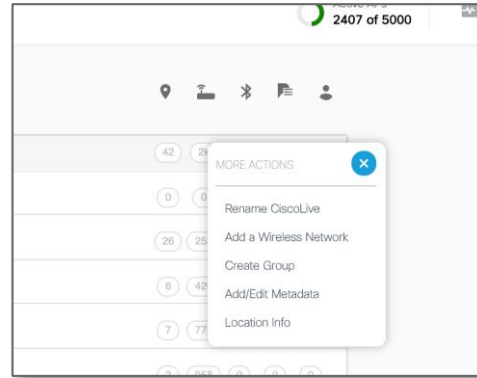
# Business Metrics

# Business Metrics with SEE is first step into extracting value from Cisco DNA Spaces

- Business Insights is included as part of Cisco DNA Advantage and provides the best data when

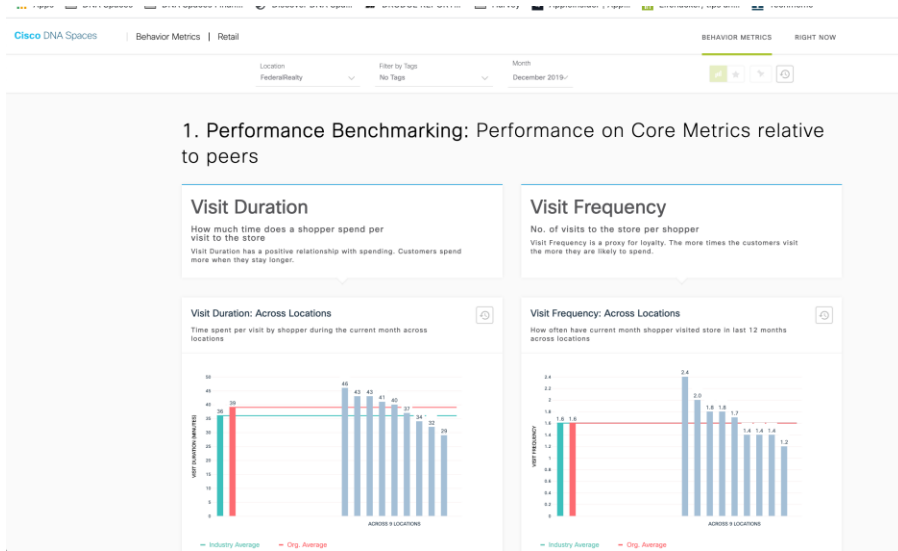
1. Location Hierarchy setup to be relevant to business (ie group stores together)
2. Time zone is set in Metadata to get open hours correct
3. Sq Footage is entered to get per sq foot normalization correct
4. Vertical is reported to get vertical specific analytics (vs Generic)

- Enter Location Info METADATA to improve Business Insights



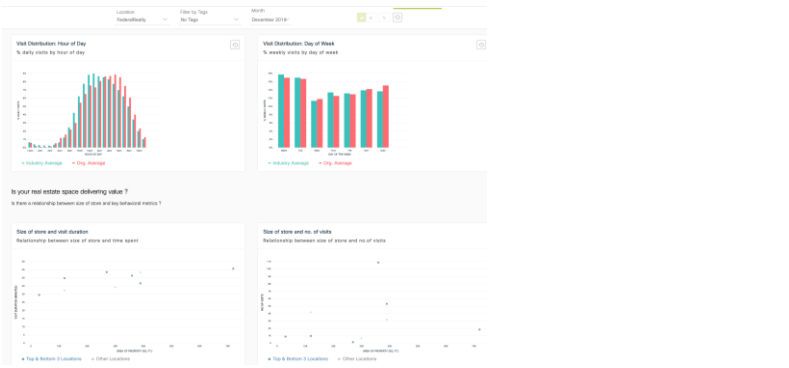
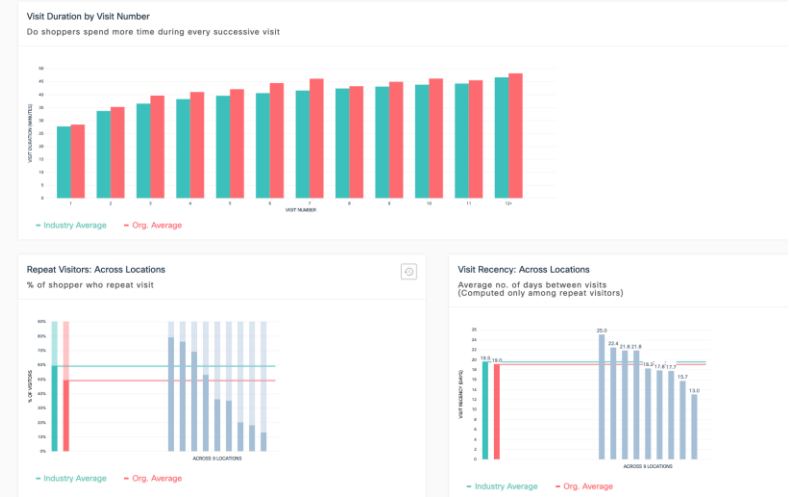
- Business Insights uses sophisticated Machine Learning to remove anomalies from data and provide MONTHLY aggregated data only.

# Behavior Metrics – Retail Example

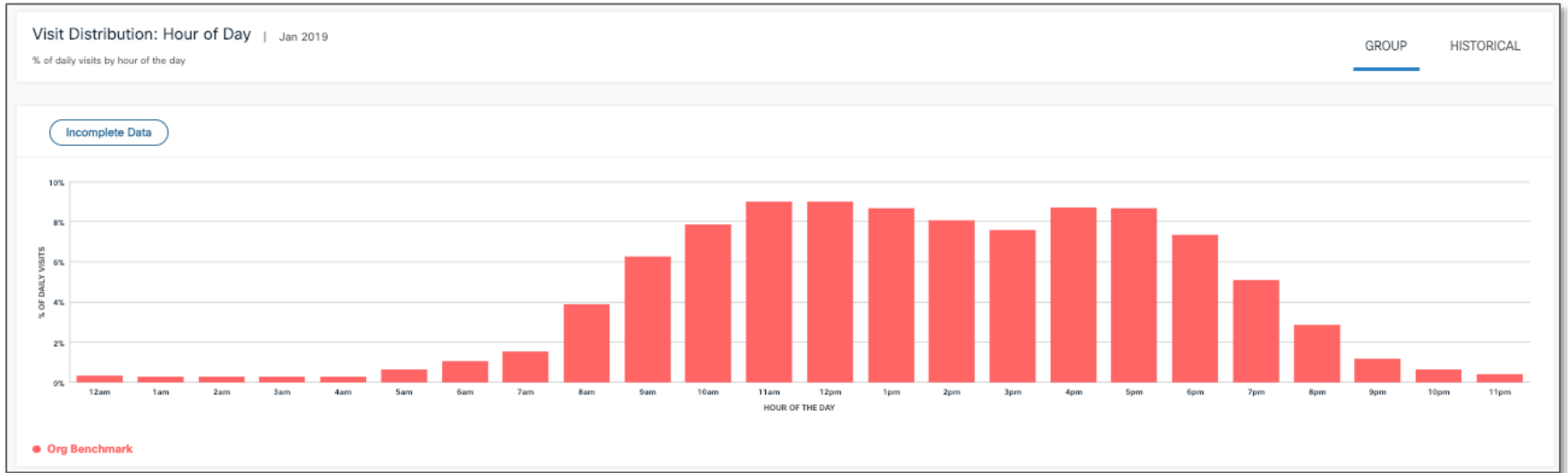


Business Metrics are core value of SEE and can be compared across different customers.

## 2. Diagnostics: Factors that Impact or are Impacted by the Core Metrics



# Business Metrics at Cisco Live: Visitor Distribution by Hour of Day



# Detect & Locate

# DNA Spaces – Detect & Locate



The screenshot displays the Cisco DNA Spaces interface. The main view shows a floor plan of a building with various rooms and equipment. A red dashed box highlights a specific area. Below the floor plan is a world map. A search results table is overlaid on the right side of the screen.

**Global Search**

Select Device Type: **IP Address** search term: **10.132.128.35**

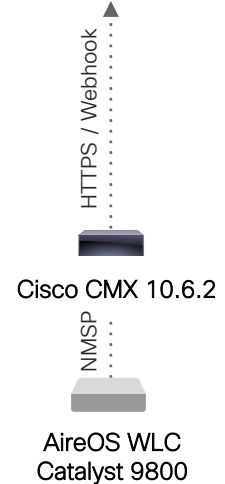
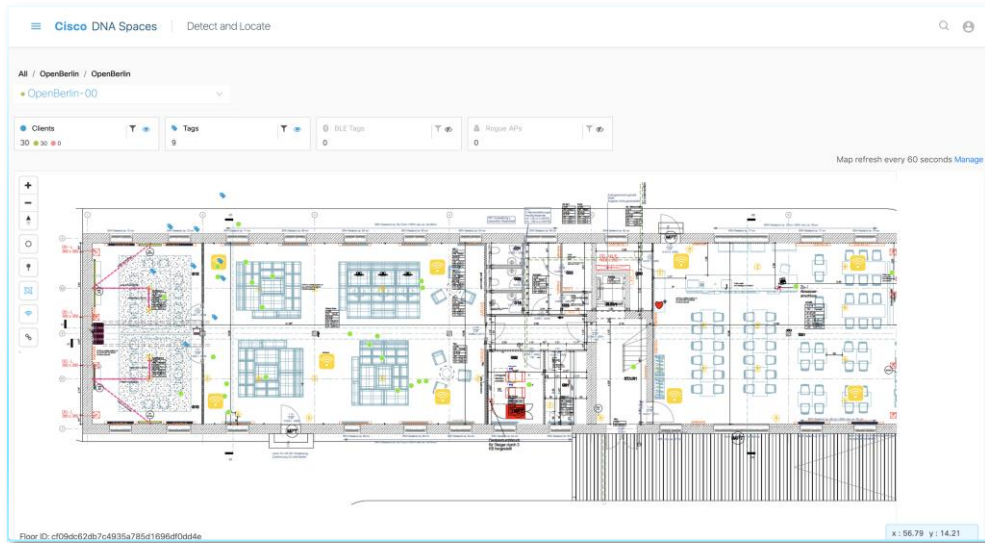
SEARCH RESULTS: CLIENT (1)

