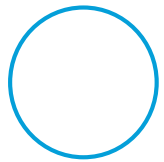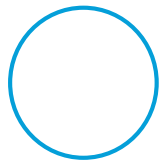# Wireless Solutions

Solutions and technology update

Radoslav Tsochev
Systems Engineer

rtsochev@cisco.com
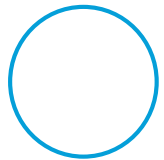
Agenda

Cisco Unified Wireless Deployments overview
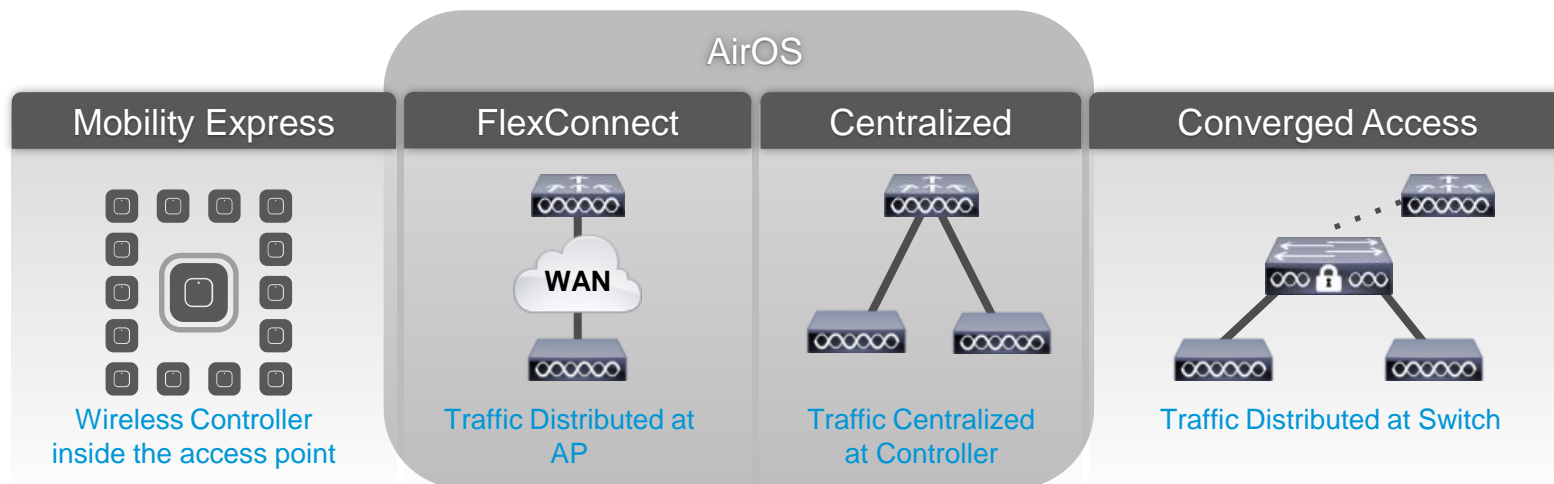
Mobility Express

Cisco High Density Experience

Unified Access—Wireless Deployment Modes

AirOS

	Mobility Express	FlexConnect	Centralized	Converged Access
	Wireless Controller inside the access point	Traffic Distributed at AP	Traffic Centralized at Controller	Traffic Distributed at Switch
Target Positioning	**Small Wireless Network**	**Branch**	**Campus**	**Branch and Campus**
Deployment	Wireless only	Wireless only	Wireless only	Wired and Wireless
Benefits	• Simple and cost-effective for small networks	• Highly scalable for large number of remote branches • Simple wireless operations with DC hosted controller	• Simplified operations with centralized control for Wireless • Wireless Traffic visibility at the controller	• Wired and Wireless common operations • One Enforcement Point • One OS (IOS) • Traffic visibility at every network layer • Performance optimized for 11ac

Cisco WLC portfolio

AirOS clasical

AireOS 2504
- 75 APs
- 1000 clients
- 1 Gbps

AireOS 5804
- 500 APs
- 7000 clients
- 8 Gbps

AireOS 5520 **NEW**
- 1500 APs
- 20,000 clients
- 20 Gbps

AireOS 8540 **NEW**
- 6000 APs
- 64,000 clients
- 40 Gbps

AireOS Virtual WLC
Scale with 8.2
- ESXi & KVM
- **3K APs**
- **32K clients**
- 500 Mbps

