cisco Live!

Let's go

The bridge to possible

7 Tricks to Succeed as a Wireless Rockstar

Rosario Medrano – Solutions Engineer Cisco Spaces
@Chayayinn_

BRKEWN-1742

Cisco Webex App

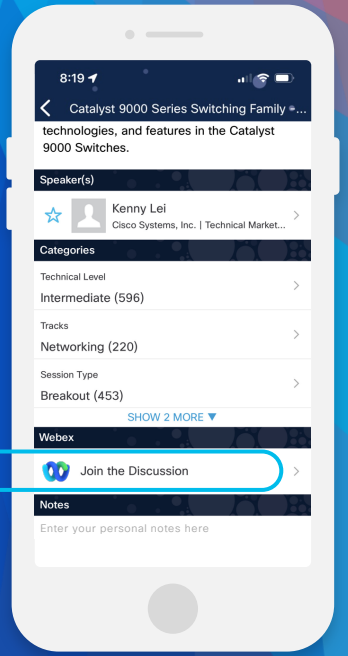
Questions?

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

How

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

Webex spaces will be moderated by the speaker until December 22, 2023.



https://ciscolive.ciscoevents.com/ciscolivebot/#BRKEWN-1742

Success is not the same as not failing

Definition of success:
“The accomplishment of an aim or purpose”

About Me:

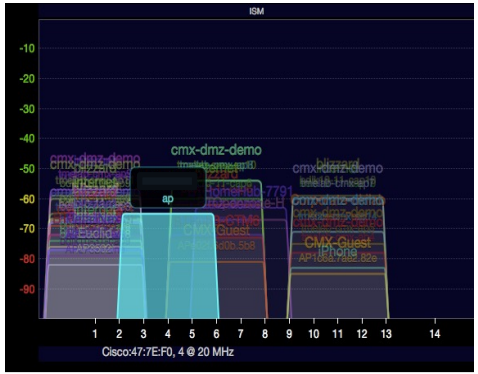
Rosario Medrano

Solutions Engineer

Cisco Spaces

- Cisconian for 9+ Years
- From Mexico 🌮🇲🇽
- Living in The Netherlands 🍟🇳🇱
- First Time in Australia 😀🇦🇺

Over years, we know there's many ways to fail:



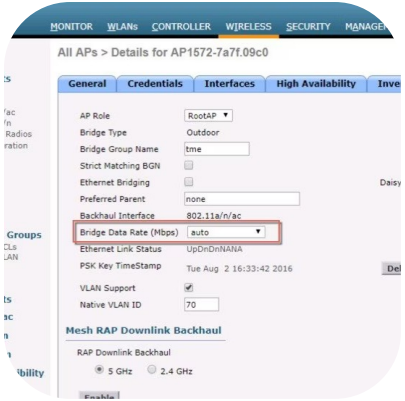
Wrong Channel Placements

Access Point unfriendly Placements

Inefficient security

Am I doing things, right?

What many think is to be a Wireless Rockstar?



Knowing all configs?

Knowing how to troubleshoot??

Remembering all configs, sites, AP location, channels, security !!

But even when we can achieve those 3 things..

Users

Applications

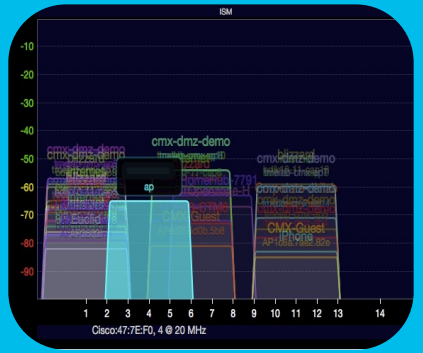
The situation is....

The wireless network is still deeply...

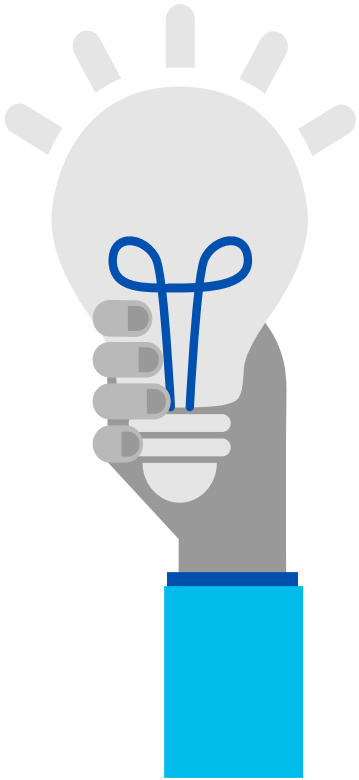
Misunderstood

Misconfigured

Misused



The wireless network ideally should be:



A platform to deliver:

- Innovation
- User Experience
- Productivity

Key areas that a Wireless Rockstar considers

Coverage

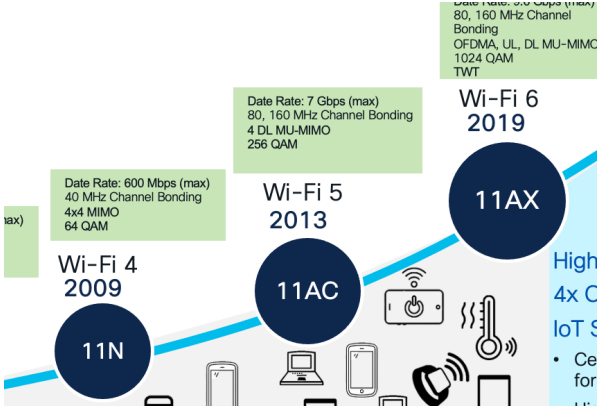
Capacity

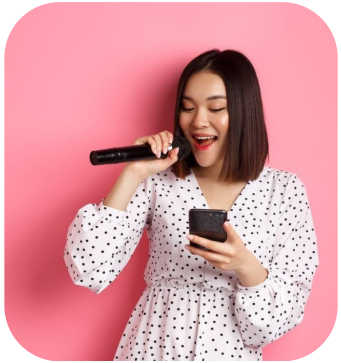
Scalability

Security

Meet Use Cases

Wireless Rockstar....





7 tricks to succeed as a wireless rockstar

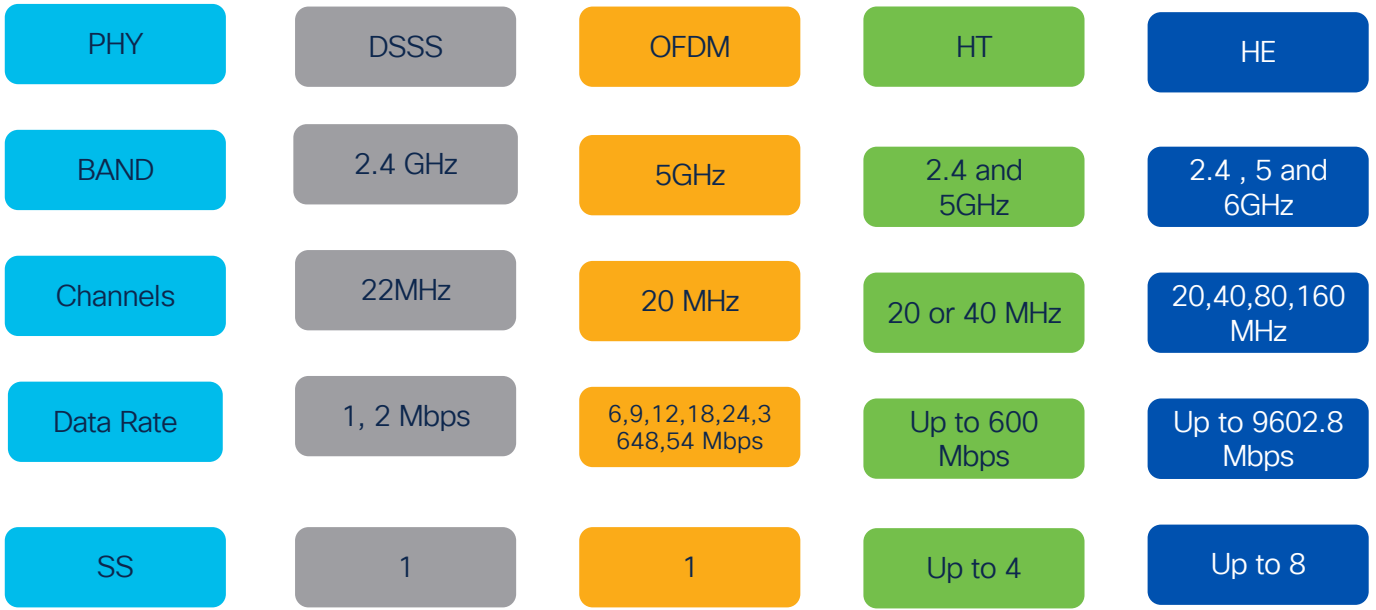
1. Leverage the rules of PHYsics
2. Set a good stage for your waves
3. The remastered Sine wave
4. Always run a Sound check
5. Be nice to your guests
6. Call Security!
7. Featuring IOT

Am I offering the best service for all generations of devices?

What is the trick?

Leverage the rules of PHYsics

PHYsical layer in Wireless Networks



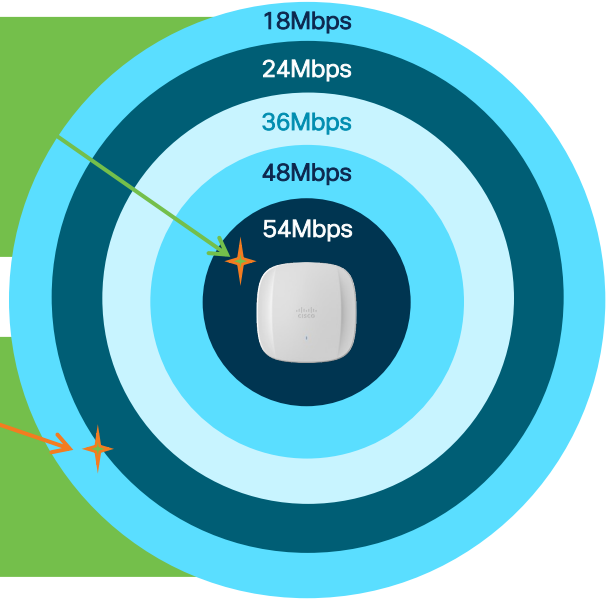
To consider the PHYsics is to set the expectations

PHY	DSSS	OFDM	HT	HE
BAND	2.4 GHz	5GHz	2.4 and 5GHz	2.4 , 5 and 6GHz
Channels	22MHz	20 MHz	20 or 40 MHz	20,40,80,160 MHz
Data Rate	1, 2 Mbps	6,9,12,18,24,3 648,54 Mbps	Up to 600 Mbps	Up to 9602.8 Mbps
SS	1	1	Up to 4	Up to 8

Data Rates and Distances

Client near AP:
Higher PHY Rate
More Efficient

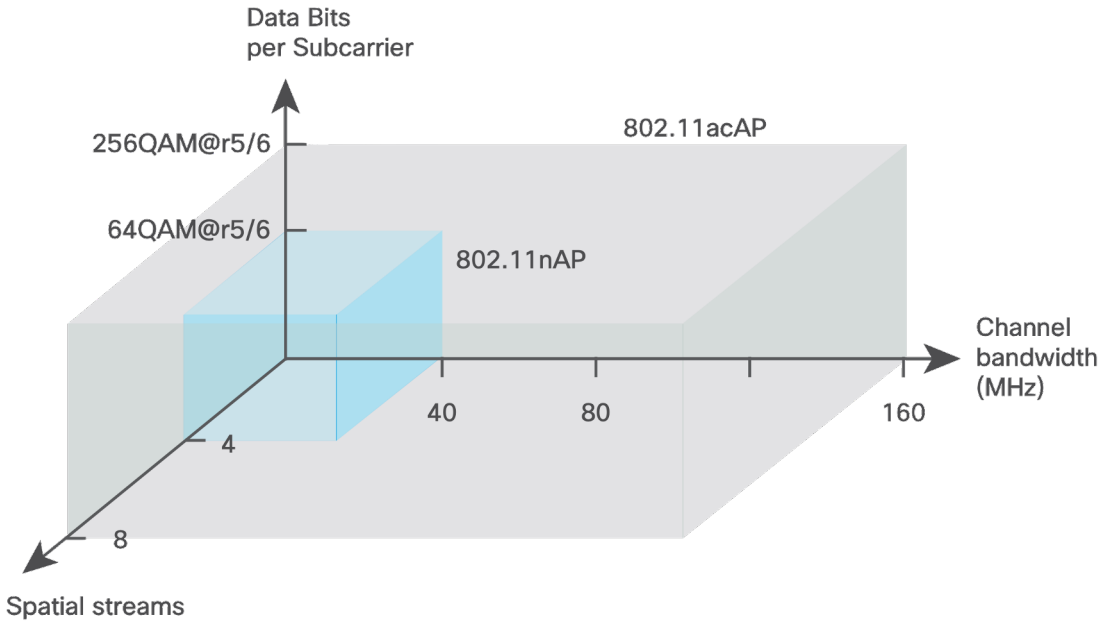
Client far from AP:
Lower PHY Rate
Less Efficient



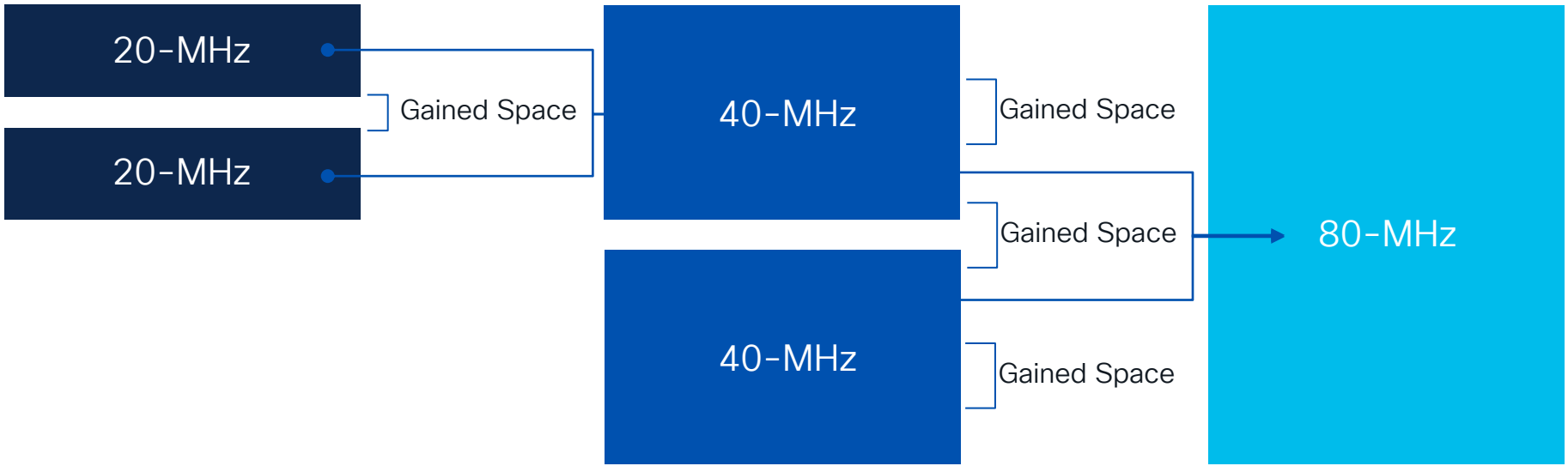
Elements affecting Data Rates

Not just the AP Model …

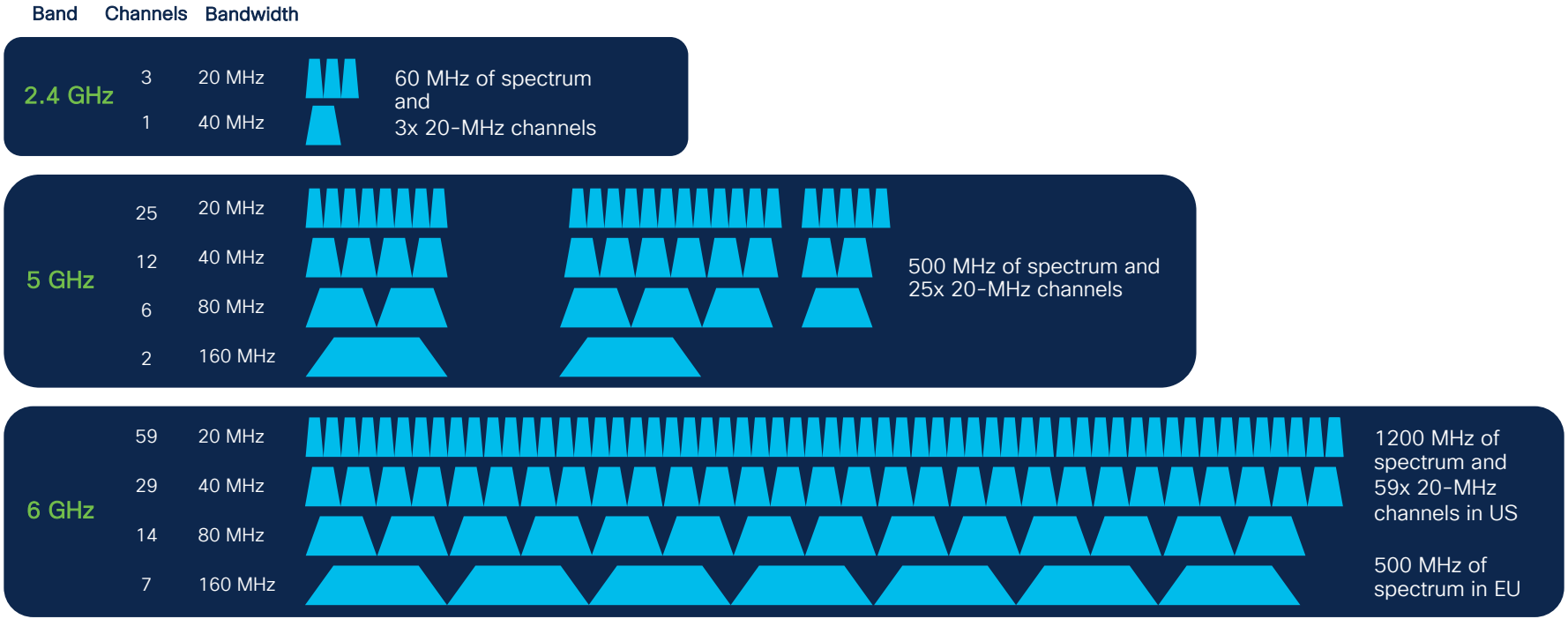
- Channel Aggregation
- Digital Modulation
- Spatial Multiplexing



How Channel Aggregation Help

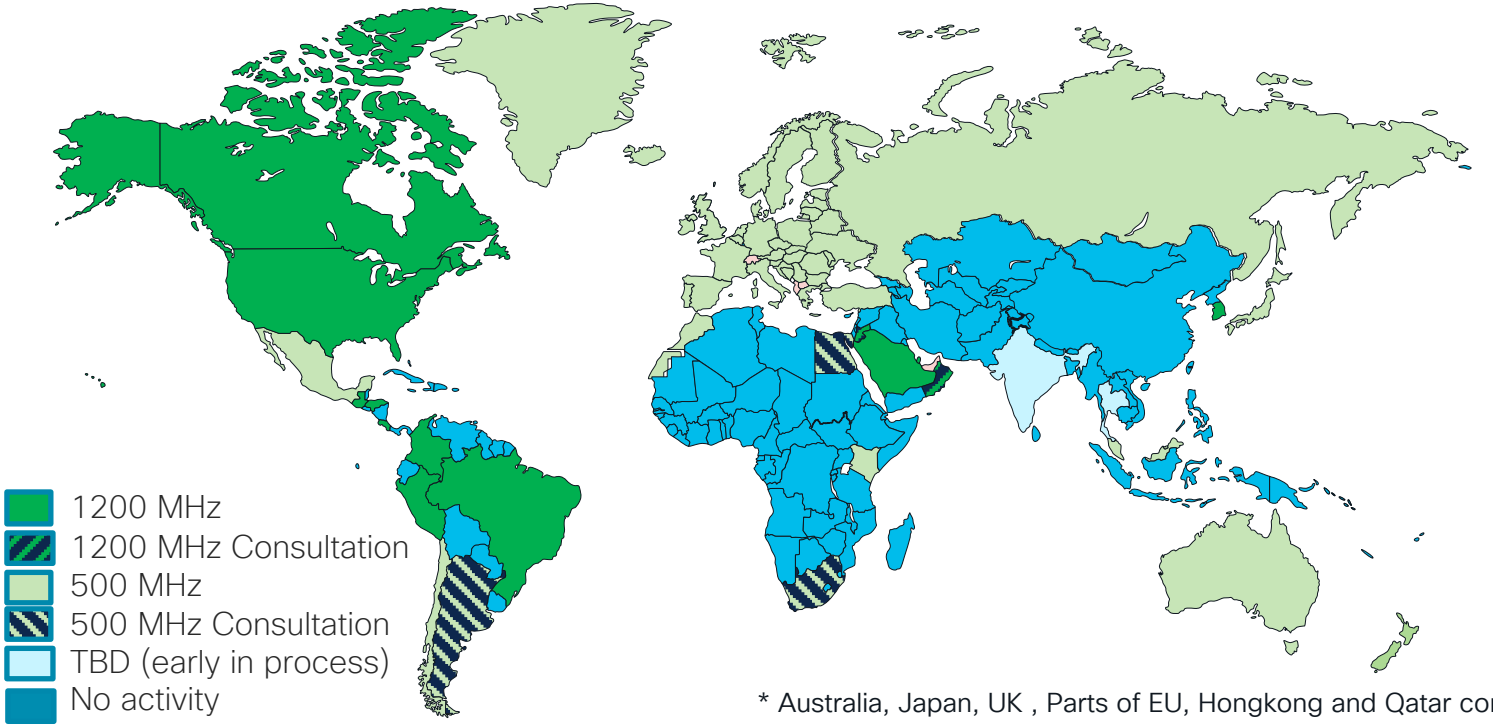


Channel Aggregation with the different Bands



Global availability of 6 GHz band for Wi-Fi

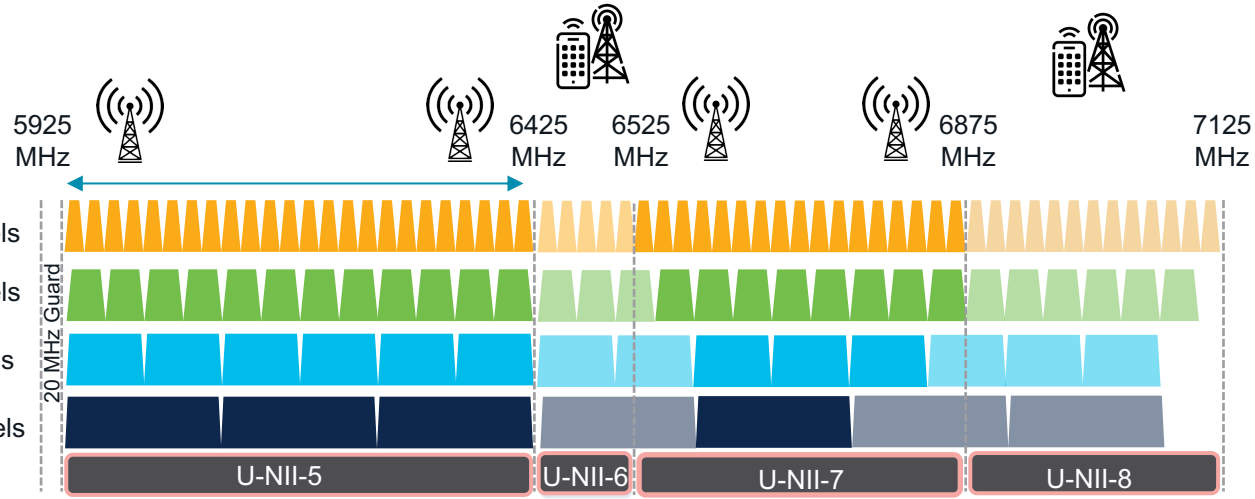
(https://www.wi-fi.org/countries-enabling-wi-fi-6e)



