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You make possible

Next Generation Wireless

Sarath Gorthi
Technical Marketing Engineer, EN

BRKEWN-2010

cisco Live!
Barcelona | January 27–31, 2020

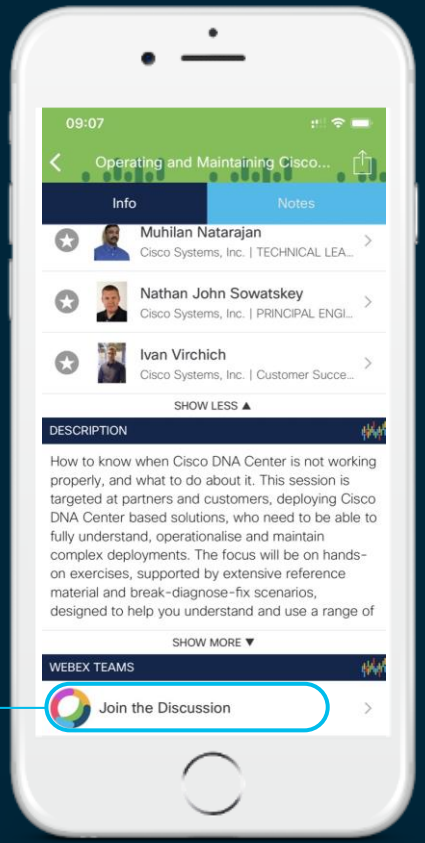
Cisco Webex Teams

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



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It’s Time to Think Differently about Mobility

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Agenda

- Next Generation Wireless Stack
- Wi-Fi 6 and Cisco Catalyst 9100 Access Points — BRKEWN-2017
- Cisco Catalyst 9800 Controller and IOS-XE — BRKEWN-2670
- Cisco DNA Center
  - Assurance — BRKEWN-2034
  - Automation — BRKEWN-2026
- Cisco DNA Spaces and CMX — BRKEWN-2012
- Campus of the Future

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Next Generation Wireless Stack

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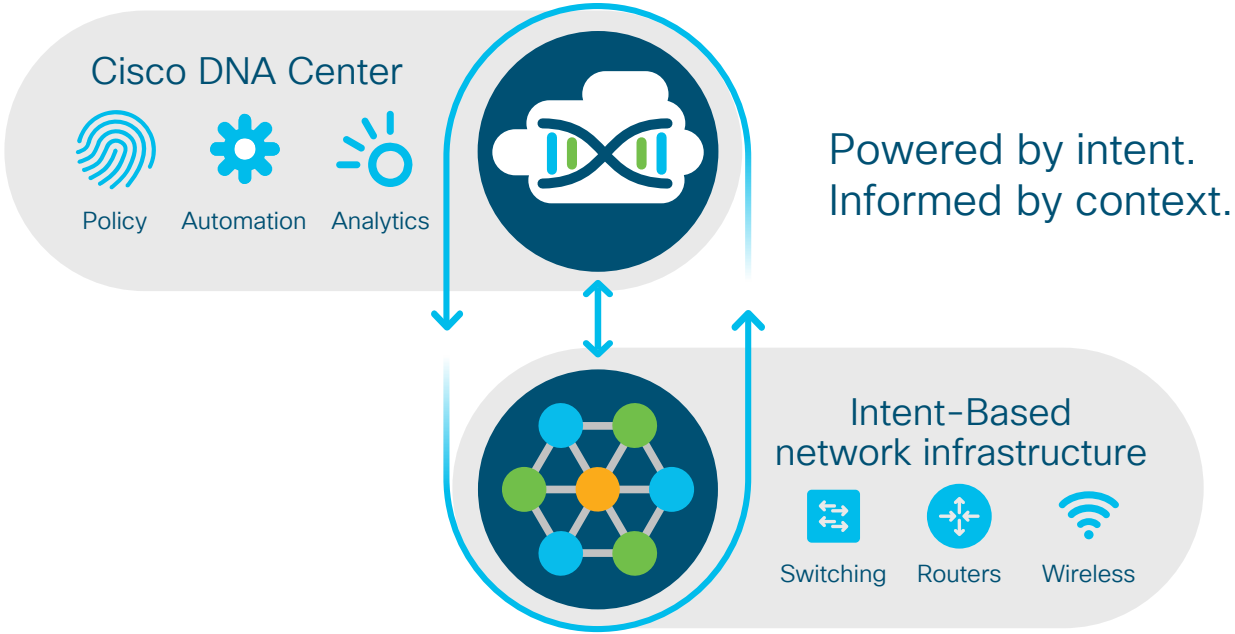
It’s Time to Think Differently about Mobility

Immersive Experiences	Mobility for IoT	Technology Transitions
Basic Data Connectivity	Industrial IoT	Cellular | Wi-Fi
Streaming Video 4K / 8K AR / VR / LBS	Autonomous Vehicles & Machines Physical Access / Medical Equipment Vending Machines / Sensors	Seamless 5G + Wi-Fi 6
Superior HD connectivity and user experience	Classification and rapid threat containment	Beyond Wi-Fi, drive digital business forward

It’s Time to Think Differently about Networking

Intent-Based Networking



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Cisco Next Generation Wireless Stack

Catalyst 9100
Access Points

Catalyst 9800
Wireless Controllers

Cisco DNA
Assurance &
Automation

Cisco
DNA
Spaces

Cisco DNA
Spaces

Resilient, Secure, Intelligent

An Introduction to Wi-Fi 6 and Cisco Catalyst 9100 Access Points

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6 for 6

Increased Speed

Higher Density & Capacity

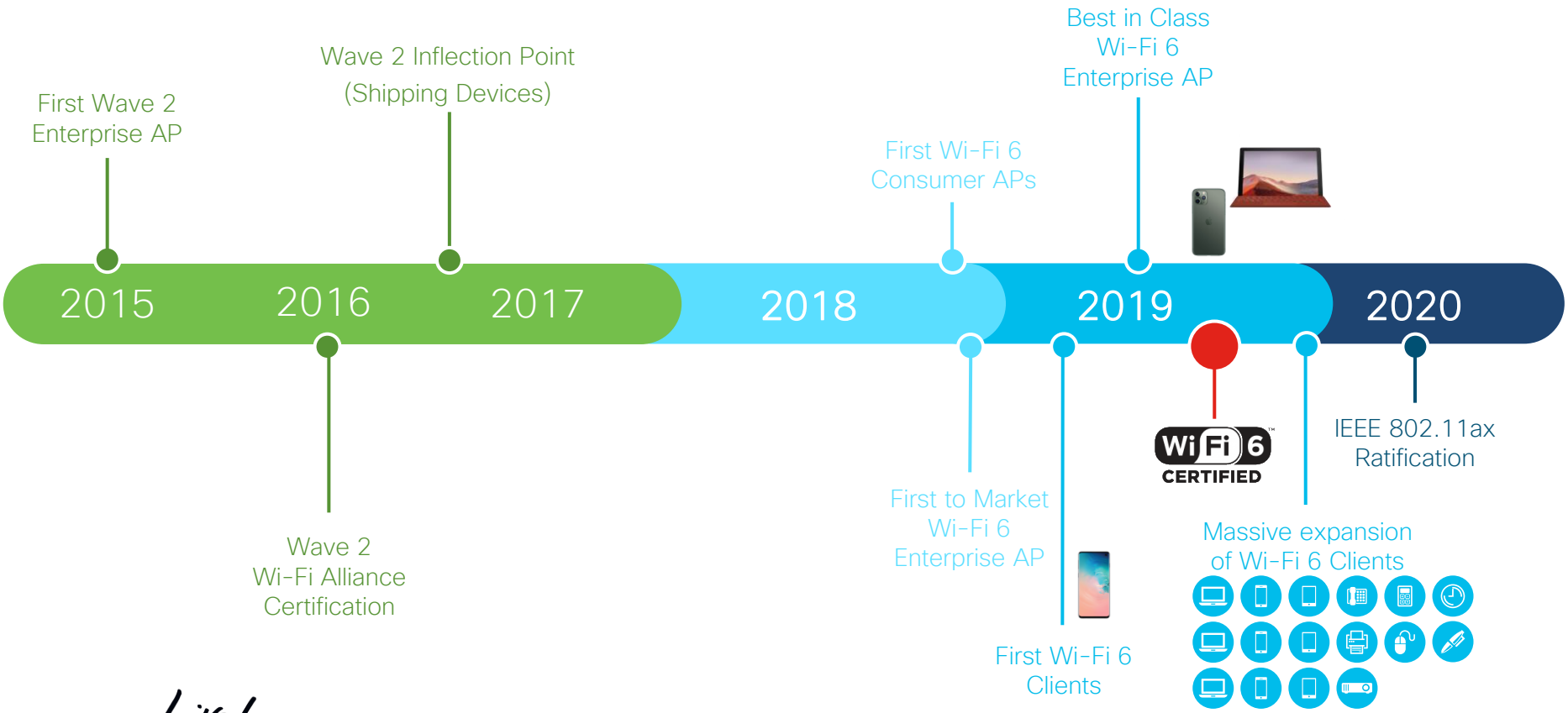
Improved Security

Reduced Latency

Greater Range

Power Efficient

Wi-Fi Evolution



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Cisco is Making Wi-Fi 6 Even Better

Innovation Beyond the Standard

Spectrum Intelligence
Interference and
Rogue Detection

AI/ML Assurance
RF Analytics
Location Analytics

Built for IoT & Security

Multilingual Radio

RF Snapshot

IoT Segmentation

Wireless Ecosystem

Device
Interoperability

Google and
Facebook
Wi-Fi

OpenRoaming

Powered by **Next Generation Cisco** Catalyst Wireless Access

New Cisco Catalyst 9100 Series access points

Ideal for small to medium-sized deployments

Mission critical and scale deployment

9115AX

- 4x4 + 4x4
- MU-MIMO, OFDMA
- Spectrum Intelligence
- 1 x 2.5 mGig
- TWT

9117AX

- 8x8 + 4x4
- MU-MIMO, OFDMA (only DL)
- Spectrum intelligence
- 1 x 5 mGig
- TWT
- Integrated Antenna only

Powered by Cisco RF ASIC

9120AX

- 4x4 + 4x4
- Cisco RF ASIC for Next Gen CleanAir
- Dual 5GHz, Next Gen HDX
- RF signature capture
- IoT ready (Zigbee)
- Application Hosting
- 1 x 2.5 mGig
- TWT

Powered by Cisco RF ASIC

9130AX

- 8x8 + 4x4; 4x4 + 4x4 + 4x4
- Tri-radio: Dual 5GHz + 2.4GHz
- Cisco RF ASIC for Next gen CleanAir
- Full iCap with data packets
- Dual 5GHz, Next Gen HDX
- RF signature capture, TWT
- Smart Antennas supporting up to 8x8
- IoT ready (Zigbee)
- Application Hosting
- 1 x 5 mGig
- First 8x8 AP with external antennas

Cisco DNA Assurance with iCAP | Bluetooth 5 | USB | Integrated or external antenna SKUs

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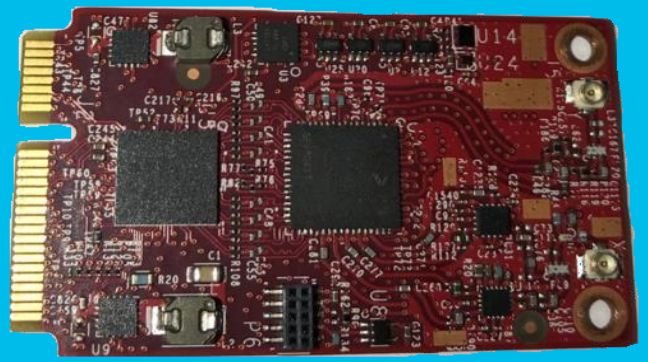
Cisco Catalyst 9120 Powered by Cisco RF ASIC

Cisco RF ASIC



RF Signature Capture, Spectrum Intelligence

Clean Air, Off-channel RRM, FRA

Dual Filter DFS, Zero-Wait DFS

Fast Locate w/o performance impact

WIPS/WIDS/Rogue Detection

Optimised Roaming for mobile devices

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Cisco Catalyst 9800 Controller and IOS-XE

Next Generation Wireless Architecture

Catalyst 9800
Next Generation Wireless Controller

ENCS

KVM vmware ESXi

Google Cloud Platform aws

Built for Intent-based Networking | Powered by IOS XE | Deploy Anywhere

The Most Deployed Controller

RF excellence | Device ecosystem | Wireless assurance

A Modern Modular OS

High Availability | Programmability | Scale

Bringing together network leadership with RF Innovation

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Flexible Deployment Options

Catalyst 9800
Embedded Wireless*
100 APs, 2K Clients

Catalyst 9800
Embedded Wireless**
200 APs, 4K Clients

Catalyst 9800-L
250 APs, 5K Clients,
5 Gbps

Catalyst 9800-40
2000 Aps, 32K Clients,
40 Gbps

Catalyst 9800-CL
1000 APs, 10K Clients

Catalyst 9800-80
6000 APs, 64K clients
80 Gbps

Catalyst 9800-CL
1000, 3000 or 6000 APs
10K, 32K or 64K Clients

*Supports Local Switching only
**SD-Access only
^Catalyst 9800 for Public cloud FlexConnect only

Up to 100 APs | Up to 250 APs | Up to 1000 APs | Up to 3000 APs | Up to 6000 APs

Distributed Branch & Small Campus | Medium Campus | Large Campus

Cisco Catalyst 9800-80

Up to 6,000 APs	Up to 64,000 Clients	80 Gbps

SP/RP Port
Fiber RP Port

USB
3.0

Console
Port

Redundant
Hot-Swappable
Power Supply

8x 10GE
Uplinks

Modular Uplinks
GE, 10GE, 40GE, **100GE**

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Cisco Catalyst 9800-40

Up to 2,000 APs	Up to 32,000 Clients	40 Gbps

Console Port

USB 3.0

SP/RP Ports

Fiber RP Port

4x 1GE/10GE Ports

Redundant Hot-Swappable Power Supply

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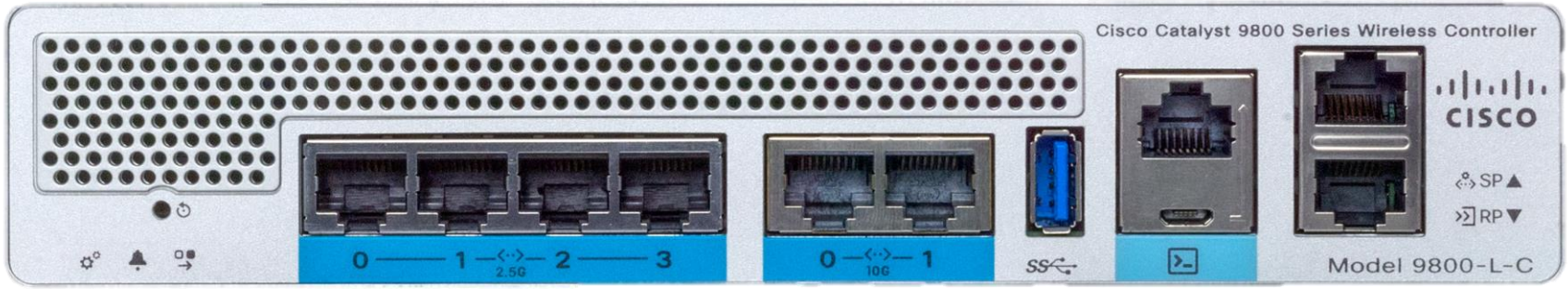
Cisco Catalyst 9800-L

Up to 250 APs	Up to 5,000 Clients	5 Gbps



4x 1GE/2.5GE mGig Ports

10 GE mGig Ports

USB 3.0

Console Port

SP/RP Ports

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Cisco Catalyst 9800-CL

Catalyst 9800 for Private Cloud

Scale to 6,000 APs and 64,000 Clients^

Centralised, FlexConnect, SDA Fabric

Open and Programmable

Catalyst 9800 for Public Cloud

Scale to 1,000 APs and 10,000 Clients

FlexConnect Local Switching

Open and Programmable

^Centralized support for 6000 APs in Future

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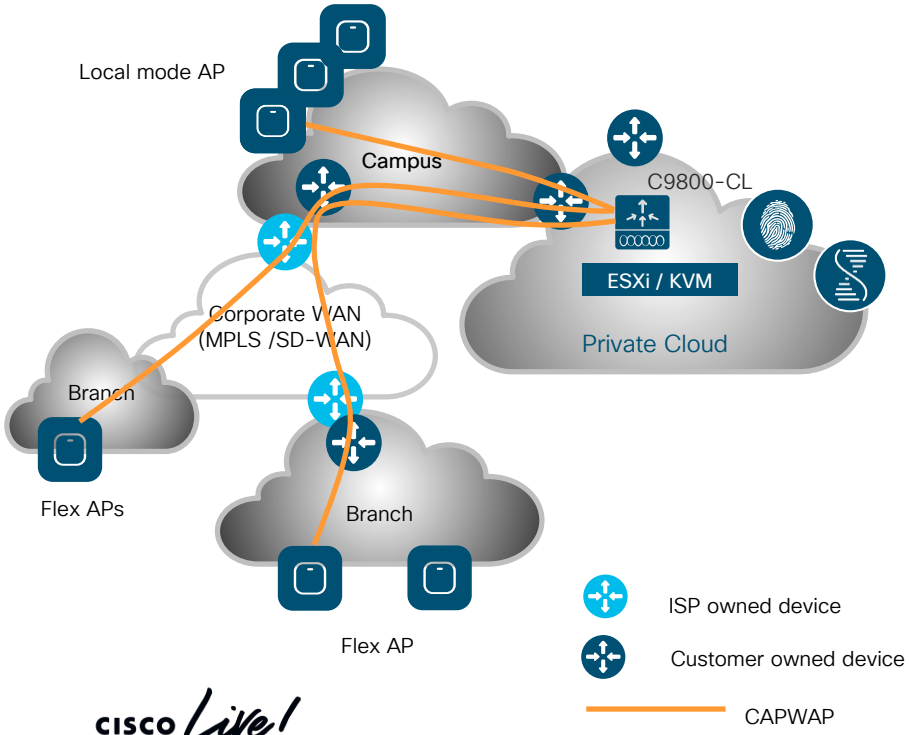
Catalyst 9800 Private Cloud Deployment