CLIENT	Overview	History	Accuracy Test
	MAC Address		00:00:80:06:13:0a
	Status		● ASSOCIATED
	IP Address		10.132.128.3
	Coordinates		X: 465.98, Y: 96.45
	Compute Type		RSSI
	Last Seen		Jan 25th, 2020 02:37:28 PM
	Manufacturer		CRAY COMMUNICATIONS A/S
	Connected AP		d4:ad:bd:a2:6a:a0
	Detecting Controller		10.130.0.9
	SSID		OpenRoaming
	Max RSSI Detected		-52 dBm
	Username		2ca97b0923b7f335417411b870ba7cd2115892db
	Band		5 GHz
	Bytes Sent		16.02 GB
	Bytes Received		6.07 MB
	Source		COMPUTE
	Device Location		CiscoLive2020->Hall6-Hub->H6-L0



# Cisco DNA Spaces: Detect and Locate

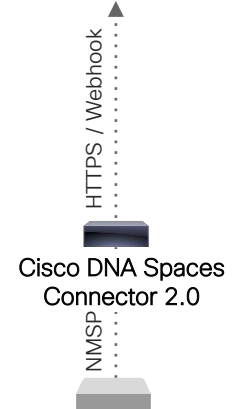
- Tethering with CMX on-prem
- Requires CMX 10.6.2
- Currently only option for DNA Center integration
  - DNA Center does not support a map export via GUI (roadmap) but syncs map with CMX





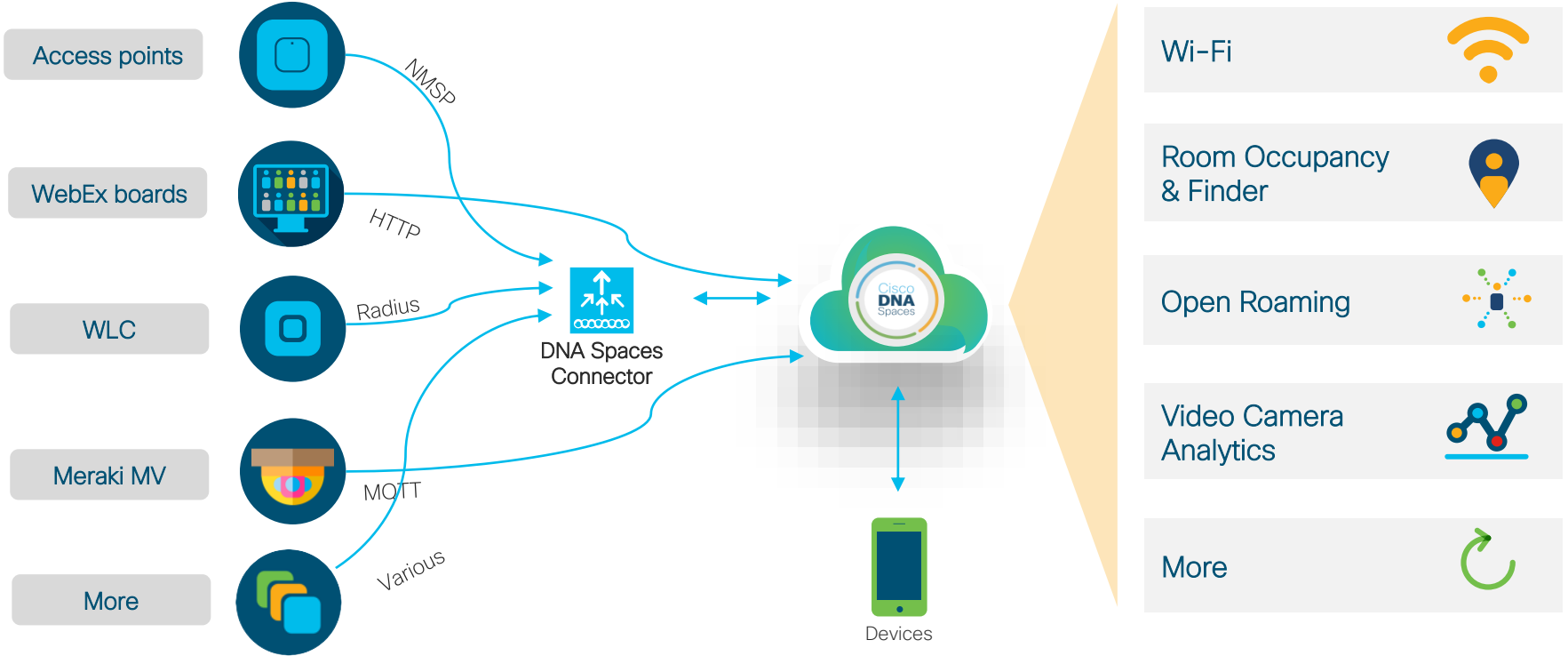
# Cisco DNA Spaces: Detect and Locate

- RSSI Location Calculation in Cloud



# Migration

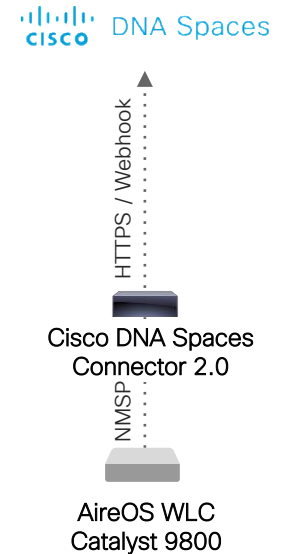
# DNA Spaces



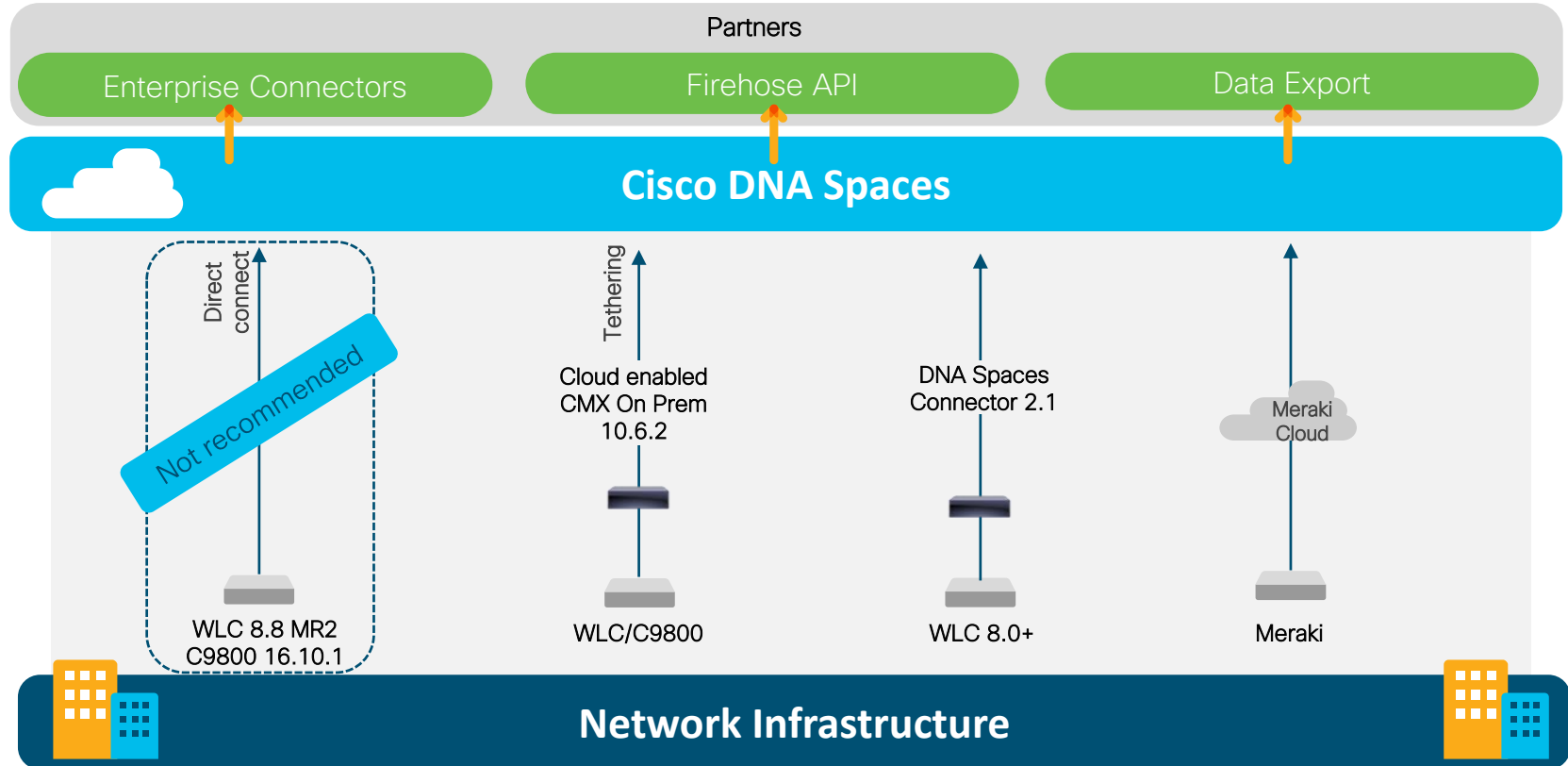
The Connector and Cloud architecture is the basis for expanding new applications on existing hardware

# Why migrating to DNA Spaces

- New, cloud based, future proof platform
- DNA Spaces has no scale limitations like CMX on-prem
- Being in the Cloud, DNA Spaces has a faster pace of Innovation
- Single interface for 3<sup>rd</sup> party integration: Firehose API
- GDPR compliance
- Migrate CMX Analytics to Cloud Analytics
  - Trained filters for different verticals
  - Location Personas, Impact Analysis, etc.
  - Very long history retention
- Migrate CMX Connect to Cloud Captive Portal
  - No need to direct users to CMX in datacenter
  - Powerful captive portal editor