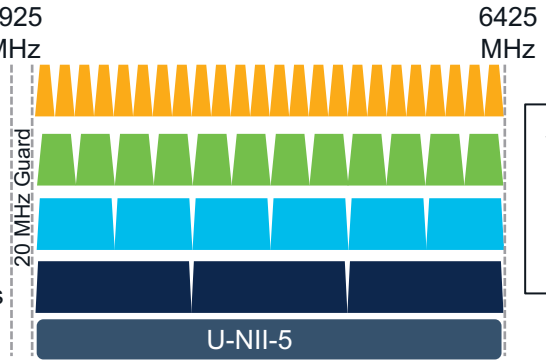
* Australia, Japan, UK , Parts of EU, Hongkong and Qatar considering 1200 MHz

6 GHz band:

United States
Canada
S Korea
1200 MHz

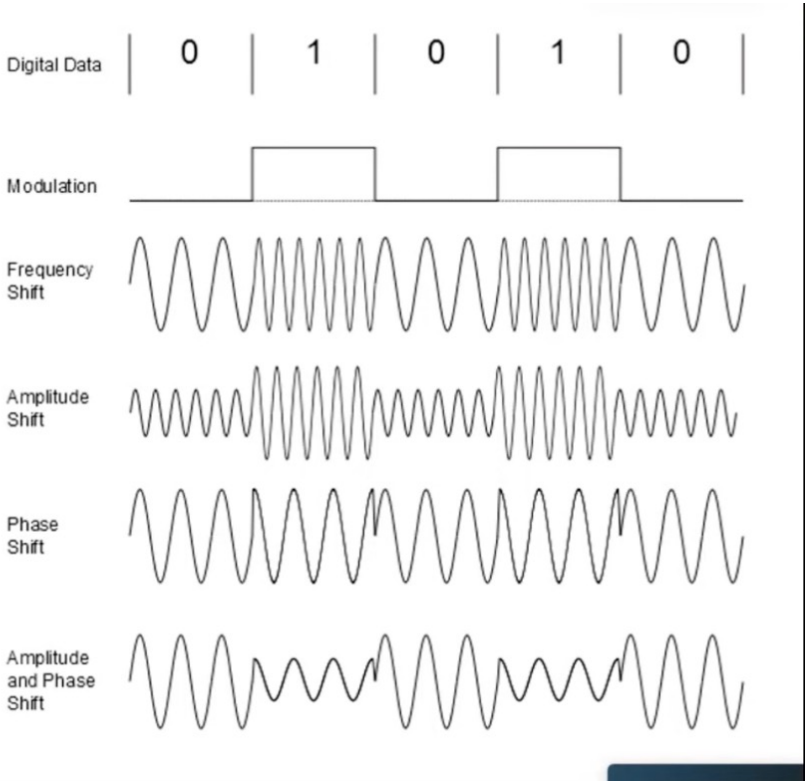


Europe/CEPT
Most APAC
500 MHz



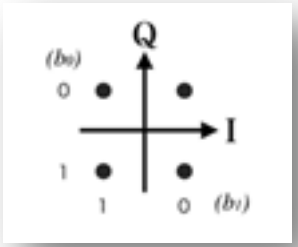
5955 – Central Frequency of the first 20 MHz channel
→ Starting at 5925 MHz +
20 MHz of guard band +
10 MHz to get to the center of the first 20 MHz channel

Digital Modulation

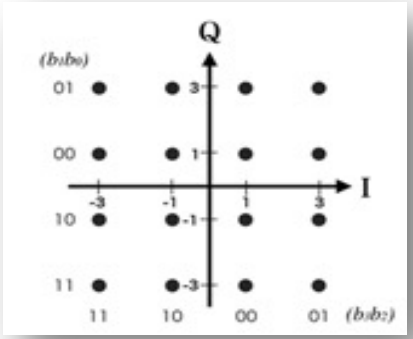


QAM

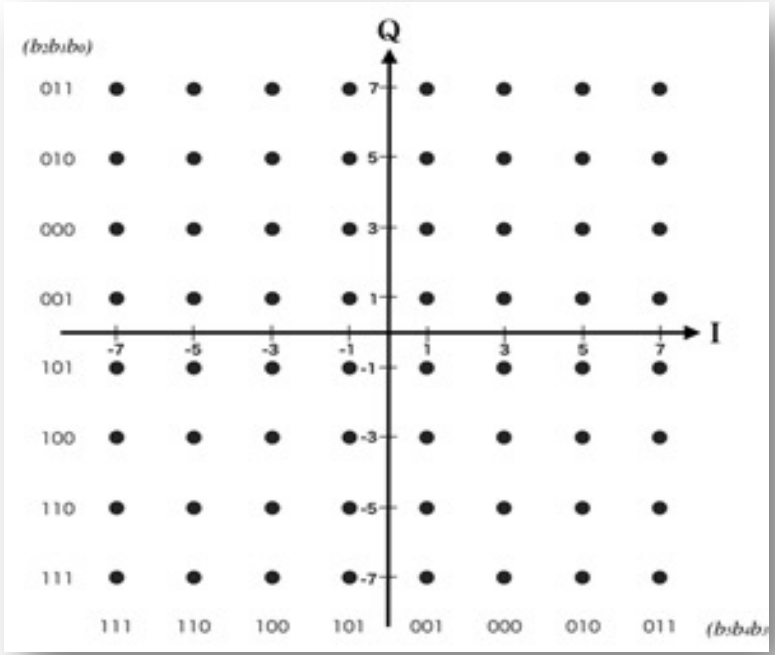
Digital Modulation Constellations



4-QAM



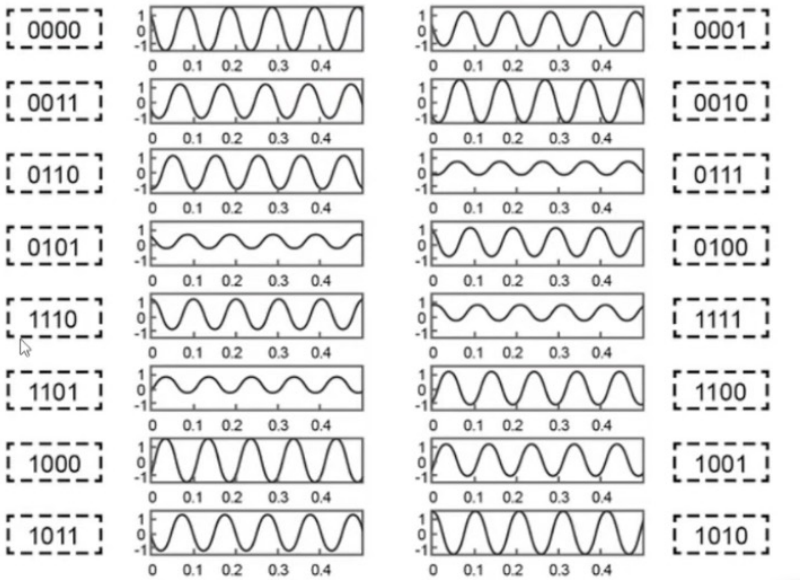
16-QAM



64-QAM

16 QAM Example

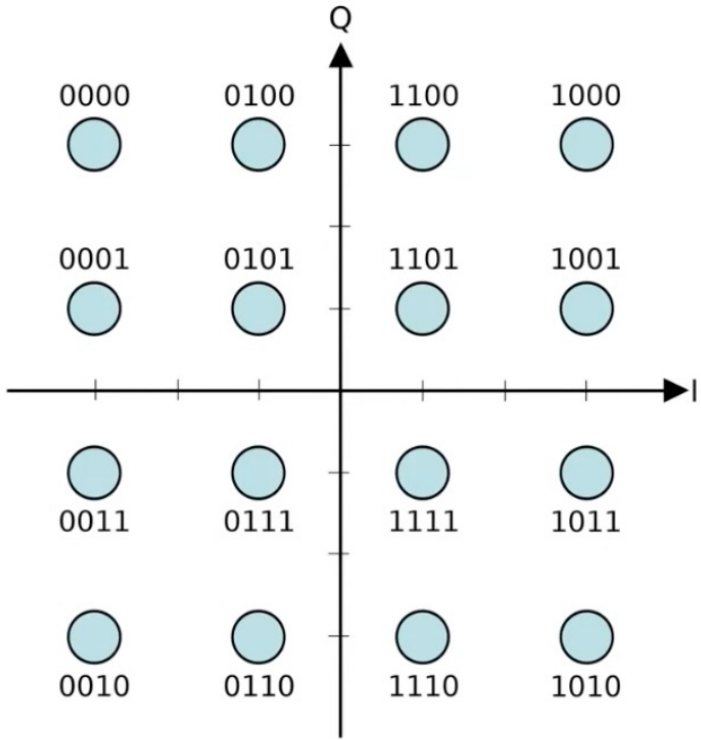
8 Levels of Amplitude
8 levels of Phase



16 QAM Example

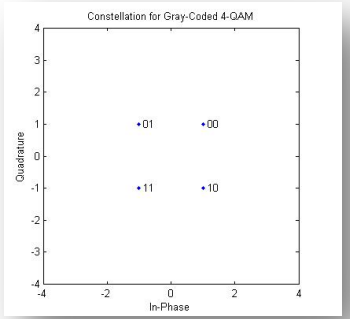
8 Levels of Amplitude
8 levels of Phase

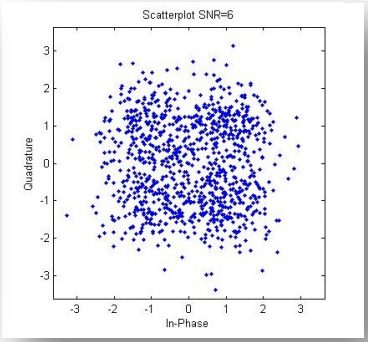
4 bits



Noise

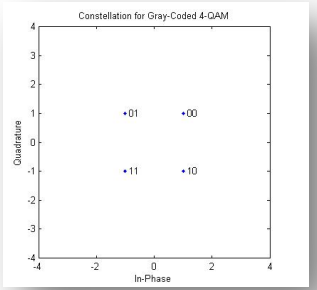
Signal to Noise Ratio (SNR) Difference of our signal and floor noise

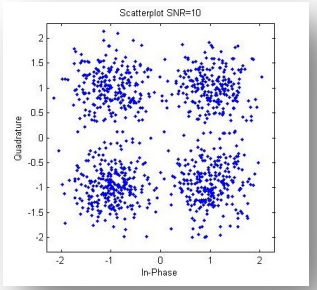




SNR=6

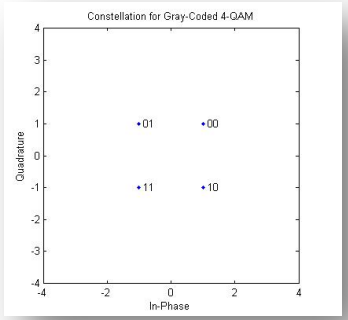
4-QAM



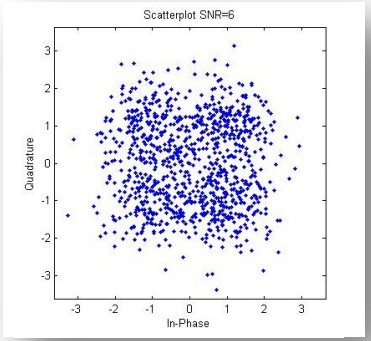


SNR=10

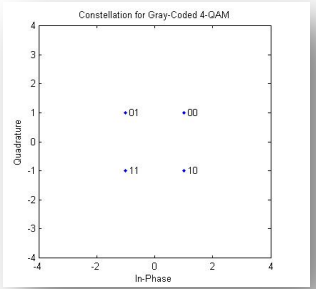
High SNR vs Low SNR

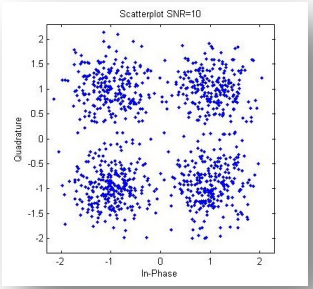


4-QAM



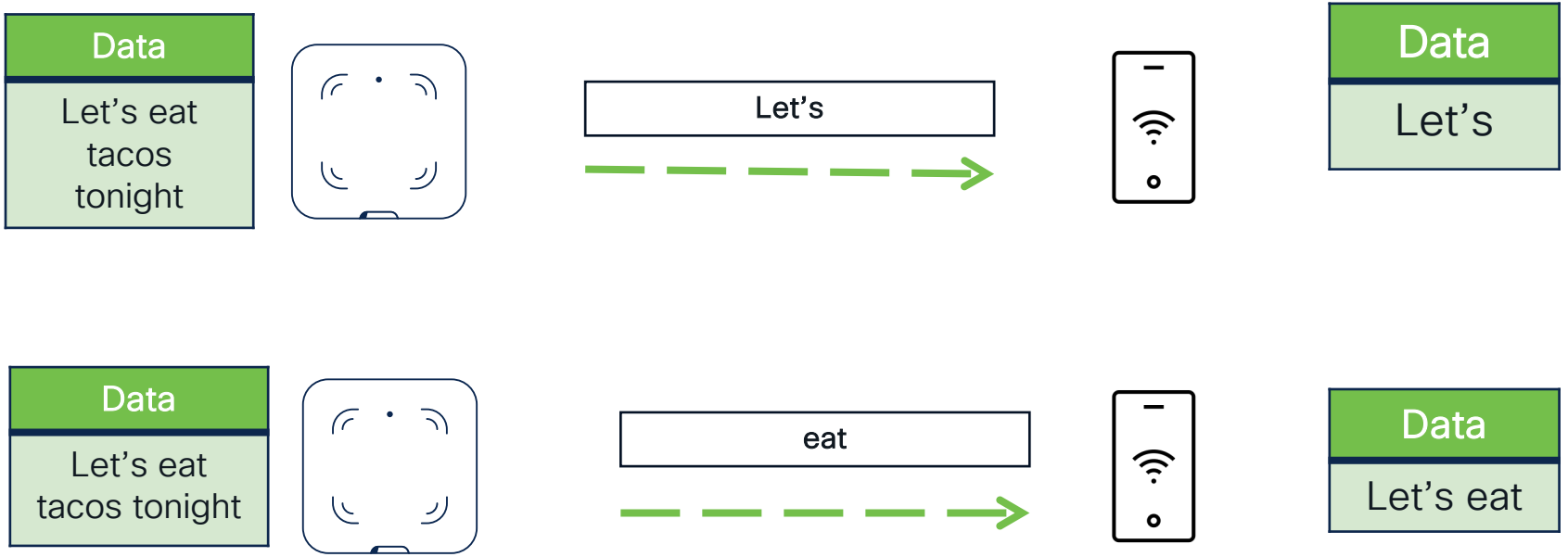
SNR=6



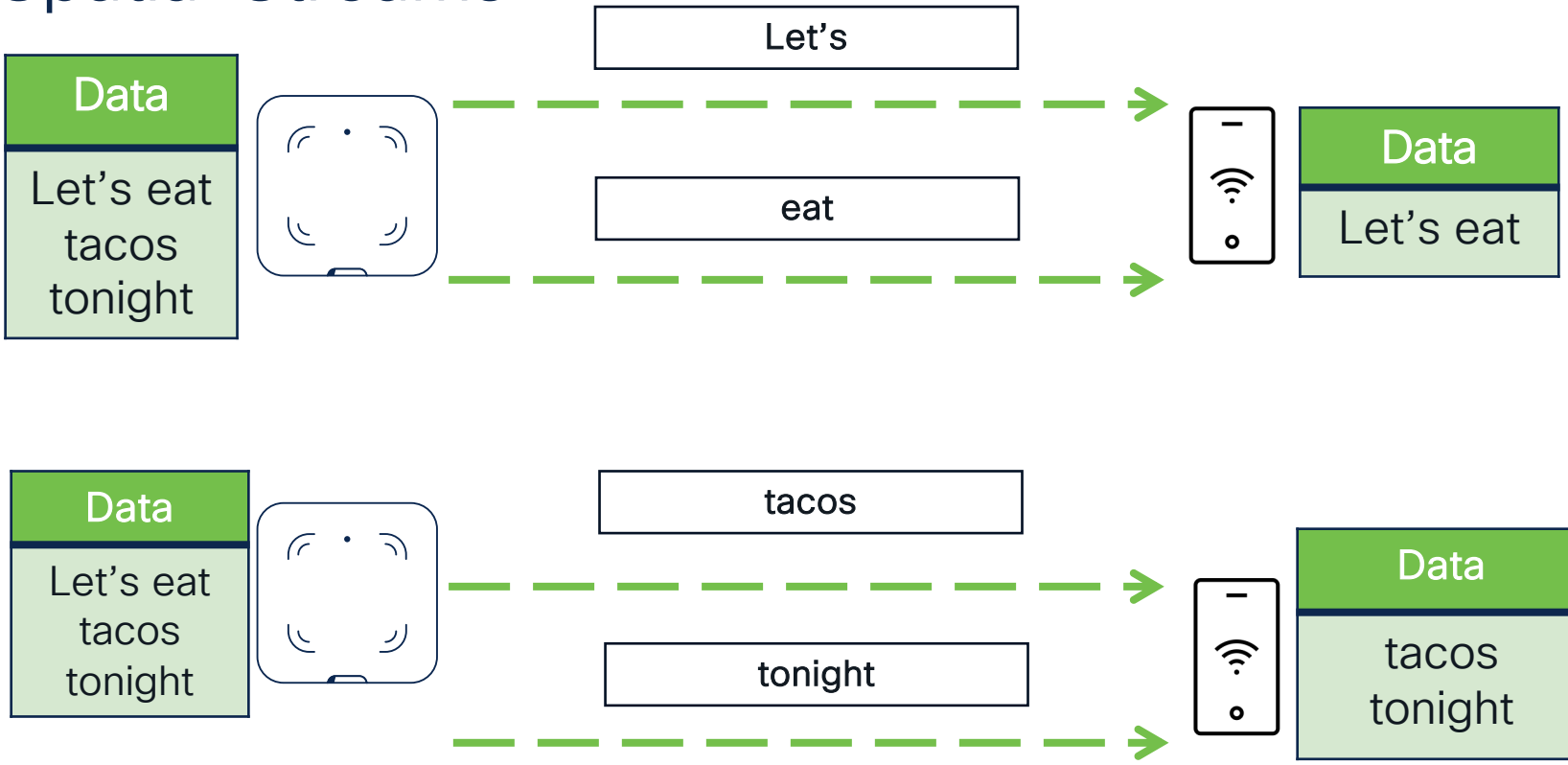


SNR=10

Spatial Streams Working



Spatial Streams



Leverage the Rules of PHYsics

Data Rates Depend on: Channel Bandwidth, Modulation and Spatial Streams

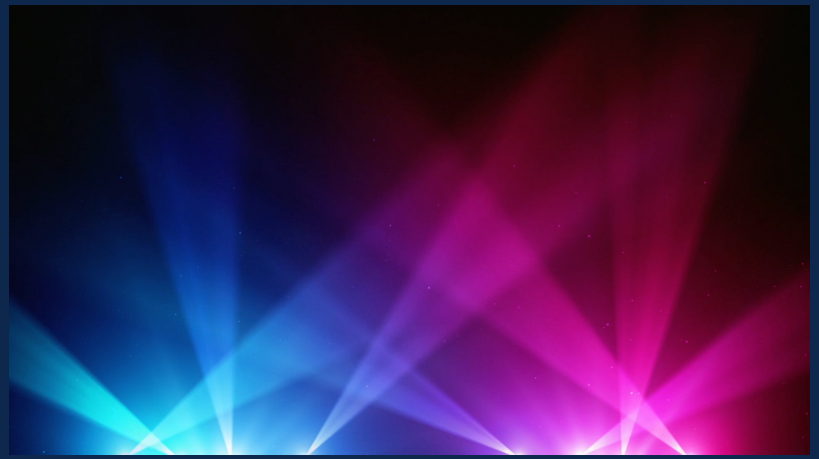
Always keep a HIGH SNR

How many APs do I need, and where?