Wireless Infrastructure Virtualisation



- VMware ESXi , KVM and ENCS
  - ESXi vCenter or KVM Virt-Mgr for VM provisioning
  - Automated VM bootstrap flow (ESXi vCenter only)
- Support all AP modes and deployment models
  - Design for centrally switched traffic < 2.5 Gbps

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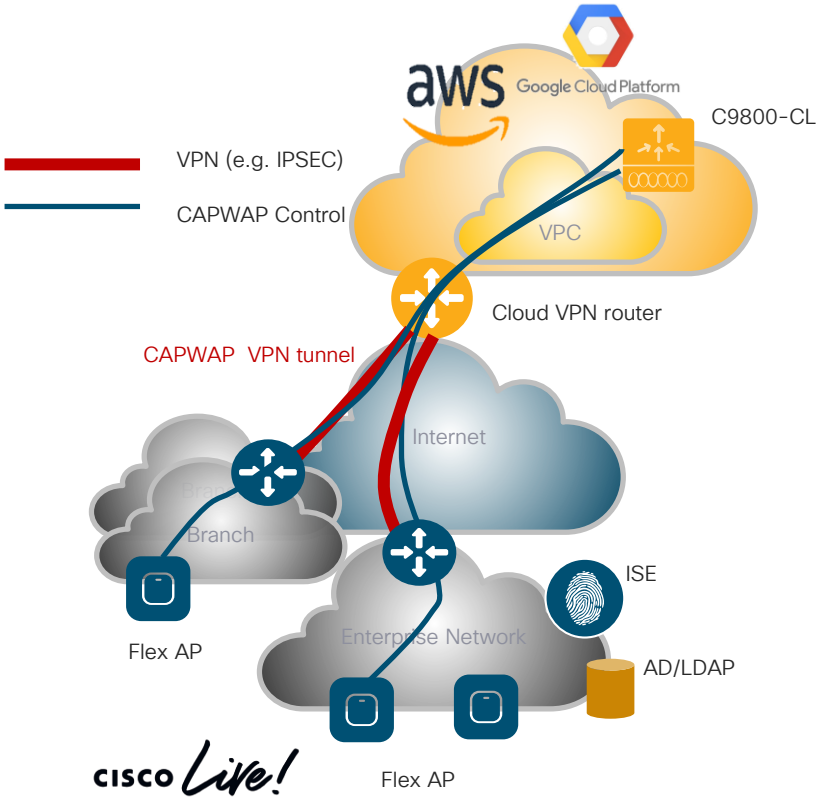
Catalyst 9800-CL Public Cloud Deployment

Wireless Infrastructure as a Service



- VM provisioned via AWS and GCP web console
  - AWS CloudFormation template to ease the initial setup
- Supports N+1 HA
- Flex central authentication and local switching
  - ISE and AD typically on-premise
- VPN recommended
  - Reduces risk of publicly exposed network infrastructure

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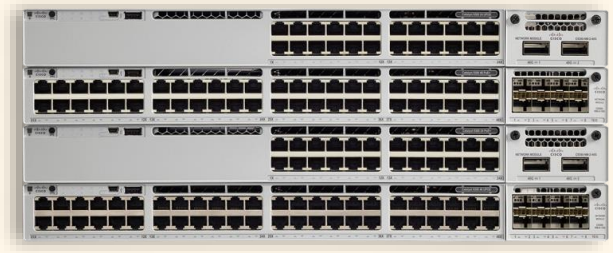
Cisco Catalyst 9800 Embedded Wireless



Catalyst 9800 for Catalyst Switch

Scale to 200 APs and 4,000 Clients

SDA Fabric

Supported on Catalyst 9300, 9400 and 9500 Series switches

new

Catalyst 9800 for Catalyst Access Point

Scale to 100 APs and 2000 Clients^

FlexConnect Local Switching

Support on Catalyst 9100 Series access points

^50 Aps and 1000 Client on 9115/9117

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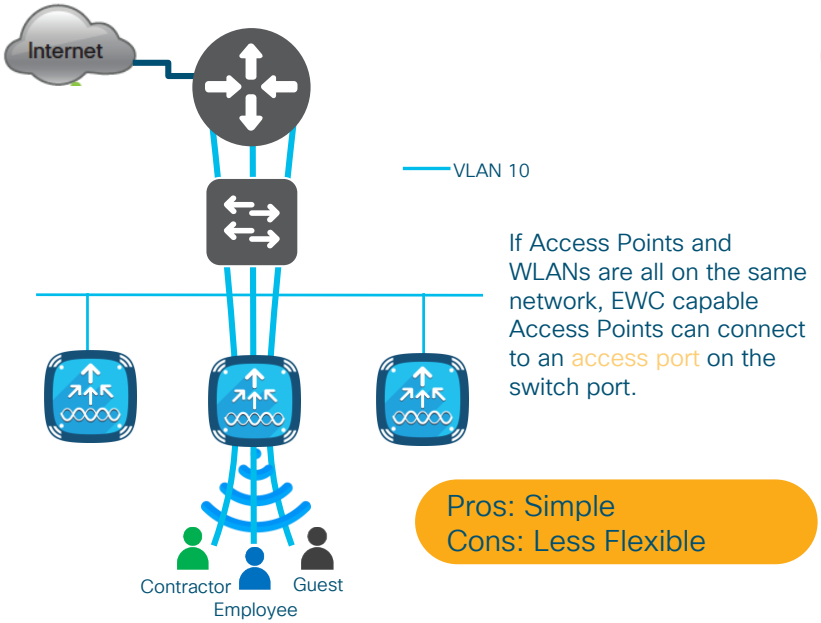
Deploying Cisco Embedded Wireless Controller

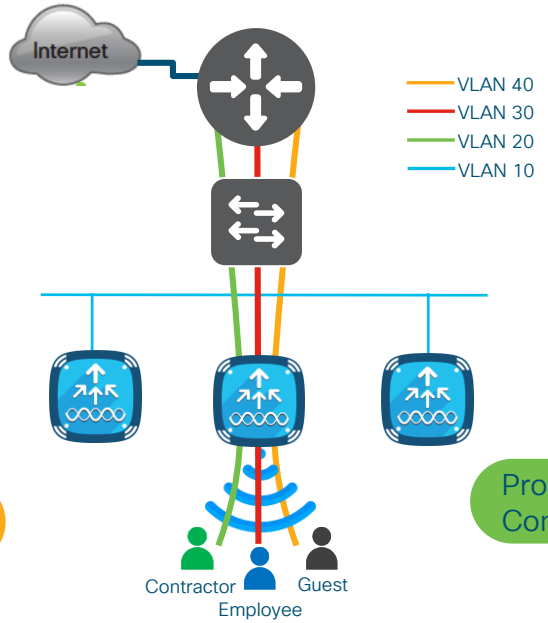
Embedded Wireless Controller for Catalyst 9100 Series

- EWC capable Access Points can be connected to an access port or a trunk port on the switch depending on the deployment method
  - Management traffic is always untagged



If Access Points and WLANs are all on the same network, EWC capable Access Points can connect to an access port on the switch port.

Pros: Simple
Cons: Less Flexible



If Access Points and WLANs are all on different VLANs, EWC capable Access Points will connect to a trunk port on the switch and traffic for individual WLANs will be switched locally.

Pros: Flexible, Secure
Cons: More configuration

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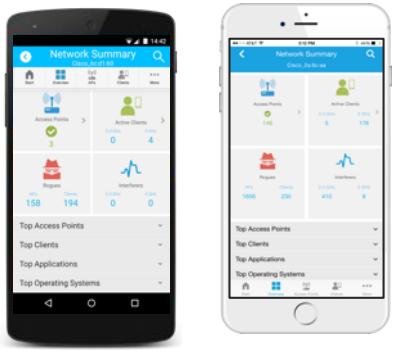
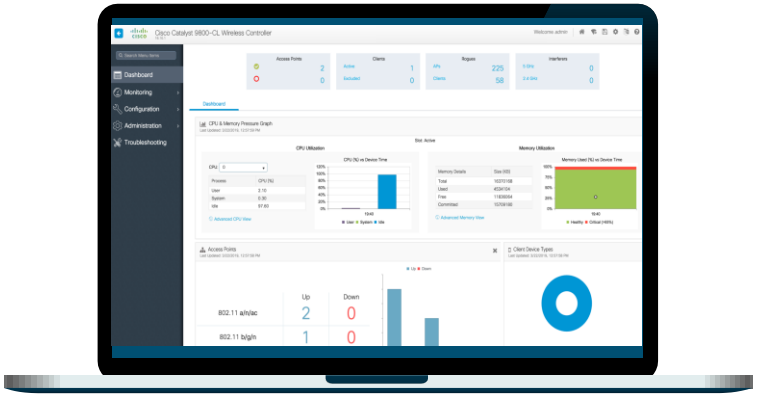
Over-The-Air Provisioning

Embedded Wireless Controller for Catalyst 9100 Series





Cisco Wireless Mobile App

WebUI

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Embedded wireless controller ready for mid-market & enterprise branch deployments

Resilient

Redundancy with active and standby controllers on two AP's & serving clients at the same time

<10 seconds

Active to standby switchover in a few seconds

SMU (patching) support for both controller and access point

Secure

aWIPS,* rogue detection, identification, and **mitigation**

Walled garden and DNS blocking

Cisco Umbrella

Cloud-delivered enterprise security with Cisco Umbrella™*

Intelligent, with IT simplicity

Simplified WebUI for monitoring, provisioning, and day-N operations

Cisco DNA Center Plug and Play (PnP), Automation, and Assurance

Open standards-based programmability with NETCONF and YANG

*Cisco IOS XE 17.1.

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Embedded Wireless Controller on Catalyst 9100 Access Points

Ideal for single or multisite small to medium-sized enterprise deployments

C9115AX-EWC-x

- **50 access point,1000 clients**
- 4x4 + 4x4
- MU-MIMO, OFDMA
- Spectrum intelligence
- Bluetooth 5
- 1 x 2.5 mGig
- USB
- Integrated or external antenna

C9117AX-EWC-x

- **50 access point, 1000 clients**
- 8x8 + 4x4
- MU-MIMO, OFDMA (only DL)
- Spectrum intelligence
- Bluetooth 5
- 1 x 5 multigigabit
- USB
- Integrated antenna only

Mission critical

Best suited for high density enterprise branch deployments

Powered by Cisco® RF ASIC

C9120AX-EWC-x

- **100 access point, 2000 clients**
- 4x4 + 4x4
- MU-MIMO, OFDMA
- Cisco RF ASIC
- Dual 5GHz, HDX
- RF signature capture
- 1 x 2.5 multigigabit
- Integrated or external antenna

Best in class

Best suited for high density enterprise branch deployments

Powered by Cisco RF ASIC

C9130AX-EWC-x

- **100 access point, 2000 clients**
- 8x8 + 4x4 or 4x4 + 4x4 + 4x4
- Tri-radio (Dual 5GHz + 2.4GHz), HDX
- Cisco RF ASIC
- RF signature capture
- Decrypted data packet ICAP
- 1 x 5 multigigabit
- 8 port smart antennas

Software feature parity across APs | Supports up to 100 APs, 2000 clients | Supports Wave 2 APs as client serving | Cisco DNA Assurance with ICAP

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What about 802.11ac Wave 2 access points?

All Wave2 Access Points supported in client serving mode

Ideal for small to medium-sized deployments

Mission critical

Indoor

1815w

1815i, 1815m

1832

1842

1852

2802

3802

4800

Outdoor

1540

1560

ALL 802.11ac Wave 2 access points can connect to the embedded wireless controller

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Embedded Wireless Controller – Flexible management options

WebUI or mobile app

Mobile app for iOS and Android devices

Use app to deploy, monitor, and **manage**

Feature rich, yet simple

Wizard-driven provisioning flows

Cisco DNA Center

Policy

Automation

Analytics

Standards-based interoperability

CI/CD tools

SDN controllers

Network management systems

Embedded wireless controller

Intent-based network infrastructure

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Day-0 provisioning – What's new?

- All APs join to EWC-AP in day 0
- Single "CiscoAirprovision-<ABCD>" PSK SSID
- **mywifi.cisco.com** URL for accessing EWC-AP WebUI
- Mobile app provisioning
- No need for static management IP
- No reboot of EWC-AP after day-0 configuration

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Catalyst 9800 High Availability

Unplanned Events
Device and network interruptions

- ✓ Stateful Switch Over with an active standby
- ✓ N+1 redundancy for always-on network, services and clients

Infrastructure Updates
Software maintenance & AP updates

- ✓ Seamless software updates for wireless controllers and APs
- ✓ AP device pack and flexible per-site updates contain impact area

Software Image Upgrades
Wireless controller image upgrades

- ✓ N+1 rolling AP upgrades ensure seamless client connectivity
- ✓ Radio resource management automates group creation

Contain impact within release
Fixes for defects and security issues without need to requalify a new release

Faster resolution to critical issues
Provide fixes to critical issues found in network devices that are time-sensitive

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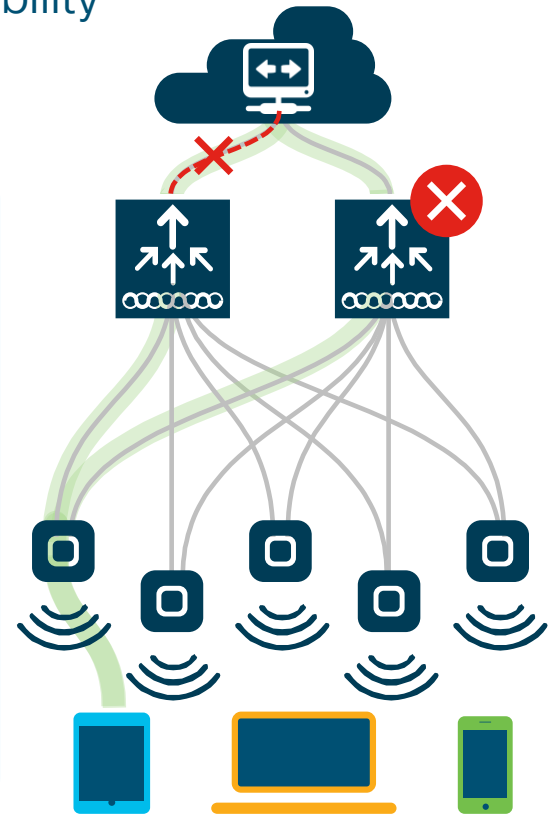
Unplanned Events

Catalyst 9800 High Availability

Always on Network
APs continue to stay associated

Always on Services
Uninterrupted voice, video and data services

Always on Clients
Users and end-points continue to stay connected



How it Works

- ✓ Upstream device and network interruptions trigger a switchover to maintain end-point connectivity
- ✓ Hot standby controller takes over in case of failure of an active controller
- ✓ Seamless connectivity with Stateful Switchover (SSO) for end-points

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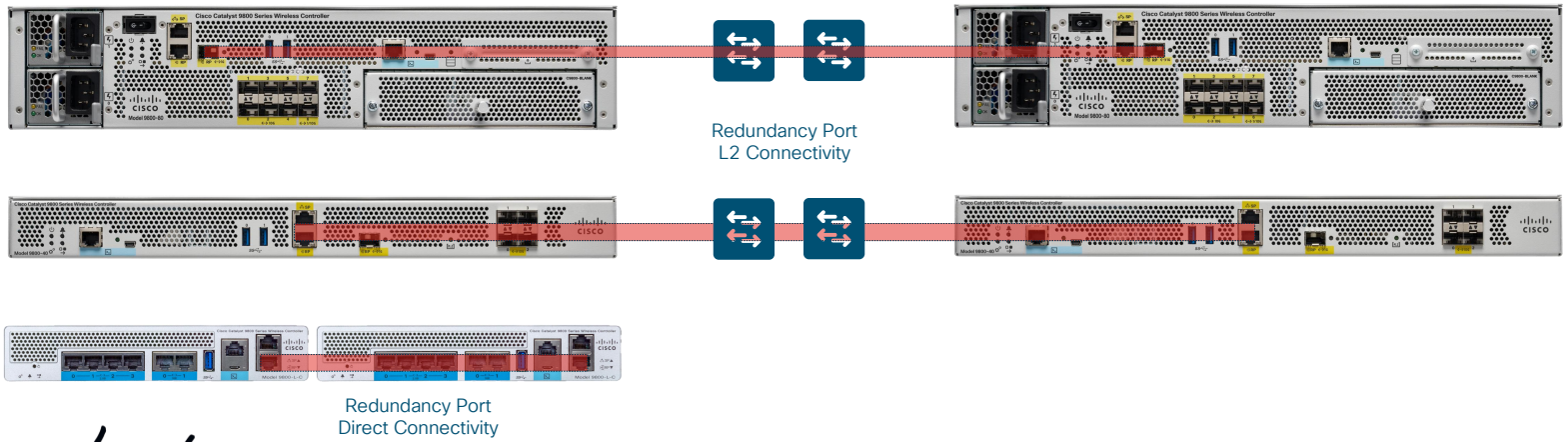
High Availability

Catalyst 9800 Physical Appliance

- A direct physical connection between Active and Standby Redundant Ports or Layer 2 connectivity is required to provide stateful redundancy within or across datacenters
- Sub-second failover with no SSID outtage