# Supports all Cisco Wireless Topologies



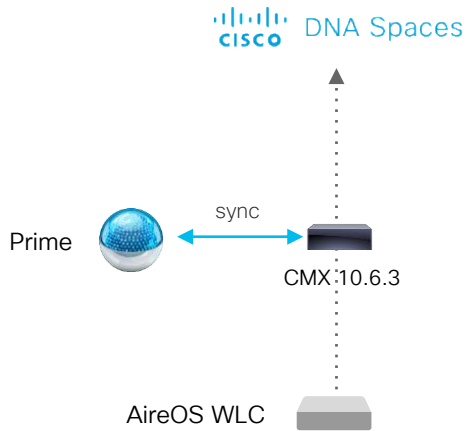
# DNA Spaces Migration options

# Migration Options

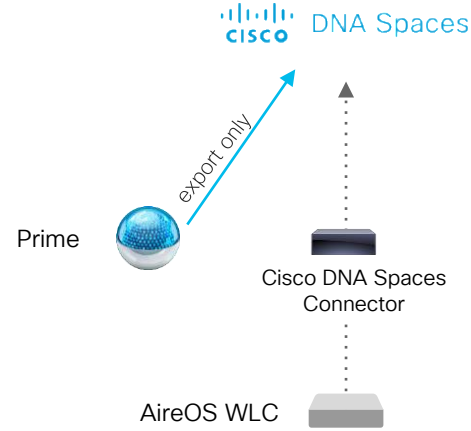
- Option 1
  - Keep existing AireOS WLC and PI
  - Migrate MSE / CMX to DNA Spaces
- Option 2
  - Keep existing AireOS WLC
  - Migrate PI to DNA Center
  - Migrate MSE / CMX to DNA Spaces
- Option 3
  - Keep Prime
  - Migrate WLC to C9800
  - Migrate MSE / CMX to DNA Spaces
- Option 4
  - Full stack migration

# DNA Spaces Migration - Option 1

- Keep AireOS WLC and PI and migrate to DNA Spaces



Recommended

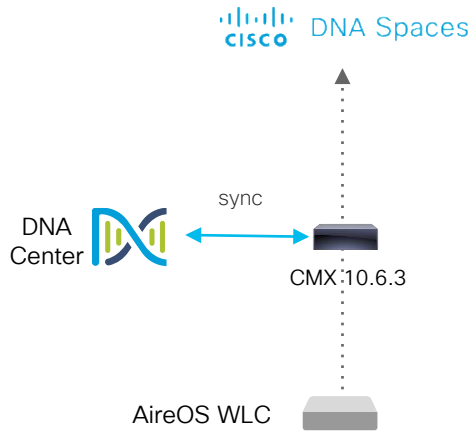


If customer doesn't have CMX on-prem.  
Note: no client location in Prime

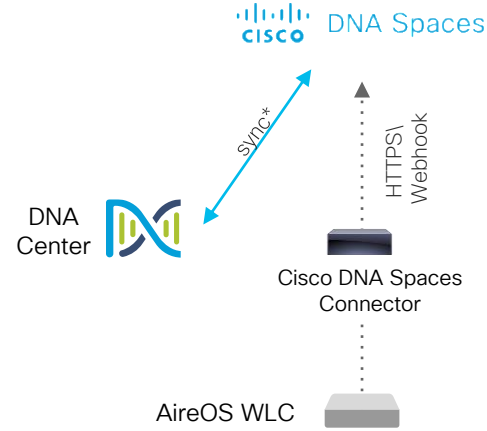


# DNA Spaces Migration - Option 2

- Keep AireOS WLC and migrate to DNA Center and DNA Spaces



Recommended



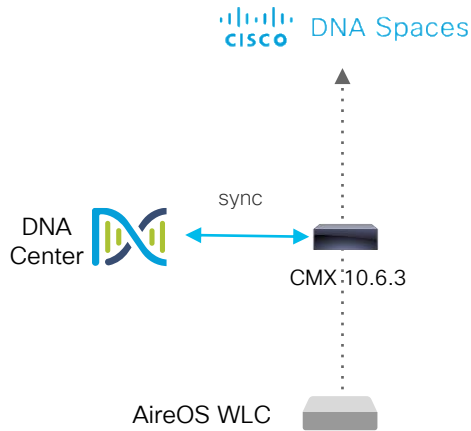
\*Roadmap

Recommended if customer is migrating from MSE or doesn't have CMX on prem.

Note: no client location in DNA Center (roadmap)

# DNA Spaces Migration – Option 2

- Keep AireOS WLC and migrate to DNA Center and DNA Spaces



Recommended

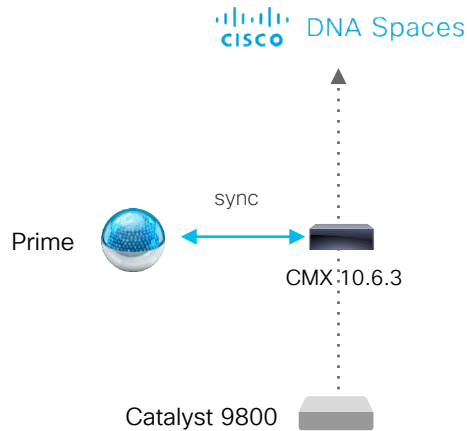
## Note:

An existing Prime can be used to help in the migration to Cisco DNA Center for maps and managed devices

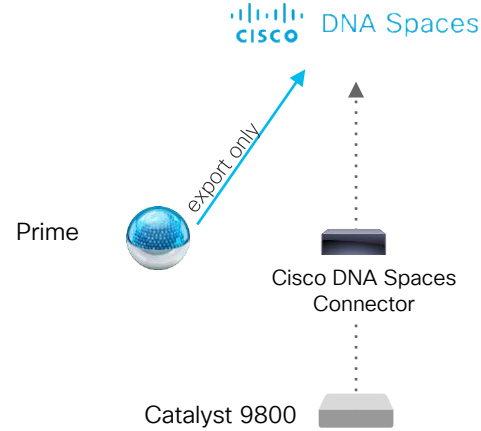
CMX can be synched to Prime or Cisco DNA Center, but not to both at the same time

# DNA Spaces Migration - Option 3

- Keep Prime and migrate to C9800 and DNA Spaces



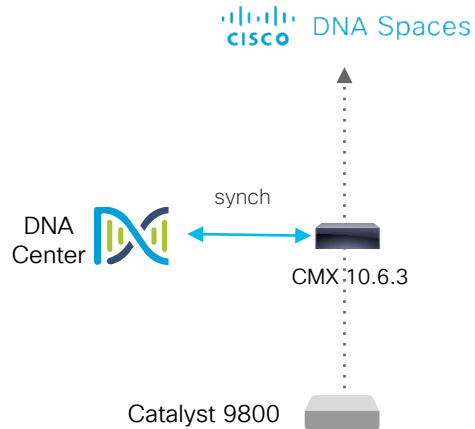
Recommended



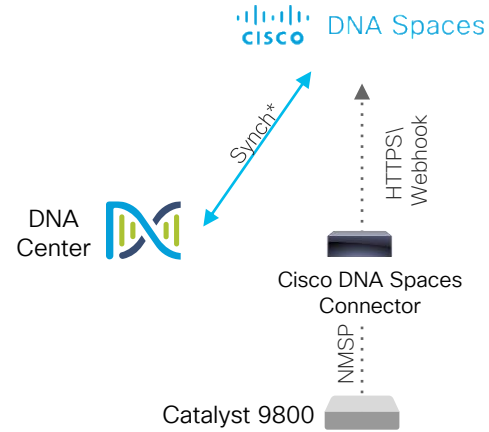
If customer doesn't have CMX on-prem  
Note: no client location in Prime

# DNA Spaces Migration – Option 4

- Full stack migration



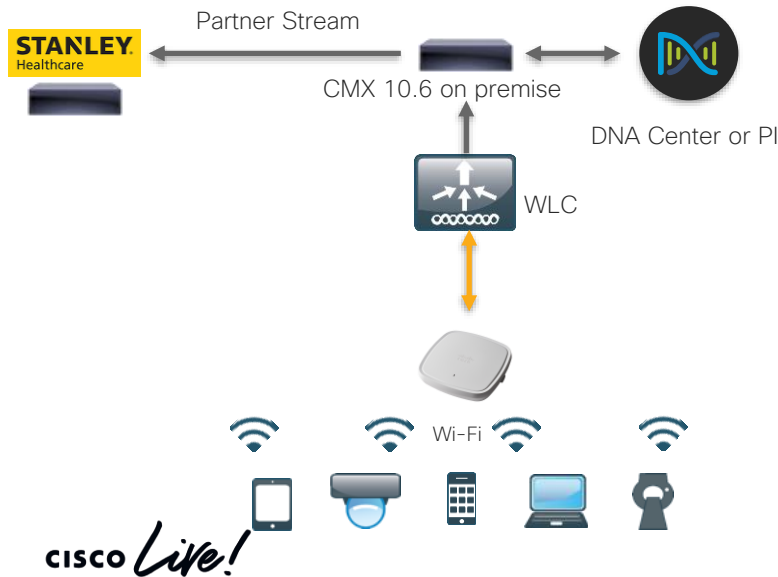
Recommended



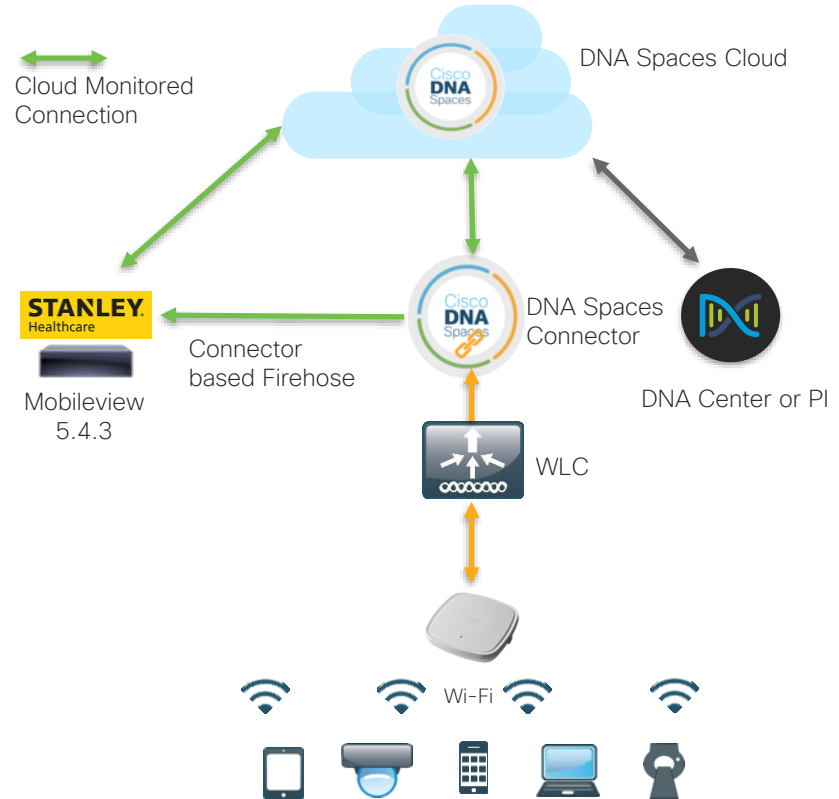
If customer doesn't have CMX on-prem  
Note: no client location in DNA Center