What is the trick?

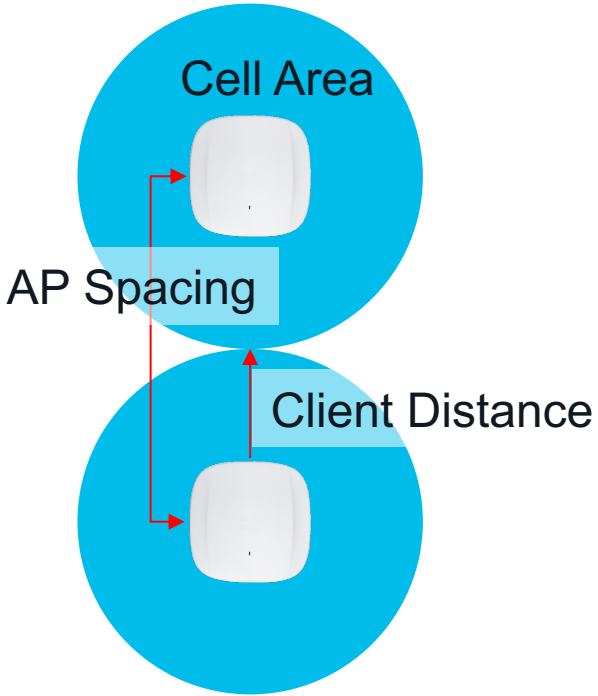
Set a good Stage

Setting a good stage



Cell Size
Transmission power
RSSI
AP Proper Mount

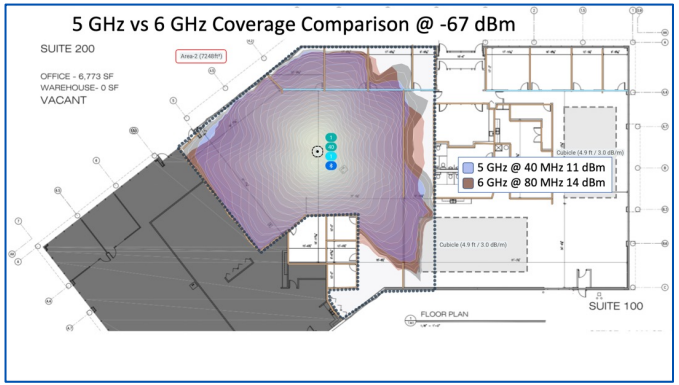
AP Cell Areas



Cell Area/Coverage	AP Spacing 1 AP every	Max Client Distance to AP
1k ft^2/92m^2	36 f /11 m	18 f / 5.5 m
1.2k ft^2/111m^2	40 f /12 m	20 f / 6 m
1.5k ft^2/140 m^2	44 f /13.5 m	22 f / 6.7 m
2K ft^2/185 m^2	50 f /15.2 m	25 f / 7.6 m
2.8K ft^2/260 m^2	60 f /18.2 m	60 f / 18.2 m

Planning Coverage for for 6GHz

- AP antenna patterns at 6GHz are similar to 5GHz

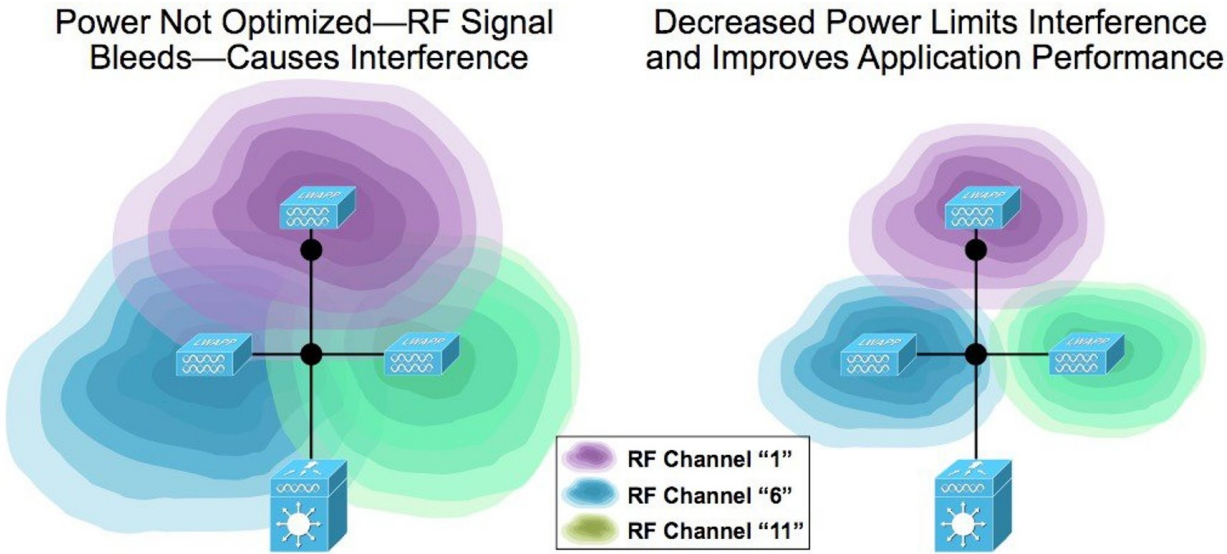


5GHz @40 MHz 11dbm

6GHz @80 MHz 14 dbm

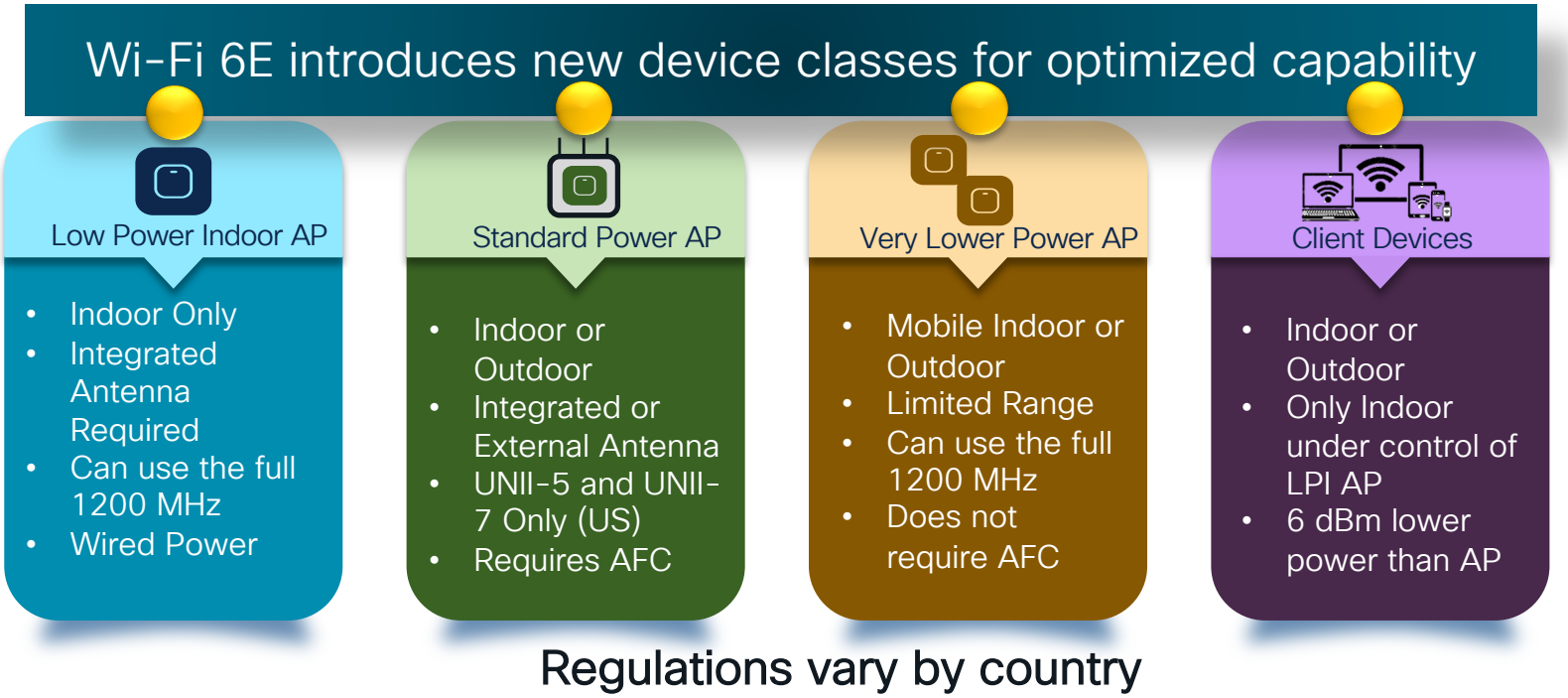
- With brick walls, elevator and other environments, you would probably need to measure and add few APs

How Transmission Power Helps



Example with 2.4 GHz

6 GHz – New Device Classes



Regulations vary by country

Low-Power Access Points (indoor)

6 GHz power is measured as **Power Spectral Density (PSD)**
a Maximum of 5 dBm/MHz is permitted for LPI
***(Power Spectral Density** – Amount of power over a given bandwidth)*

5 dBm = 3.162278 mW

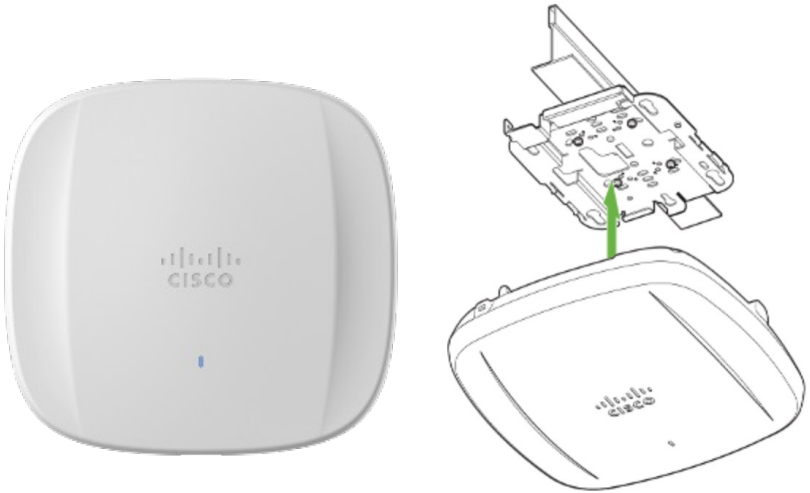
3.162278 mW x 20 MHz = 63.24556 mW = 18 dBm
3.162278 mW x 40 MHz = 126.4911 mW = 21 dBm

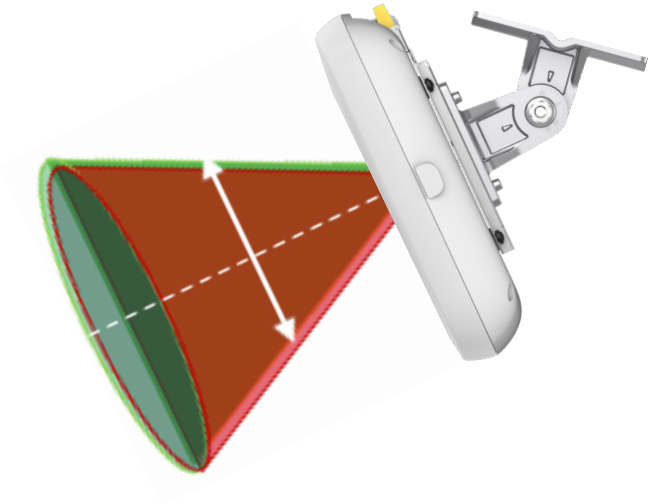
Client power also has a PSD rule of 6 dB less than the AP's max EIRP

Channel BW	AP EIRP	Client EIRP
20 MHz	18 dBm	12 dBm
40 MHz	21 dBm	15 dBm
80 MHz	24 dBm	18 dBm
160 MHz	27 dBm	21 dBm

AP Proper Mount

Choose the Right Antenna





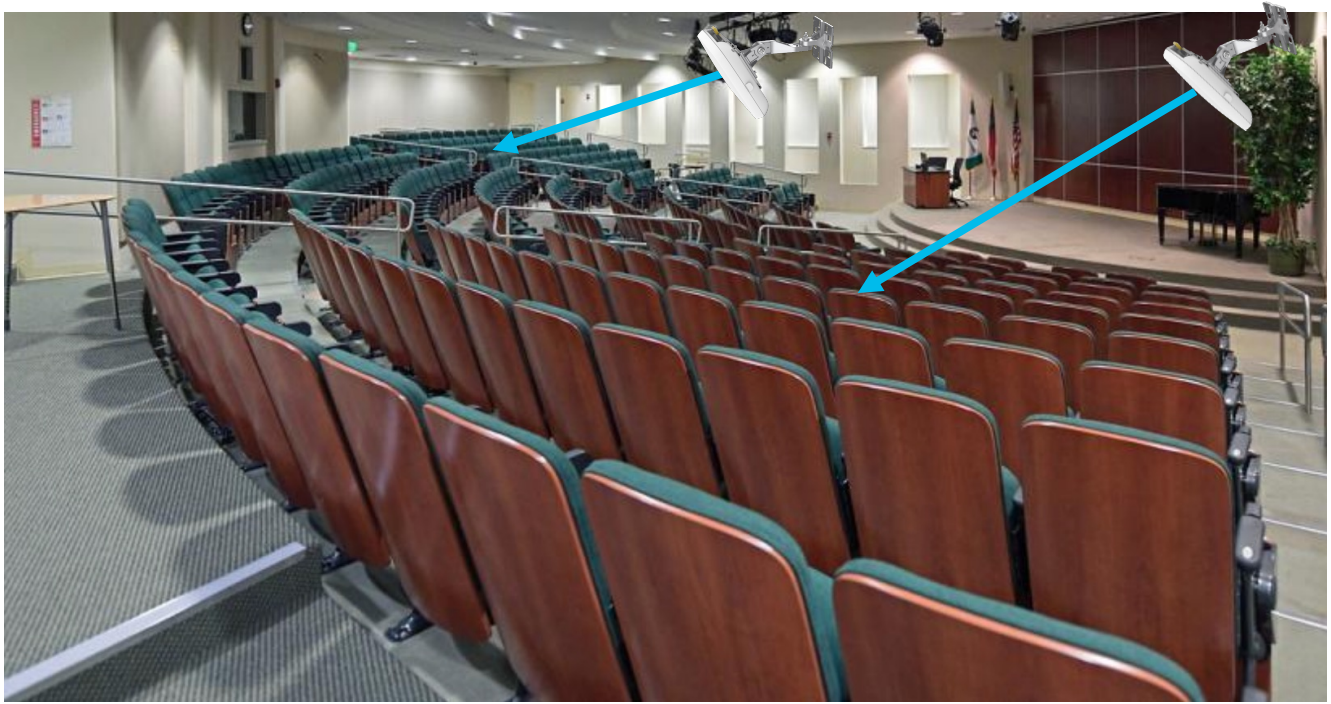
Omni

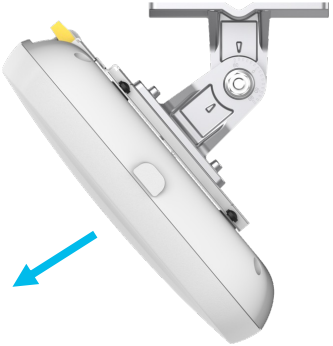
Mount for a “360 degree” coverage pattern – ideal for offices, conventional buildings

Directional

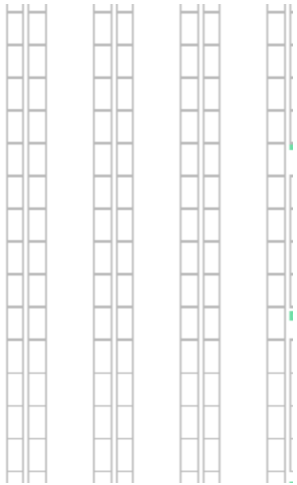
Allowing the coverage pattern to favor the area the AP is facing – ideal for warehouse, auditoriums etc.

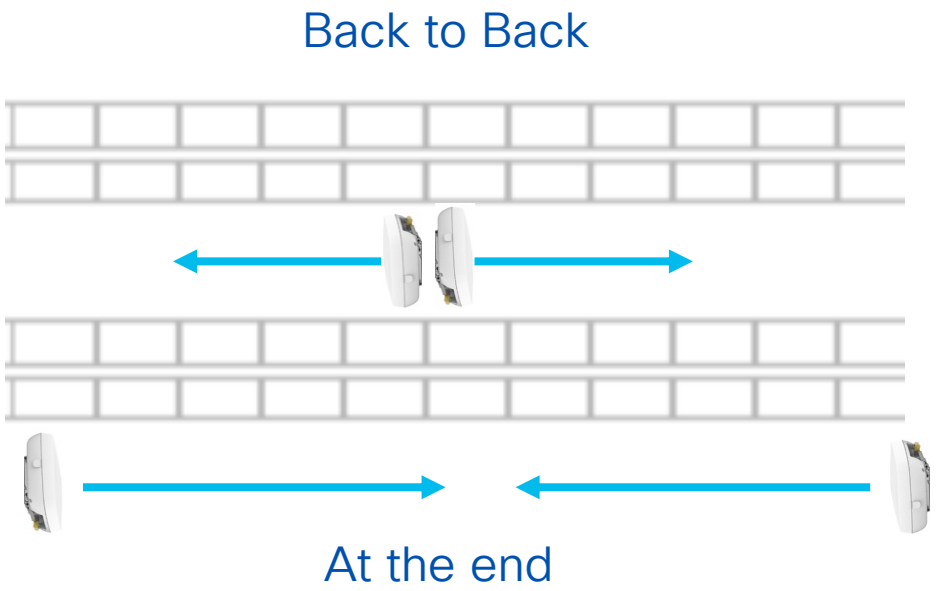
Example – Auditoriums (Focused connectivity)





Example – High Ceilings, Long Aisles





Tip

Cell size and Transmit Power

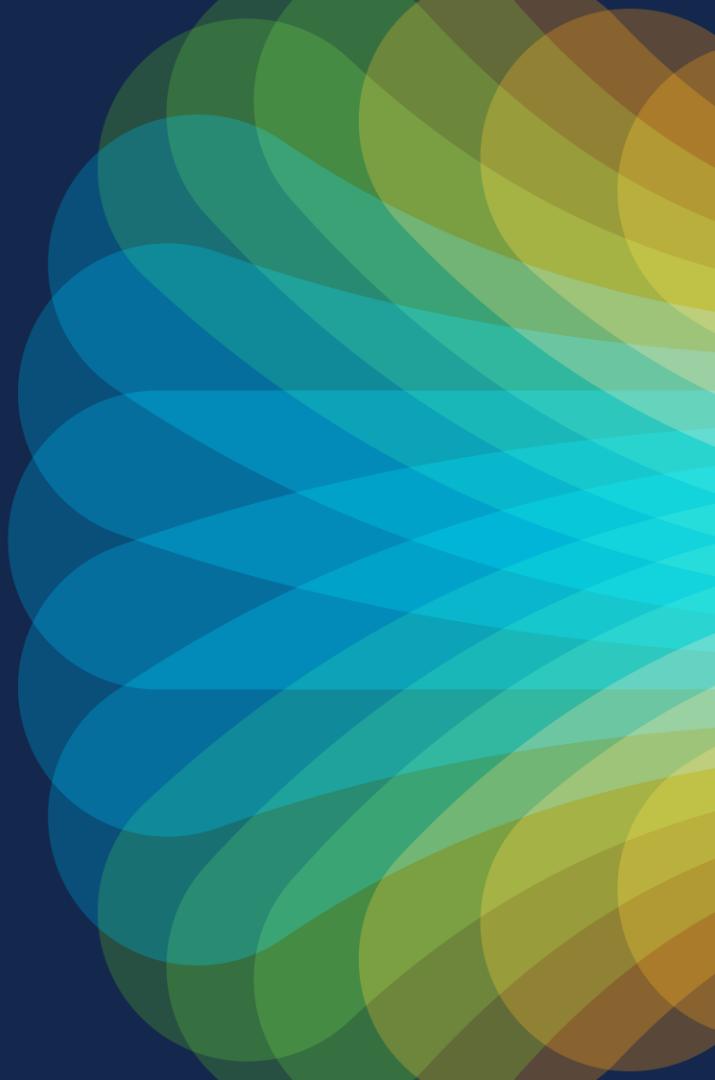
Mount Omni or Directional

Keep consistency on the network

What is the trick?