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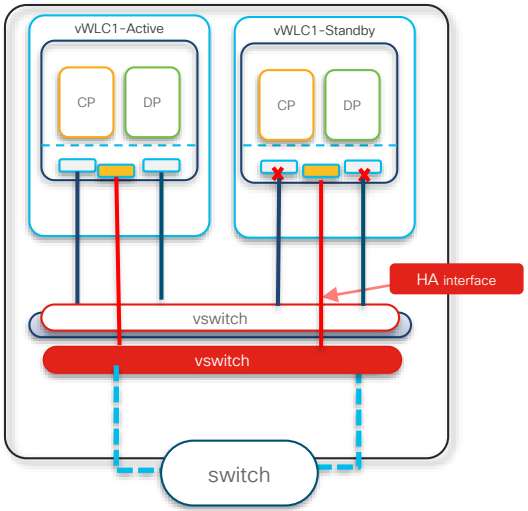
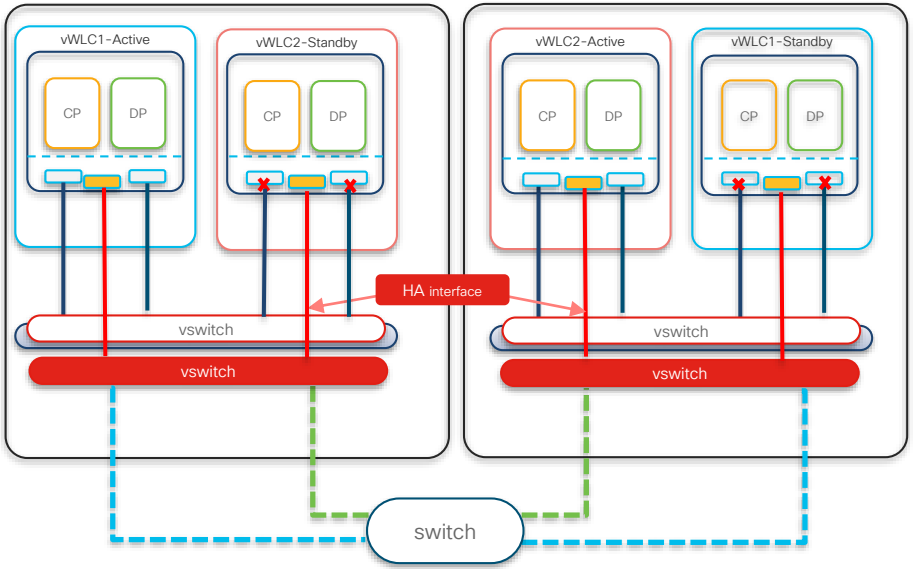
High Availability
Catalyst 9800 Virtual Appliance



Redundancy Port
Direct Connectivity



Redundancy Port
L2 Connectivity

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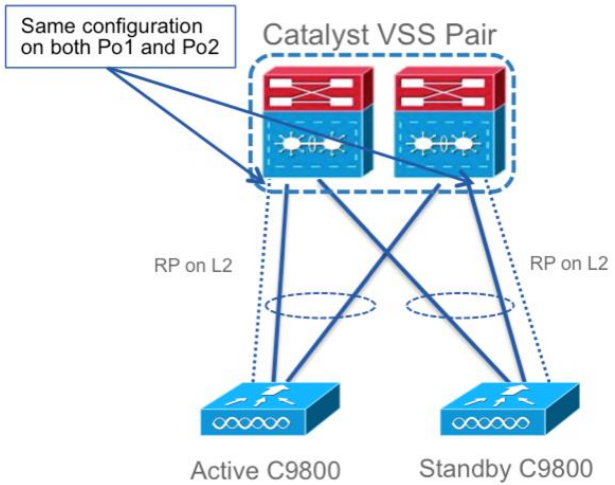
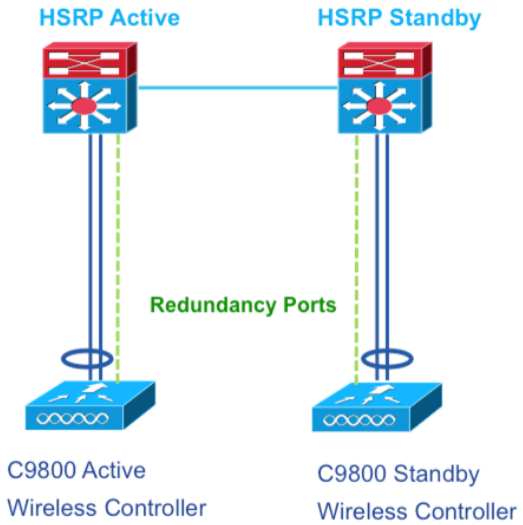
High Availability
Campus and Branch Network Design

Virtual Switching System



Hot Standby Routing Protocol



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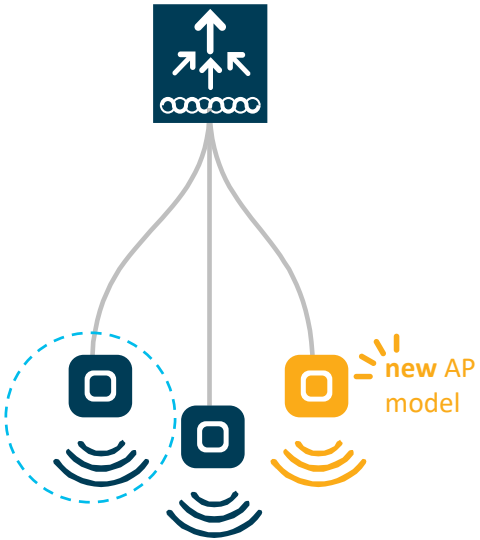
Infrastructure Updates

Catalyst 9800 High Availability

- Software Maintenance Updates (SMU)
  - Hot patch controllers without client downtime
  - Cold patch controllers with N+1 Hitless Rolling AP Update
- AP Service Pack (APSP)
  - Service updates for specific Access Point models without impacting other models
- AP Device Pack (APDP)
  - Introduce new AP models in your network without any downtime and without impacting other APs



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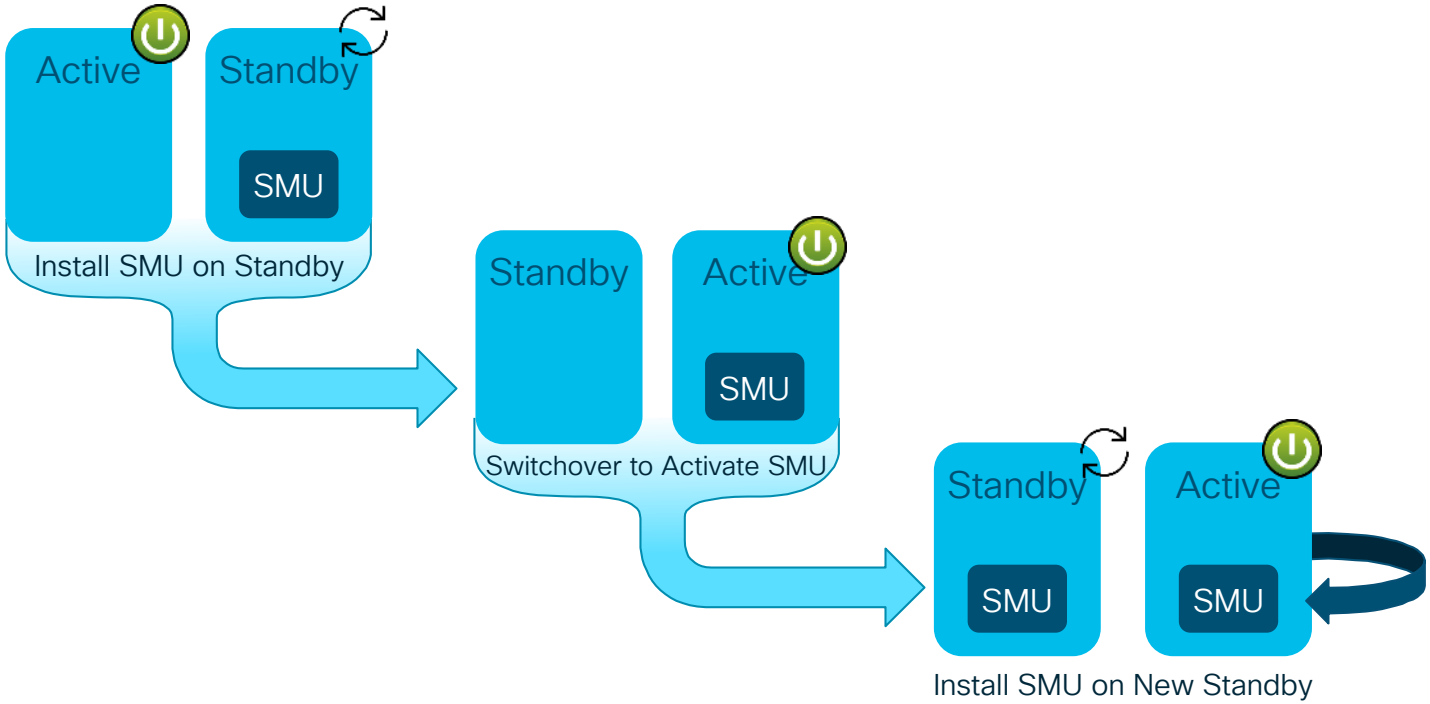
Software Image Upgrades

Catalyst 9800 High Availability



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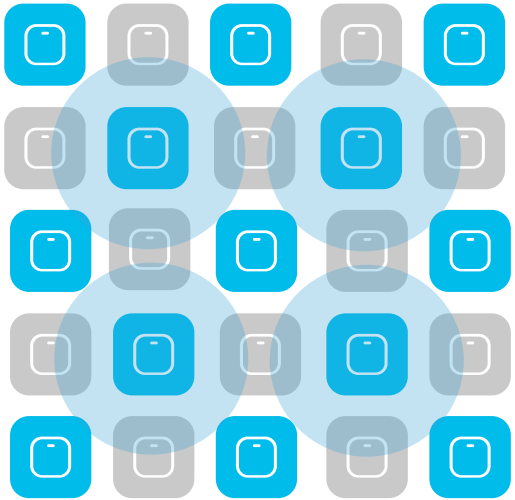
N+1 Hitless Rolling AP Upgrade

Software Image Upgrades



25%

15%

5%

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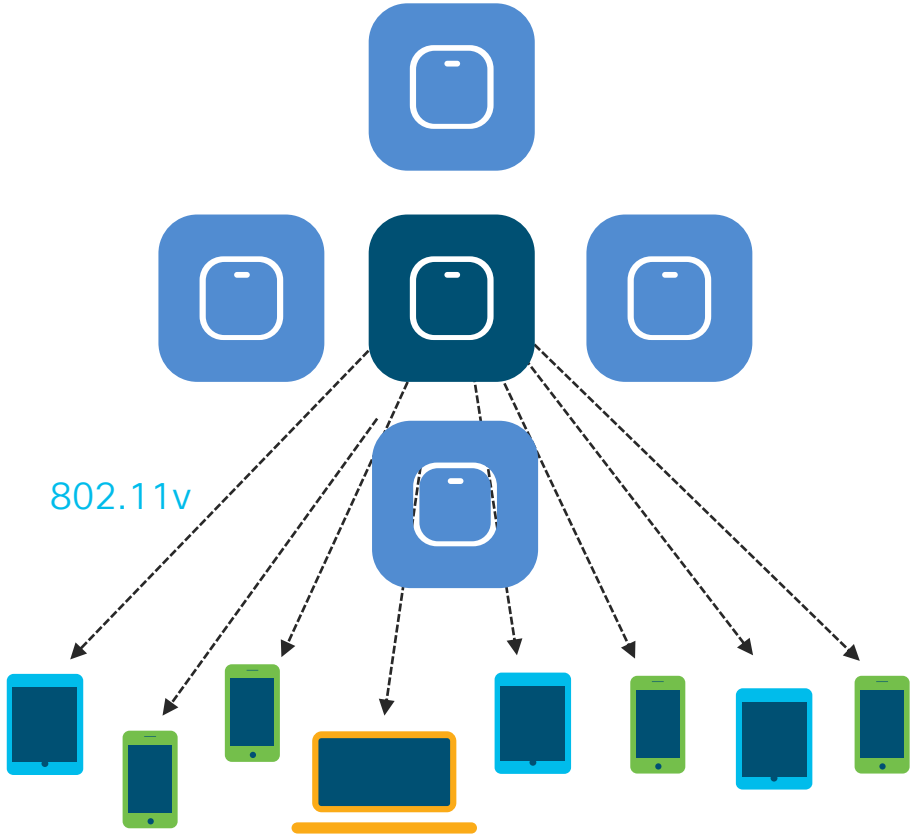
Client Steering

N+1 Hitless Rolling AP Upgrade

- Clients steered from candidate APs to non-candidate APs
  - 802.11v BSS Transition Request
    - Dissociation Imminent
  - Non-802.11v clients will be de-authenticated before AP reload



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Flexible Management Options

DNA Center

Policy Automation Analytics

Standards Based Interoperability

CI/CD Tools

SDN Controllers

NMS Systems

Custom Development

Model Driven Programmability

Zero Touch Provisioning

App Hosting

YANG Data Models

Guest Shell (On Box Python)

Prime Infrastructure

Native Controller UI

Catalyst 9800 Wireless Controllers

Intent-Based Network Infrastructure

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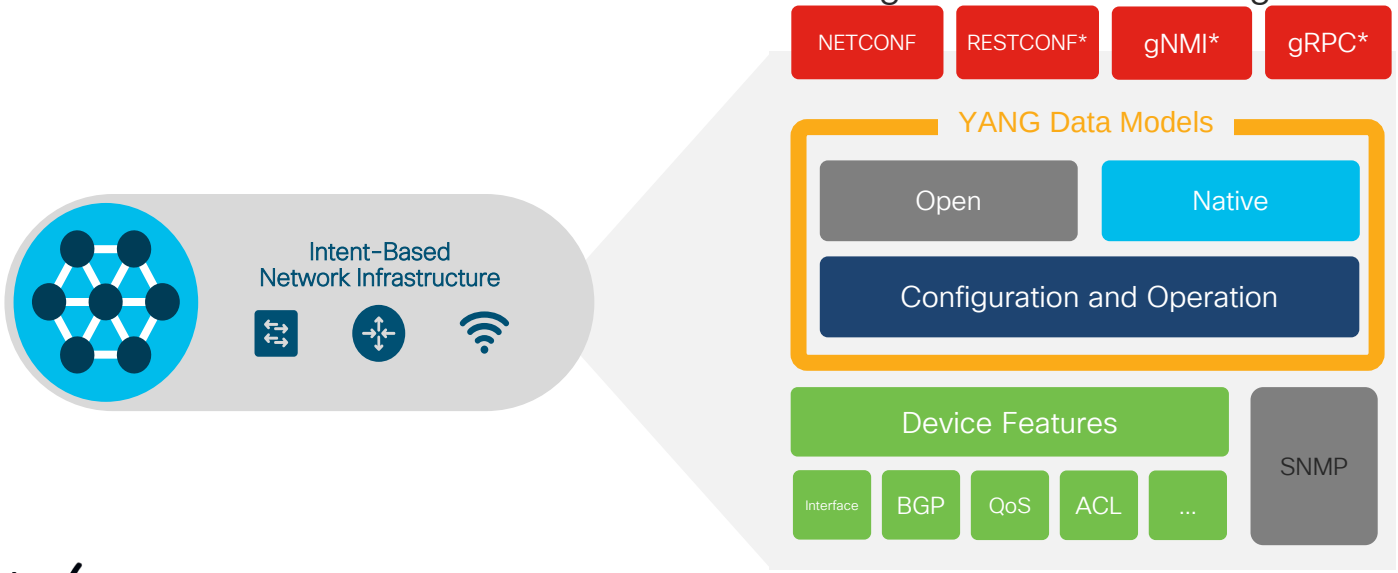
Wireless Programmability Stack

Cisco IOS-XE

The NETCONF, RETCONF, gNMI and gRPC are programmatic interfaces that provide additional methods for interfacing with the device

YANG data models define the data that is available for configuration and streaming telemetry



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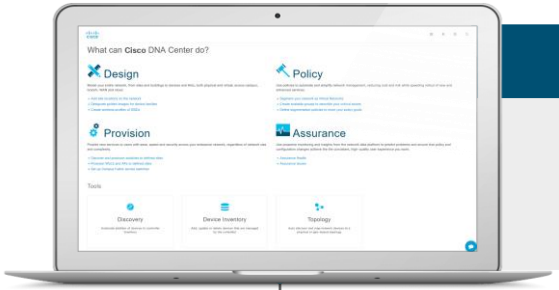
Cisco DNA Center and Assurance and Automation

cisco Live!

Cisco DNA Center



Cisco DNA Center

Policy Provision Design Assurance

Cisco DNA Center Appliance

Physical and virtual infrastructure

Cisco and third party

Complete network management system

- Single pane of glass for all devices
- End-to-end health information in real time
- Granular visibility
- Simplified workflows

Automation for provisioning

- Zero-touch deployment
- Device lifecycle management
- Policy enforcement

Analytics for assurance

- Verify intent of network settings
- Proactively resolve issues
- Reduce time spent troubleshooting

Platform for extensibility

- Integrate APIs with third-party solutions
- Integrate and customize ServiceNow
- Evolve operational tools and processes

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What is Assurance?