# Cisco DNA Spaces Stanley Architecture

Traditional MSE, CMX on-premise Model



New Cloud Based Model



# Use Cases Cisco DNA Spaces

# Digitizing Spaces: People & Things



# Key Use Cases



## Retail

- Understand shopper, associate behavior, benchmark performance, make informed decisions
- Acquire visitors, deliver relevant experiences through notifications
- Locate and monitor assets like shopping carts
- Monitor temperature, humidity of assets and sensors like refrigerators and trigger alerts



## Hospitality

- Insights into guest, visitor and employee behavior. Benchmark performance
- Acquire and identify guests/ members
- Deliver contextual on premises notifications
- Monitor and locate assets such as luggage trolleys



## Workspaces

- Insights into employee and visitor behavior to measure workspace utilization, understand patterns
- Understand how conditions in the office and events impact employee behavior
- Trigger notifications, alerts and business workflows based on behavior of people and things
- Track and locate assets and monitor asset telemetry



## Healthcare

- Insights into patient, visitor & staff behavior
- Onboard & acquire patients, visitors. Provide location & user specific information (links to services, retail, surveys, etc.)
- Avoid loss of medical equipment and reorder stock only as it runs low
- Ensure devices are in compliance with CDC
- Locate/track assets, monitor assets sensitive to environmental conditions and trigger alerts



## Manufacturing

- Insights into employee and visitor behavior.
- Trigger alerts when equipment hasn't been used in a long time, enter prohibited zones
- Automate data monitoring of equipment.
- Prevent inventory damage from environmental conditions
- Enhance your equipment paths of operation and make better workflows.



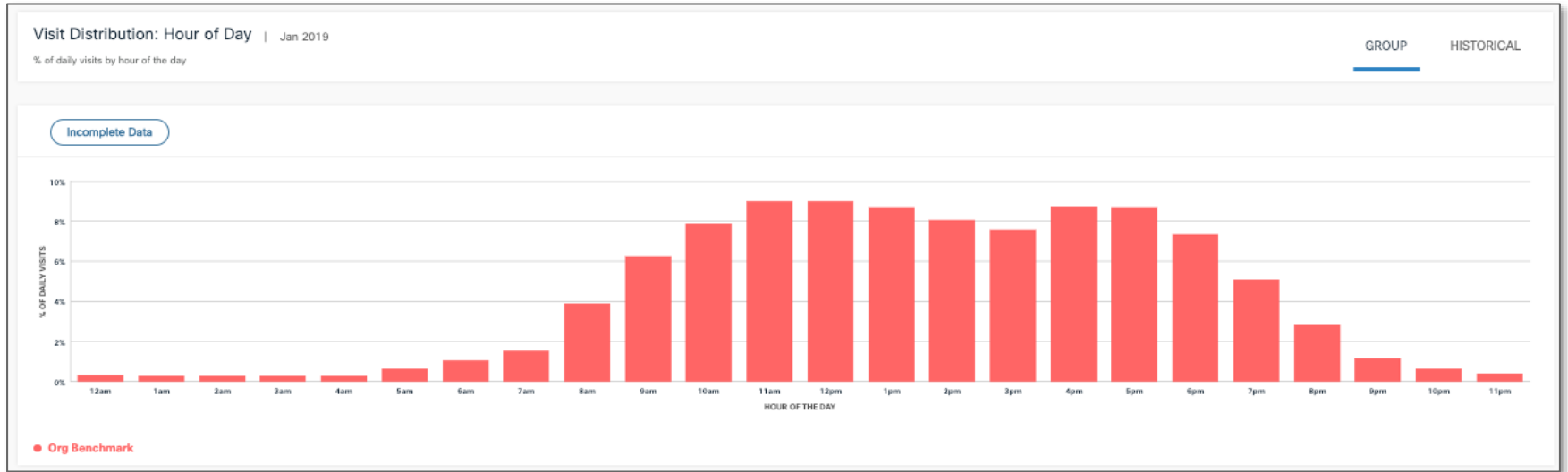
## Education

- Insights into student, employee and visitor behavior
- Understand how events and variations impact behavior
- Trigger notifications, alerts and business workflows based on behavior of people and things
- Track and locate assets and monitor asset telemetry



# Business Insights at CLEUR 2019

# Visitor Distribution by Hour of Day



# Location Personas – Technical Seminars

**RULE NAME** LIVE  
 TechnicalSeminar

---

**SENSE**  
 When user is on WiFi and present at location for 120 minutes

---

**LOCATIONS**  
 For all locations under  
 H8-LO

---

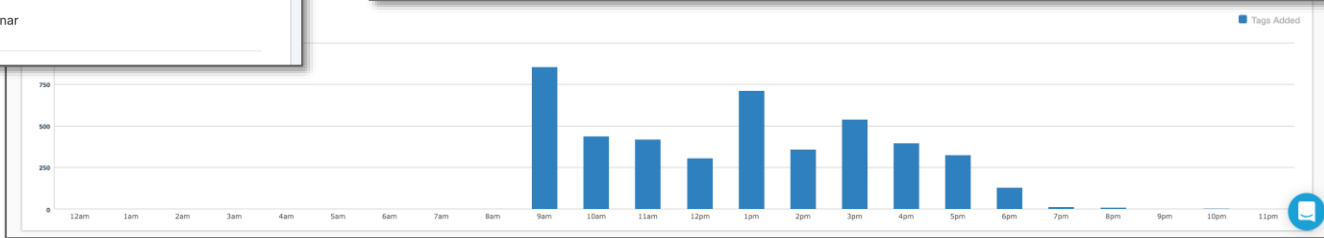
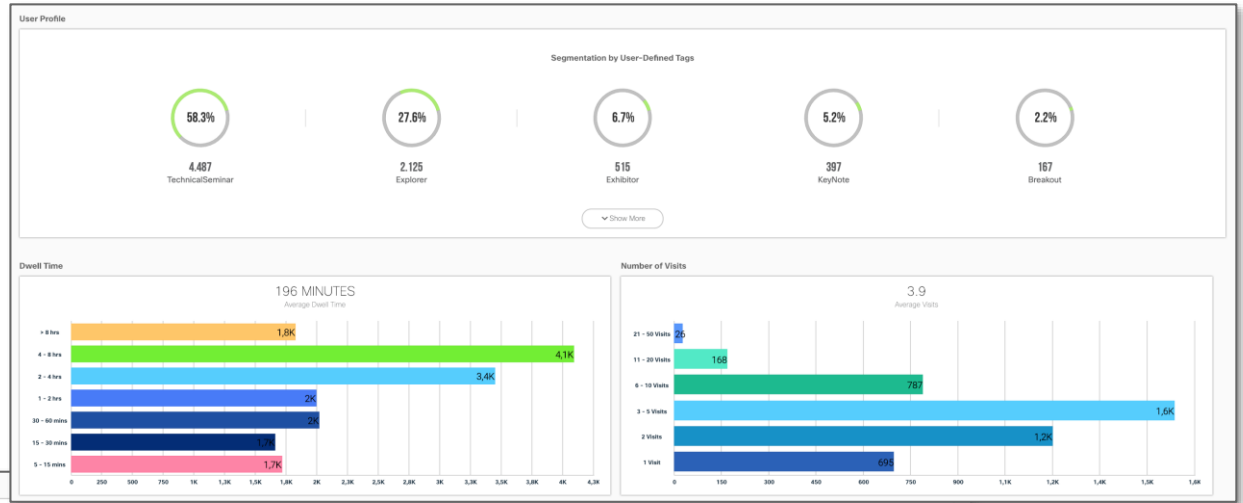
**AUDIENCE**

---

**SCHEDULE**  
 Starts from 28 January 2019 to 28 January 2019

---

**ACTION**  
 Tag user as TechnicalSeminar



# Location Personas - Explorer

**SUMMARY**

RULE NAME LIVE  
 Explorer

---

SENSE  
 When user is on WiFi and present at location for 60 minutes

---

LOCATIONS  
 For all locations under  
 Hall6-Hub+Keynote , Hall7-WoS

---

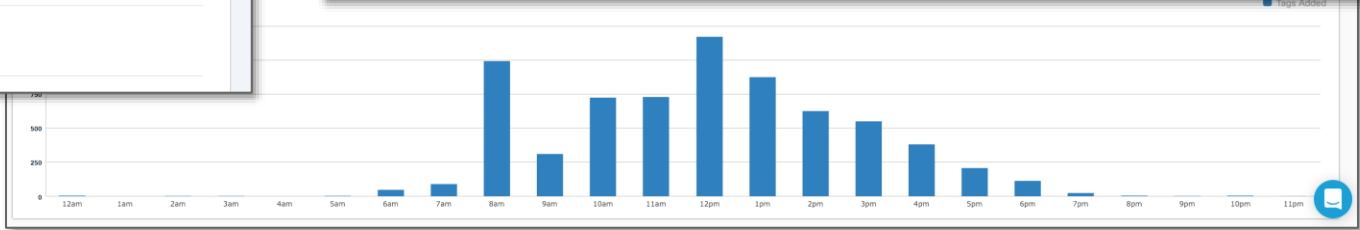
AUDIENCE

---

SCHEDULE

---

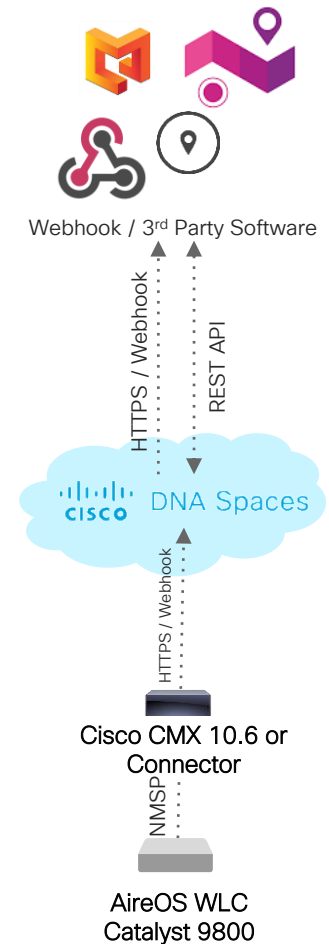
ACTION  
 Tag user as Explorer



# How to integrate 3rd Party Applications

# Cisco DNA Spaces Cloud APIs

- Requires EXTEND License
- 3rd party communicates with Cisco DNA Spaces cloud
  - All designs supported (Connector, CMX, Meraki)
- REST API
  - API like on-prem but not 1:1
  - Returns JSON data
- Notifications
  - Requires a receiver / webhook
  - Posts JSON data to the webhook
- Limited number of 10 messages per second will be enforced