Mobility Express

AireOS AP 1800
- 25 APs
- 500 clients
- Flexconnect

Converged Access IOS Based

Doubled AP scale With 3.7 MR

5760
- 1000 APs
- 12,000 clients
- **Indirectly connected APs**
- 60 Gbps

Catalyst 36503850
- **50/100 APs** per switch/stack
- **Directly connected APs**
- 1K/2K clients per stack
- 40 Gbps per switch

Catalyst 4500-E SUP 8-E
- 100 APs per SUP
- **Indirectly connected APs**
- 2K clients per stack
- 40 Gbps per switch

Cisco Mobility Express

Mobility Express
Optimized for Small Scale Wi-Fi implementations

3-step over-the-air wireless network configuration with Cisco WLAN Express Setup Wizard

1

Management for up to 25 Access Points and 500 clients

2

Runs on latest Cisco® Aironet® Series Access Points

3

Mobility Express: Zero Compromise

Large Enterprise Features optimized for Small Scale implementations

✓

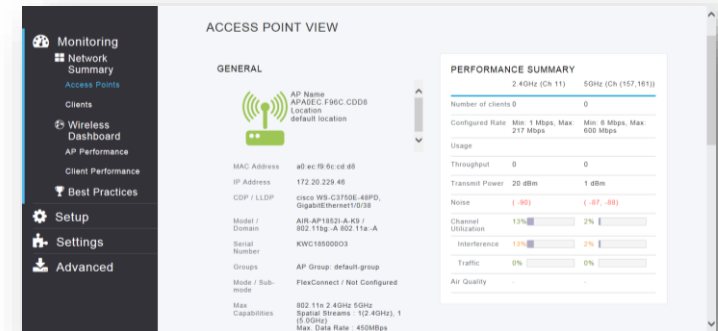**Zero Compromise**

Optimized Wi-Fi Environment

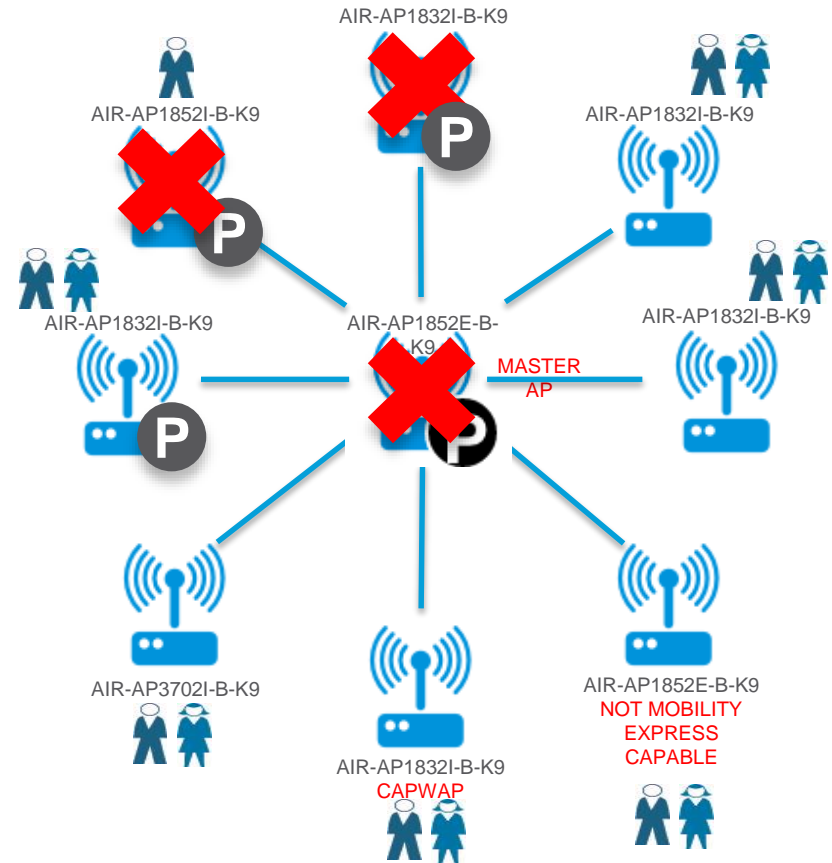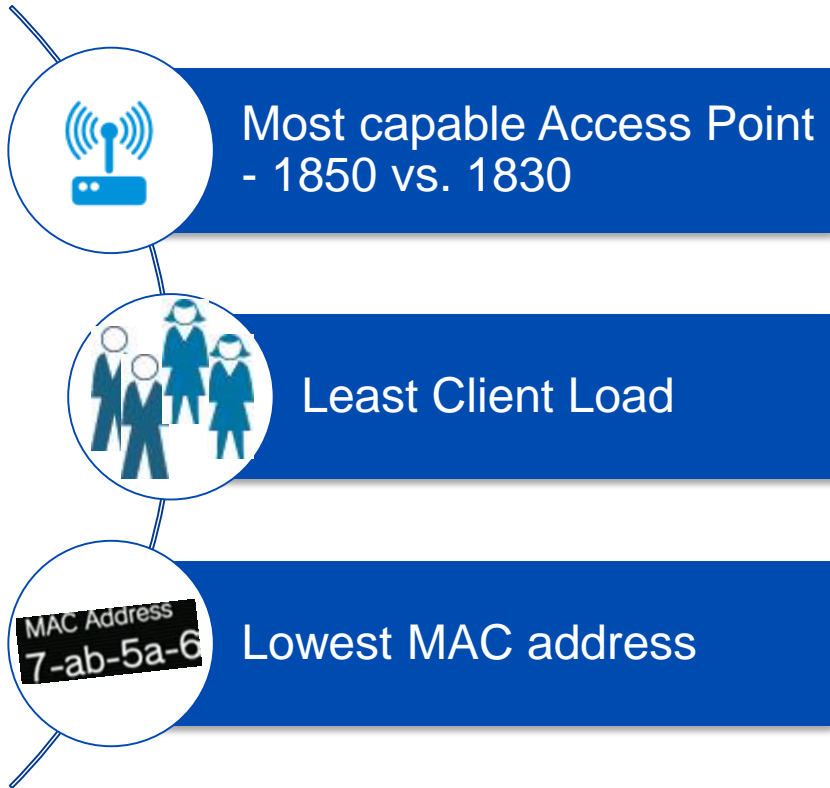Streamline deployments with out of the box best practice configuration