The guarantee that the infrastructure is doing what you intended it to do

Continuous verification

Configurations, changes, routing, security, services, VMs, compliance, audits

Successful IT rollouts

Insights and visibility

Visibility, context, historical insights, prediction

Reduced downtime, increased user productivity

Corrective actions

Guided remediation, automated updates, system optimization

IT productivity

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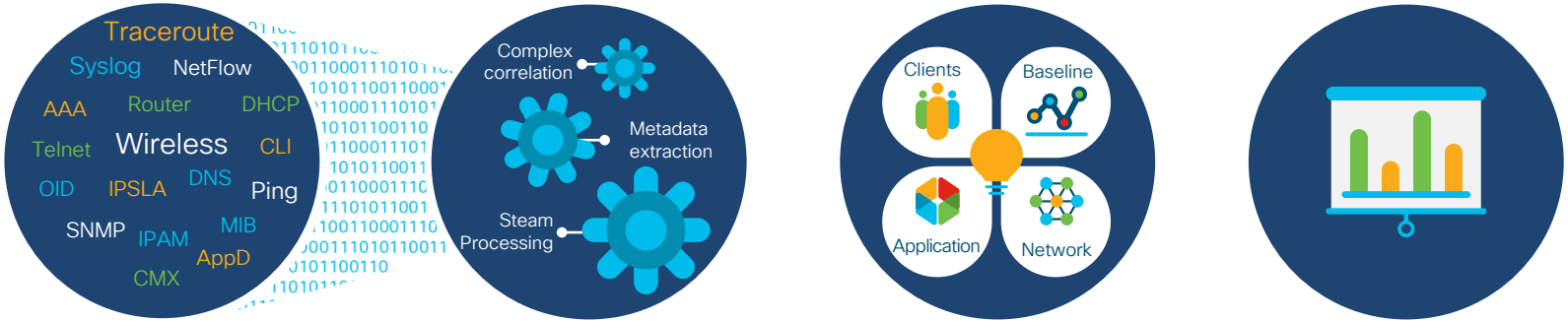
Cisco DNA Assurance

From network data to business insights

Network telemetry contextual data | Complex event processing | Correlated insights | Suggested remediation



Everything as a sensor

Over 150 actionable insights

Clients | Applications | Wireless | Switching | Routing

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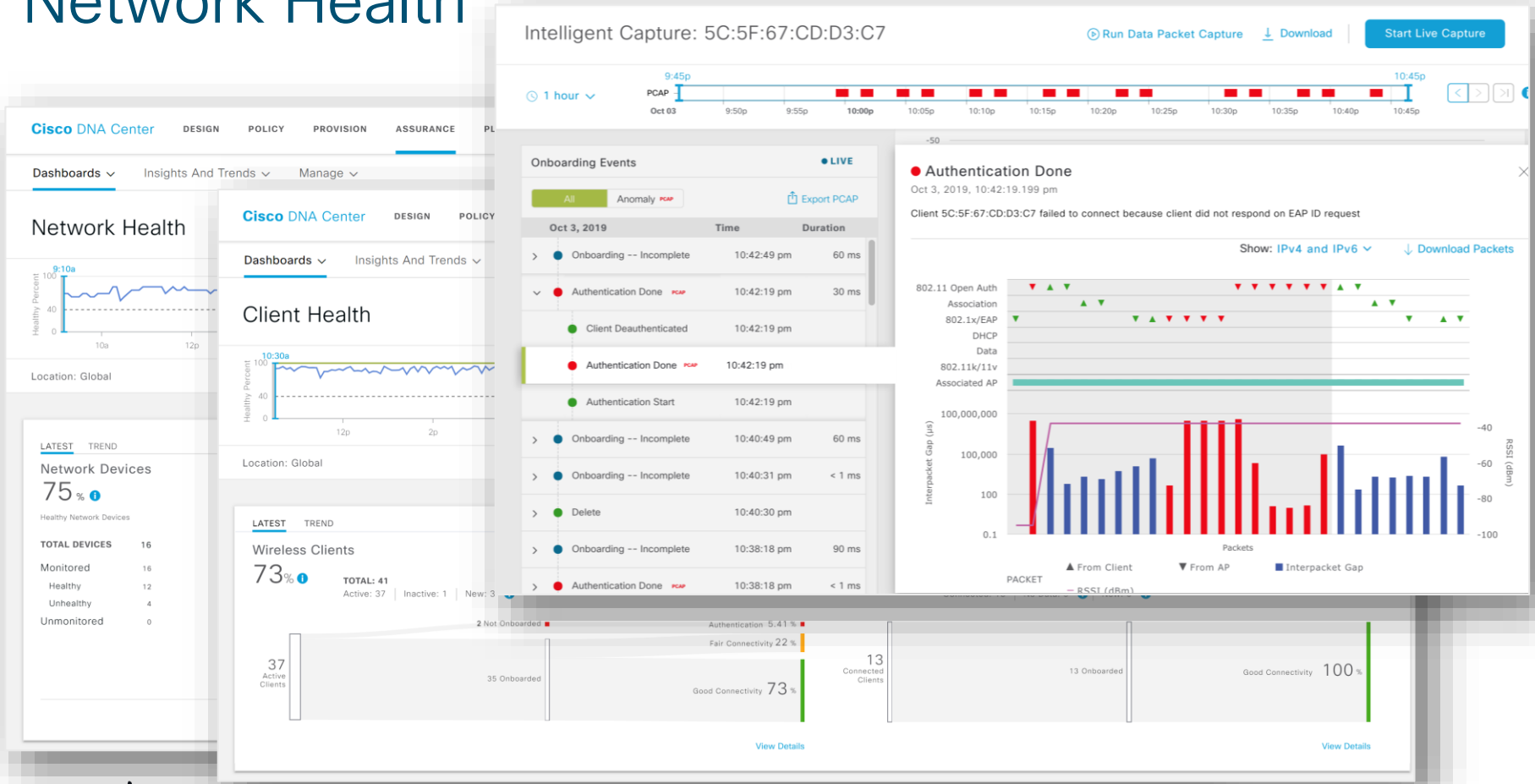
Network Health



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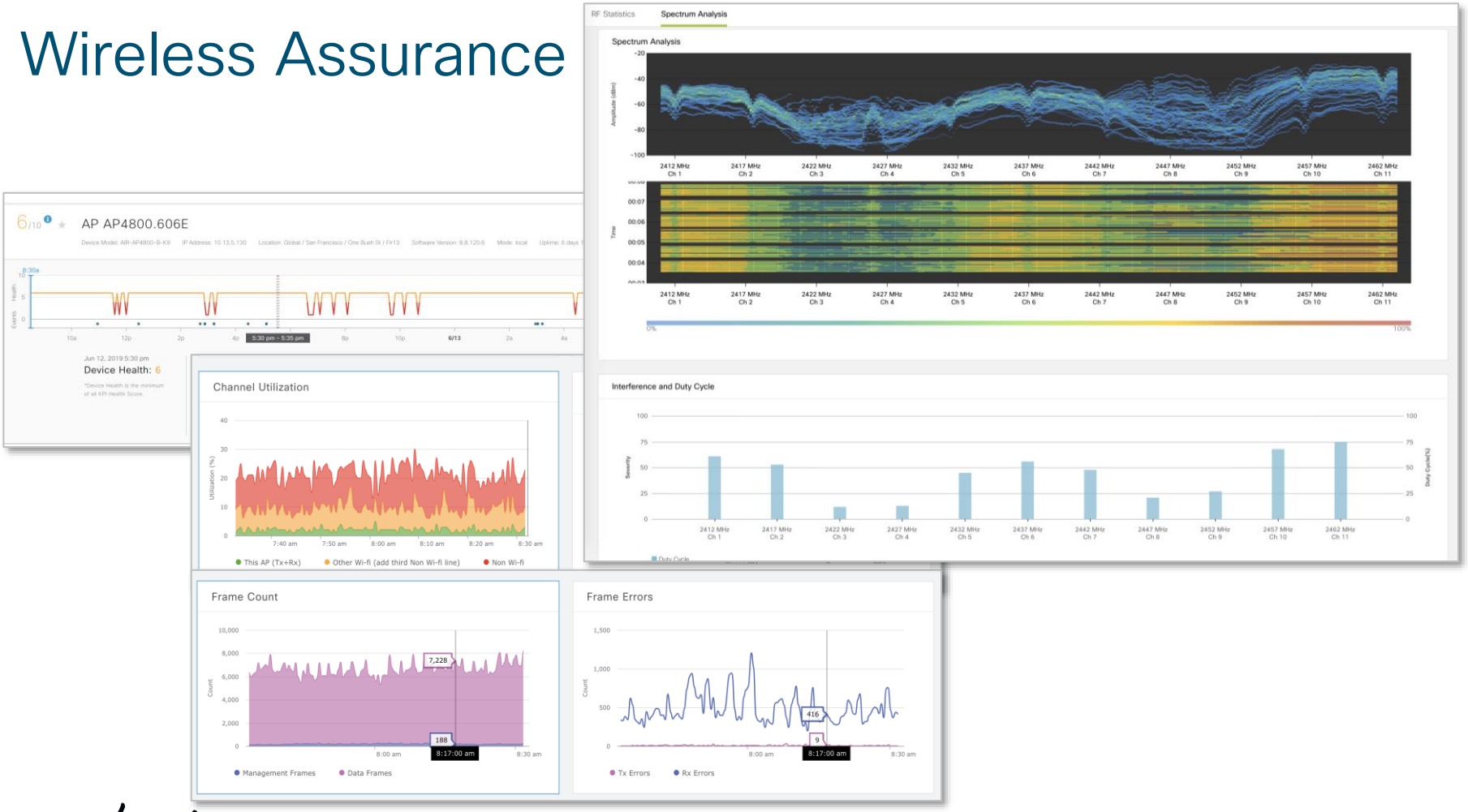
Wireless Assurance



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Client Health

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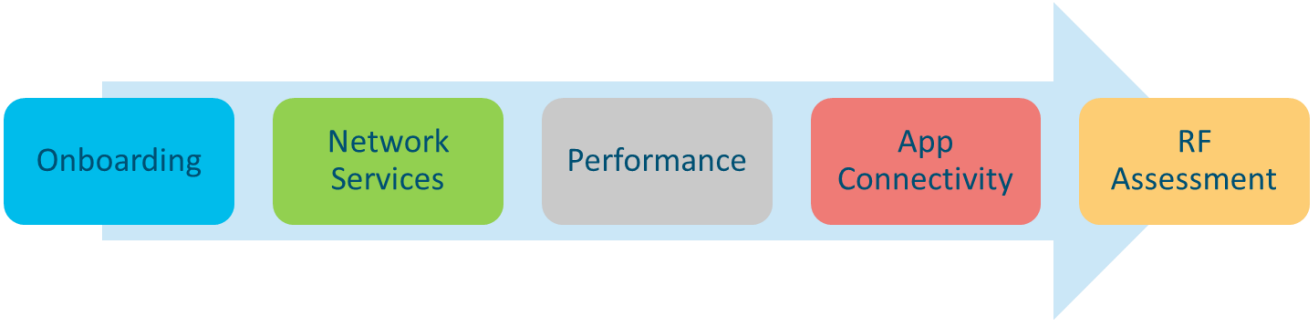
Wireless Active Sensor

1800S Active Sensor

Client Wireless Performance and Network Readiness Test

- Desktop mount
- Client Wi-Fi Performance (2x2 with 2 SS)
- Multiple powering options



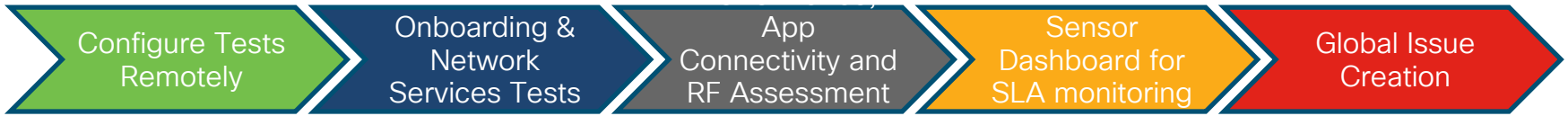
- Assoc.
- Auth.
- DHCP
- 802.1x EAPTLS, PEAP

- DNS
- RADIUS

- IP SLA: Packet Loss, Jitter, Latency for UDP based apps
- Speed Tests from network to cloud

- Web: HTTP
- Email: POP3, IMAP, Outlook
- Host Reachability
- File Transfer: FTP

- Active RF scan: RSSI, SNR, Data rate
- AP Discoverability



Test Your Network Anywhere at Any time from a Real-world Client perspective

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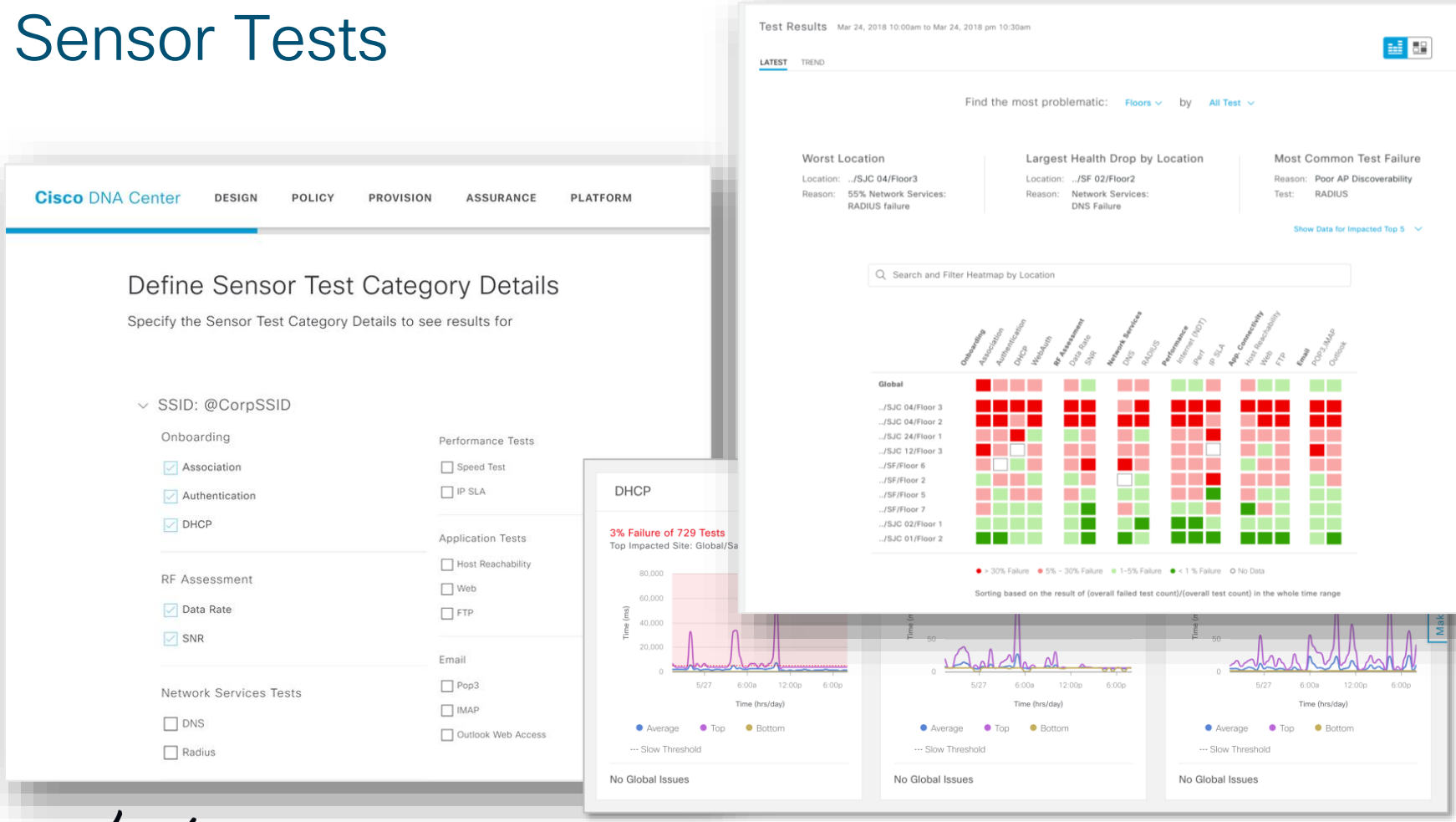
Sensor Tests



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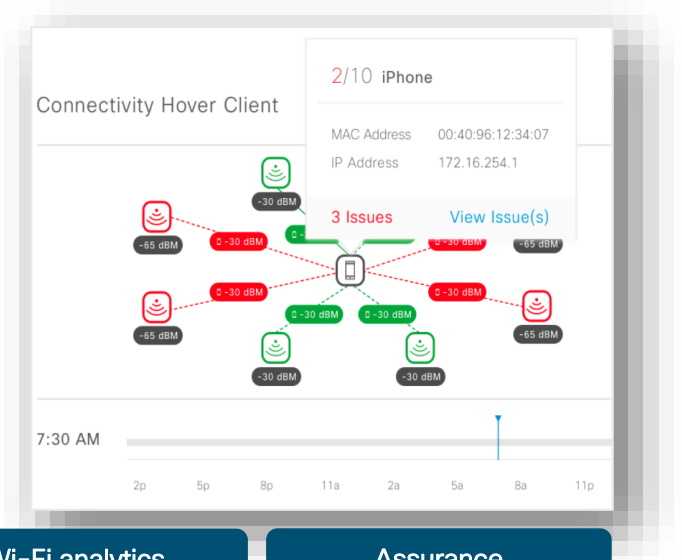
iOS and Samsung Analytics

Wireless Client Insights

- Samsung
  - S10 Series (S10e/S10/S10+/S10 5G), Note10, Galaxy Fold
  - Galaxy M10, M20, Galaxy Tab S5e, A10.1(2019)
- Apple
  - iPhone 7
  - iPad Pro 2017
  - iOS 10



Device Profile

Client shares these details
1. Model
2. OS version

Support per-device-group policies and analytics

Wi-Fi analytics

Client shares these details
1. BSSID
2. RSSI
3. Channel number

Insights into the client's view of the network

Assurance

Client provides disassociation reason code

Clarity into the reliability of connectivity

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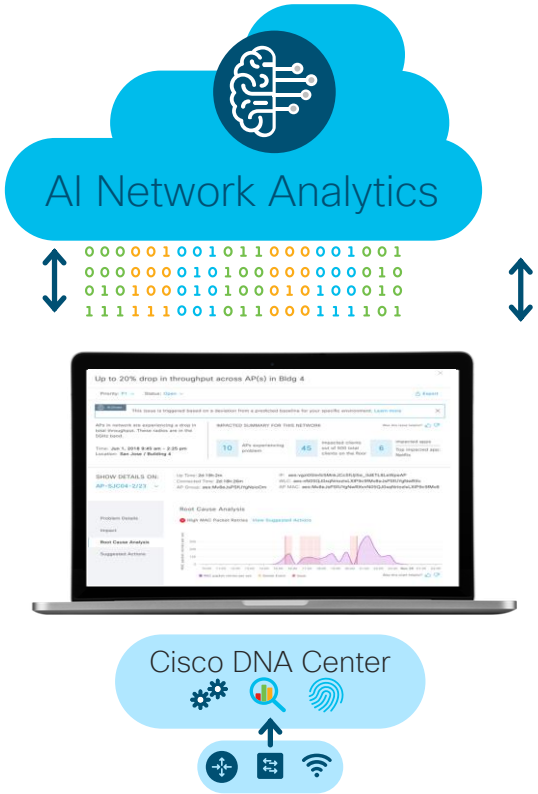
Cisco AI Network Analytics