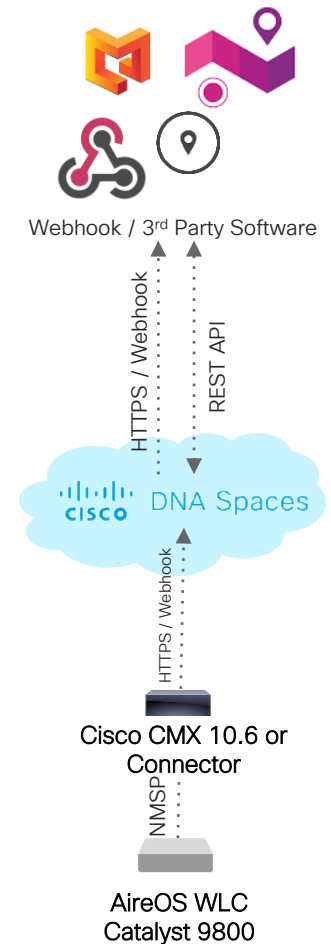


# Cisco DNA Spaces Cloud APIs

<https://developer.cisco.com/docs/dna-spaces-cloud-swagger/>

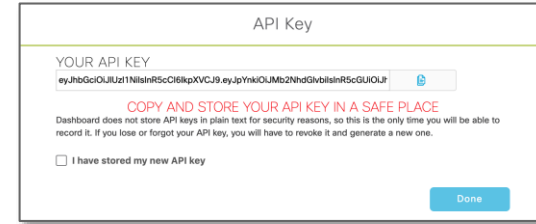
The screenshot shows the Swagger UI for the DNA Spaces Location Cloud API. The page title is "DNA Spaces Location Cloud API" with a "1.0.0" version tag. Below the title, it lists the base URL as "dnaspaces.io/api/location/v1" and the Swagger JSON file. A description states: "The Location APIs provided by ApiServer for Map, Clients, History and Notifications." There is a "Schemes" dropdown menu set to "HTTPS" and an "Authorize" button. The main content area is titled "Map" and "Active Clients". Under "Active Clients", there is a "GET /clients" endpoint. A description for this endpoint says: "This API supports searching by a variety of parameters. If no parameters are given, all active clients are returned with pagination. The default page number is 1, default number of items per page is 1000." Below this is a "Parameters" section with a "Try it out" button. A table lists the parameters:

Name	Description
deviceType	CLIENT, TAG, ROGUE_AP, ROGUE_CLIENT or INTERFERER
string	
(query)	
deviceId	The device unique identifier, for example the device macAddress.
string	



# Cloud: REST API and Notifications

- REST API
  - Requires JWT / Bearer Authentication
- Notifications
  - Type:
    - Absence
    - Association
    - Location Update
    - In / Out
  - Requires a receiver / webhook
  - Posts JSON data to the webhook



API Key

YOUR API KEY

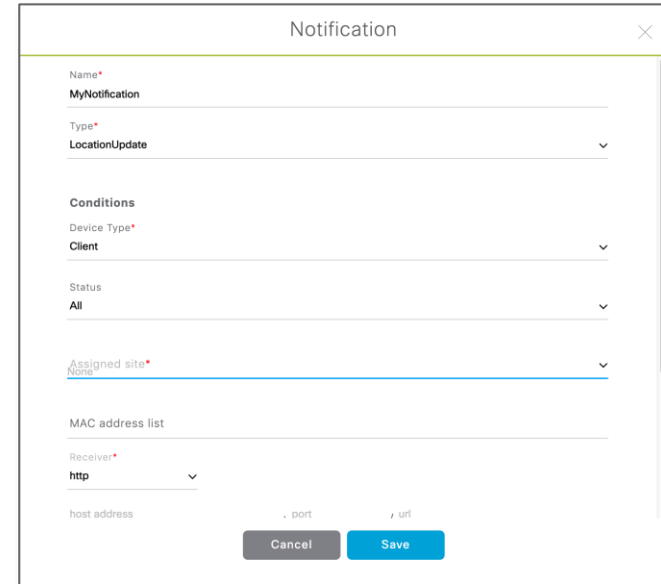
eyJhZGc0LjUz1NlslR5cC8kKpXVCJ9.eyJpYnkiOUM6Z2h0GmVibslR5cGUlOUJ...

**COPY AND STORE YOUR API KEY IN A SAFE PLACE**

Dashboard does not store API keys in plain text for security reasons, so this is the only time you will be able to record it. If you lose or forget your API key, you will have to revoke it and generate a new one.

I have stored my new API key

Done



Notification

Name\*  
MyNotification

Type\*  
LocationUpdate

Conditions

Device Type\*  
Client

Status  
All

Assigned site\*  
None

MAC address list

Receiver\*  
http

host address . port , url

Cancel Save



# Cloud APIs

KEY	VALUE	DESCRIPTION
<input checked="" type="checkbox"/> deviceType	CLIENT	
<input checked="" type="checkbox"/> deviceId	40:98:ad:71:e8:b9	
Key	Value	Description

```
1  {
2    "results": [
3      {
4        "tenantId": 10884,
5        "macAddress": "40:98:ad:71:e8:b9",
6        "deviceId": "CLIENT",
7        "campusId": "bf487ca34fab48cc93d046601d4bef0b",
8        "buildingId": "0f1057a846934c1183abb08e90a68c6d",
9        "floorId": "ab2cba381e374789a6b724016ee2735c",
10       "hierarchy": "Amsterdam->AMS->Floor1",
11       "coordinates": [
12         48.215527,
13         67.51242
14       ],
15       "rawCoordinates": [
16         48.457905,
17         67.347755
18       ],
19       "geoCoordinates": null,
```

# Integrating Business App via the DNA Spaces Firehose API

Cloud-first, high performance, and low latency Firehose API used specifically for partners to integrate their business applications with Cisco DNA Spaces

## Firehose API characteristics:

- Secure and high-volume streaming API
- Carries multiple technology data
- Contains machine learning algorithms



# Meeting Room Finder



By combining user location updates & Webex Board presence updates...

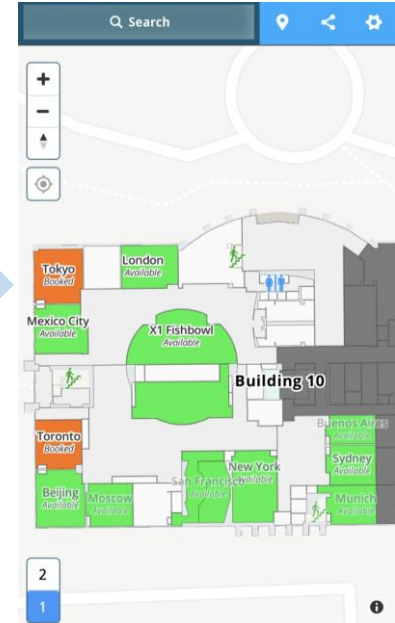


Firehose Streaming API

Workspaces



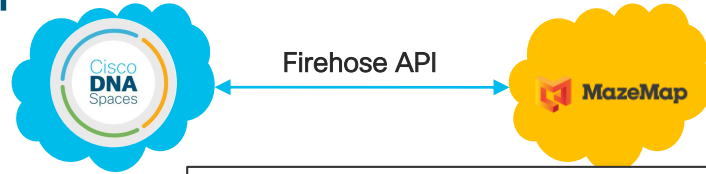
- Room Utilization
- Employee Experience



...Cisco DNA Spaces & MazeMap can help employees and office managers better utilize their meeting rooms



# How the Firehose API powers this demo



HTTP Post  
(Faces detected)



Wi-Fi Clients  
Detected

- Location of Wi-Fi Devices (via AP detection)
- Room Availability Status via Webex Endpoint (Webex Board, Room Kit, etc.)
- Combined and sent to partner MazeMap via Firehose API for visualization

LIVE: <https://dnas-demos.web.app/>

**cisco** Live!

```
{
  "recordUid": "event-3331335b",
  "recordTimestamp": 1570213298000,
  "spacesTenantId": "spaces-tenant-dc8d3aa5",
  "spacesTenantName": "CXC",
  "partnerTenantId": "cxc",
  "eventType": "TP_PEOPLE_COUNT_UPDATE",
  "tpPeopleCountUpdate": {
    "tpDeviceId": "SJC Mexico City WB",
    "location": {
      "locationId": "location-854d183e",
      "name": "Mexico City",
      "inferredLocationTypes": [
        "ZONE"
      ]
    }
  },
  "presence": false,
  "peopleCount": 4,
  "standbyState": 1,
  "ambientNoise": -1,
  "drynessScore": -1,
  "activeCalls": 0,
  "presentationState": 0,
  "timeStamp": 1570213298000
}
```

Record Details e.g.