. . . .

Analytics Dashboard

Better decisions with Access Point, Client, and Application Visibility

. . . .

Cisco Advanced Functionality

Cisco Large Enterprise DNA applied to enhance Small Scale implementations

Self-Healing Redundancy: Master Election Process
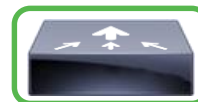
Most capable Access Point - 1850 vs. 1830

Least Client Load

Lowest MAC address

MAC Address
7-ab-5a-6

AIR-AP1832I-B-K9

AIR-AP1852I-B-K9

AIR-AP1832I-B-K9

AIR-AP1832I-B-K9

AIR-AP1852E-B-K9

AIR-AP1832I-B-K9

MASTER AP

AIR-AP3702I-B-K9

AIR-AP1832I-B-K9
CAPWAP

AIR-AP1852E-B-K9
NOT MOBILITY EXPRESS CAPABLE

Mobility Express
Investment Protection

Investment Protection
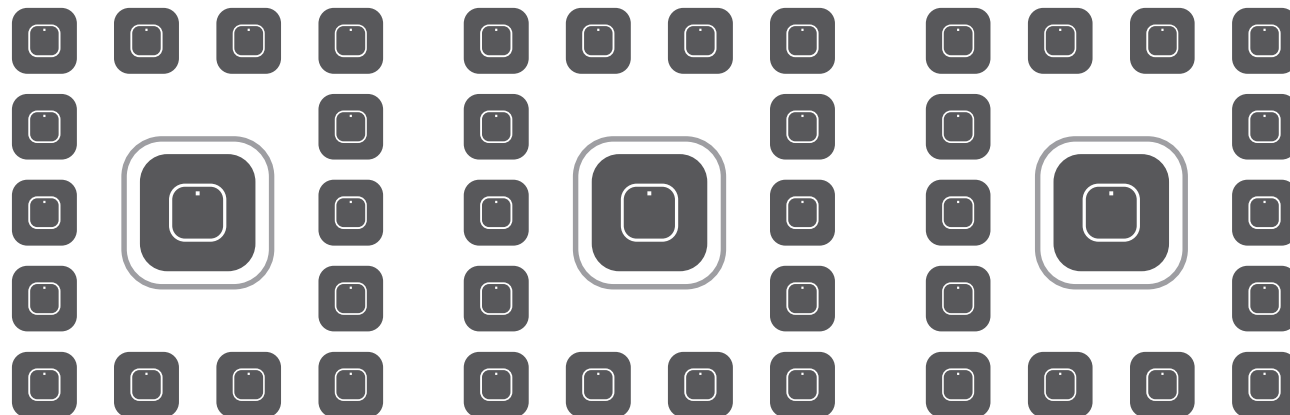
Management Point

Wireless Controller

Hardware Protection   **Flexible Migration**   **Feature Protection**

Cisco Mobility Express Access Points
Industry best 802.11ac access points

New

New

Best in Class

Mission Critical

Enterprise Class **1810**	Enterprise Class **1830**	Enterprise Class **1850**	Mission Critical **2800**	Best in Class **3800**

- 2x2:2SS 80 MHz; 867 Mbps
- Tx Beam Forming
- 1 GE Port uplink
- 3 GE Local Ports, including 1 PoE out
- Local ports 802.1x ready
- Integrated BLE Gateway*

- 802.11ac W2
- 870 Mbps PHY
- 3x3:2SS
- Spectrum Analysis*
- Tx Beam Forming
- USB 2.0

- 802.11ac W2
- 2.0 Gbps PHY
- 4x4:4SS
- Spectrum Analysis*
- Tx Beam Forming
- 2 GE Ports, USB 2.0

- 5 Gbps PHY
- 4x4:3SS – 160 MHZ – MU-MIMO
- 2 Ethernet Ports, 2xGbE
- Dual 5 GHz
- HDX Technology
- USB 2.0
- StadiumVision
- CleanAir 160MHz, ClientLink 4.0, Videostream

- 5 Gbps PHY
- 4x4:3SS,160 MHZ, MU-MIMO
- 2 Ethernet Ports, GbE + mGig (1G, 2.5G, 5G)
- Dual 5 GHz