Visibility: Personalized Baselining

Intelligently define personalized ”network normal” using unified global telemetry collected

Insight: Intelligent Analysis

Increase signal-to-noise, improve issue relevancy, and accurately identify trends and root causes

Action: Accelerated Remediation

Create automated resolution options for IT to act on based on machine reasoning algorithms

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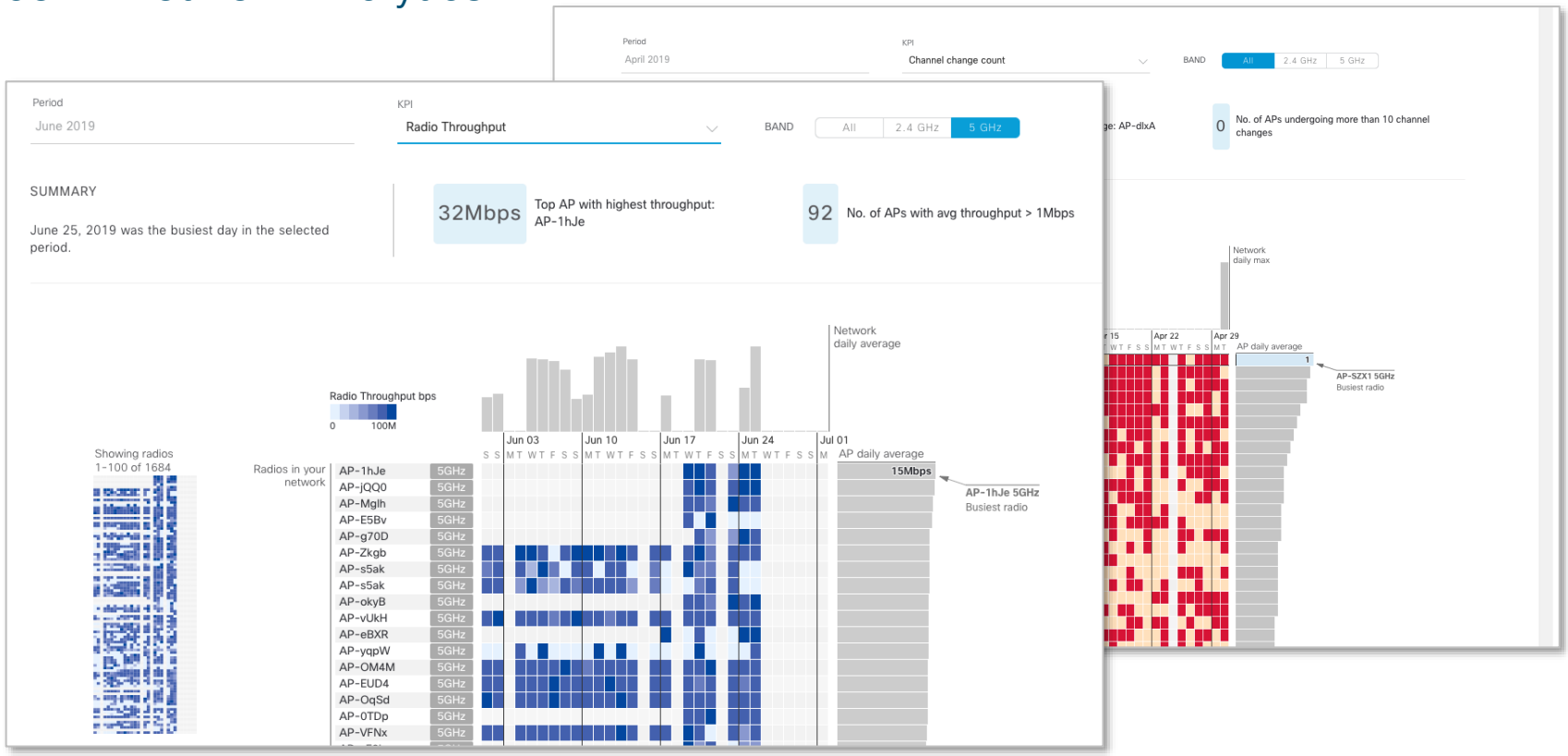
Network Heatmaps

Cisco AI Network Analytics



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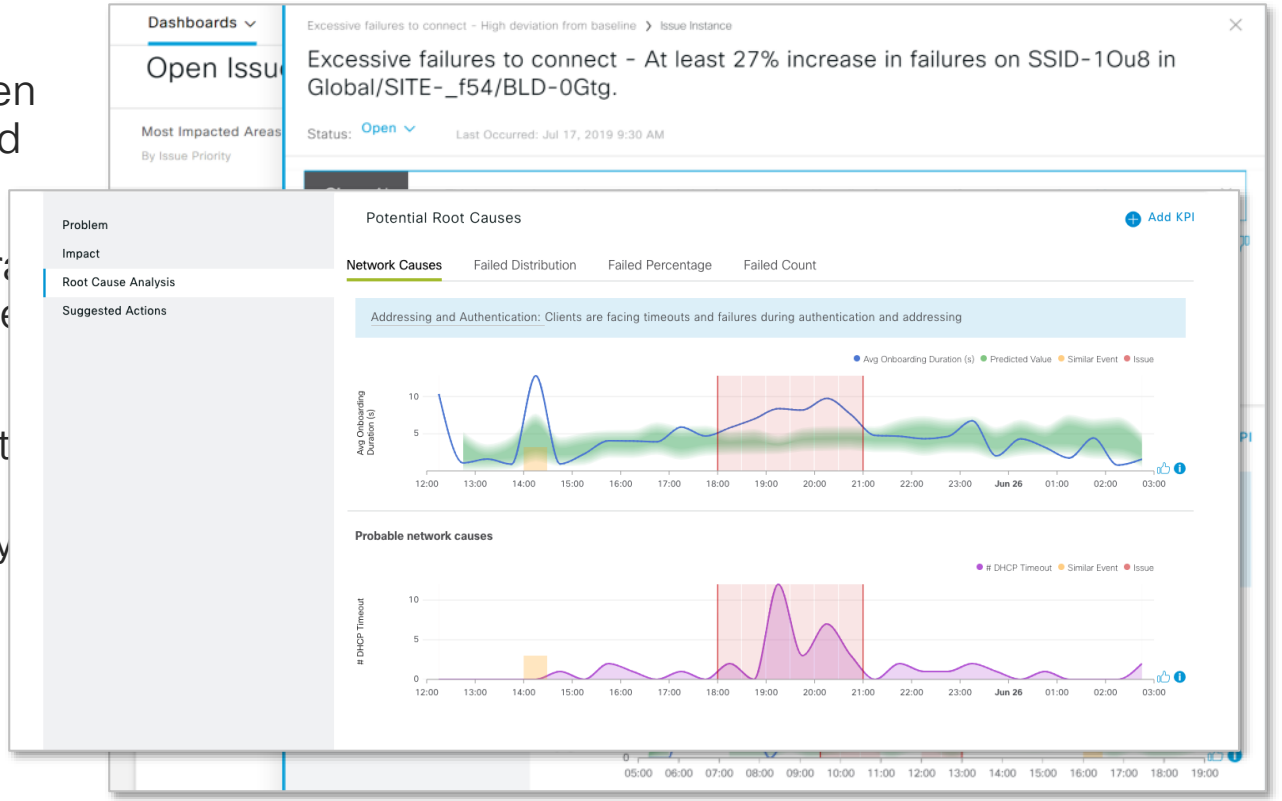
Predictive Modelling

Cisco AI Network Analytics

- Static thresholds can often lead to false positives and negatives
- Dynamic threshold genera based on predictive mode
  - Improves alert quality
- Correlation with other net issues
  potential root cause analy



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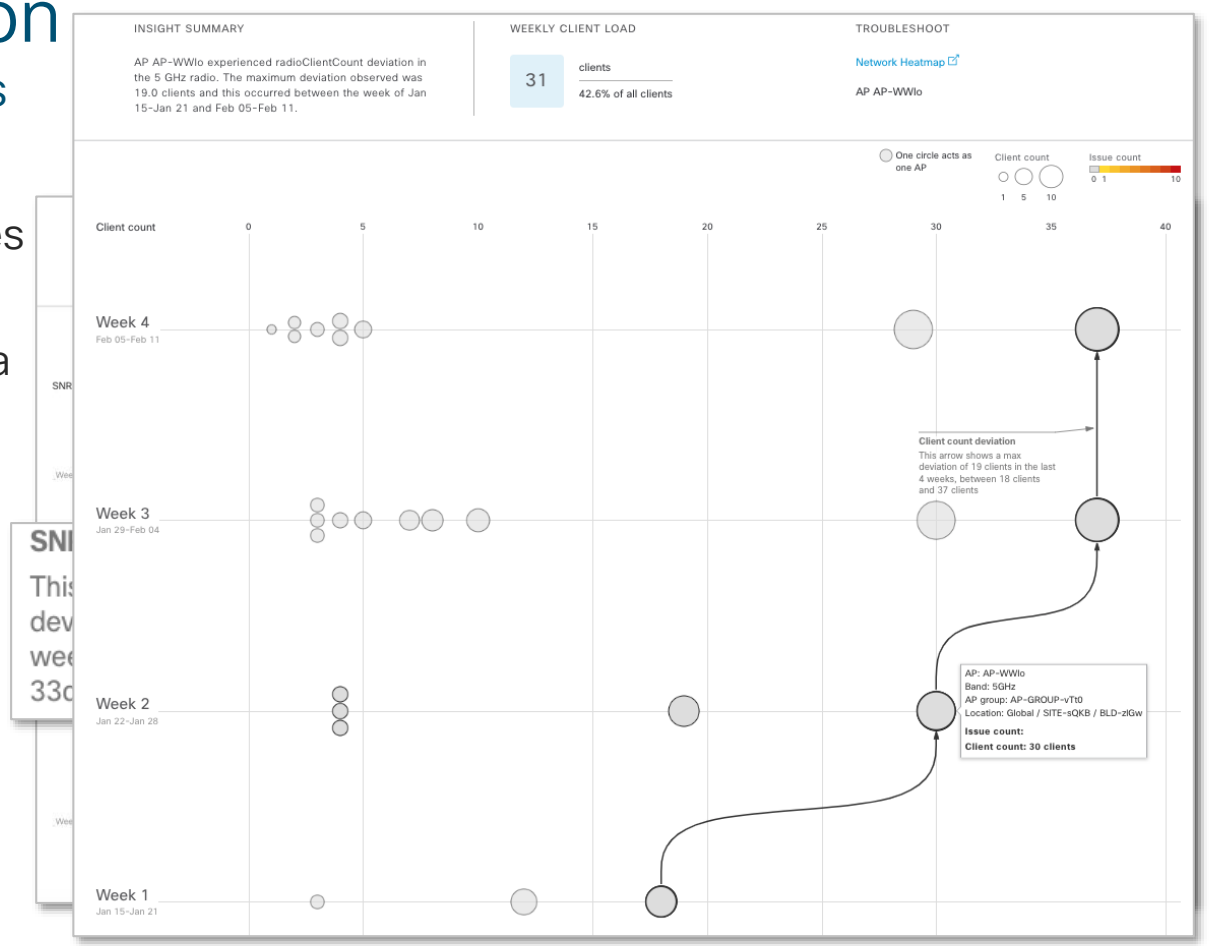
Anomaly Detection

Cisco AI Network Analytics

- Analyses trends and identifies changes in behaviour
- Automatically generated on a weekly basis
  - Illustrates weekly trends over the previous month
- Links back to Network Heatmap and AP360 for additional contextual information



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Cisco DNA Automation

Reduce the time and complexity involved in getting your network connected and doing what you intended it to do.

Deploy

Policy, design, provision, integrate platforms

Successful IT rollouts

Manage

Software image management, changes, routing, security, compliance

Reduced downtime, increased user productivity

Assure

Guided remediation, automated updates, system optimization

Network intent
IT productivity

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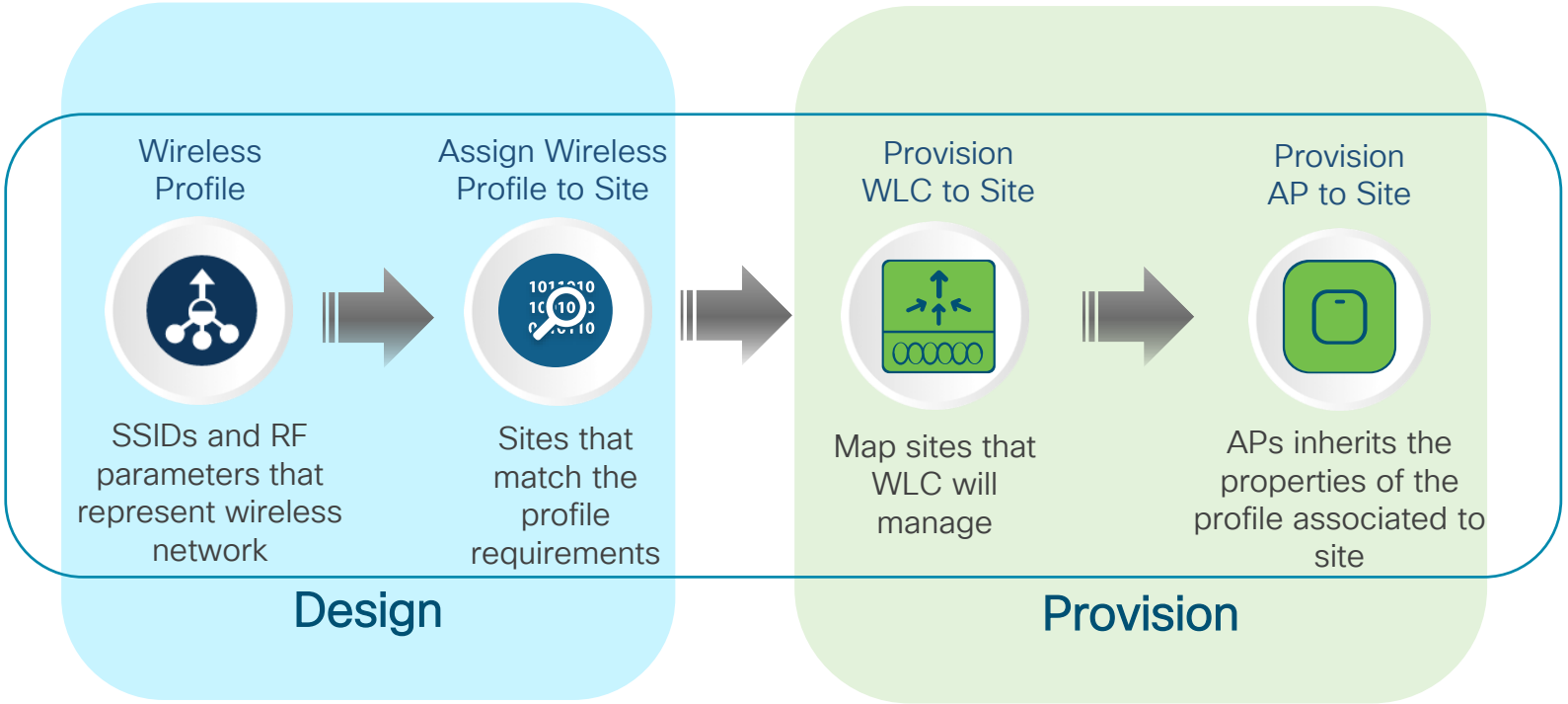
Wireless Network Deployment Automation

Cisco DNA Automation



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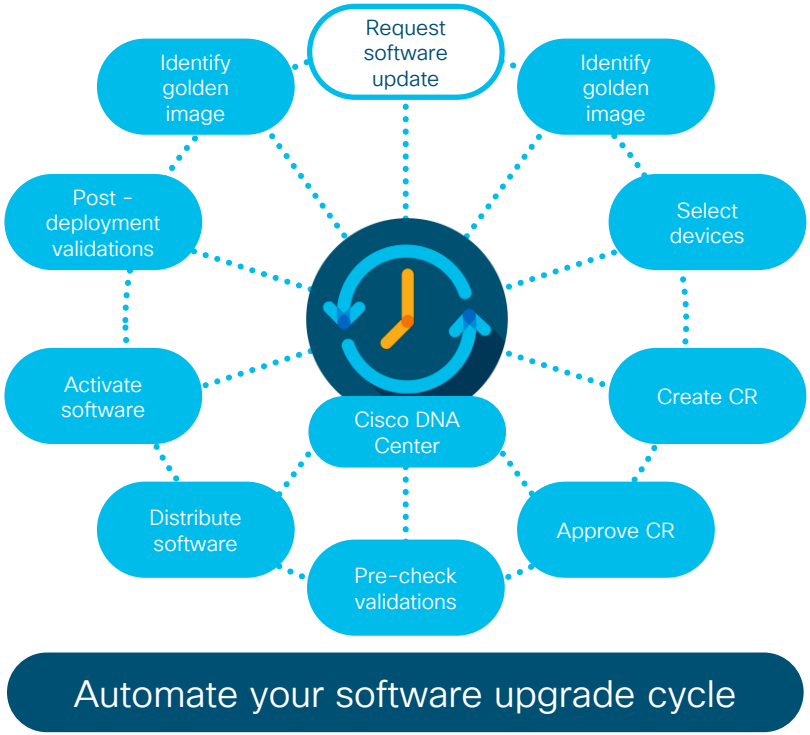
Software Image Management