- Time
- Event Type
- Location (Site, Floor, Zone)

Event Details

- Presence (binary)
- People Count
- Time

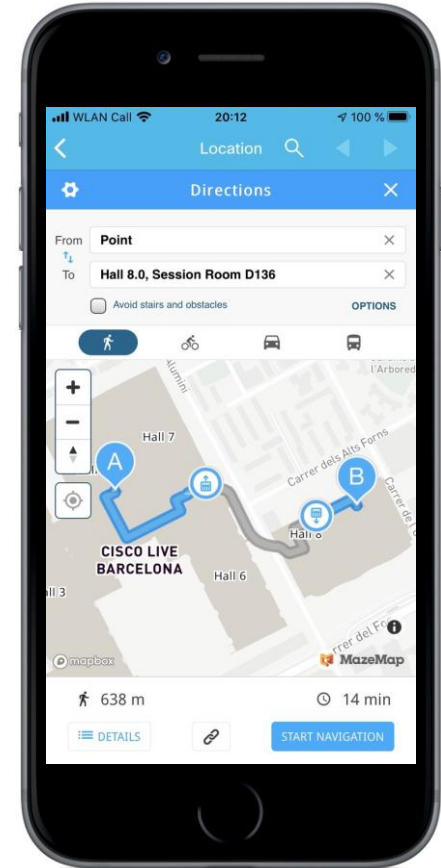
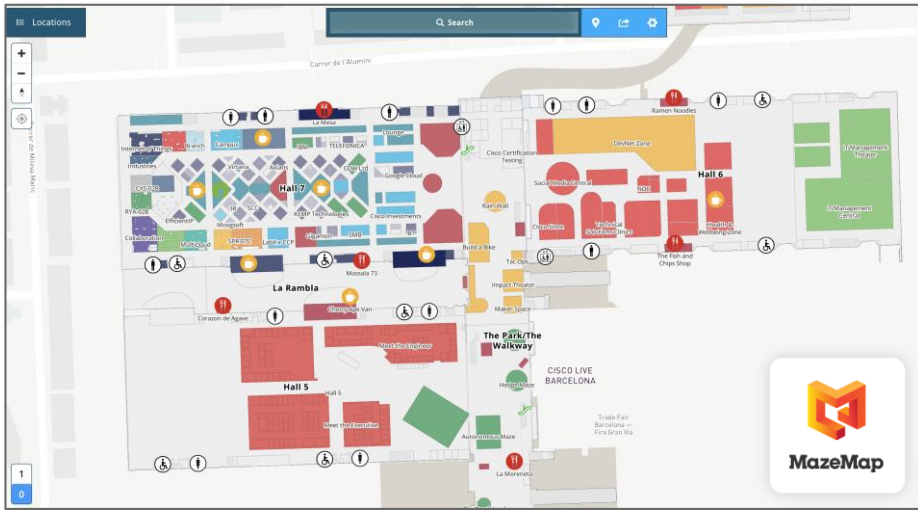
# Wayfinding at #CLEUR 2020



Cisco Events

# Cisco Event App

- Browser based map
- Easy integration into any mobile app
  - Map POIs to URLs



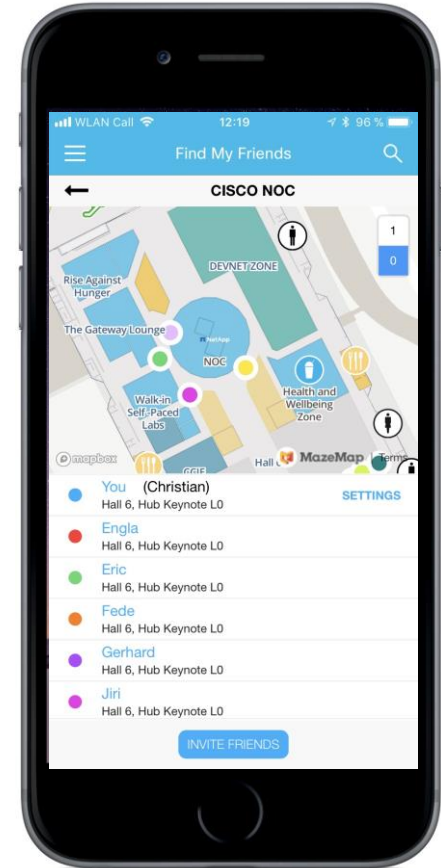
*cisco Live!*



Cisco Events

# Find my Friends

- Create a Group
- Send Invite link to your friends
  - Via Webex Teams, E-Mail, WhatsApp, SMS, ...
- Your friends click on the link and become member of the group





# Enable Partner App Integration

The image displays a series of overlapping screenshots from the Cisco DNA Spaces interface, illustrating the process of enabling Partner App Integration. The background shows the main interface with a sidebar for filtering by Industry, Category, and Technology, and a top bar with 'Cisco DNA Spaces' and 'Active APs 0 of 1500'.

The sequence of steps shown is:

- Terms and conditions:** A dialog box titled 'Terms and conditions' with a close button. It contains the text: 'Accept DNA Spaces Store terms and conditions to continue. These Cisco Terms of Service apply to all users who use App Center Systems, Inc. ("Cisco") products. BY PRESSING "I AGREE", YOU ACCEPT THESE TERMS AND CONDITIONS ON BEHALF OF YOURSELF AND YOUR COMPANY. All use of App Center Systems, Inc. ("Cisco") products is subject to this Agreement (for "You" or "Your" in the Agreement). Download a copy of the Agreement.  Accept Terms & Conditions'.
- Activate MazeMap (Step 1):** A dialog box titled 'Activate MazeMap' with a close button. It shows a progress indicator with '1 Sign Up & Onboarding' selected. The text reads: 'Before activating the app, you must sign in to their system. You might be asked to sign in to their system.' There is a radio button selected for 'I have an existing account'.
- Activate MazeMap (Step 2):** A dialog box titled 'Activate MazeMap' with a close button. It shows a progress indicator with '2 Permissions' selected. The text reads: 'As an essential function of Cisco App Center, this app requires location updates. Location update events continue to be connected to the network. This information is used to provide location updates to the app. Information available in Cisco App Center will govern the terms of use of this app.' There is a section for 'Location' with a sub-section 'CiscoLiveEU' and a checkbox 'Enable for all locations' which is checked.
- Activate MazeMap (Step 3):** A dialog box titled 'Activate MazeMap' with a close button. It shows a progress indicator with '3 Choose Locations' selected. The text reads: 'Choose the locations you would like to enable for this app.  Enable for all locations. CiscoLiveEU'.
- Log in to MazeMap Admin:** A dialog box with the MazeMap logo and the text 'Contact support@mazemap.com if you do not have an account'. It contains a form with 'Email' (ogauer@cisico.com) and 'Password' fields, and a 'Log in' button. A link 'Forgotten your password?' is at the bottom.
- Connect MazeMap to DNA Spaces:** A dialog box with the MazeMap logo and the text 'Connect MazeMap to DNA Spaces'. It contains an 'Accept' button.

The final dialog box has 'Cancel' and 'Select & Activate' buttons at the bottom right.

# Partner App Settings

The screenshot shows the Cisco DNA Spaces interface for the 'MazeMap' app. At the top, it displays 'Cisco DNA Spaces' and 'Active APs: 0 of 1500'. The app name 'MazeMap' is shown with a 'CLOUD' tag. Below this, there is a section for 'Activations' with a '+ New Activation' button. A table lists the activation details for 'cgauerciscocom-6fbd-mazemap', including the location name 'CiscoLiveEU' and the account 'cgauer@cisco.com'. A 'Delete' button is present next to the activation name. Below the table, there is a '+ Add / Edit Locations' link. The 'Permissions' section shows 'Location' as the active permission. A detailed description of the app's requirements for location data is provided. At the bottom, there is a 'Remove App' section with a 'Remove app' button.

**Activations** + New Activation

cgauerciscocom-6fbd-mazemap [Delete](#)

Location Name	Account	Actions
CiscoLiveEU	cgauer@cisco.com	<a href="#">Remove Location</a>

[+ Add / Edit Locations](#)

**Permissions**

- Location

This app requires XY and/or latitude, longitude level location data and a map of your location. Location update events continuously generate an approximate location of the device when connected to the network. This app requires zone, floor, or site level presence data. These events include location updates and entry, exit and dwell for devices connected to your network. These events are generated every time a device enters/exits a building, a floor or a zone. Information available in Cisco DNA Spaces about those devices and high level information about their location is also shared.

**Remove App**

You can delete the app integration if you do not want to use it anymore. This app will not be available again from the App Center.

[Remove app](#)

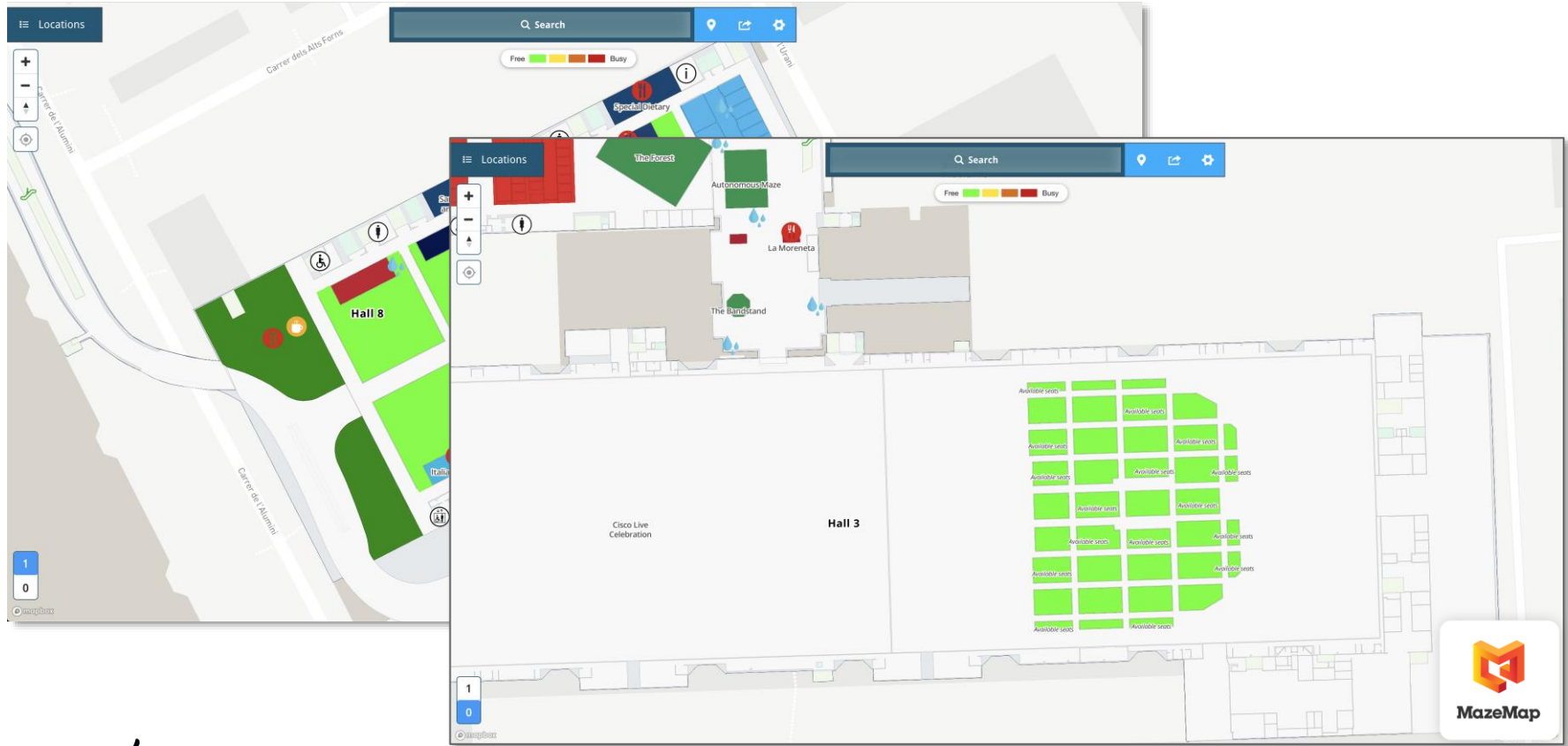
## Registered Cisco DNA Spaces partnerTenantIds associations

cgauerciscocom-6fbd-mazemap

Last received Device Location Update Event: "2020-01-23T19:22:52.505Z"