- HDX Technology
- USB 2.0
- StadiumVision
- CleanAir 160MHz, ClientLink 4.0, Videostream
- Side Mount Modular Architecture

Cisco Mobility Express is supported on all 11ac Wave 2 Access Points

Best In Class

Flexible Radio Assignments
Aironet 2800 and 3800 Series Innovations

5GHz Serving	**2.4GHz Serving**	• Default operating mode • Serve Clients on both 2.4GHz and 5GHz
5GHz Serving	**5GHz Serving**	• Dual 5GHz Support, both radios serving clients on 5GHz • Maximum over the air data rate up to 5.2Gbps
5GHz Serving	**Wireless Security Monitor**	• Wireless Security Monitoring • Scan both 2.4GHz and 5GHz for security threats • Serve Client of 5GHz
5GHz Serving	**Wireless Service Assurance***	• Wireless Service Assurance* • Proactively monitors the network performance • Serve Client of 5GHz
5GHz Serving	**Enhanced Location***	• Enhanced Location* • Improves the client location accuracy • Serve Client of 5GHz

CISCO

Dual 5GHz radio benefits
Aironet 2800 and 3800 Series Innovations

802.11ac wave 2 – Dual - 5GHz 80 MHz Channels

	Radio 1 – 5GHz	Radio 2 – 5GHz	Total
Max Data Rate	1.3Gbps	1.3Gbps	2.6 Gbps
Actual Throughput*	845Mbps	845Mbps	1.69 Gbps

802.11ac wave 2 – 160 MHz Channels

	Radio 1 – 2.4GHz	Radio 2 – 5GHz	Total
Max Data Rate	216Mbps	2.6Gbps	2.81 Gbps
Actual Throughput*	140Mbps	1.69Gbps	1.79 Gbps

802.11ac wave 2 – Dual - 5GHz 160 MHz Channels

	Radio 1 – 5GHz	Radio 2 – 5GHz	Total
Max Data Rate	2.6Gbps	2.6Gbps	5.2 Gbps
Actual Throughput*	1.69Gbps	1.69 Mbps	3.38 Gbps

* Denotes 65% Duty Cycle which emulates normal wireless network operation

- 802.11ac wave 2 utilizes key technologies such as Multi-user MIMO and 160MHz wide channels to push wired throughput above 1Gbps