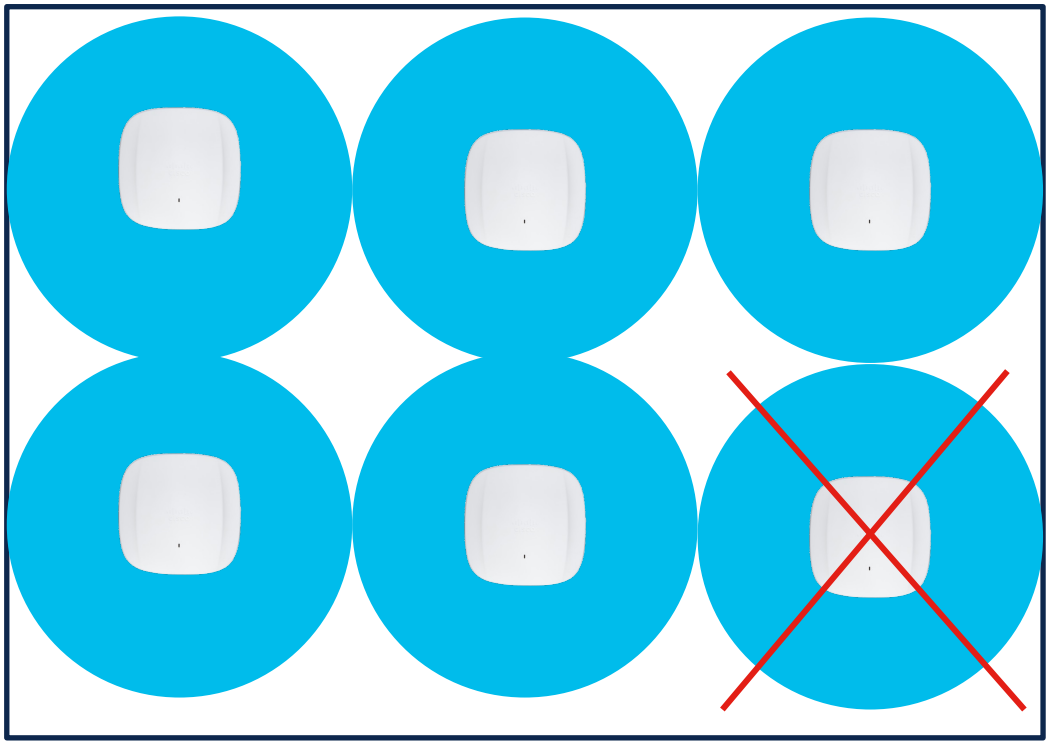
1 2 3 4 5 6 7

Remastered



Remastered

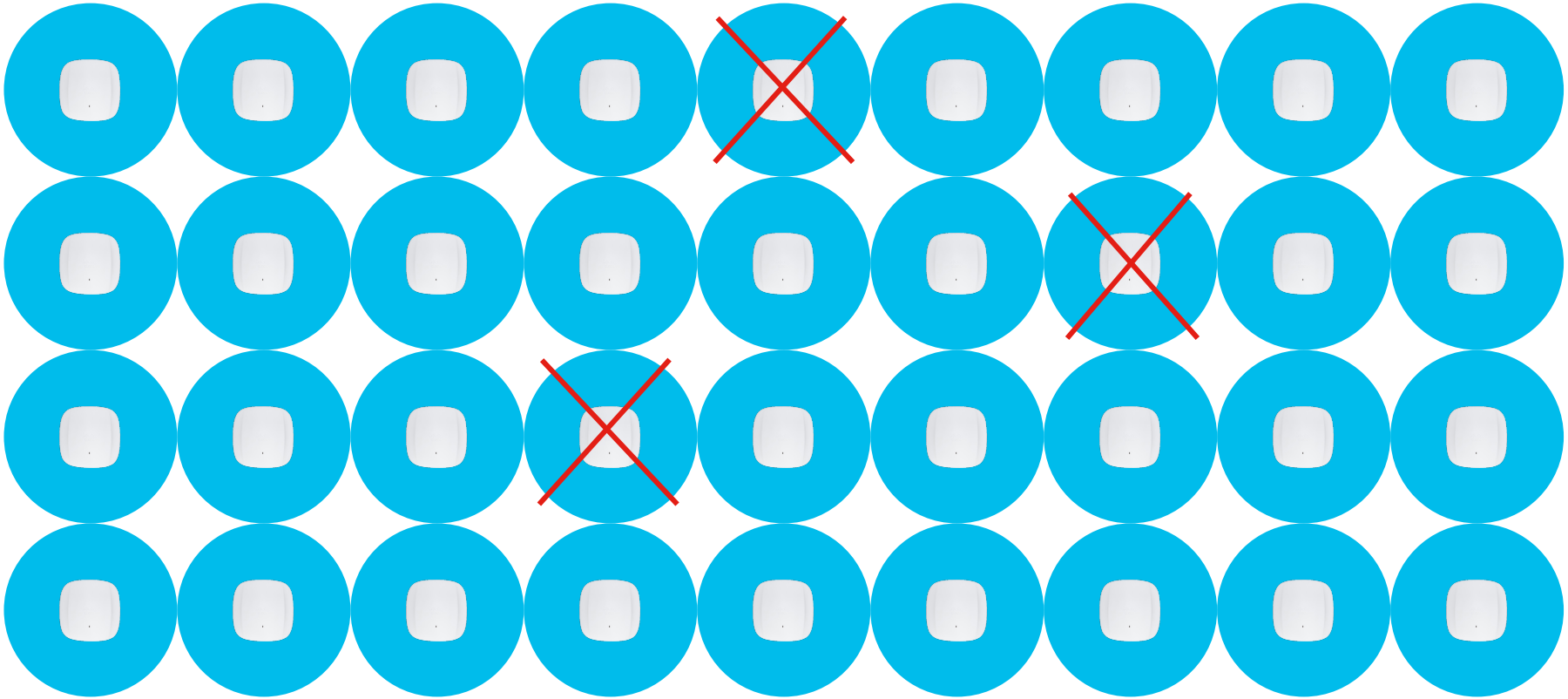
Keeping the RF efficient



To consider for Each AP

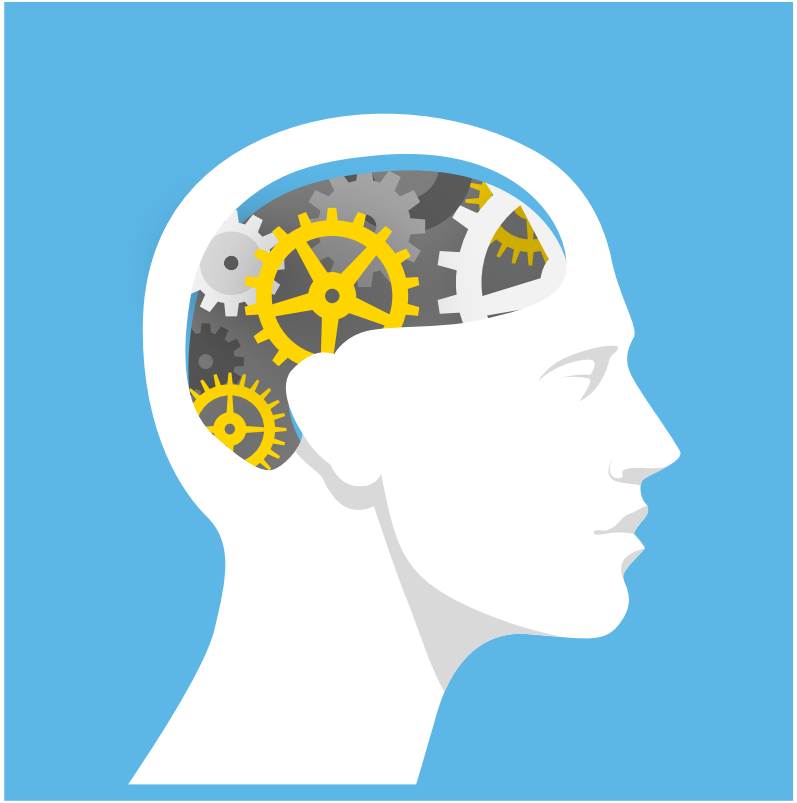
- Channel number
- Transmit Power Level
- Multiple Bands
- Channels greater than 20MHz ?

But, there’s more than 6 APs



What is Machine Learning?

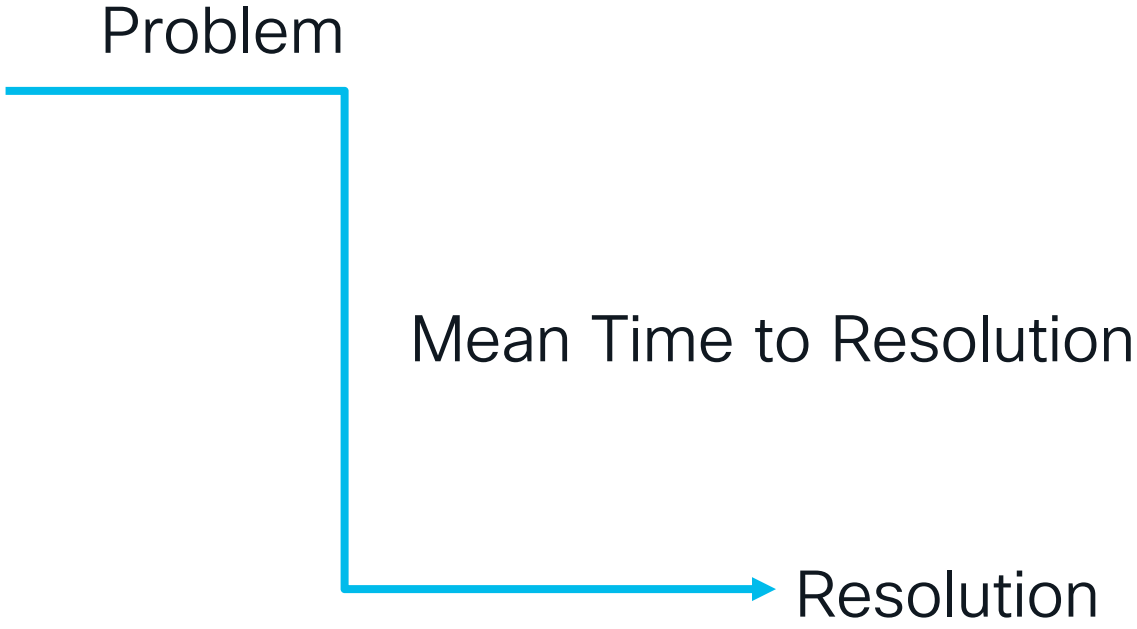
- Machine learning is a form of **artificial intelligence** (AI) that can learn things that **humans cannot**
- Learning begins with data, and uncovers correlations, inferences, insights, and can make predictions
- The primary goal is to use these systems is to improve the business.



Large Language Models

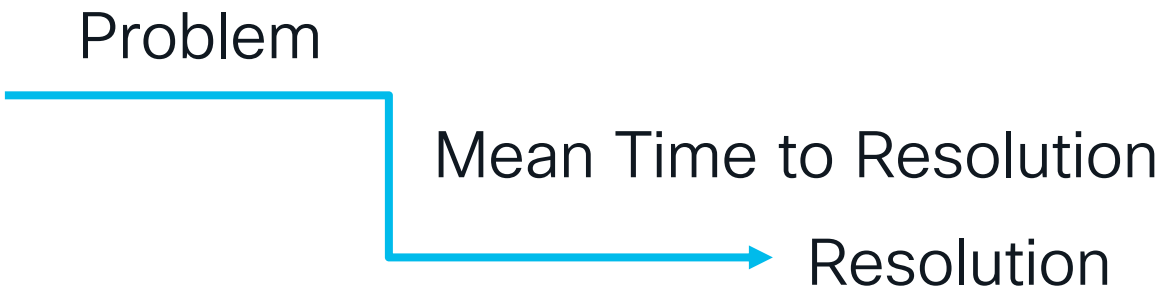
Large language models are advanced AI systems capable of understanding and generating human-like language, powered by deep learning algorithms.

Benefits of AI/ML in Wireless Networks



Benefits of AI/ML in Wireless Networks

Dynamic Baselines
Decrease Alert Fatigue



Baselines

To Detect

- Anomaly detection
- Trends
- Compare
- Predict

Data Collection

- Onboarding Time
- Onboarding Failures
- DHCP Transaction Time
- Authentication
- Association

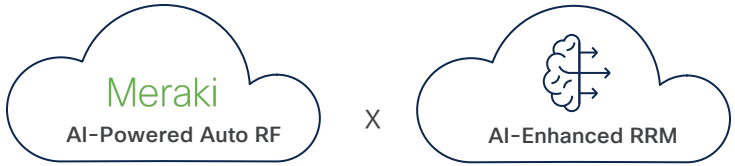
Wireless AIOps – Focus areas

By focusing AIOps on a mission of optimizing client experience on Wi-Fi, it becomes a powerful user-centric solution

Painpoints & Themes

1	Users struggle to discover and prioritize issues, including how issues relate to applications and any upstream or downstream impact.	→ **Prioritize & triage**
2	Users struggle with where to start because data is scattered, and gathering it is time consuming and manual.	→ **Contextual workflows**
3	Users struggle to predict how changes may impact their network and thus struggle to know where to invest to optimize.	→ **Predict, Optimize, Self-Heal**

How do we provide a consistent RF outcome without regard to platform?

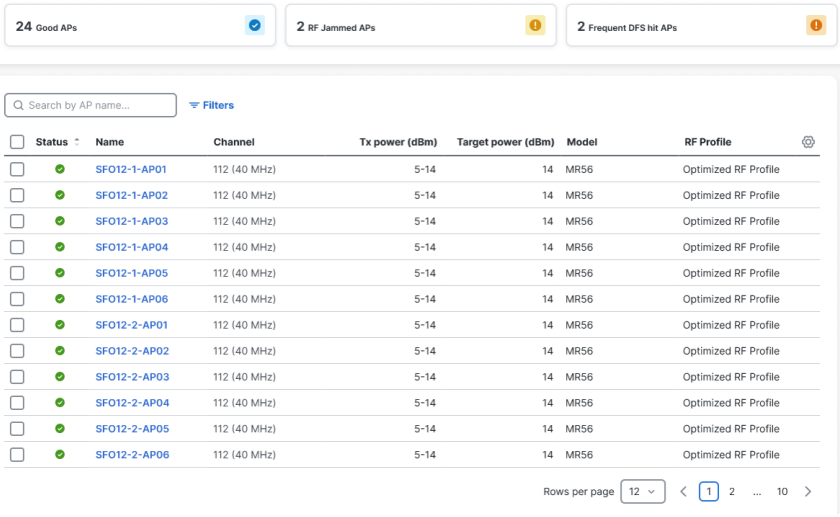


Integration with AI-Enhanced RRM

- Inherit advanced RRM features with less development cycles.
- Best in class solutions available regardless of your architecture choice
- Brings benefit to 192k+ customers and 8M+ APs immediately.

What is AI-Powered Auto RF?

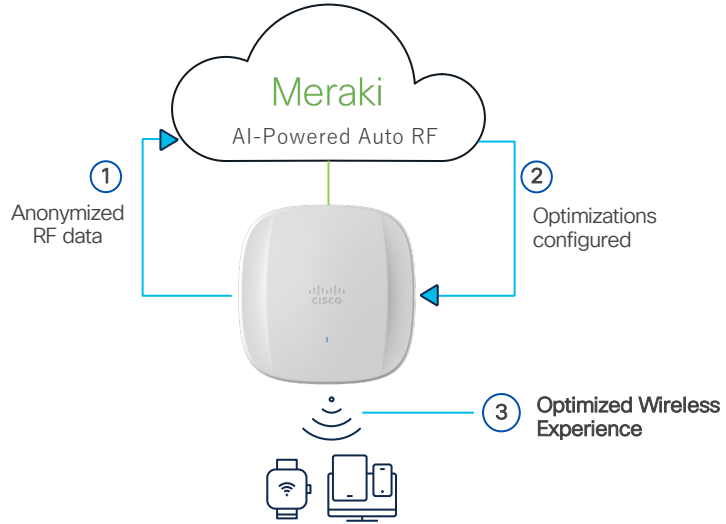
Simplified Visibility & Automated Control



Status	Name	Channel	Tx power (dBm)	Target power (dBm)	Model	RF Profile
	SFO12-1-AP01	112 (40 MHz)	5-14	14	MR56	Optimized RF Profile
	SFO12-1-AP02	112 (40 MHz)	5-14	14	MR56	Optimized RF Profile
	SFO12-1-AP03	112 (40 MHz)	5-14	14	MR56	Optimized RF Profile
	SFO12-1-AP04	112 (40 MHz)	5-14	14	MR56	Optimized RF Profile
	SFO12-1-AP05	112 (40 MHz)	5-14	14	MR56	Optimized RF Profile
	SFO12-1-AP06	112 (40 MHz)	5-14	14	MR56	Optimized RF Profile
	SFO12-2-AP01	112 (40 MHz)	5-14	14	MR56	Optimized RF Profile
	SFO12-2-AP02	112 (40 MHz)	5-14	14	MR56	Optimized RF Profile
	SFO12-2-AP03	112 (40 MHz)	5-14	14	MR56	Optimized RF Profile
	SFO12-2-AP04	112 (40 MHz)	5-14	14	MR56	Optimized RF Profile
	SFO12-2-AP05	112 (40 MHz)	5-14	14	MR56	Optimized RF Profile
	SFO12-2-AP06	112 (40 MHz)	5-14	14	MR56	Optimized RF Profile

Rows per page 12 1 2 ... 10

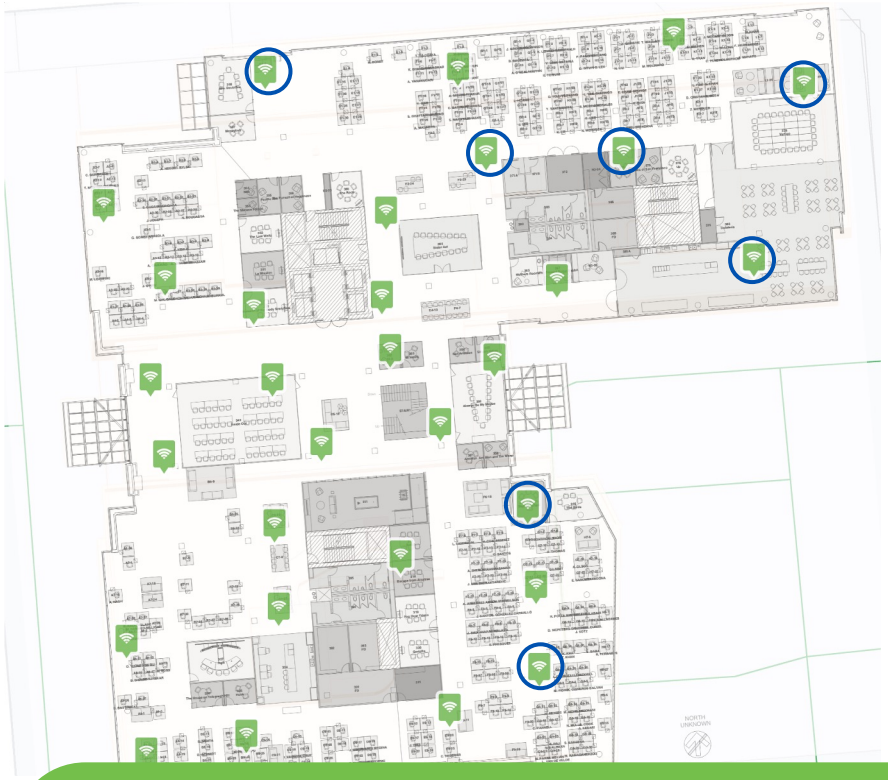
Topology



Cisco Meraki AI-Driven RRM solution

Reduce

Channel Changes by half by DFS events/hits

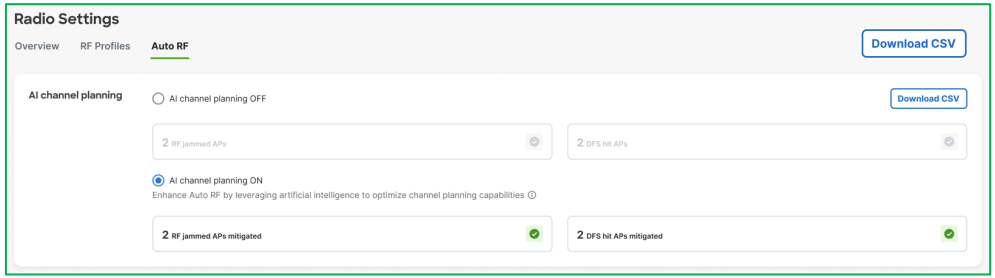


Retain historical DFS events, Auto-update RF Profile to avoid DFS-impacted channel

Intelligent Channel Planning

with AI-Powered AutoRF

- Channel Avoidance dynamically manages ***each AP's*** Channel Avoid List
- Both DFS events and Channel Blocked events are tracked – separately
- An event is assessed the initial penalty of 6, and will be avoided for 1 day. Subsequent events during Monitoring will increment in severity
- A channel is returned to the "Available" list after successfully completing the monitoring period, else it is assigned a new severity and left on the Avoid list



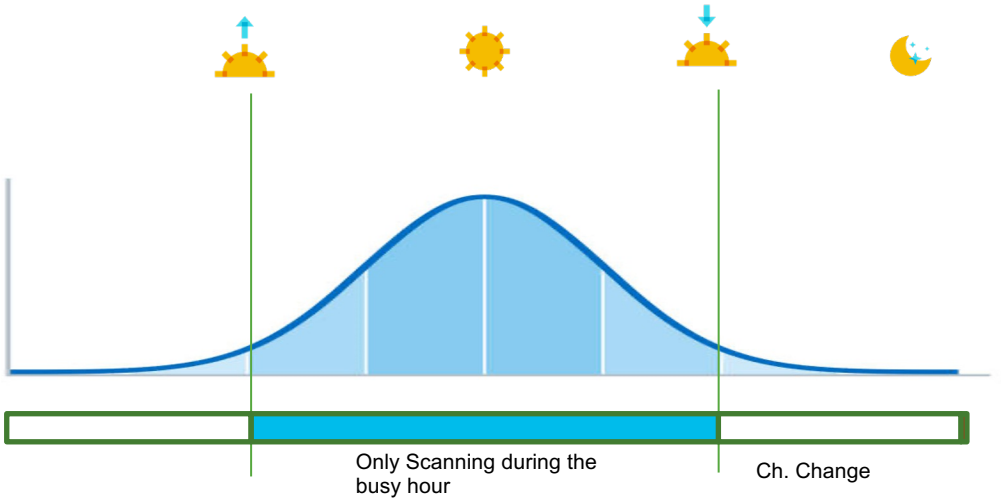
	Severity	Avoid/Mute	Monitor
	1	30 Days	6 Hours