Last received People Count Update Event: No Events Received

# How busy is catering in Hall 8.1 and Keynote



*CISCO Live!*

## Problem:

How do we enable a seamless guest onboarding experience across enterprise and consumer markets?

# OpenRoaming

# OpenRoaming gets your customers connected, seamlessly and securely

## Access providers



Enterprise  
Consumer locals  
Large Venues

Join >

Identity Federation

< Join

Seamless,  
zero touch  
Wi-Fi for  
users



Secure  
authentication  
on a secure  
SSID



Significantly  
more users  
on your Wi-Fi

## Identity providers

SAMSUNG



Device manufacturers  
Service providers  
Loyalty apps  
Cloud providers  
Enterprises

# OpenRoaming

## Identity Providers



Additional users engaged on platform; stickiness

Provides better customer experience as a differentiator

Extends access network and footprint; OPEX savings with offload to Wi-Fi (SP)

More engagement

## Access Providers



Brings back data ownership and additional revenue stream

Promise of a better experience for customers

Enable actionable location based analytics

Prove value in IT infrastructure

Better experience

## End Users



Better mobile experience across the board

Remove onboarding pain points everywhere

Movement from LTE to Wi-Fi; saves data

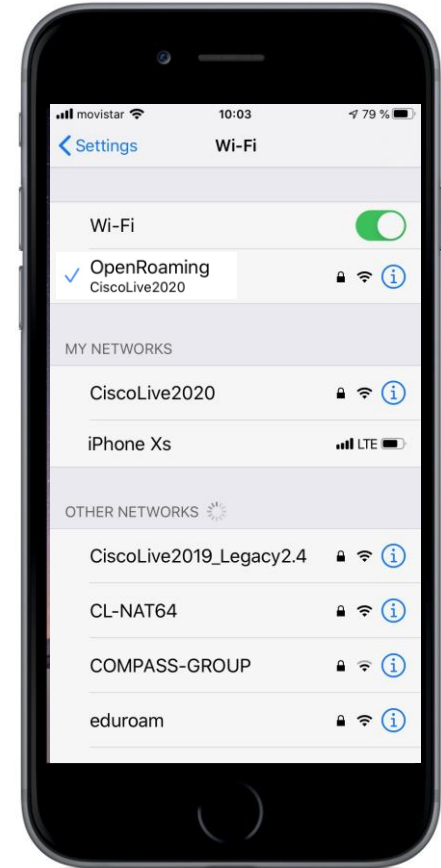
Seamless mobility



Cisco Events

# Seamless on-boarding

- Sign up
  - Install Cisco Events App
  - Login with your Cisco One ID
  - Accept terms & Services
  - App adds a Hotspot configuration with your ID to your device
- Device Support
  - Apple iOS11 and above
  - Android 9 and above from Samsung, Google, Motorola and HTC
  - Currently no support on Huawei, OnePlus, some Google Pixel and Sony



**CISCO** *Live!*



# OpenRoaming: How it works

1

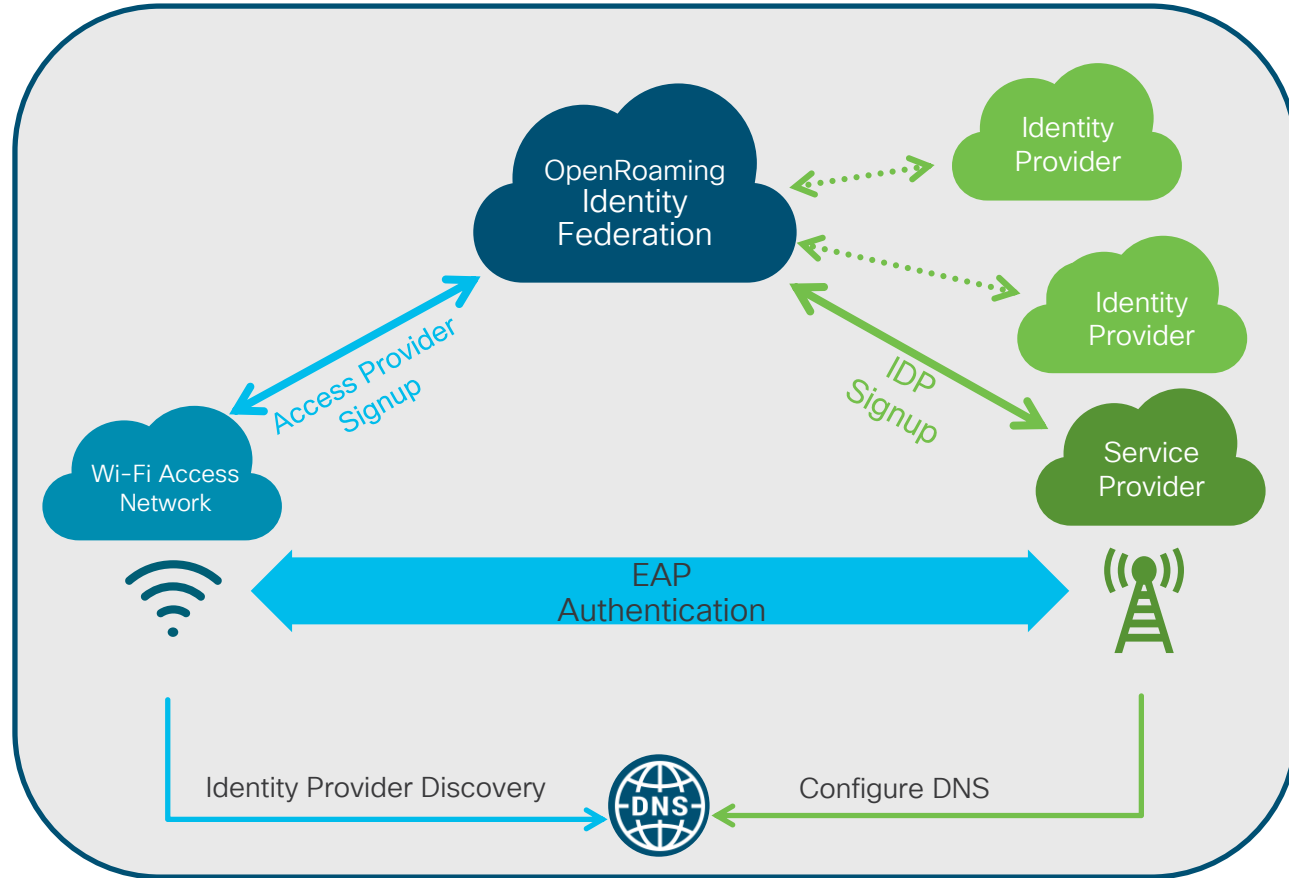
## Signup:

- Certificate Authority verifies entity & issues cert
- Identity Provider (IdP) configures DNS
- Device configuration

2

## Automated Wi-Fi onboarding:

- Device tries to attach to Passpoint SSID
- Network looks up IdP in DNS
- Secure & authenticated tunnel
- EAP authentication inside tunnel
- WPA-protected secure guest access



# How to enable OpenRoaming on your network

The screenshot displays the Cisco DNA Spaces interface with a modal dialog for OpenRoaming configuration. The main interface shows a progress bar with four steps: 1. Install Spaces Connector OVA, 2. Configure Spaces Connector, 3. Add Controllers, and 4. Import Controllers into Location Hierarchy. The modal dialog, titled "OpenRoaming Policy Wizard", prompts the user to select an OpenRoaming policy and preferred credentials.

**Connect your wireless network**

**Connect via Spaces Connector**

Spaces Connector is an easy way to get your wireless network connected to Cisco DNA Spaces. No need to upgrade Wireless LAN Controllers or reconfigure your wireless network.

- 1 Install Spaces Connector OVA**  
Download and install Spaces Connector OVA as a virtual machine.  
[Download Spaces Connector OVA](#)
- 2 Configure Spaces Connector**  
You will need a token to configure Spaces Connector. You need to connect to `https://<your connector IP>/` from a browser to configure the token. You can optionally configure Spaces Connector to connect via HTTPS proxy.  