- Cisco Dual-5GHz radio technology more effectivity utilizes the 5GHz RF spectrum to drive the wired throughput toward multi-gigabit speeds

Optimal coverage
Aironet 2800 and 3800 Series Innovations
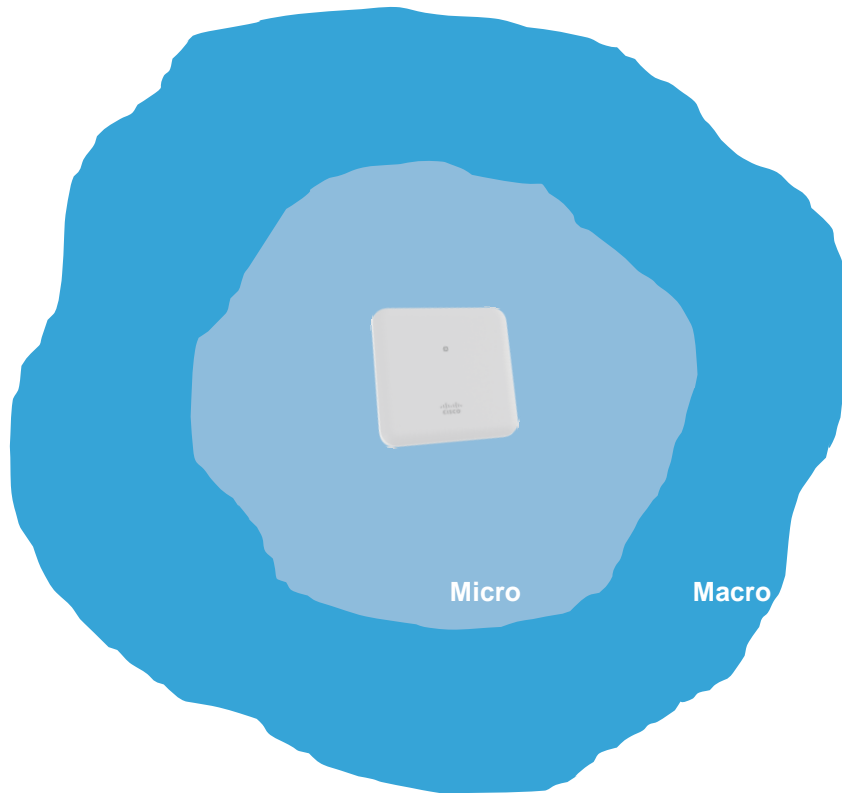
Micro

Macro

- Improves the Effective Spectrum Usage of the Cell
- Micro-Radio
  - 802.11ac Clients near the AP
  - High Performance Wi-Fi Clients at 802.11ac data rates
  - Excellent speed and performance
- Macro-Radio
  - All legacy Clients join macro-cell
- Future of wireless

Users have a better overall experience on a Dual 5GHz Access Point

Cisco High Density Expirience

Turbo Performance
Hardware matters

Hardware architecture for high throughput in high density environment

Utilize dedicate packet CPU's and memory

Advanced per client packet scheduler

Implemented in 2700, 3700, 2800 and 3800 series

Cisco's custom silicon architecture allows for distribution of processing between radio CPU and main CPU along with a 4x4 Antenna Design

Traditional Access Point Design

Radio - 2.4GHz

Radio - 5GHz

Dual-Core CPU 800MHZ

DRAM (512MB)
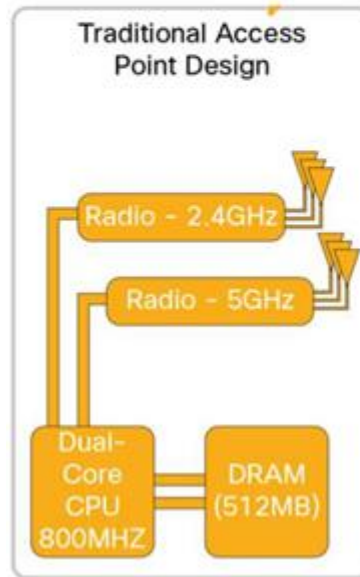
On-radio CPU and memory for distributed packet processing and optimizing throughput