AI Channel Planning Avoid and Monitor List

Channel	Avoid Start Time	Avoid End Time	Monitor Start Time	Monitor End Time
100	3/24/23 - 1745	3/25/23 - 1745	3/25/23 - 1745	3/25/23 - 1845
104	3/23/23 - 1245	3/25/23 - 1245	3/25/23 - 1245	3/25/23 - 1445
108	3/23/23 - 1745	3/27/23 - 1745	3/27/23 - 1745	3/27/23 - 1745

Minimize

Client Disruption During Busy Hours



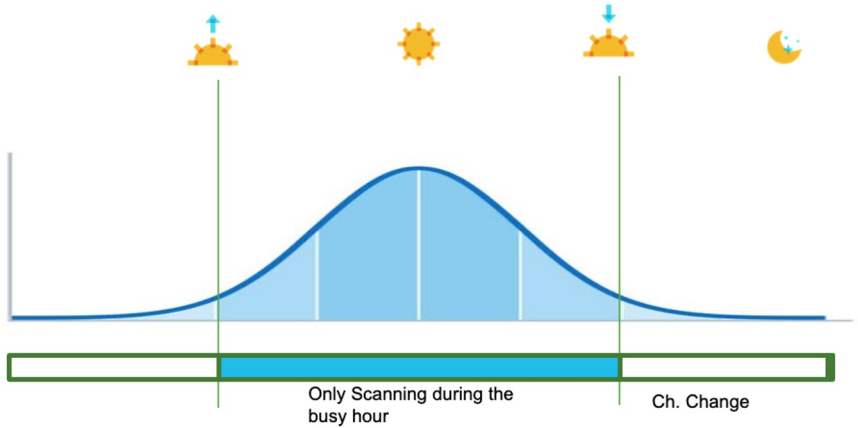
Busy Hour can be either automatically or manually configured

Avoid client disconnection or roaming due to channel change

Intelligent Busy Hour

with AI-Powered AutoRF

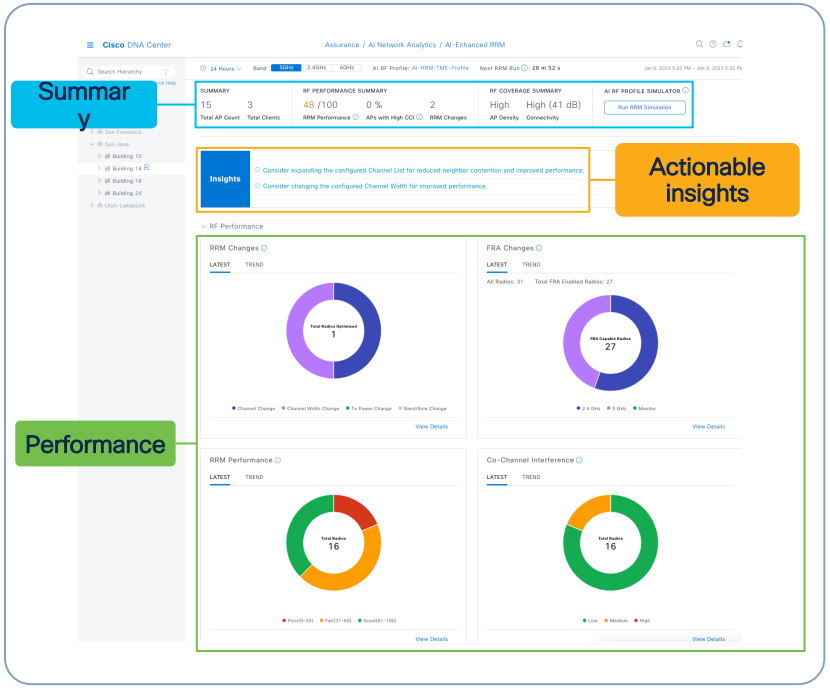
- Work hours are not the same for each network
- With the power of Dashboard, AutoRF can now optimize each network individually for its unique busy hour daily



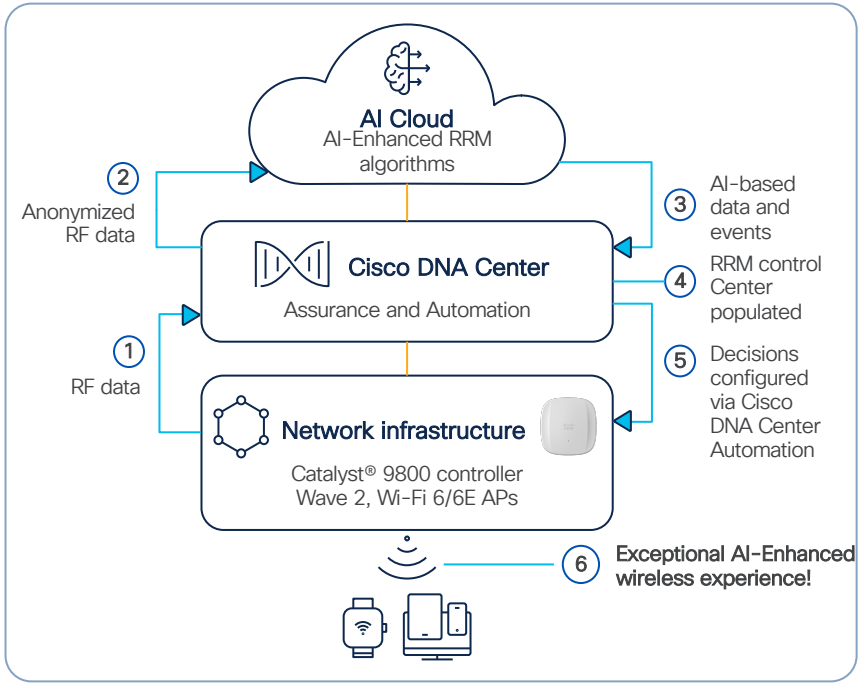
What is AI-Enhanced RRM?

Catalyst's AI-Driven RRM solution

Deep RF visibility & advanced control



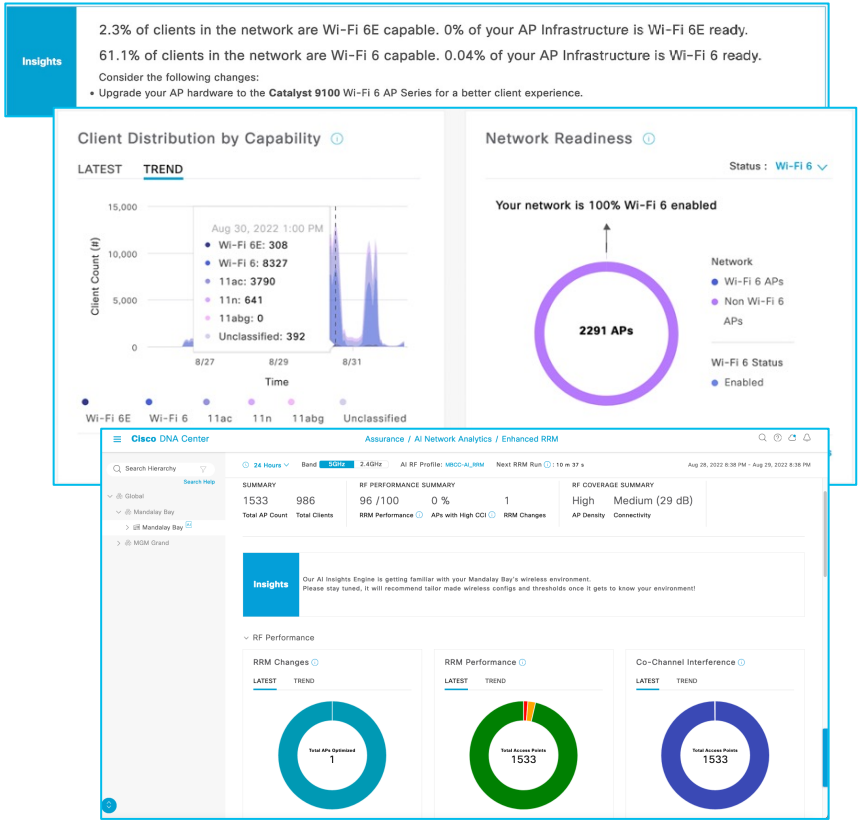
Proactive optimizations for all deployment sizes



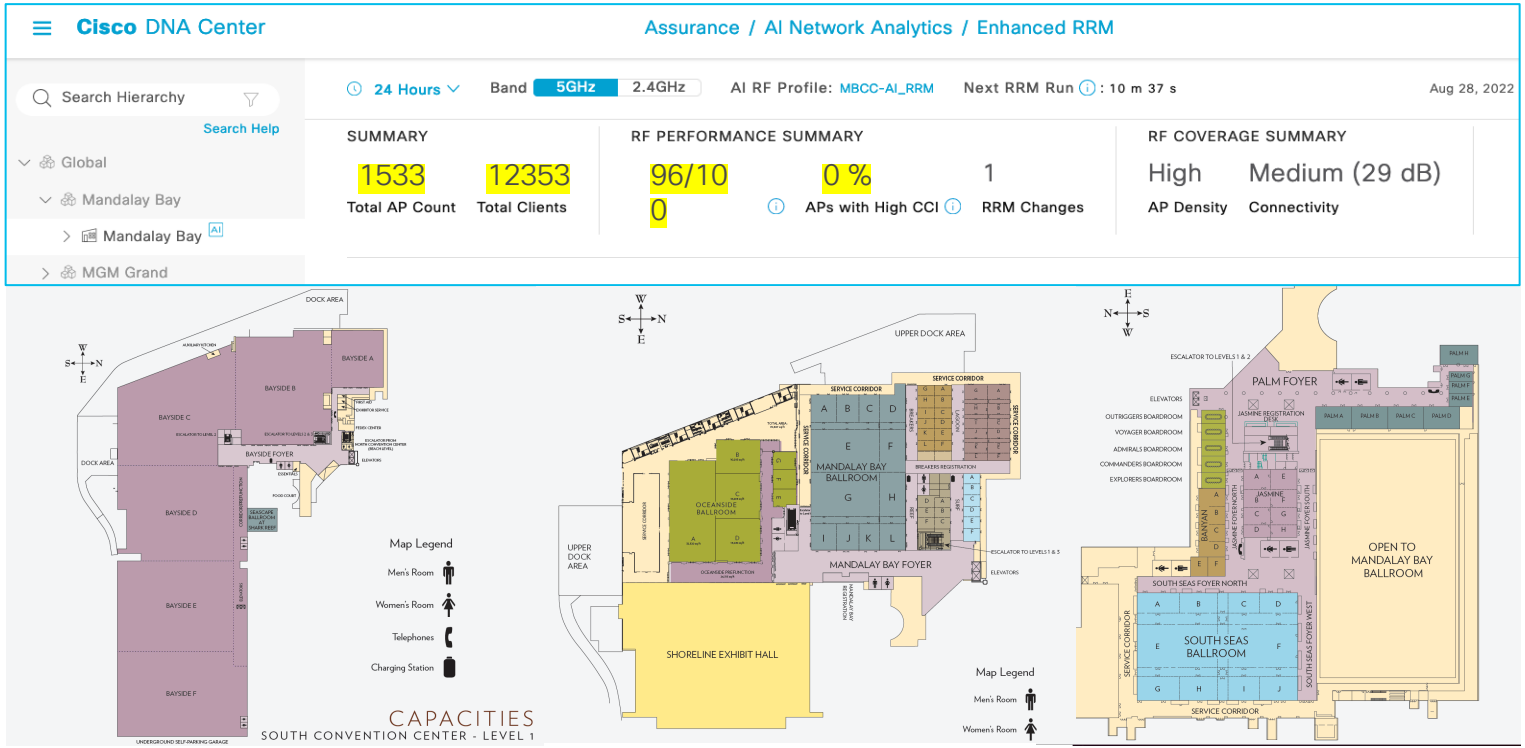
Cisco Event

AI-Enhanced RRM In Action

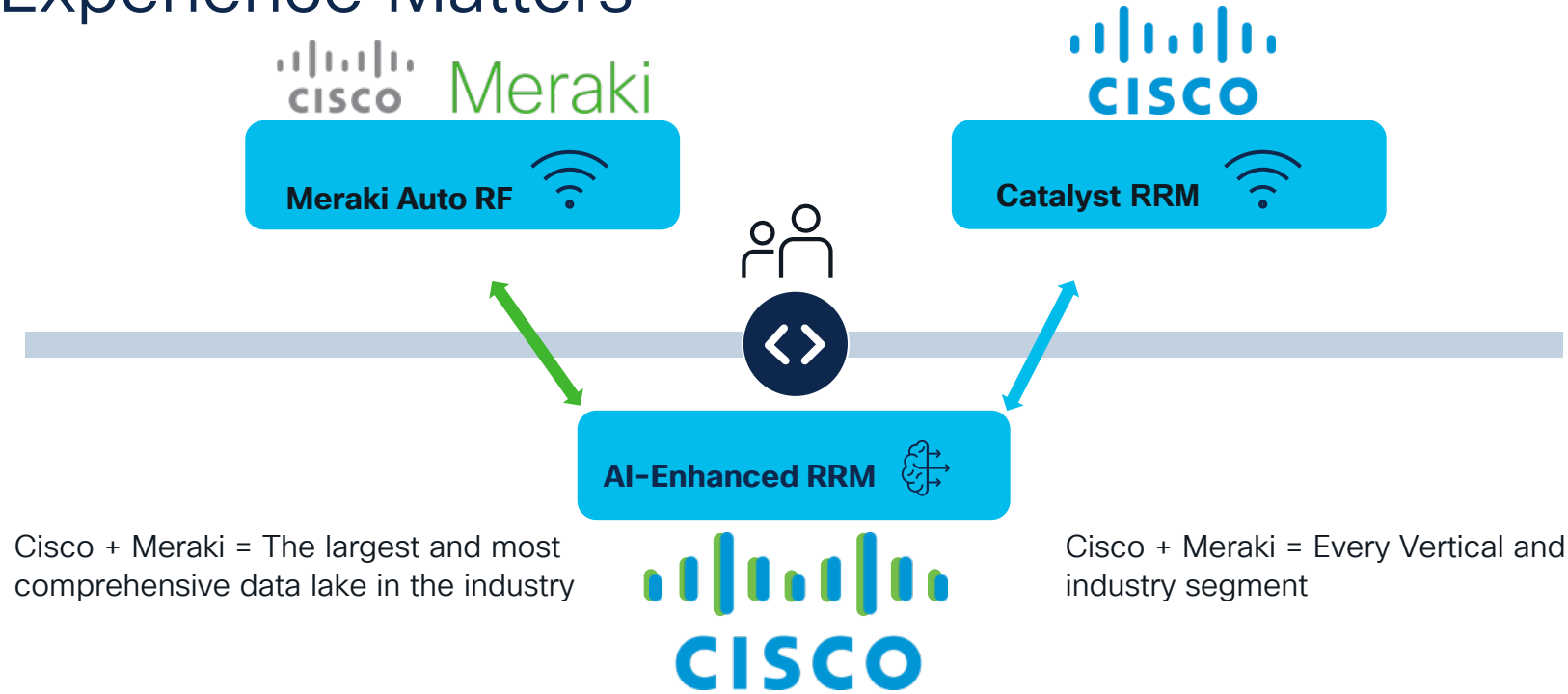
- 2291 APs
- AI-Enhanced RRM ran 1530 of the AP's
- Peak Client load was 13,458
- Only serving 5 GHz, 2.4 GHz free since June 2022!



Mandalay Bay South Convention Center



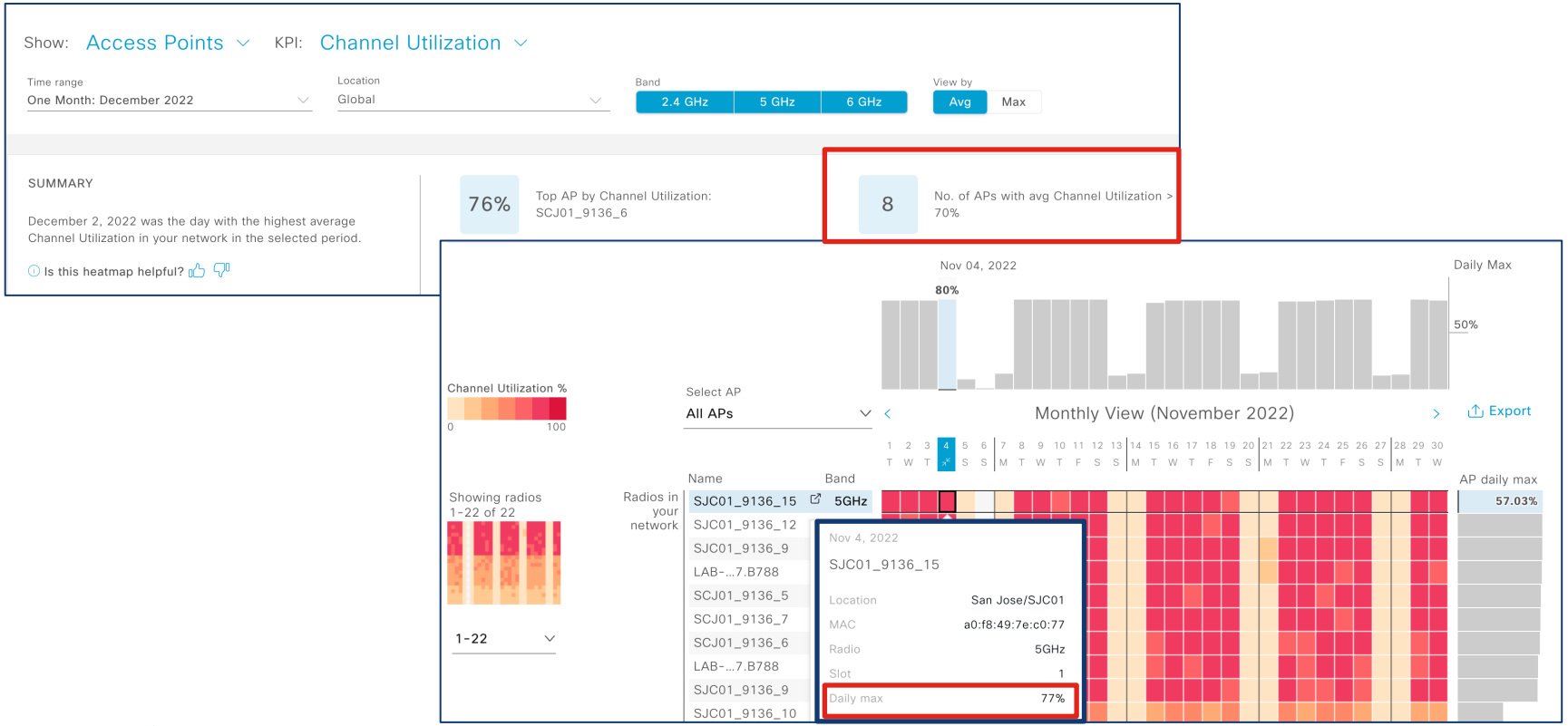
Customer Choices – Outcomes Matter Experience Matters



Cisco + Meraki = The largest and most comprehensive data lake in the industry

Cisco + Meraki = Every Vertical and Every industry segment

Observe Channel Utilization in your Network



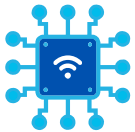
Cisco CleanAir Pro™

15 years of innovations and excellence carried forward

Cisco CleanAir®

RF ASIC-based excellence

Purpose built for 2.4- and 5-GHz wireless



Cisco CleanAir™ Pro

Evolving Wi-Fi excellence into 6 GHz

- Full 2.4-, 5-, and 6-GHz band support
- Multiradio architecture
- AI/ML-driven scanning radio decoding HE frames
- ML-based interferer classification, on AP

AI RRM

Minimize Channel Changes

Automatically control Transmit Powers

My RF is performing well, what about the rest of the network

What is the trick?