1 / 1	connector(s) active	<a href="#">Create a new token</a> <a href="#">View Connectors</a>
1	OpenRoaming hotspots added	<a href="#">Add OpenRoaming Hotspot</a> <a href="#">OpenRoaming Controller Configuration</a>
- 3 Add Controllers**  
Add and associate controllers to your Cisco DNA Spaces Connector(s)  

5 / 5	controller(s) active	<a href="#">Add Controllers</a> <a href="#">View Controllers</a>
-------	----------------------	---
- 4 Import Controllers into Location Hierarchy**  
Once the controllers are added, you can import them into your location hierarchy. You can only import controllers with at least one access point.  

controller(s) imported to location hierarchy	<a href="#">Import Controllers</a> <a href="#">View Location Hierarchy</a>
--	---

**OpenRoaming Policy Wizard**

Please Select your OpenRoaming Policy

- I will accept all authenticated OpenRoaming members (default)
- I will accept all authenticated OpenRoaming members that present a real identity
- I will only accept certain Identity types

[Configure](#)

Preferred credentials:

- I do not have any preferred credentials
- I have preferred credentials, which I want to be used before any other:

[Cancel](#) [Next](#)

# Catalyst 9800 Hotspot 2.0 config



Reference

## Connector acts as RADIUS

```
aaa group server radius OR
  server name connector
  mac-delimiter hyphen
!
aaa authentication dot1x OR group OR

aaa server radius dynamic-author
  client 10.0.0.10 server-key secret

radius server connector
  address ipv4 10.0.0.10 auth-port 1812 acct-port 1813
  key secret
```


 DNA Spaces



HTTPS / RadSec

  
Cisco DNA Spaces  
Connector 2.0

RADIUS

  
AireOS WLC  
Catalyst 9800

# Catalyst 9800 Hotspot 2.0 config

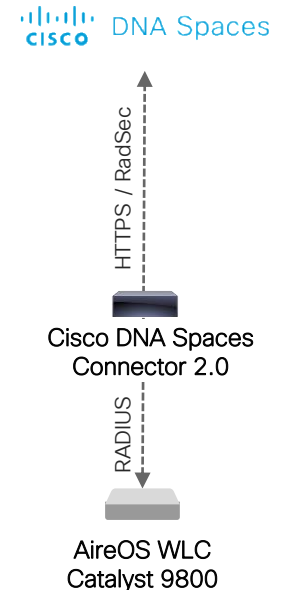


Reference

## ANQP Configuration

```
wireless hotspot anqp-server openroaming
domain clus.openroaming.net
domain ciscooneid.openroaming.net
nai-realm open.openroaming.org
eap-method eap-ttls
  inner-auth-non-eap pap
network-type chargeable-public internet-access allowed
roaming-oi 000216
roaming-oi 004096 beacon
roaming-oi 00502a beacon
```

```
wireless profile policy or-profile
hotspot anqp-server openroaming
vlan clients
no shutdown
```



ANQP – Access Network Query Protocol

# OpenRoaming Client on Catalyst 9800

Monitoring > Wireless > Clients

Clients Sleeping Clients Excluded Clients

Delete

Total Client(s) in the Network: 1  
Number of Client(s) selected: 0


	Client MAC Address	IPv4 Address	IPv6 Address	AP Name	SSID	WLAN ID	State	Protocol	User Name
<input type="checkbox"/>	4098.ad71.e8b9	192.168.0.125	fe80::863:9eae:494:6ee6	AP04-5D78	openroaming	2	Run	11ac	b4be505711

10 items per page

### Client

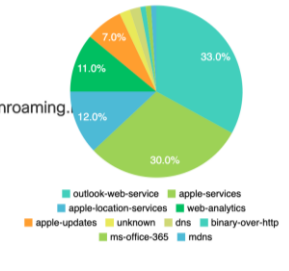
360 View General QoS Statistics ATF Statistics Mobility History Call Statistics

#### General

 User Name  
**b4be5087-7079-4877-9d19-057114af1527@ciscoeid.openroaming**

MAC Address: 4098.ad71.e8b9  
Uptime(sec): 69 seconds  
WLAN Name: openroaming  
AP Name: AP04-5D78  
Device Type: N/A  
Client Performance: Signal Strength:-33 dBm Signal Quality:59 dB  
Capabilities: 802.11ac  
Fabric Status: Disabled

#### Top Applications



- outlook-web-service 33.0%
- apple-services 30.0%
- apple-location-services 12.0%
- dns 11.0%
- apple-updates 7.0%
- ms-office-365
- web-analytics
- binary-over-http
- unknown
- mdns

OK

# Wi-Fi network selection

## Apple iOS

	Network Category	Network Security
1	Private	EAP
2	Private	WPA3
3	Private	WPA2/WPA
4	Private	WEP
5	Private	Unsecure/Open
6	Public	HS2.0/Passpoint
7	Public	EAP
8	Public	WPA3
9	Public	WPA2/WPA
10	Public	WEP
11	Public	Unsecure/Open

Source:

<https://support.apple.com/en-us/HT202831>



## Android 10

### Network evaluators ↑

Network evaluators find or create configurations ([WifiConfiguration](#)) for networks that are currently available (based on scan results) and that can be associated to with the information (for example, credentials) available to the device.

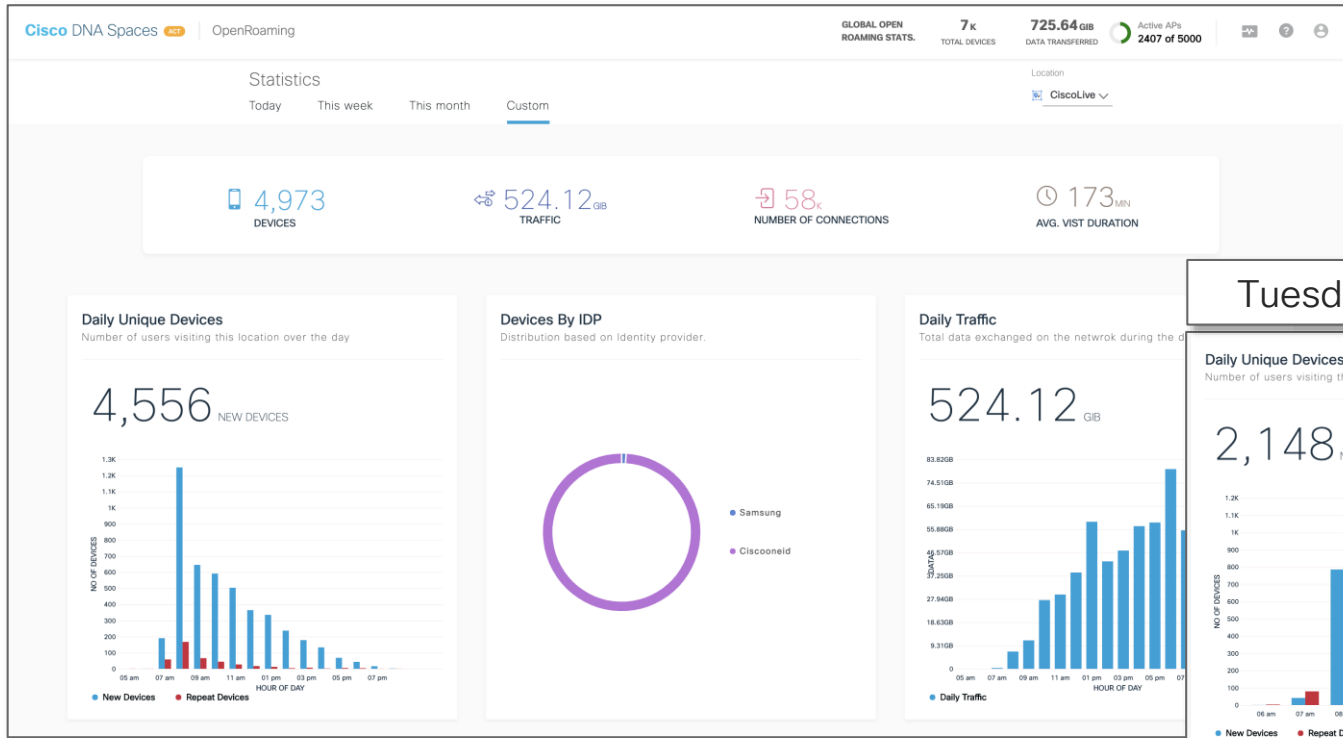
The following network evaluators are available.

- **Saved network evaluator:** Evaluates all saved networks.
- **Suggested network evaluator:** Evaluates all networks provided by apps using the [Suggestion API](#).
- **Passpoint network evaluator:** Using the scan results and the ANQP cache, evaluates all installed Passpoint profiles. Also automatically generates Passpoint profiles for any observed EAP-SIM, EAP-AKA, or EAP-AKA' networks that match the installed SIM. Auto generation only considers EAP-SIM/AKA/AKA' networks for which encrypted IMSI is possible (where an encryption configuration is available).
- **Carrier Wi-Fi network evaluator:** Evaluates all [carrier Wi-Fi](#) configurations. Only considers EAP-SIM/AKA/AKA' networks for which encrypted IMSI is possible (where an encryption configuration is available).
- **Externally scored network evaluator:** OEM mechanism to provide network connectivity options to the device. For more information, see [External network rating provider](#).

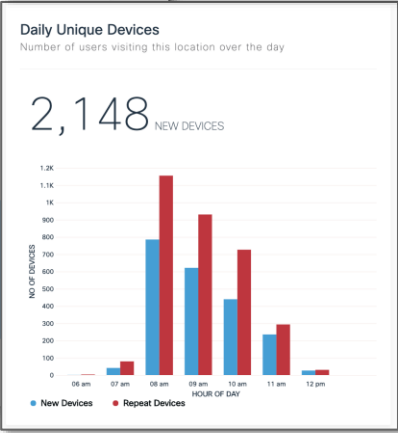
Source:

<https://source.android.com/devices/tech/connect/wifi-network-selection>

# Open Roaming at #CLEUR2020 (Just Monday)



Tuesday morning



# Complete your online session survey



- Please complete your session survey after each session. Your feedback is very important.
- Complete a minimum of 4 session surveys and the Overall Conference survey (starting on Thursday) to receive your Cisco Live t-shirt.
- All surveys can be taken in the Cisco Events Mobile App or by logging in to the Content Catalog on [ciscolive.com/emea](https://ciscolive.com/emea).

Cisco Live sessions will be available for viewing on demand after the event at [ciscolive.com](https://ciscolive.com).



# Continue your education



Demos in the  
Cisco campus



Walk-in labs



Meet the engineer  
1:1 meetings



Related sessions



Thank you





You make **possible**

# References

- Best way to get configuration guides and tips is through the web pages of your dnaspaces.io account
- DNA Spaces guides:  
<https://www.cisco.com/c/en/us/support/wireless/dna-spaces/products-installation-and-configuration-guides-list.html>
- DNA Spaces youtube channel:  
<https://www.youtube.com/channel/UCTdSQCFc72FCrH0m61hrRw>
- Wi-Fi Location-Based Services 4.1 Design Guide  
<https://www.cisco.com/c/en/us/td/docs/solutions/Enterprise/Mobility/WiFiLBS-DG.html>