Customized Access Point Design

Radio - 2.4GHz
DRAM (128MB)
CPU 384 MHz | DSP

Radio - 5GHz
DRAM (128MB)
CPU 512 MHZ | DSP

Dual-Core* CPU 800MHZ

DRAM (512MB)

cisco
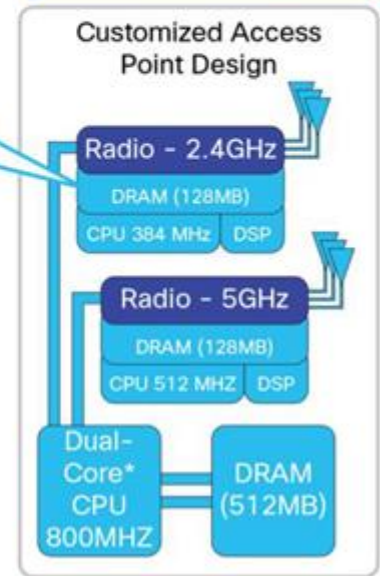
Turbo Performance - Results

Throughput Comparison
HDX Scheduling vs. Traditonal Scheduling
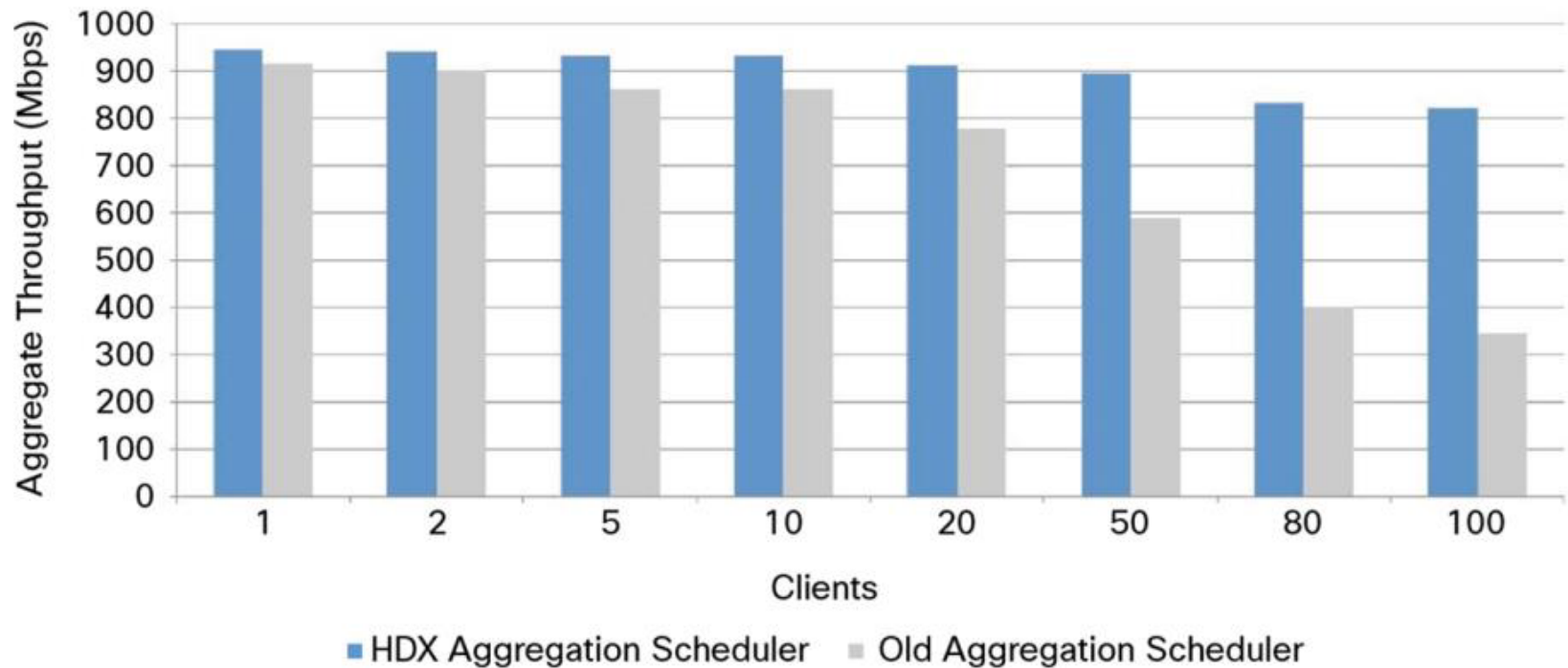
Event-Driven Radio Resource Management