Sound check

Considering End to End Rockstar design

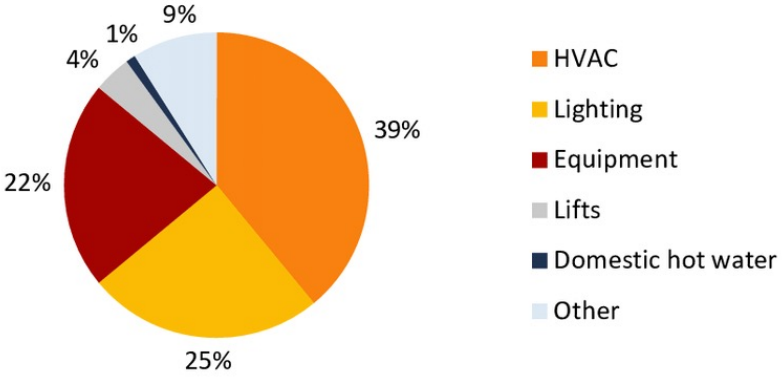
Sustainability and power levels

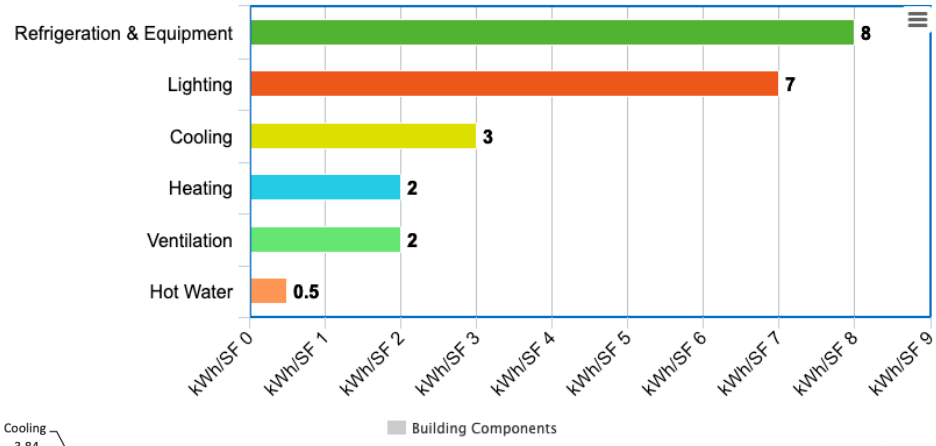
Cloud managed, On-Prem

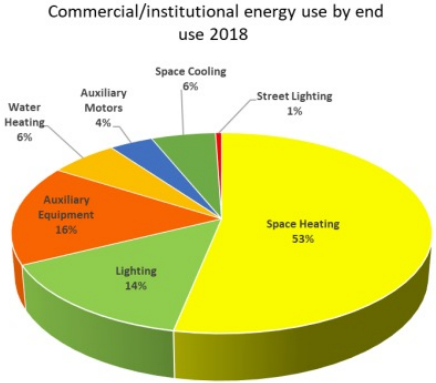
mGig

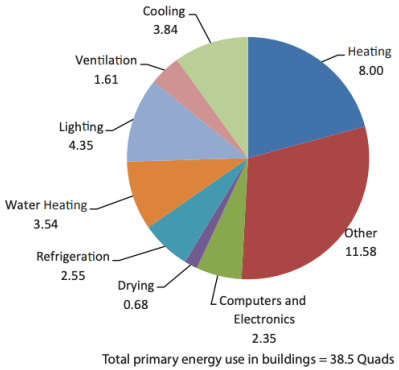
IPV6

Rockstars also care about sustainability







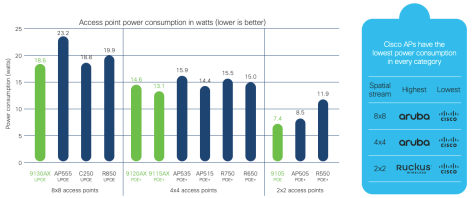


Different views of Energy consumption breakdown in office building

Calculate AP consumptions

If you want calculate AP energy savings, you need to consider four different tiers/modes of operations for the APs when it comes to energy consumption:

- AP is fully operational/full power
- AP in idle mode (no clients)
- AP on degraded power
- AP is off



Source: Miercom

AP Power Save Mode

MAX savings

Choosing an AP

Meraki MR57

	Transmitters	Receivers
2.4 GHz	4	4
5 GHz	4	4
6 GHz	4	4

- Dual 5G mGig Uplinks with failover
- PoE+ and UPoE+ compliant
- IoT Radio
- Monitor Radio

Catalyst 9136

	Transmitters	Receivers
2.4 GHz	4	4
5 GHz	4*	4*
	8	8
6 GHz	4	4

* Future SW

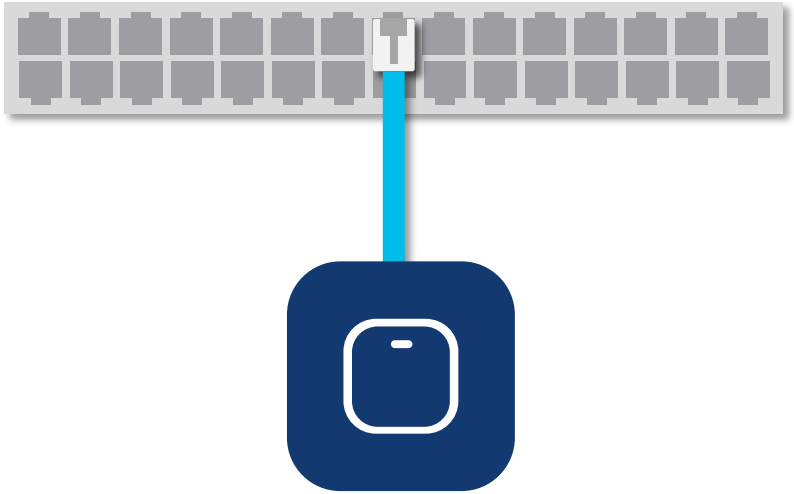
- Dual 5G mGig Uplinks with failover
- PoE+ and UPoE+ compliant
- IoT Radio
- Scanning Radio
- Environmental sensors

One Product – Two Management Modes

Cisco DNA **Management Mode**
C9800 & DNAC Stack

Meraki **Management Mode**
MR Dashboard Stack

AP to Switch connection



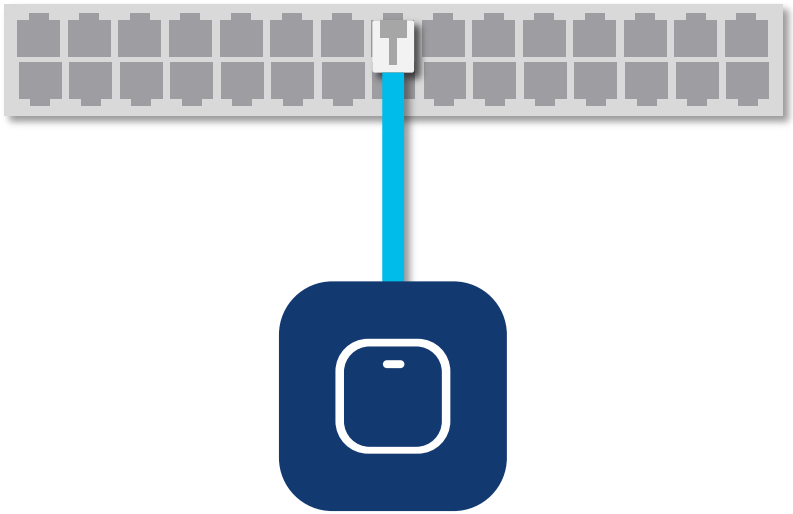
AP negotiates power, speed and duplex at boot time via CDP/LLDP

MGig switchport is recommended as Wi-Fi 6/6E speed may exceed 1 Gbps

Cabling: Cat 6/6A recommended. Cat 5e can support up to 5Gbps

CDP = Cisco Discovery Protocol
LLDP = Link Layer Discovery Protocol
Cat = Category (of ethernet cable)

AP Power Consumption



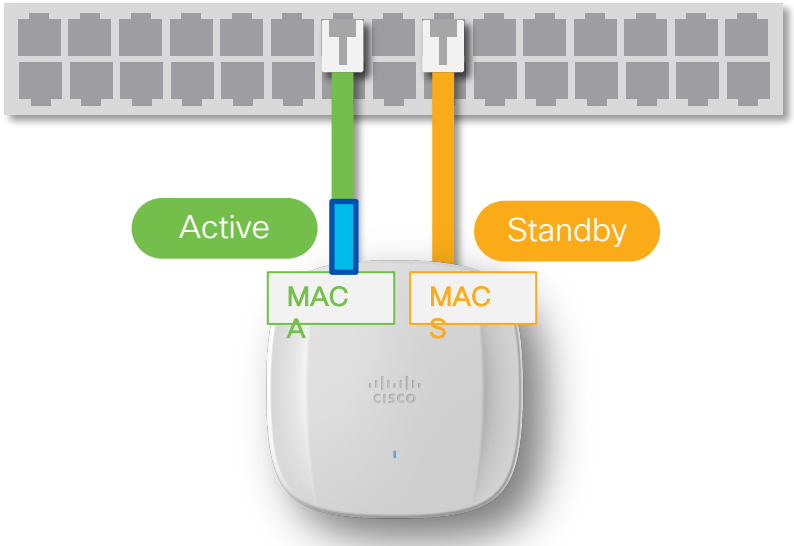
Power Allocated	Power Consumed
48.3 W	16.5 W

PoE Power Negotiation happens at boot time through CDP/LLDP

Power allocation is what you need to consider for power budget

Actual Power consumption is dependent on the AP operation

Catalyst AP C9136 to Switch connection

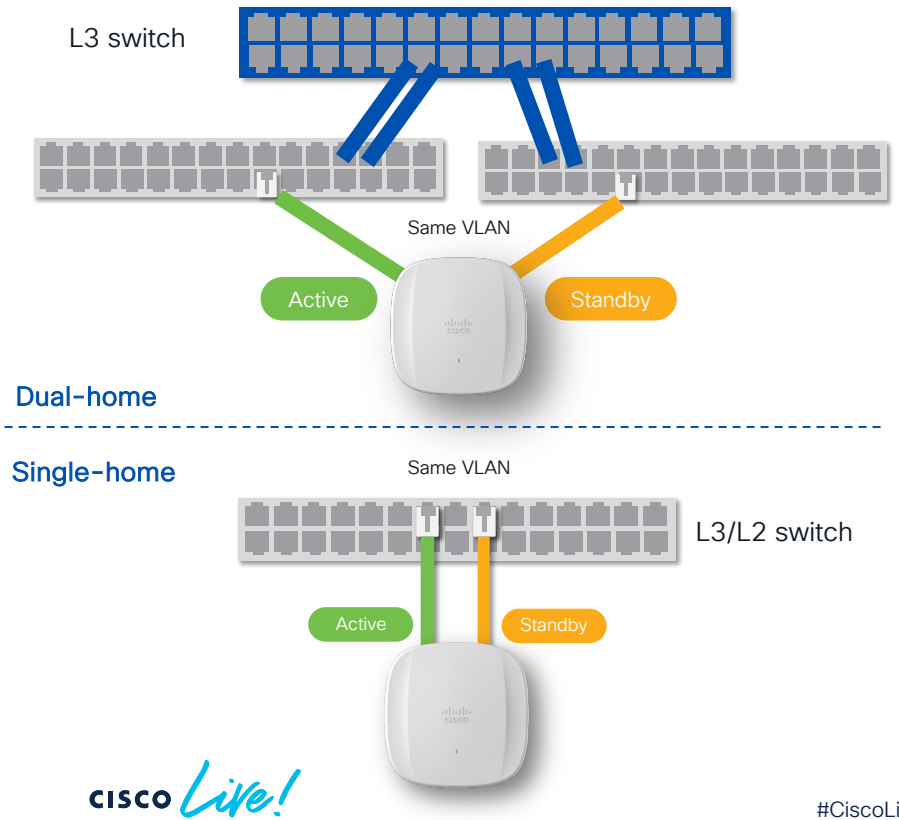


AP C9136

- When configured as standalone ports, one becomes active and the other one standby
  - If power is equal on both ports, Port 0 becomes active. Otherwise, the one with more power
- Traffic is exchanged on active port using active MAC A (CAPWAP, ARP, etc.)
- Standby port only exchanges CDP/LLDP messages with its own MAC S, no other traffic

MAC = Media Access Control
ARP = Address Resolution Protocol
CAPWAP = Control and Provisioning of Wireless Access Points

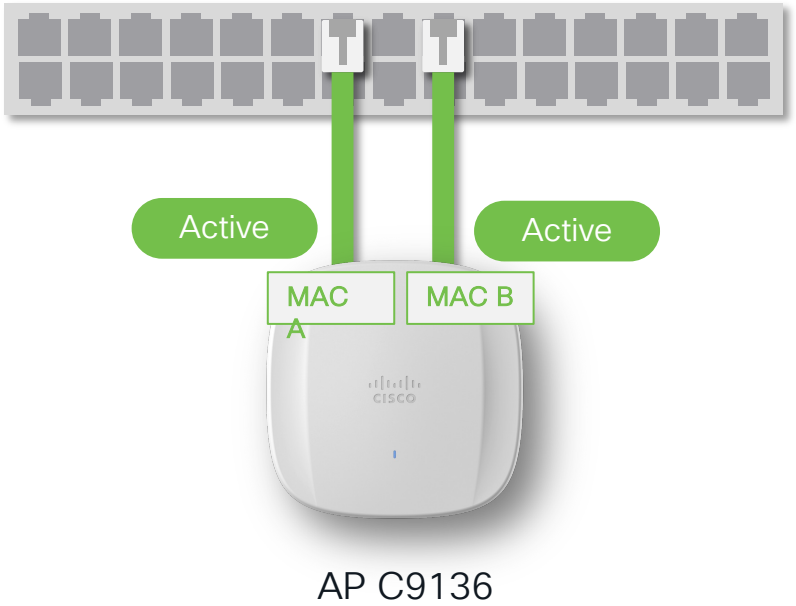
Catalyst AP C9136 to Switch connection



- When configured with standalone ports, you have two options…
- Dual-home to two different switches
  - Recommend to connect to switches in different IDF, whenever possible
- Single-home to one logical switch (Stack Wise, vPC, Multi-layer switch, etc.)
  - Recommend to connect to two different members of the stack or line-cards
- In both scenario, the switchports must be configured in the same VLAN

VLAN = Virtual Local Area Network
IDF = Intermediate Distribution Frame
vPC = virtual Port Channel

Catalyst AP C9136 to Switch connection

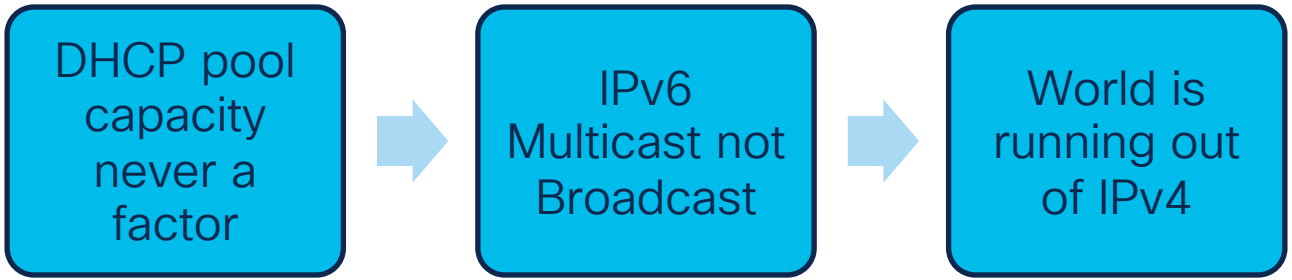


AP C9136

- When configured with LAG, both ports are Active
- LAG must be configured on both AP and switchport side.
- AP supports static LAG config (mode on) or dynamic with LACP
- Traffic is load balanced across the two links using src-dst-port algorithm. CAPWAP uses random source UDP ports
- LAG must be connected to one single (physical or logical) switch

LACP = Link Aggregation Control Protocol
src-dst-port = source-destination-port

IPV6



Rockstar

Check L2 and L3

IPv6 for Wireless Networks

My wireless network is ultimate generation, but guest experience is not.

What is the trick?

Be nice to your guests

Onboarding Guests

Title:
*First Name:
*Last Name:
Spouse/Partner First Name
Spouse/Partner Last Name
Company Name
*Street 1:
Street 2:
*City:
*State/Province:
*ZIP/Postal code:
*Country:
Phone Number:
*Email Address:

Payment Information

Credit Card Type:
*Credit Card Number:
*CVV Number: What is this?
*Expiration Date: 01 2011

Who is your guest?

Public Wi-Fi

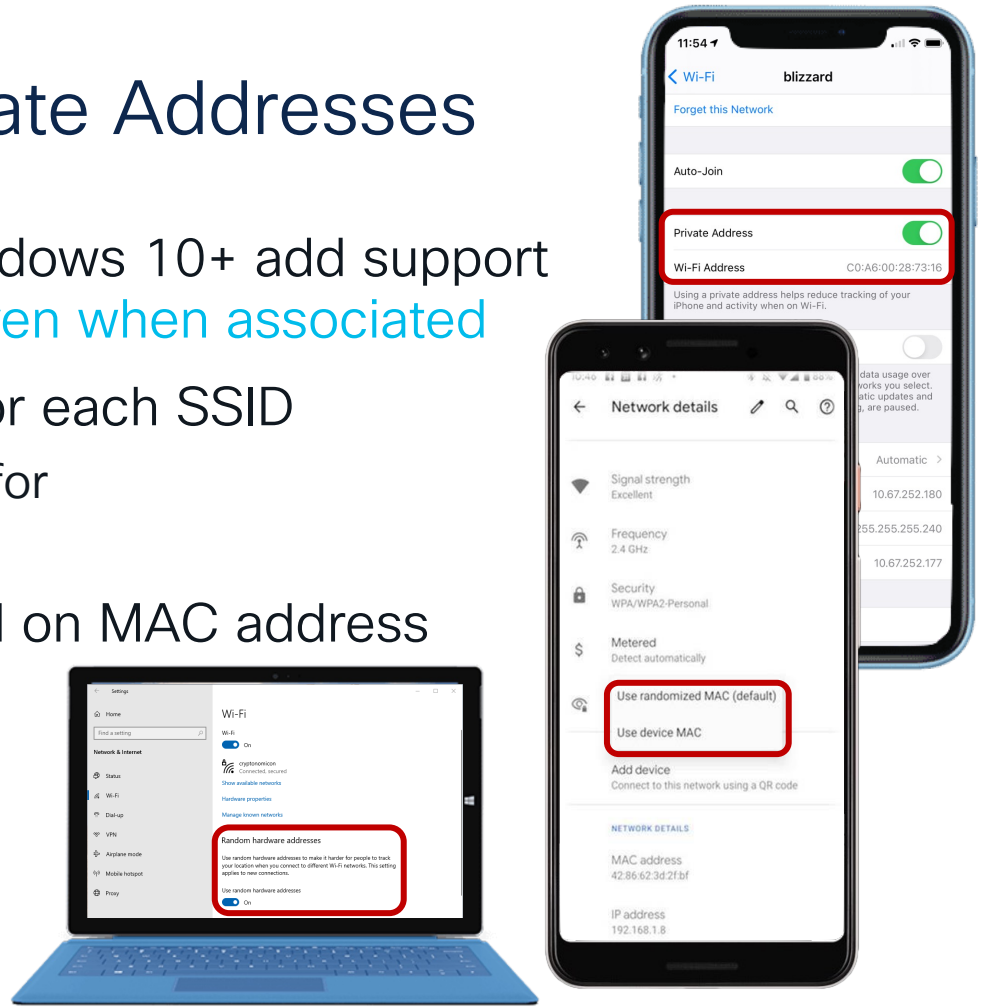
OpenRoaming

Guests in my venue

Sponsor portal

Random MAC and Private Addresses

- iOS 14+, Android 10+ and Windows 10+ add support for random MAC Addresses even when associated
- A random MAC is generated for each SSID
  - That MAC may remain constant for the saved profile
- This will impact services based on MAC address
  - MAC authentication bypass
  - Web authentication
  - Location analytics



How to authenticate

Access providers

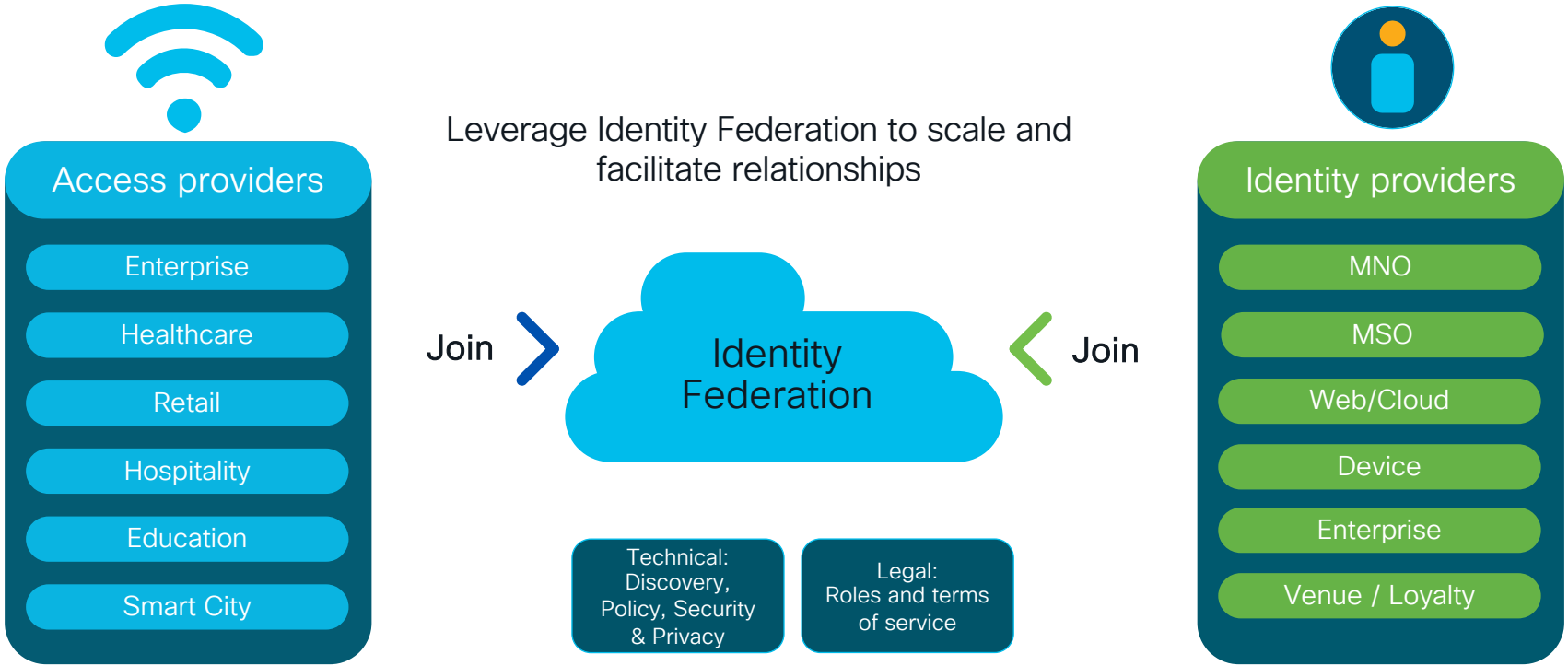
- Enterprise
- Healthcare
- Retail
- Hospitality
- Education
- Smart City

Identity providers

- MNO
- MSO
- Web/Cloud
- Device
- Enterprise
- Venue / Loyalty

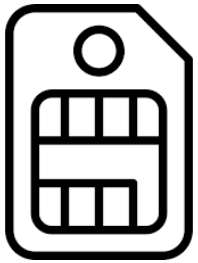
OpenRoaming Identity Federation

Opening the Wi-Fi Ecosystem to new experiences & business models



Which ID’s are available?