Cisco DNA Automation



Intent-based network upgrades

Capture your upgrade intent to automate process and drive consistency

Streamlined upgrade process

Upgrade base image, and install patches and other add-ons in one single flow

Trustworthiness integration

Assure that device images are not compromised in any way

Patching support

Pre and post checks help ensure that updates do not adversely affect the network

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Integrating Cisco Security

End-to-End Wireless Network Security

Air

Rogue intrusion detection and prevention /WIPs

Standards compliance with WPA3

- Enhanced security on open Wi-Fi
- Robust password protection
- Superior data protection
- Seamless customer migration

Devices

Enhanced threat detection with ETA

Secure device management with iPSK

Users

Seamless BYOD onboarding with ISE

Identity-Based segmentation with SD-Access

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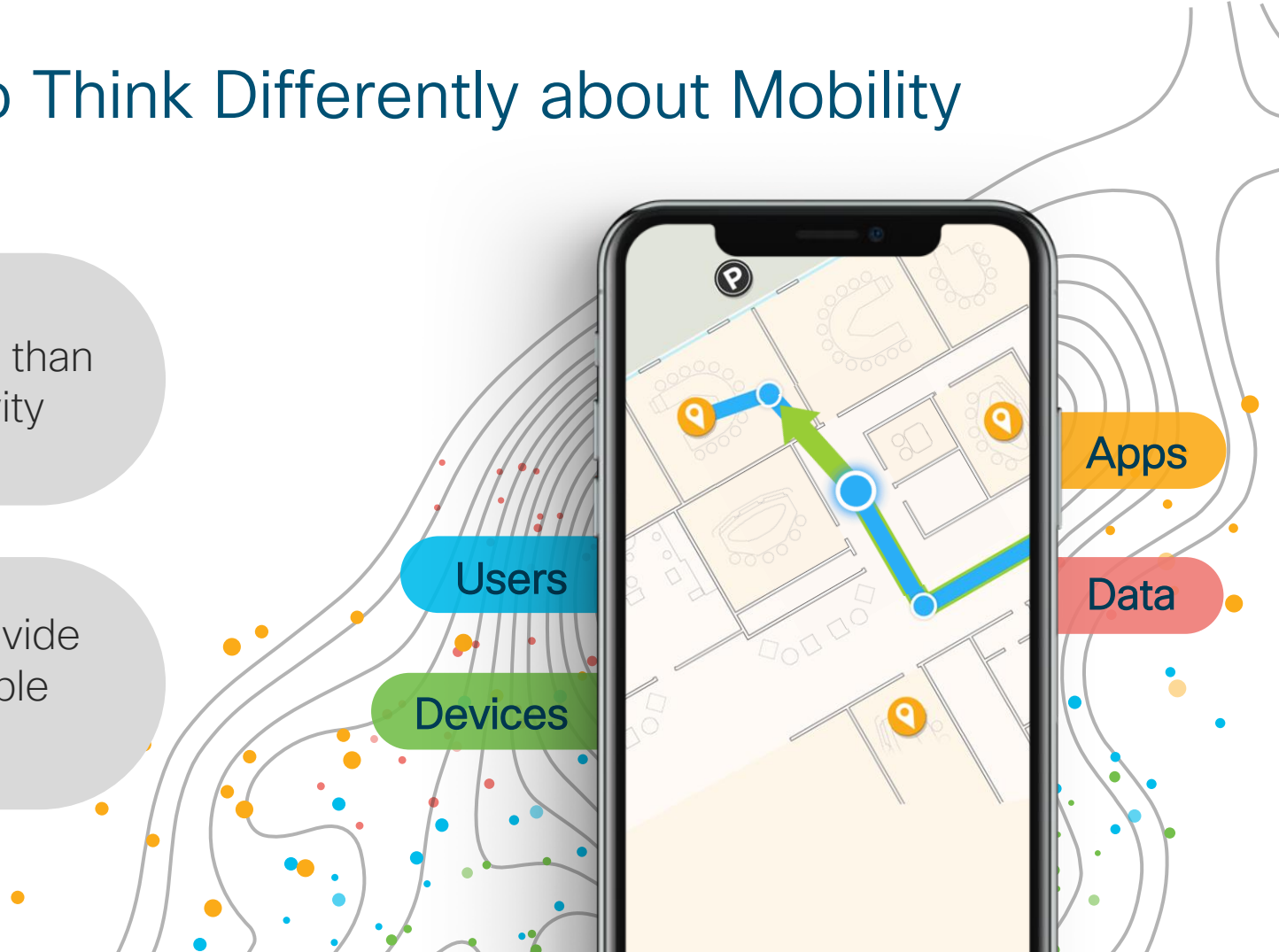
Cisco DNA Spaces and CMX

It’s Time to Think Differently about Mobility

Wireless is more than simple connectivity

Wireless can provide insights and enable experiences



Digitising Spaces, People and Things

Cisco DNA Spaces

See — See what's happening at your spaces

Act — Leverage digitisation tool kits to act on insights

Extend — Drive business outcomes with partner apps and enterprise extensions

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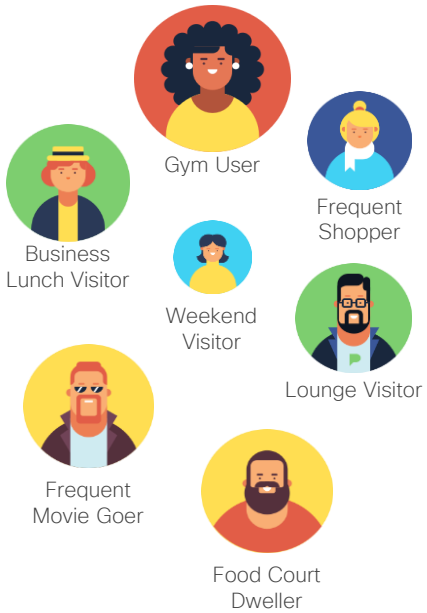
Providing Insights and Enabling Experiences

Line of Business	Operations	IT
Understand Visitor Behavior	Optimize Operations	Enterprise Integrations and Data Export
Improve Experience	Employee Productivity	Centralized Management
Customer Acquisition & Loyalty	Drive Efficiencies	Compliance
Boost Satisfaction	Reduce manual processes and save cost	End-to-End Monitoring and SLAs

Location Personas Enable Actionable Insights



Personas	Rules
Business Lunch Visitor	IF user enters Food Court Zone between 11am and 1pm on Mondays to Fridays, TAG as “Corporate Lunch Visitor”
Gym User	IF user enters Gym Zone, TAG as Gym User
Weekend Visitor	IF user enters Site on Saturday or Sunday, TAG as “Weekend Visitor”
Food Court Dweller	IF user dwell time in Food Court Zone >45 minutes, TAG as “Food Court Dweller”
Lounge Visitor	IF user enters Lounge Zone from 4pm to 6pm on Mondays to Fridays, TAG as “Lounge Visitor”
Frequent Movie Goer	IF user enters Movie Zone more than 2x in 30 day period, TAG as “Frequent Movie Goer”

Create personas meaningful to locations to understand user behaviour

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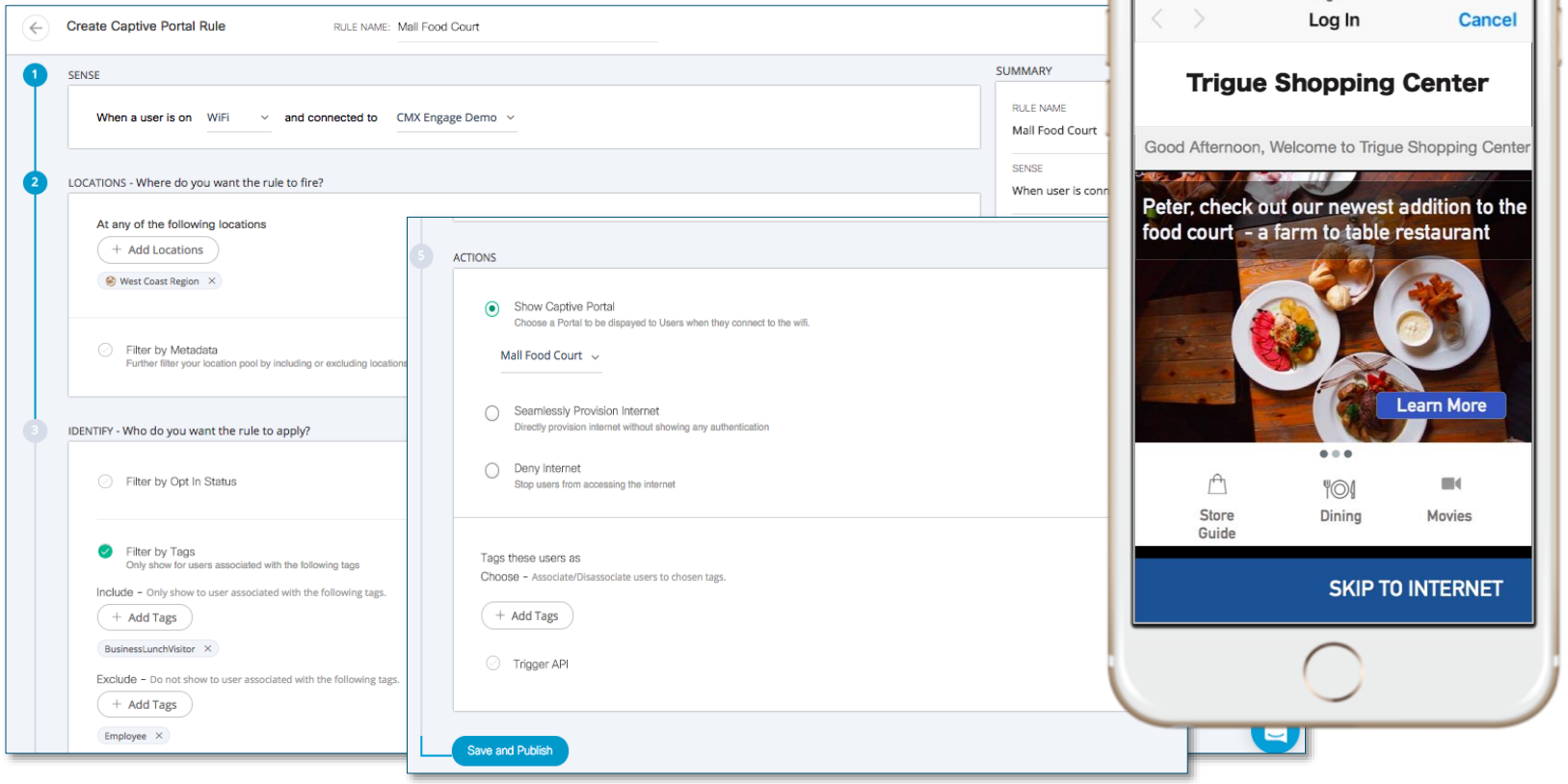
Smart Captive Portals

Business
Lunch Visitor



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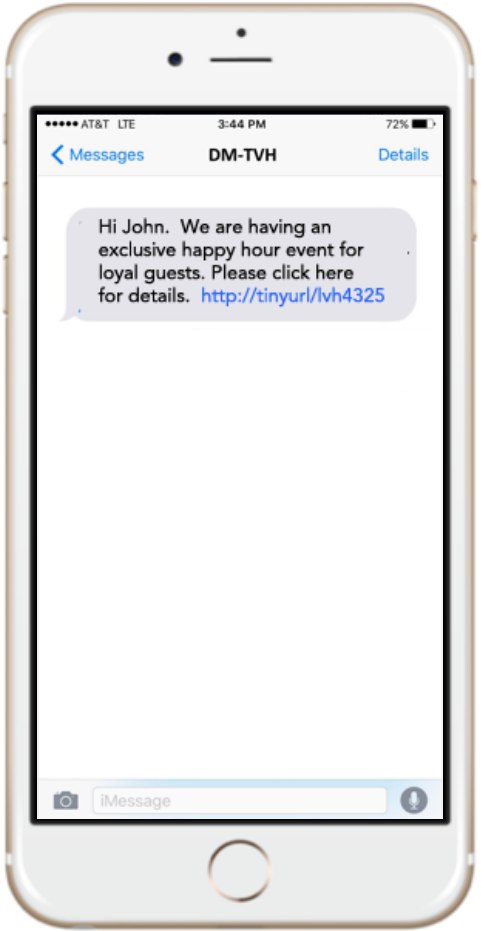
Omni-Channel Engagement

Lounge Visitor

- IF guest tagged as “loyalty member”
- AND “lounge visitor”
- AND is in the hotel between 4pm and 6pm
- THEN send Happy Hour Promotion notification
  - Push Notification for App Users
  - SMS for Non-App Users



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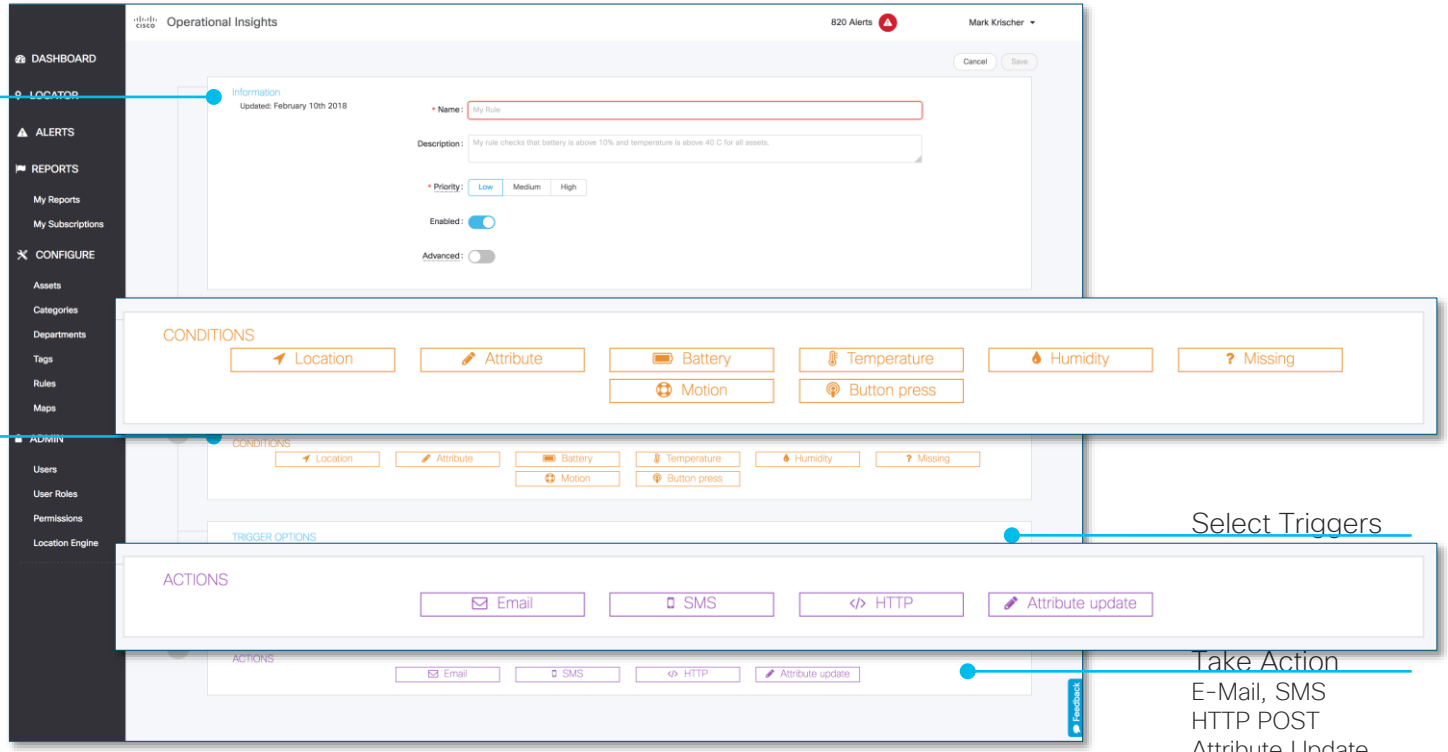
Operational Insights