Before
Rogue Wi-Fi interference decreases reliability and performance until next dynamic channel assignment (DCA) cycle

After
Mitigated RF interference for improved reliability and performance

Improved Client Performance

Air Quality

Performance

Air Quality

Performance

Rogues seen as security threat only	Non-Wi-Fi interference prioritized

Wi-Fi and non-Wi-Fi aware	Dynamic mitigation ED-RRM	Granular spectrum visibility and control

Complete Automatic Interference Mitigation Solution for Rogues and Non-Wi-Fi Interference

Optimized Roaming

Today's Solution

Weak Wi-Fi Signal

Overall Drop In Cell Performance

Client Stickiness Causes Poor User Experience

-85dB

-80dB

Cisco "Optimized Roaming"

-80dB

-80dB

Consistent User Experience

Efficient Cell Usage

3G or 4G
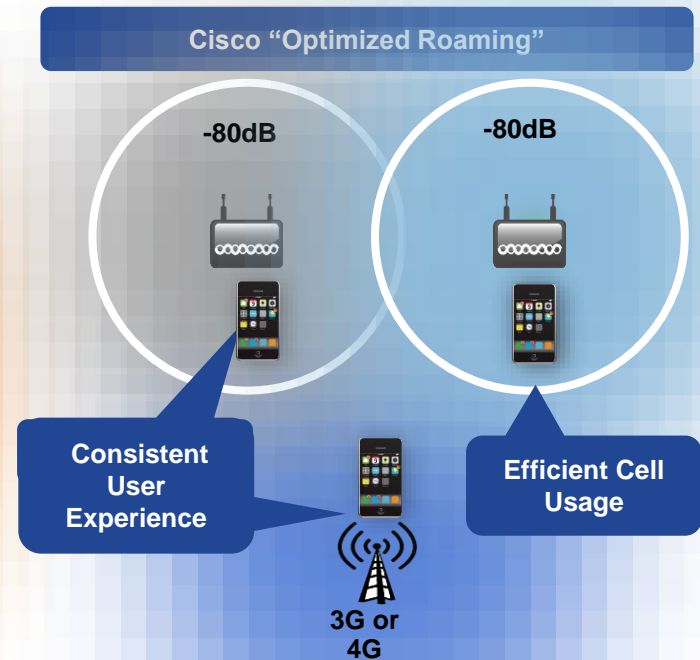
Cisco's "Optimized Roaming" helps prevent a negative experience for Wi-Fi users by monitoring the connection quality of all devices and proactively prompting poorly performing client devices to seek a better connection much sooner.

CISCO

Client Link 4.0
Client independent beamforming

Improves device performance

802.11ac Wave 2
Access Point Client
Client Link beamforming

Access Point TX

- 802.11ac Wave 2
- 802.11g
- 802.11n
- 802.11ac Wave 1
- 802.11ac Wave 2
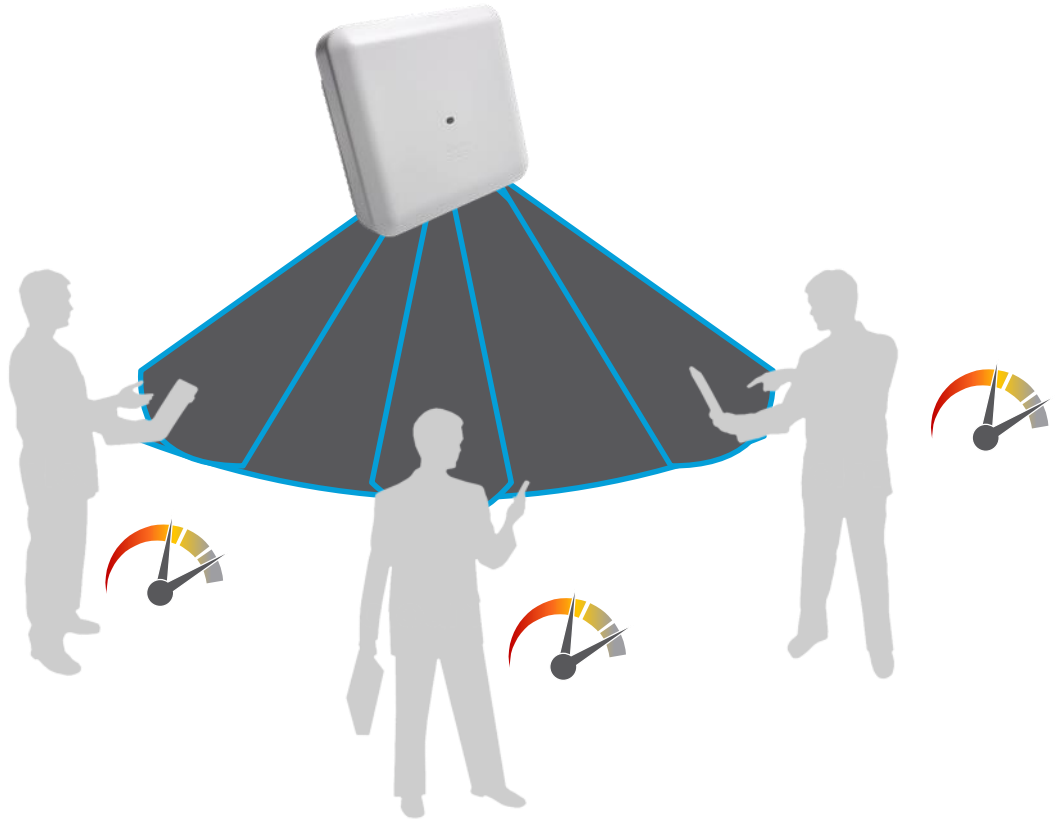
Dynamic Bandwidth Selection (DBS)