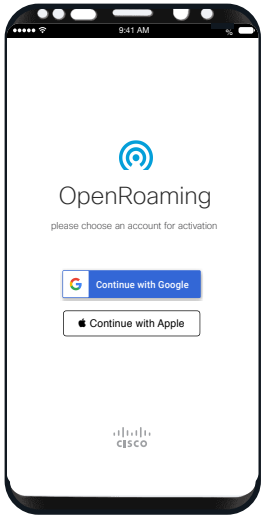
Service Provider



Enterprise

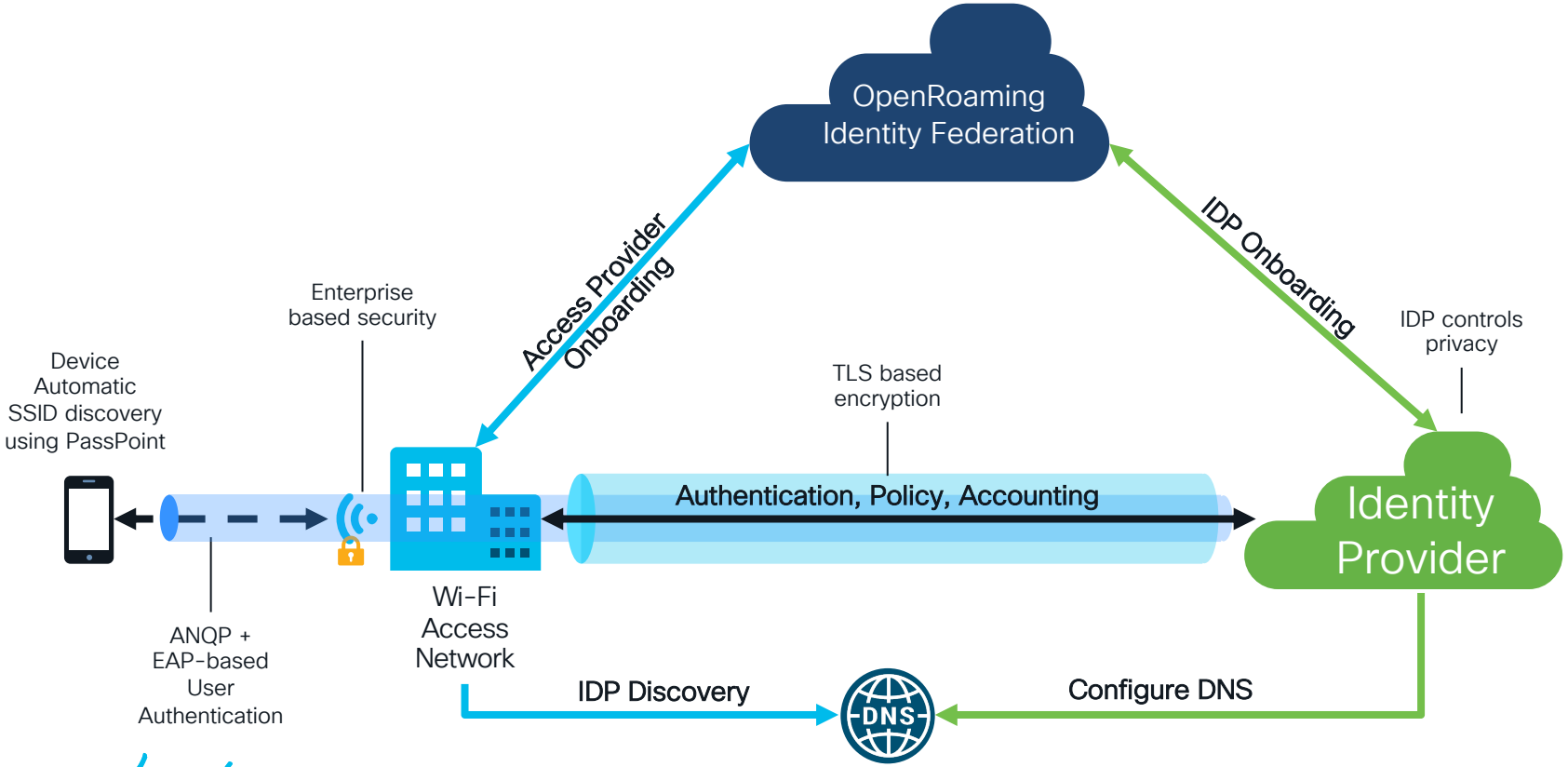
Device Embedded

Cloud ID

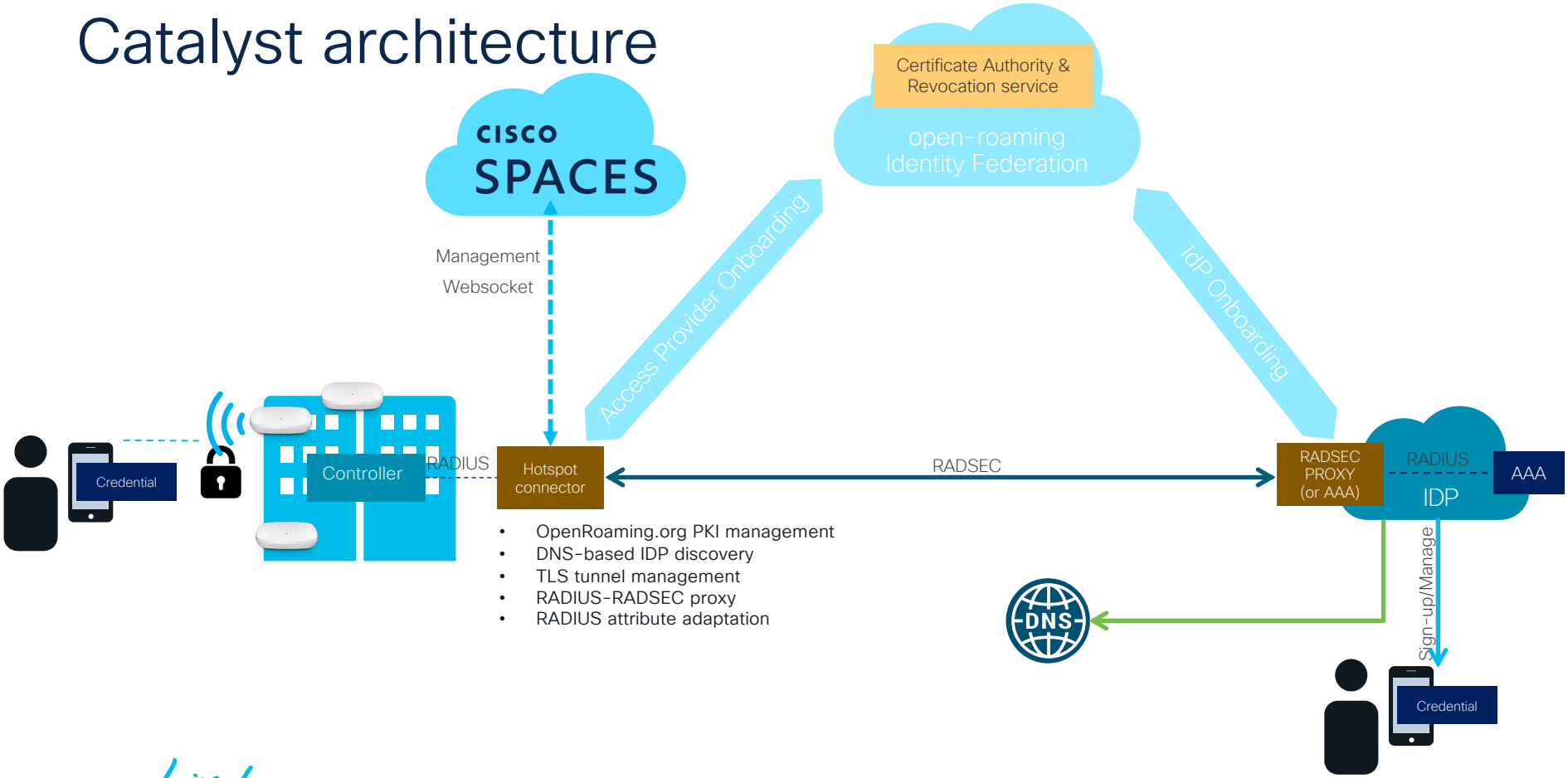


Loyalty

How it works

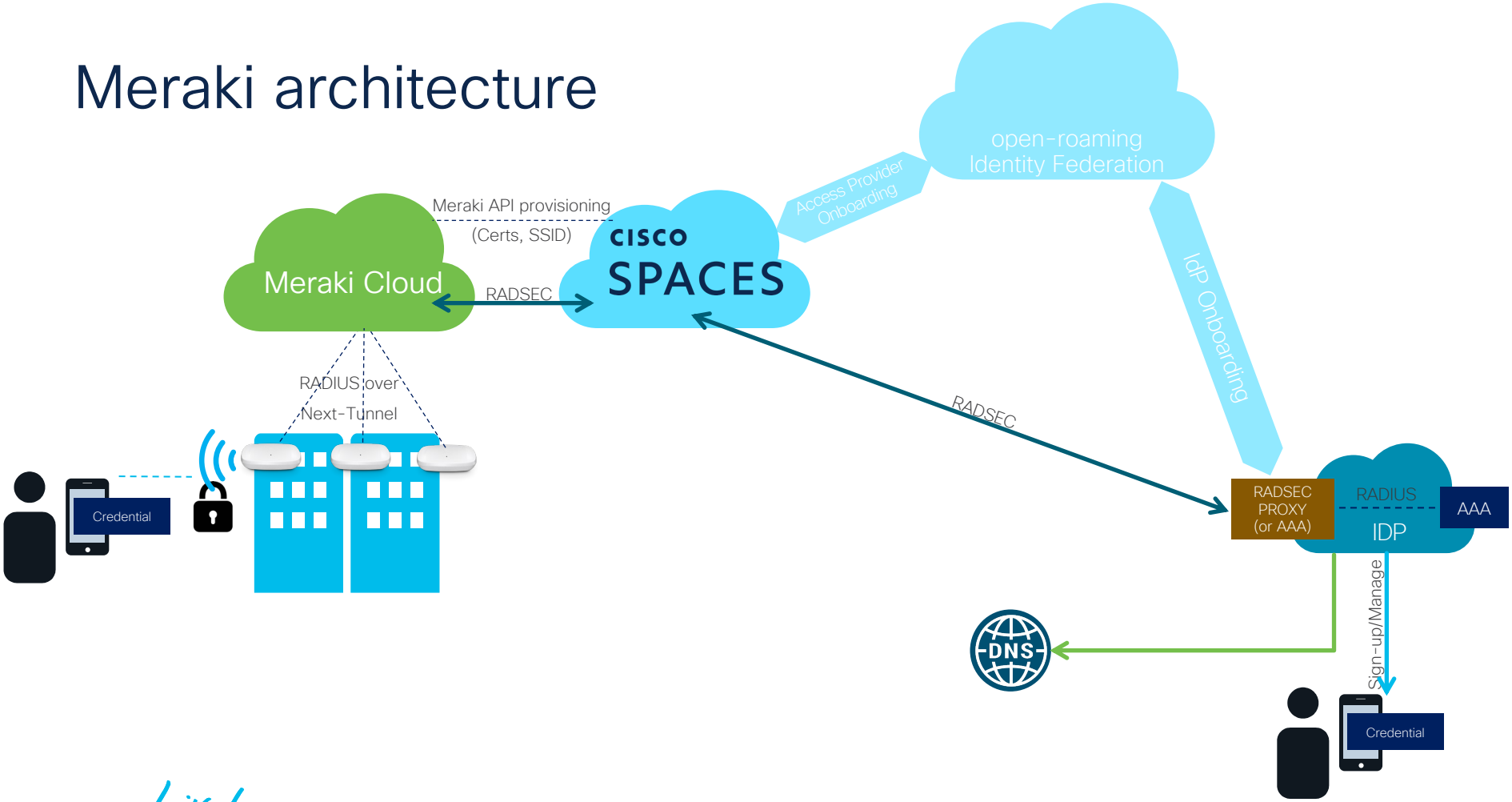


Catalyst architecture



- OpenRoaming.org PKI management
- DNS-based IDP discovery
- TLS tunnel management
- RADIUS-RADSEC proxy
- RADIUS attribute adaptation

Meraki architecture



Spaces SDK: IDP as a service

Initialization

- The app registers with the Cisco DNA Spaces account using the account API key.

User Identity Association

- User logs onto the app using either:
  - IDP supported by DNA Spaces Backend
  - Enterprise or Loyalty ID
- User sets their privacy preference

Install OpenRoaming Profile

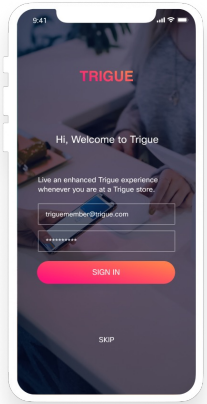
- The profile associated with the user identity is installed on their device
- Allows devices to automatically log into OpenRoaming networks

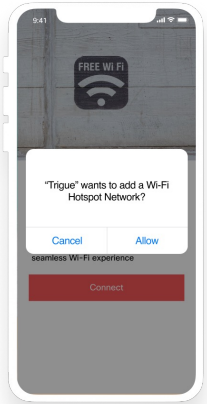
Enable Push Notifications

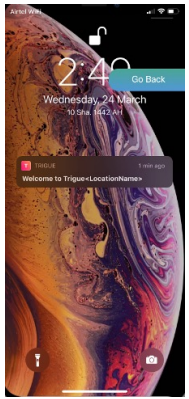
- Allows for DNA Spaces backend to send notifications to user devices

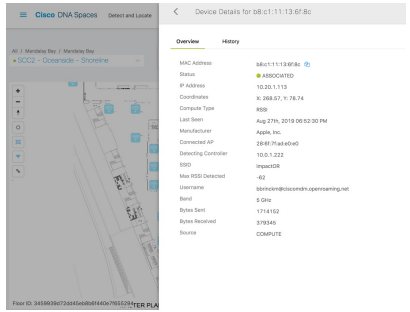
Location Information

- The app will report back the current location of the device back to DNA Spaces
- The location can be used for use cases like wayfinding or targeted engagements









B2B ISE Guest Solution Overview

1 million

# of supported Guest accounts

EMAIL PRINT SMS

Guest account notification options

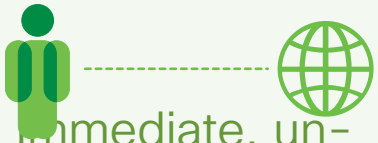
Portal language customization

Social Media Login support

API

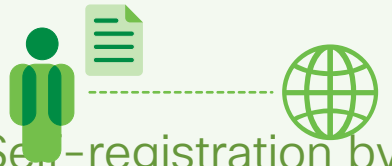
Manage guest accounts via REST

Hotspot



Immediate, un-credentialed Internet access

Self Registered



Self-registration by guests, Sponsors may approve access

Sponsored Guest Access

Authorized sponsors create account and share credentials

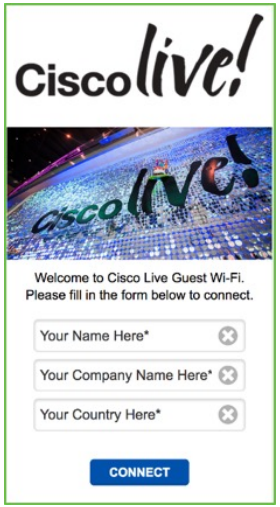
The 3 types of guest access

Wireless Broadband Alliance

OpenRoaming™ Wireless Broadband Alliance

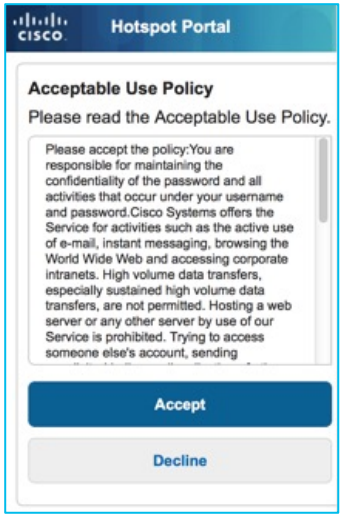
In few words

Cisco Spaces



- B2C
- Very easy/powerful to customize and assign hotspot portals based on sites.
- Ideal for passthrough with hotspot portals (or for one-time SMS/email codes).
- LWA with consent.

ISE



- B2B
- Most versatile solution.
- Ideal for both hotspot and sponsored/self-reg portals.
- It requires an additional learning curve.
- LWA or CWA.

Rockstar tip

- Do not treat all guests the same

- Public Wi-Fi networks can use openroaming
- Integrate apps with Wi-Fi

- Corporate guests
- Use Sponsor Portals to register and control access

How can I consider my network secure?

What is the trick?

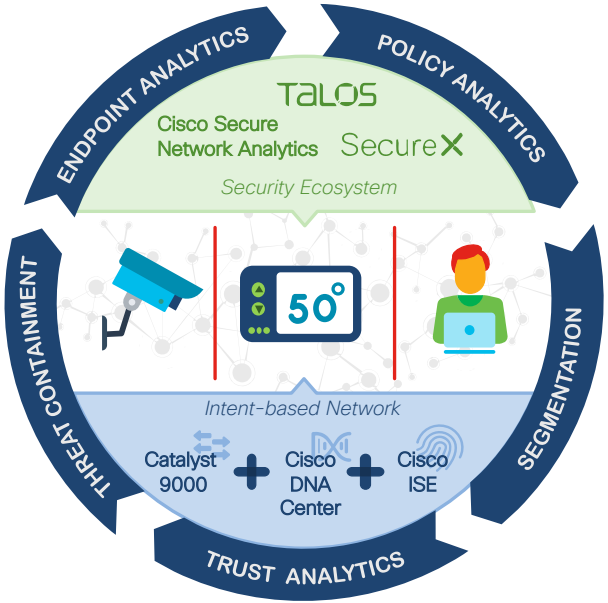
Call Security

Securing the Wireless Network

Secure the Air

Secure the Devices

Secure the Network

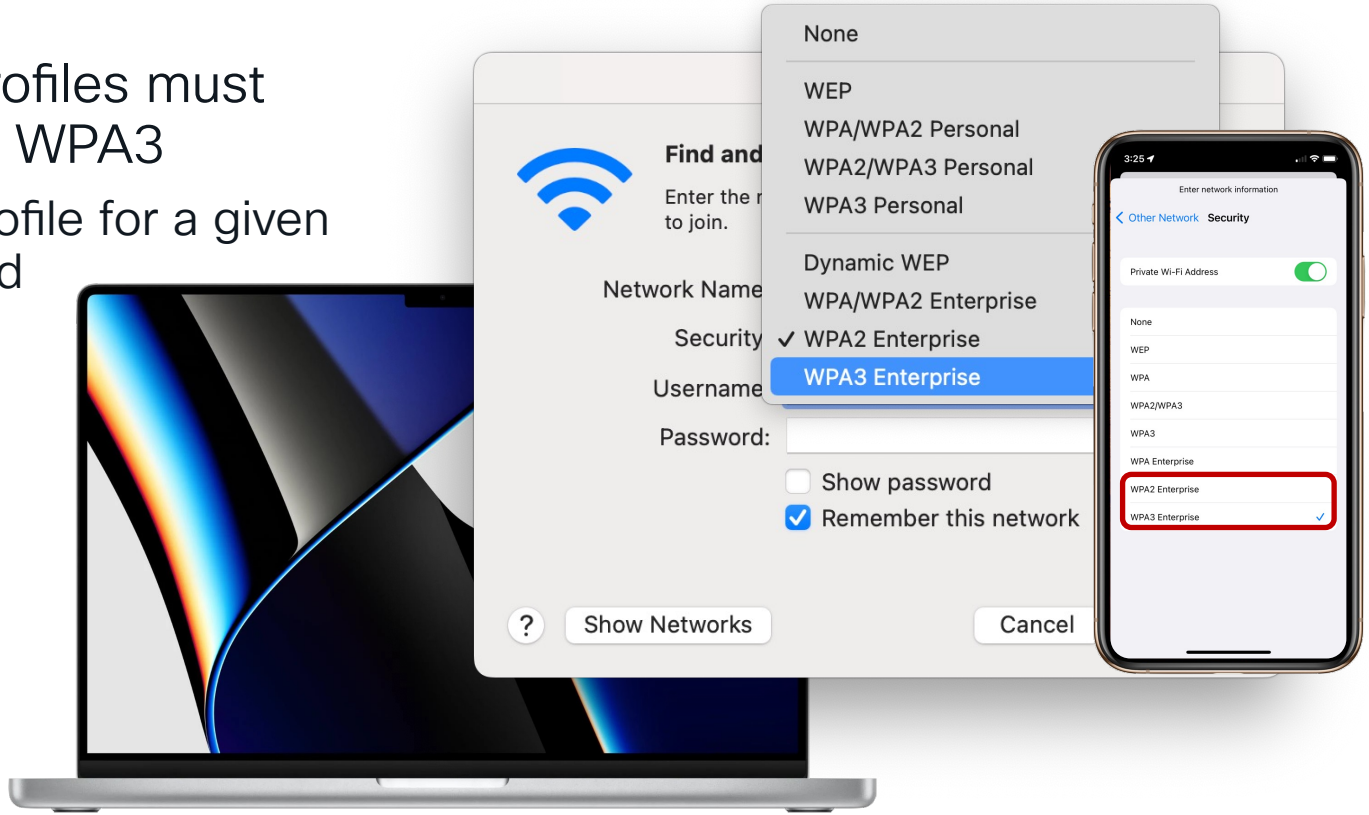


Wireless Protected Access

WPA	• A snapshot of the 802.11i Wireless Security Standard • Commonly used with TKIP encryption
WPA2	• Final version of 802.11i Wireless Security Standard • Commonly used with AES encryption
Authentication Mechanisms	• Personal (PSK – Pre-Shared Key) • Enterprise (802.1X/EAP)
WPA3	• Wi-Fi Alliance security update • Includes new capabilities and new certification requirements