Information
Name, Description
Priority

Set Conditions
Location, Attribute
Battery Level,
Button Press,
Telemetry



Select Triggers

Take Action
E-Mail, SMS
HTTP POST
Attribute Update

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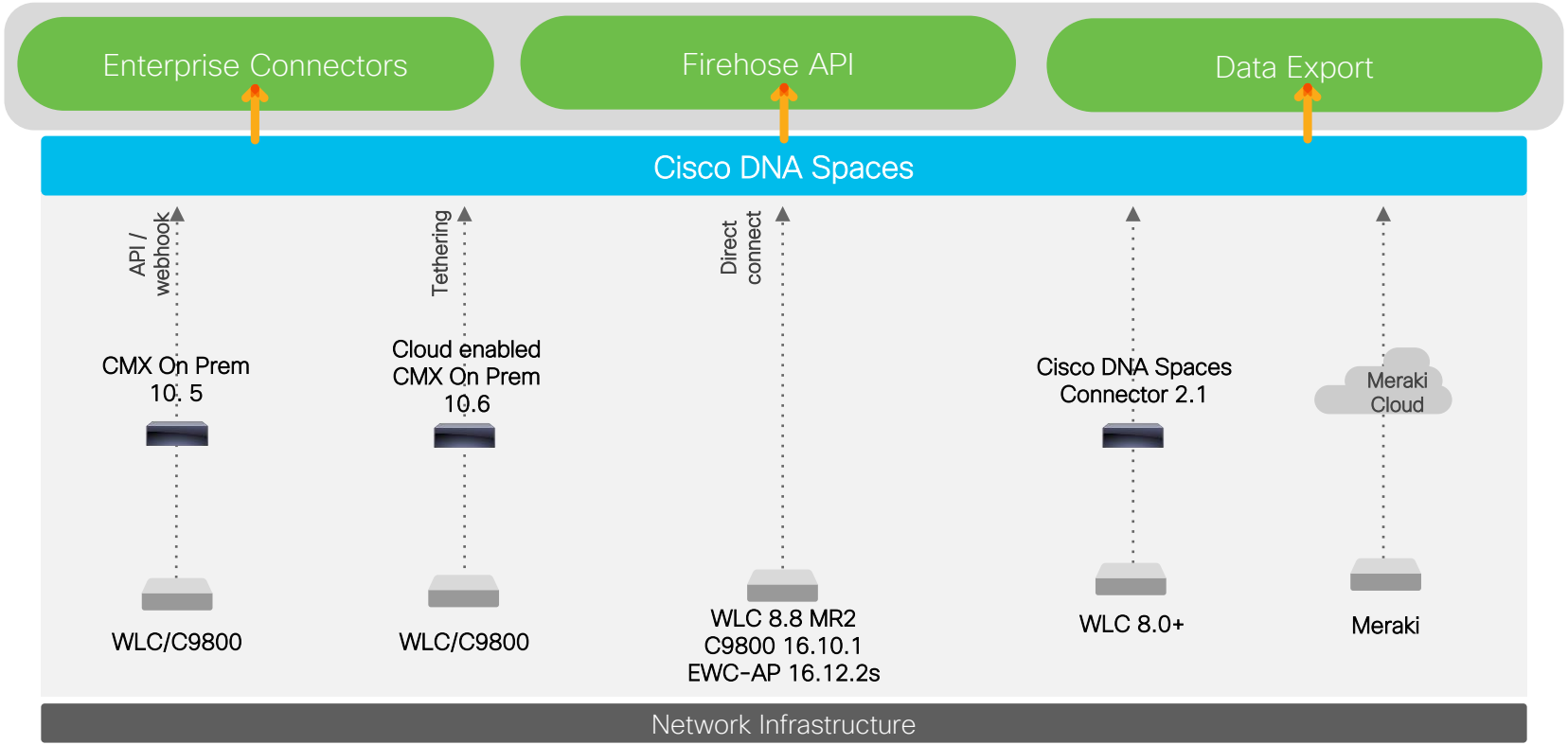
Supports all Cisco Wireless Topologies



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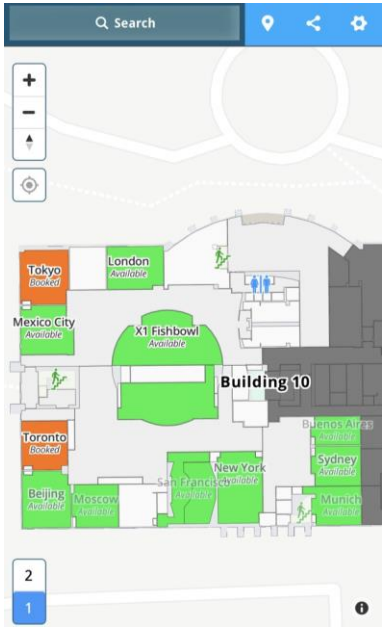
Eco-System Partners

Cisco DNA Spaces

Cisco DNA Spaces

Firehose Streaming API

Workspaces
- Room Utilization
- Employee Experience



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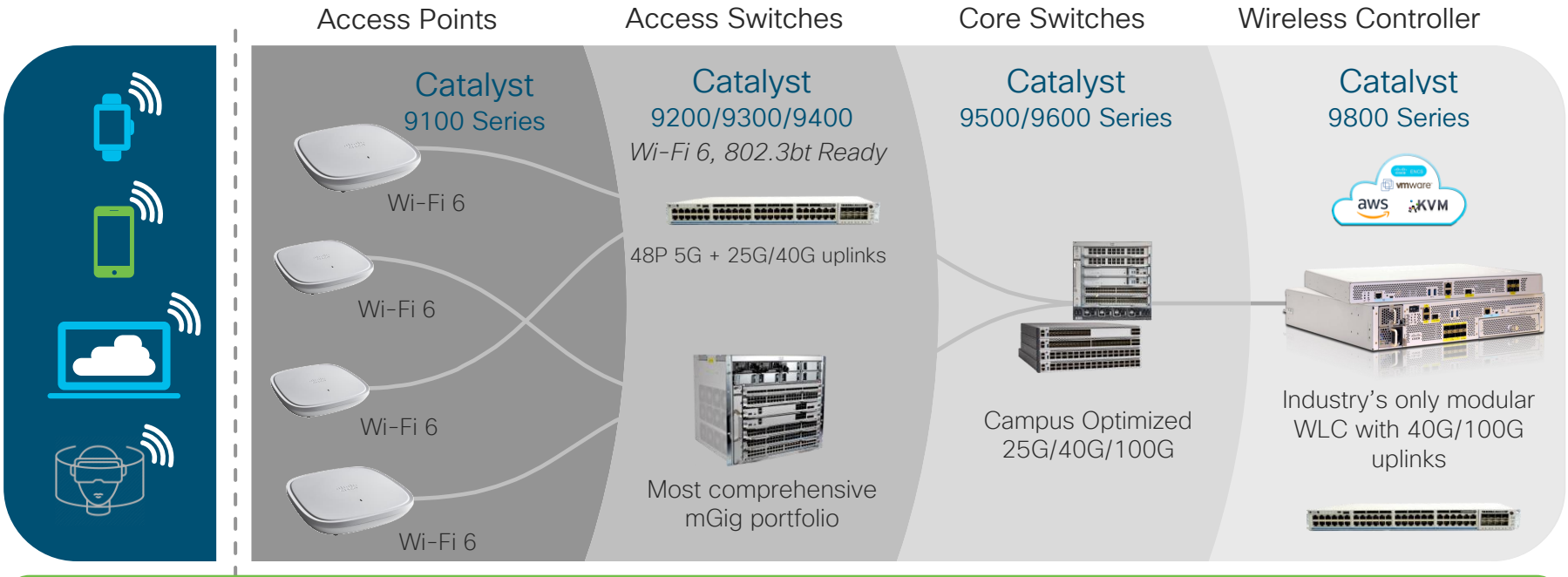
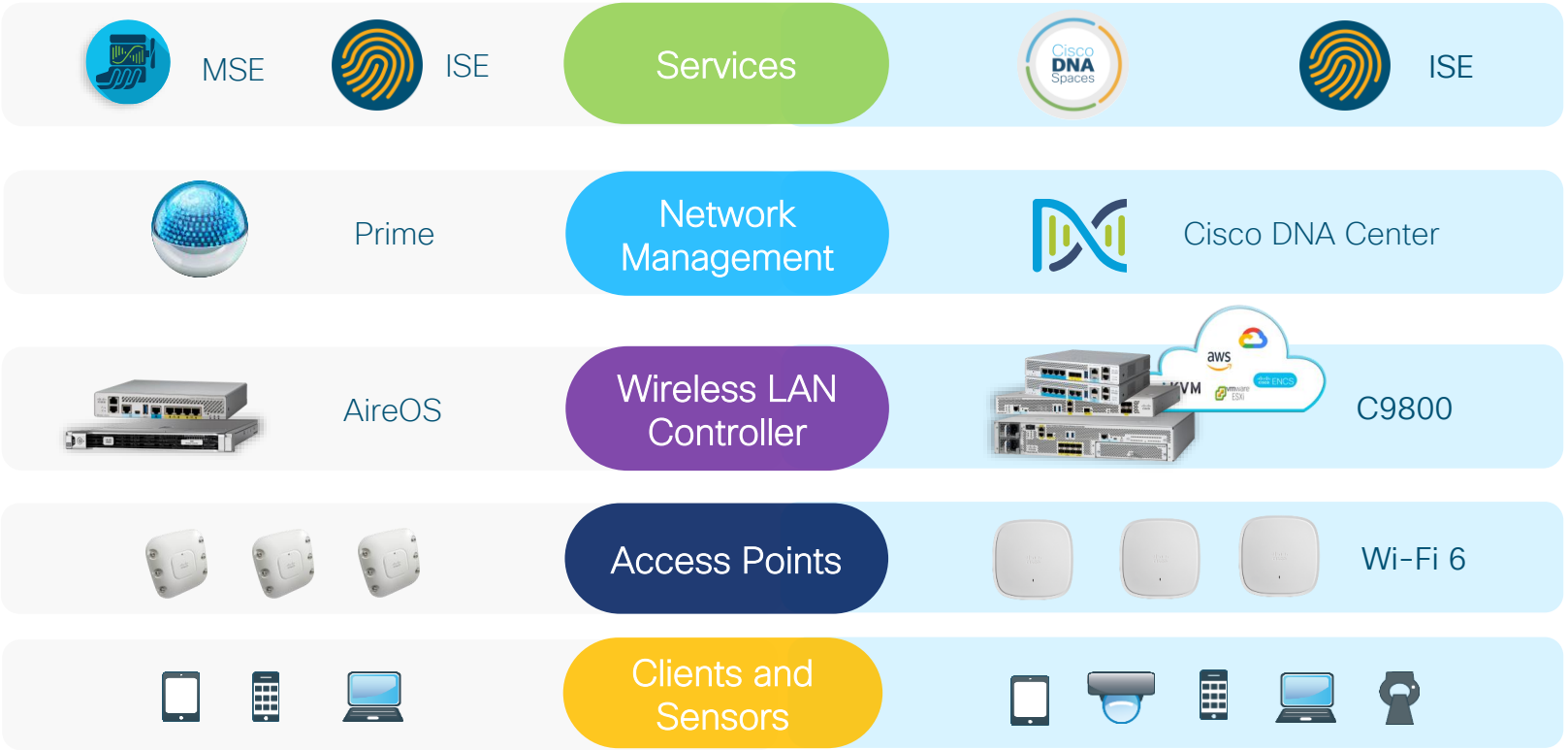
Campus of the Future

Campus of the Future



Full Stack Migration



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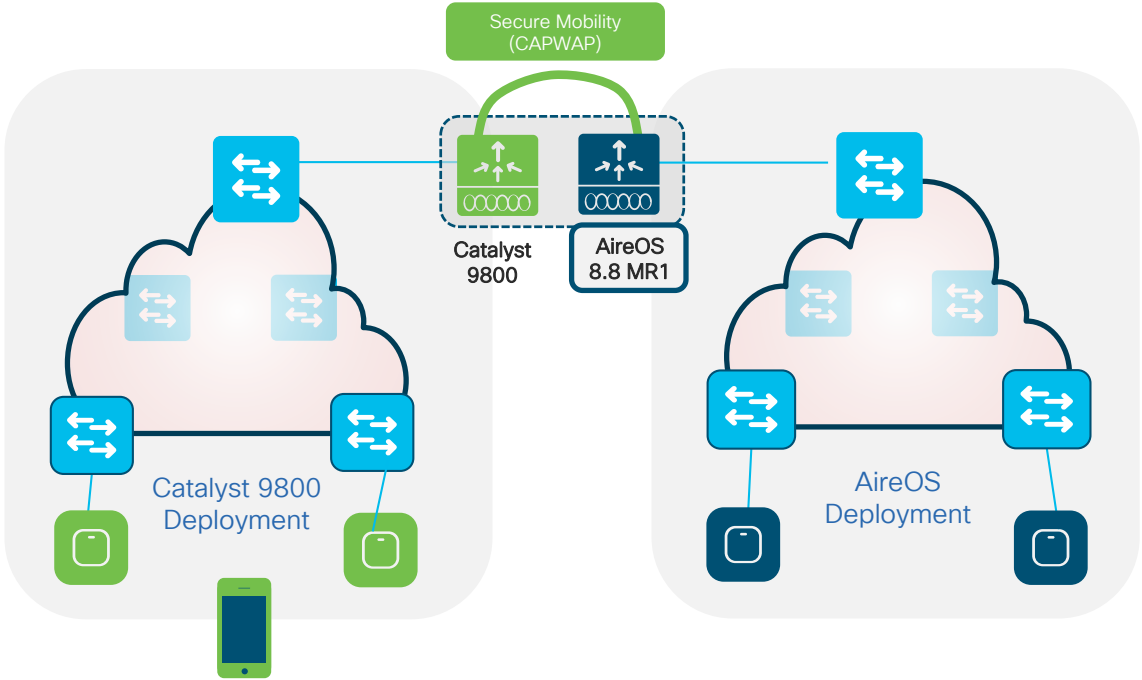
Inter-Release Controller Mobility (IRCM)

AireOS and Catalyst 9800 Seamless Layer 3 Roaming



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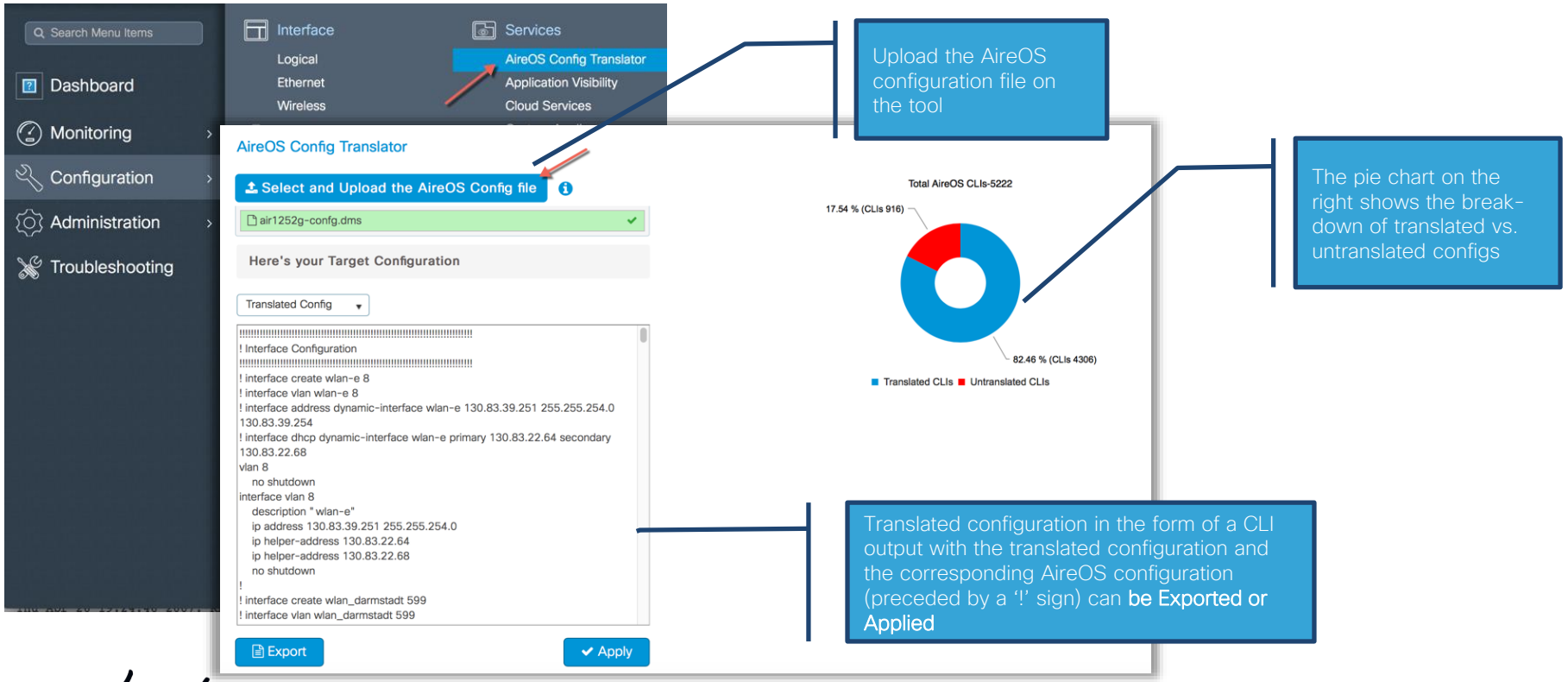
Catalyst 9800 AireOS Config Translator



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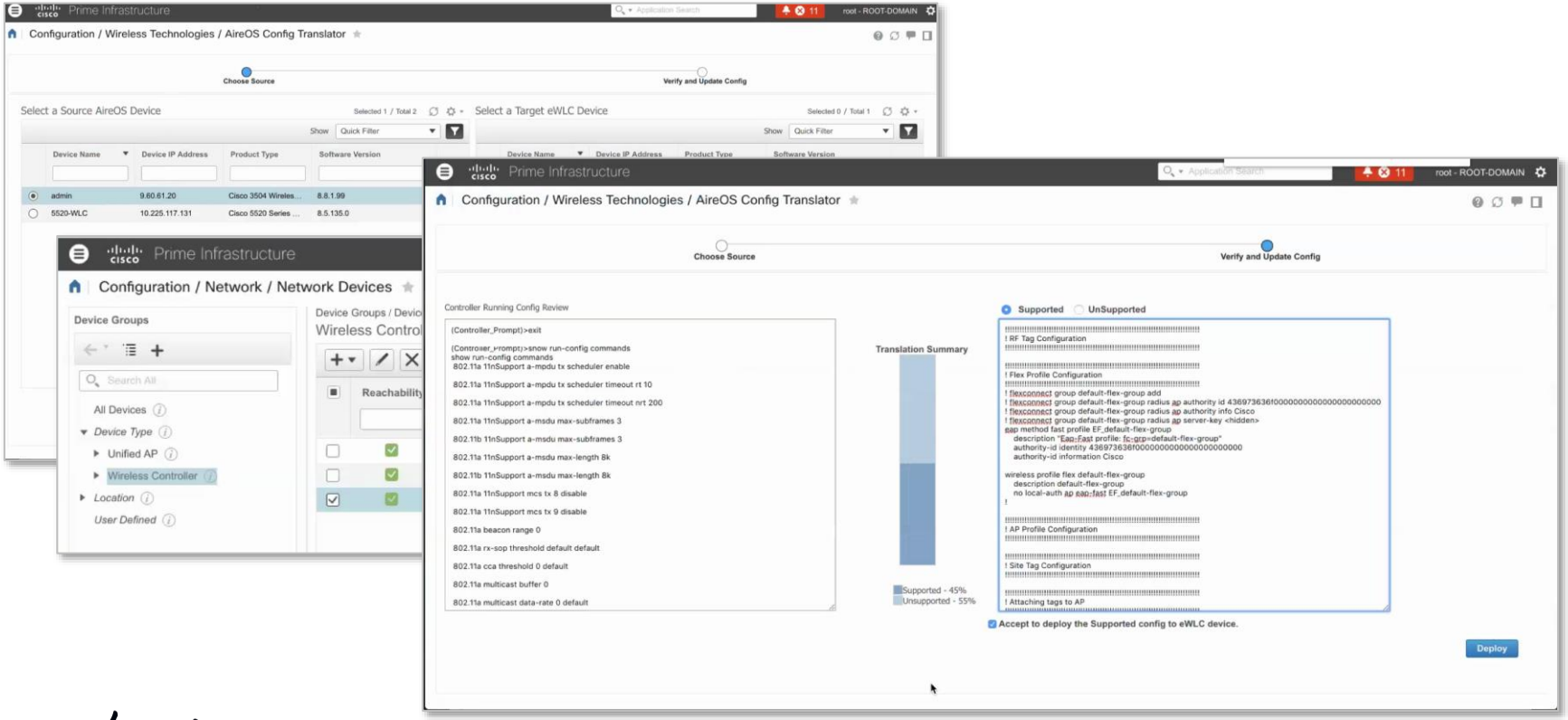
Prime Infrastructure AireOS Config Translator