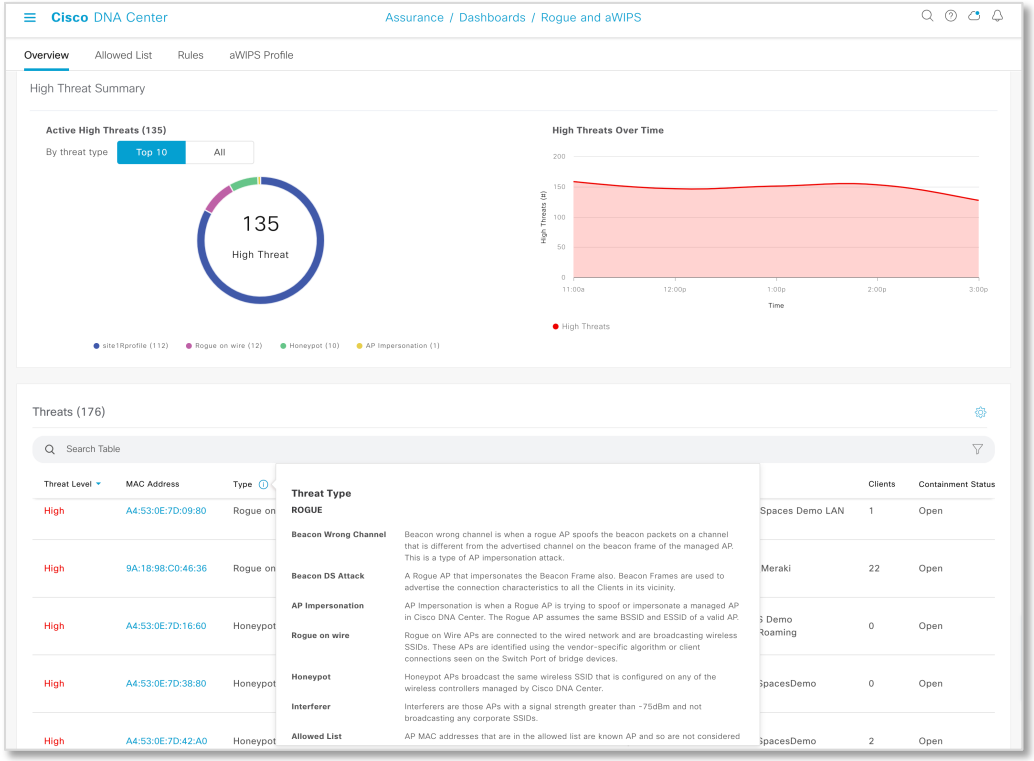
Wi-Fi 6E Security

- Client device profiles must select WPA2 or WPA3
  - And only one profile for a given SSID is permitted



Rogue Detection and Advanced WIPS

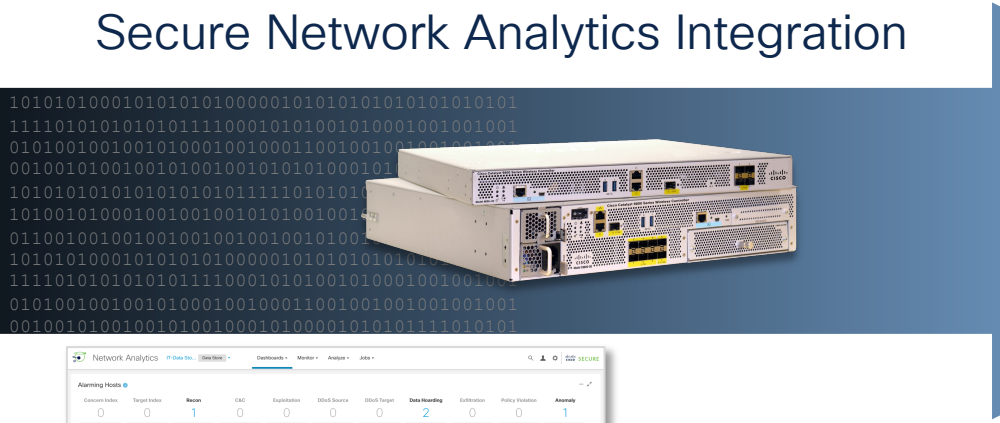
- Centralized wireless threat management
- Rogue detection
- Rogue location and mitigation
- Monitor and classify threats
- Event correlation
- Security compliance reporting



https://www.cisco.com/c/en/us/td/docs/cloud-systems-management/network-automation-and-management/dna-center-rogue-management-application/2-3-3/quick-start-guide/b_rogue_management_qsg_2_3_3.html

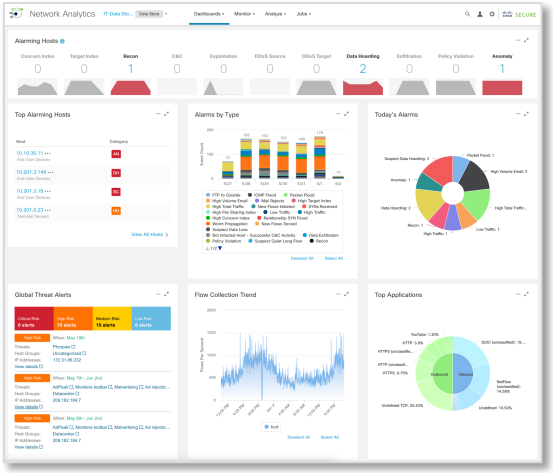
Network as a Sensor

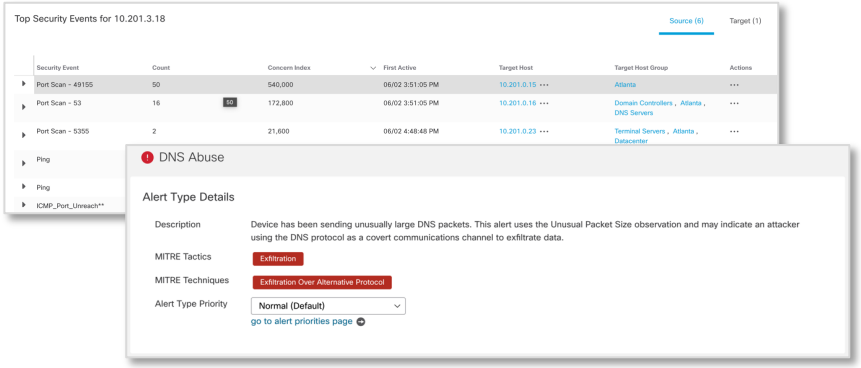
Secure Network Analytics Integration



Netflow

Malware detection and cryptographic compliance on Cisco Stealthwatch





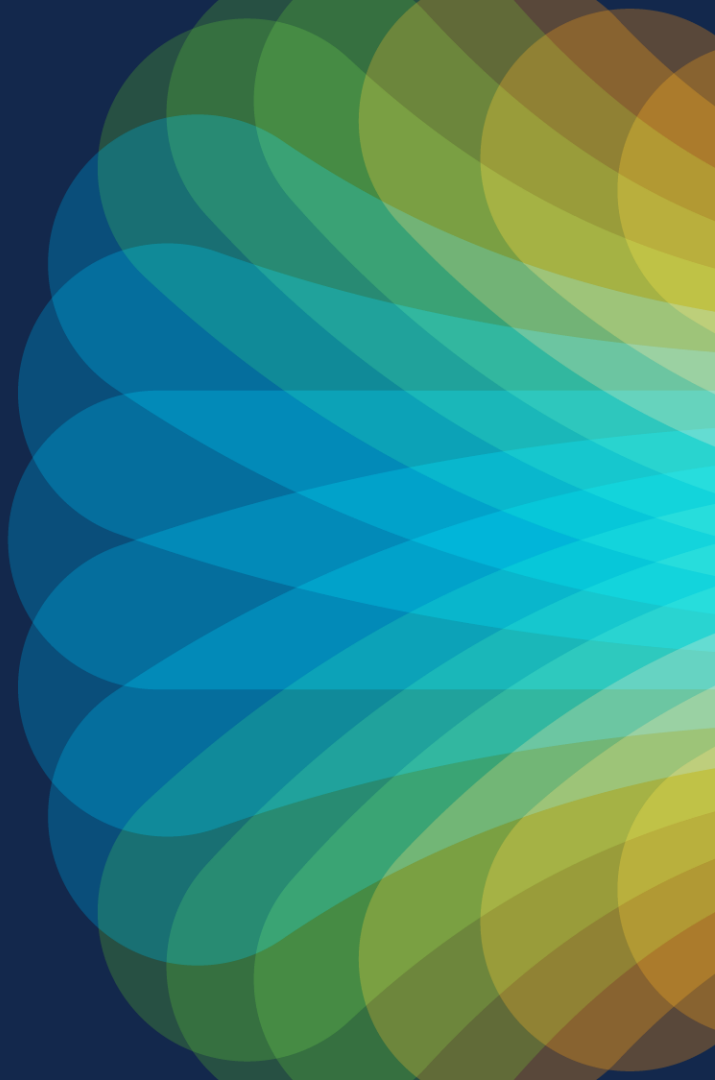
Rockstar

Secure the air, secure the network and the devices

Plan for WPA3

1 2 3 4 5 6 **7**

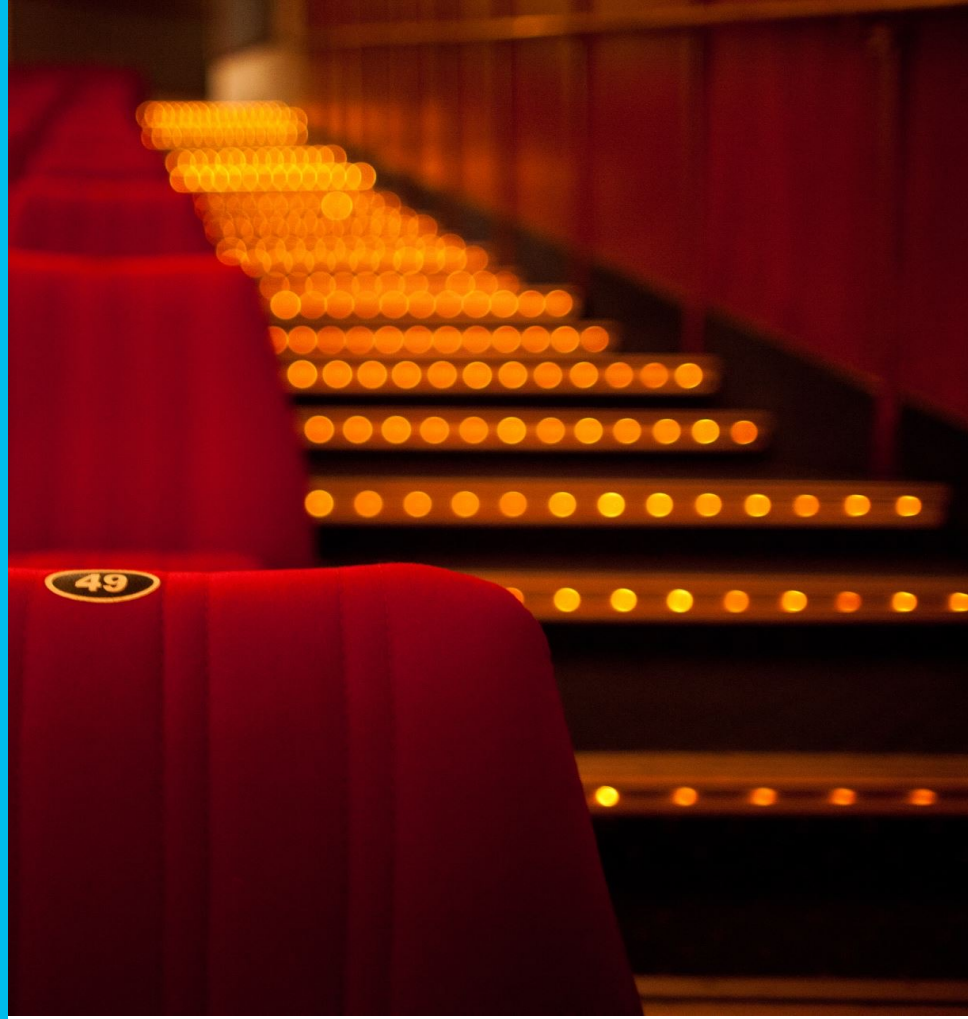
Make a collab with IOT



My RF is performing well, what about the rest of the network

What is the trick?

Featuring IOT



Importance of transforming buildings

Go Green

Remain competitive

Saves Money

HR attracts top Talent

Improve Productivity

Employees reaching their full potential

Many financial advantage of engaged employees

The Role of IT in Smart Buildings

Questions to start with a Smart Building Strategy:

- What kind of data will the system(s) generate?
- Who will control the data and manage the integration of that data across systems?
- Who will have access to the data?
- Who can benefit from access to the data? How can this benefit be shared across business units and/or departments?
- What standards will be supported for data and network integration?
- Who will have long-term responsibility for IoT within the enterprise, including the infrastructure, network security, and standards, while ensuring maximum business value?
- What will be the system of record – an enterprise resource planning (ERP) system or a building management system (BMS)?
- What KPIs will be tracked?

Data Journey

Users & Facilities

Visualize

Acquire

Collect the data
From the endpoints

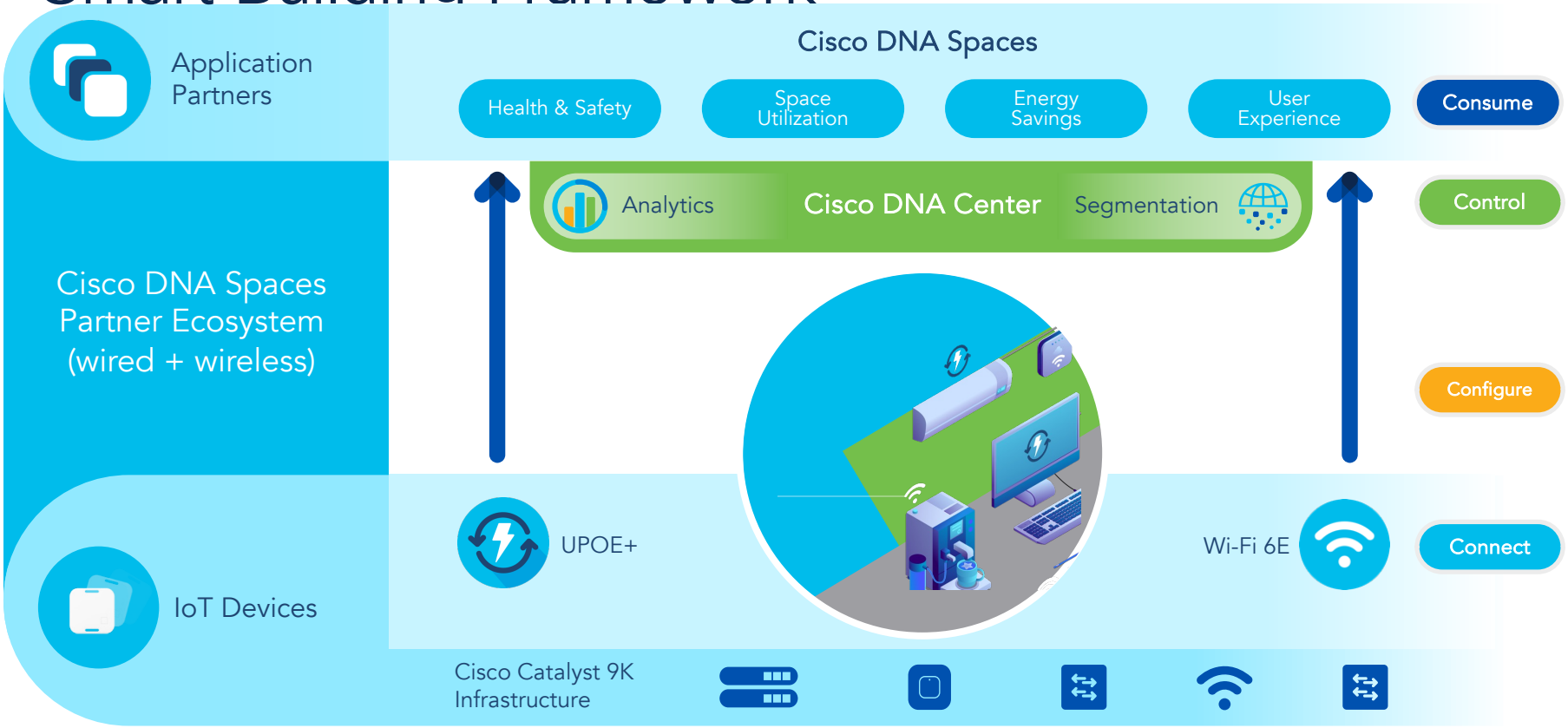
Consolidate

Normalize

Structure the data
To make meaningful

Export the data
so it can be used

Smart Building Framework



Rockstar

Wireless network is also IoT Radios

Leverage the same infrastructure

7 tricks to succeed as a wireless rockstar

1. Leverage the rules of PHYsics
2. Set a good stage for your waves
3. The remastered Sine wave
4. Always run a Sound check
5. Be nice to your guests
6. Call Security!
7. Featuring IOT

cisco Live!

Did you know?

You can have a
one-on-one session with
a technical expert!

Visit Meet the Expert in The HUB
to meet, greet, whiteboard & gain
insights about your unique questions
with the best of the best.

Meet the Expert Opening Hours:

Tuesday	**3:00pm – 7:00pm**
Wednesday	**11:15am – 7:00pm**
Thursday	**9:30am – 4:00pm**
Friday	**10:30am – 1:30pm**

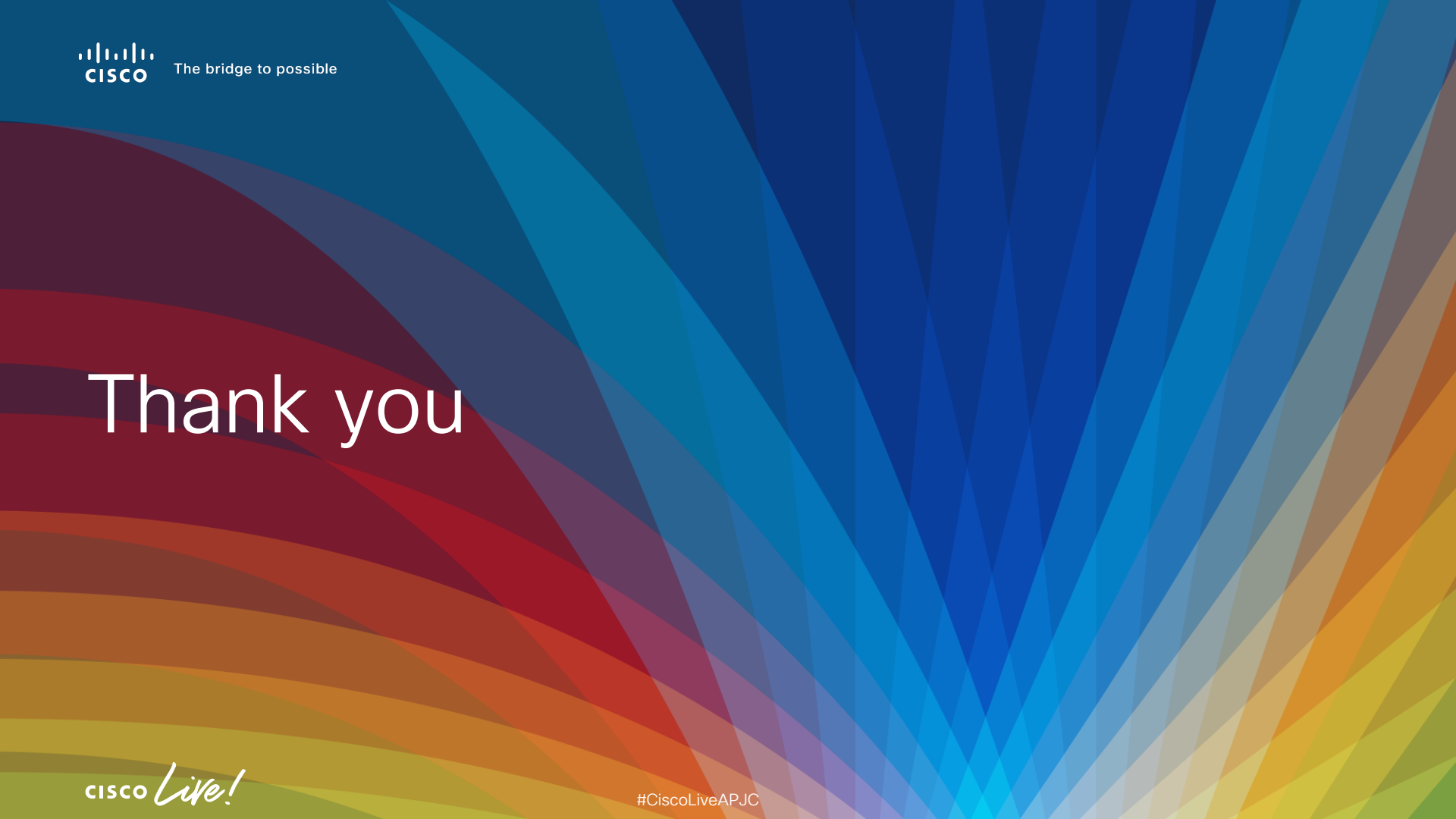
Session Surveys

We would love to know your feedback on this session!

- Complete a minimum of four session surveys and the overall event surveys to claim a Cisco Live T-Shirt.

Continue your education

- Visit the Cisco Showcase for related demos
- Book your one-on-one Meet the Expert meeting
- Attend the interactive education with DevNet, Capture the Flag, and Walk-in Labs
- Visit the On-Demand Library for more sessions at www.CiscoLive.com/on-demand


cisco
The bridge to possible
Thank you
cisco Live!
#CiscoLiveAPJC

cisco Live!

Let's go

#CiscoLiveAPJC