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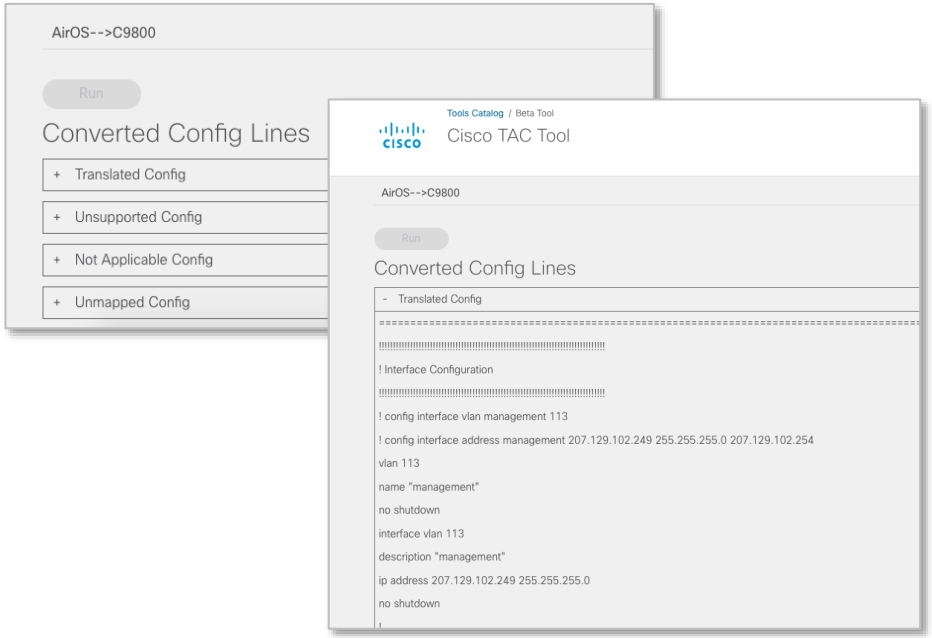
AireOS Migration Tool

TAC Supported



- Four Output Scenarios
  - Translated
  - Unmapped
  - Unsupported
  - Not Applicable
- Output is the original AireOS configuration with the corresponding IOS-XE commands
- Always review the translated config

https://cway.cisco.com/tools/WirelessConfigConverter/

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Wireless Controller Transition

Up to 100 APs

SMB, Small Campus and branch

Mobility Express

2504 Wireless Controller

Embedded Wireless in Catalyst APs

100-150 APs

Distributed Branch, Small Campus

3504 Wireless Controller

C9800-L

C9800-CL C9800 for cloud

150 to 1500 APs

Medium Campus

5508, 5520 Wireless Controller

C9800-40

C9800-CL C9800 for cloud

1500 to 6000 APs

Large Campus

7510, 8510, 8540 Wireless Controller

C9800-80

C9800-CL C9800 for cloud

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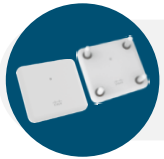
Wireless Access Point Transitions

Aironet 4800 Series

High density deployments

Continue positioning (For Hyperlocation)



Aironet 3800 Series

High density deployments

Catalyst 9130

Aironet 2800 Series

Mission critical deployments

Catalyst 9120

Aironet 1800 Series

Small to medium-sized deployments

Catalyst 9115/9117

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Cisco Recommended Releases

Catalyst 9800 and 3504/5520/8540 AireOS Wireless Controllers

For Your Reference

Access Points	IOS-XE	AireOS	DNA-C	Prime	CMX	ISE
C9115AX, C9117AX, C9120AX	16.12.1s	8.10	1.3.1.2	3.7	10.6.2	2.4 2.6
C9130AX	16.12.1s with AP DP	No support for APDP in AireOS	1.3.1.2	3.7	10.6.2	2.4 2.6
C9120AX-E, C9130AX-E	16.12.2	8.10	1.3.2	3.7	10.6.2	2.4 2.6
Wave 2 APs	16.12.1s	8.5MR5	1.3.1.2	3.7	10.6.2	2.4 2.6

Please check these links for the latest info

https://www.cisco.com/c/en/us/support/docs/wireless/catalyst-9800-series-wireless-controllers/214749-tac-recommended-ios-xe-builds-for-wirele.html

https://www.cisco.com/c/en/us/support/docs/wireless/wireless-lan-controller-software/200046-tac-recommended-aireos.html

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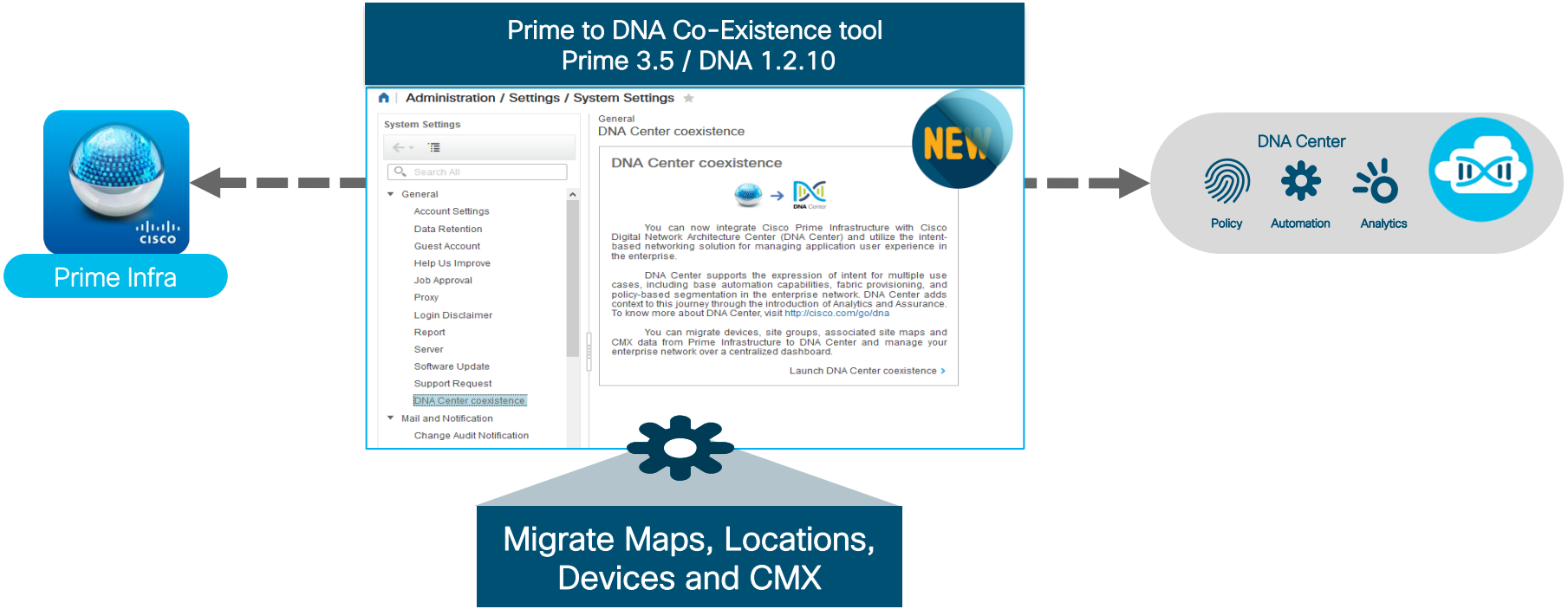
DNA Center coexistence tool

Migrate Data, Site and Services from Prime to Cisco DNA Center



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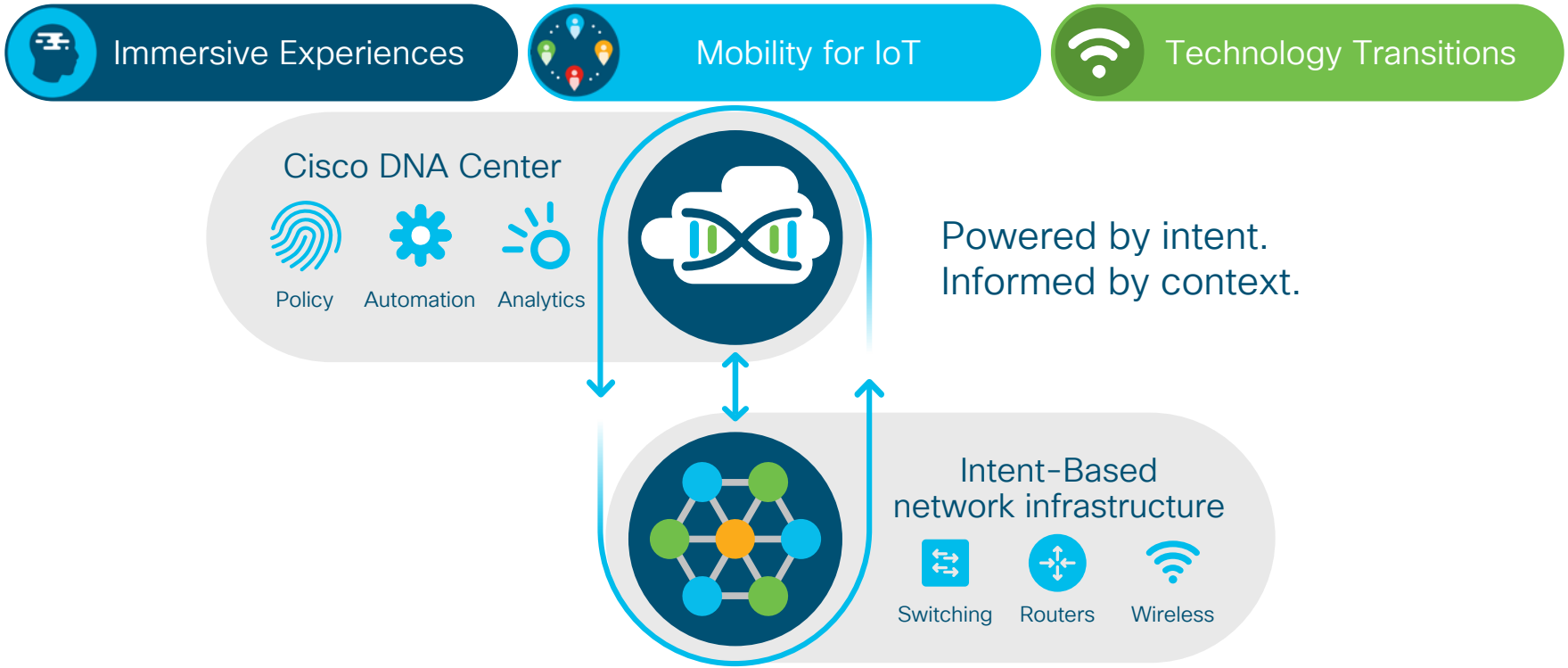
Next Generation Wireless

You make customer experience **possible**

It’s Time to Think Differently about Mobility



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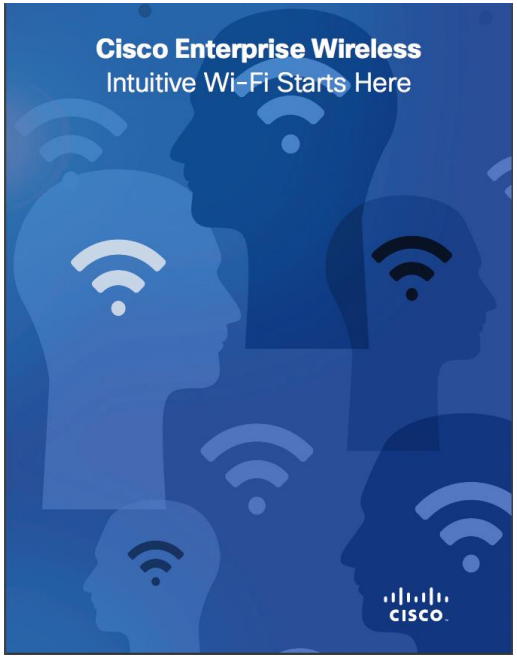
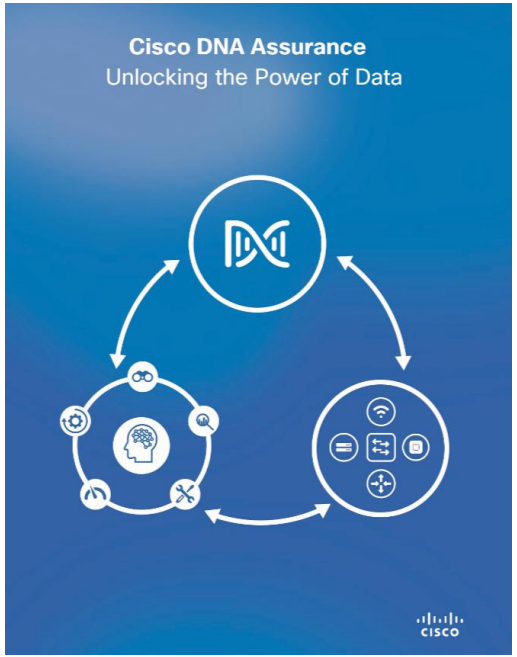
Recommended Reading

Cisco Enterprise Wireless & Cisco DNA Assurance



http://cs.co/wirelessbook



http://cs.co/assurancebook

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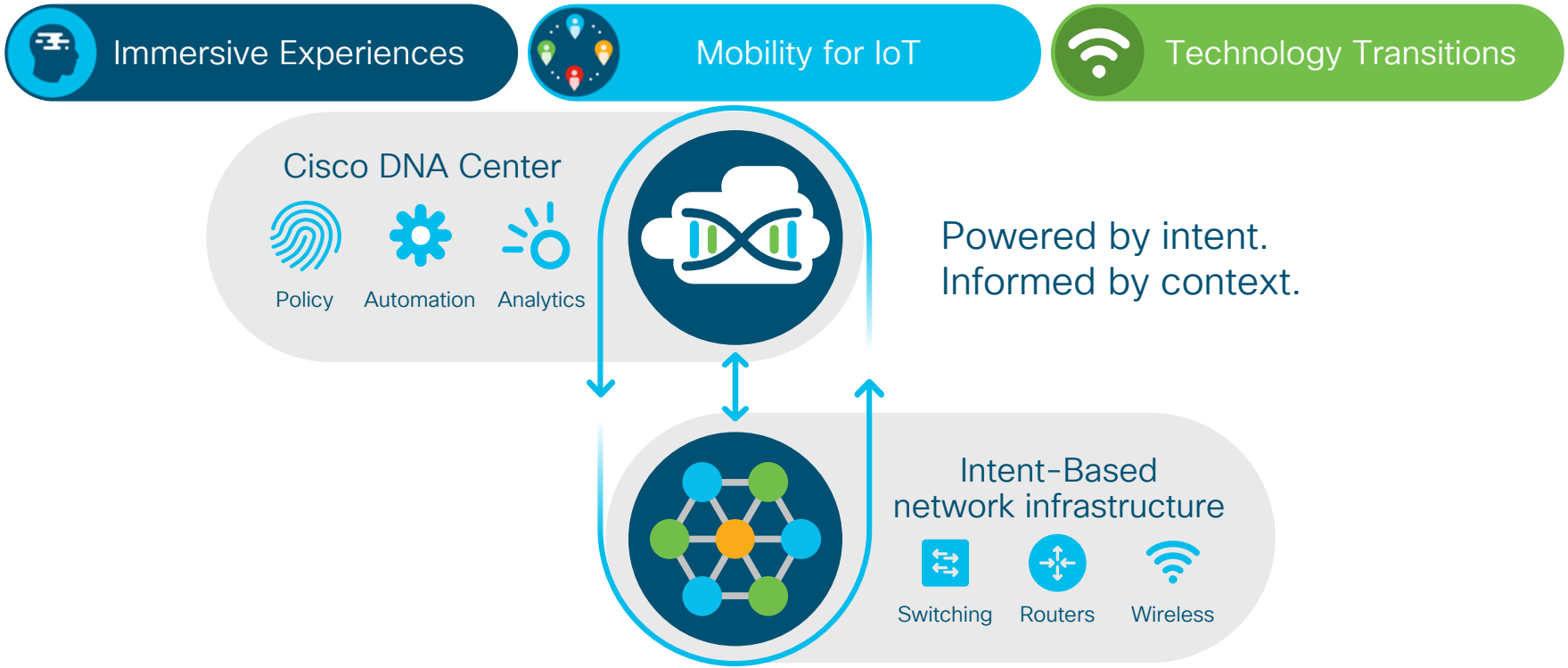
It’s Time to Think Differently about Mobility now!



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Thank you

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You make **possible**