Before	After
Complex configuration and inefficient use of spectrum	**Automatic and intelligent use of spectrum**

80 MHz Channel 52/56/60/64

Interference impacts 80 MHz…what can I use?

52 56 **60** 64

Radio Resource Management (RRM) selects channel only

Difficult to find non-overlapping channels

52 56 **60** 64

Primary 20	Secondary 20	Secondary 40

52 56 60 64

- 80-MHz channel 52/56/60/64
- Interference is impacting **only** channel 60
- 3x20 MHz channels still available or 1x40 MHz and 1x20 MHz

RRM selects channel and channel width

Automatic detection of non-overlapping channels

Air Time Fairness (ATF)

Before
Rate limiting can only specify a bit rate (throughput) limit.
There is no way to limit the duration that the bit rate will use.

After
Air time is allocated per SSID, per realm, per client.
There is now better control over how air time is shared.

Gain the Ability to Meet SLAs

SSID 2 48%

SSID 1 52%

SSID 2 30%

SSID 1 70%
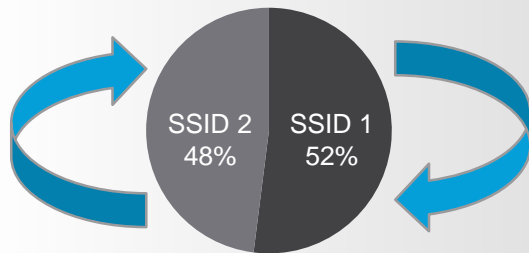
Bandwidth rate unpredictable	Client-dependent fluctuation	Not time-based
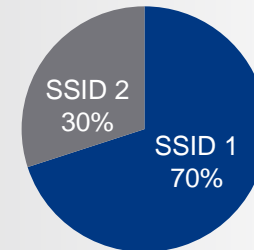
Time-based	Automatic calculation on availability	Ongoing recalculation

Improved Predictability and Performance

Apple and Cisco

Optimized Wi-Fi Connectivity
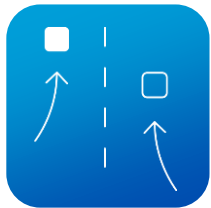
Prioritized Business Apps

What happens Today?

In 802.11, delay in roaming causes poor experience, especially for rich-media real-time applications. Interoperability increases complexity and prevents adoption.

Standards to the rescue?

- 802.11r – Fast Roaming
- 802.11k – Neighbor List
- 802.11v – BSS Transition

But

- Operational Complexity
- Multiple SSIDs – some clients can't associate with SSIDs enabled with 11r

802.11k, 802.11v, 802.11r help efficient roaming

Association

802.11r enables fast roaming without complete reauth
802.11k sends you list of neighbors
802.11v BSS Transition sends you the new best AP: Cisco-AP-2

Cisco-AP-1

Fast Transition (802.11r)

Cisco-AP-2
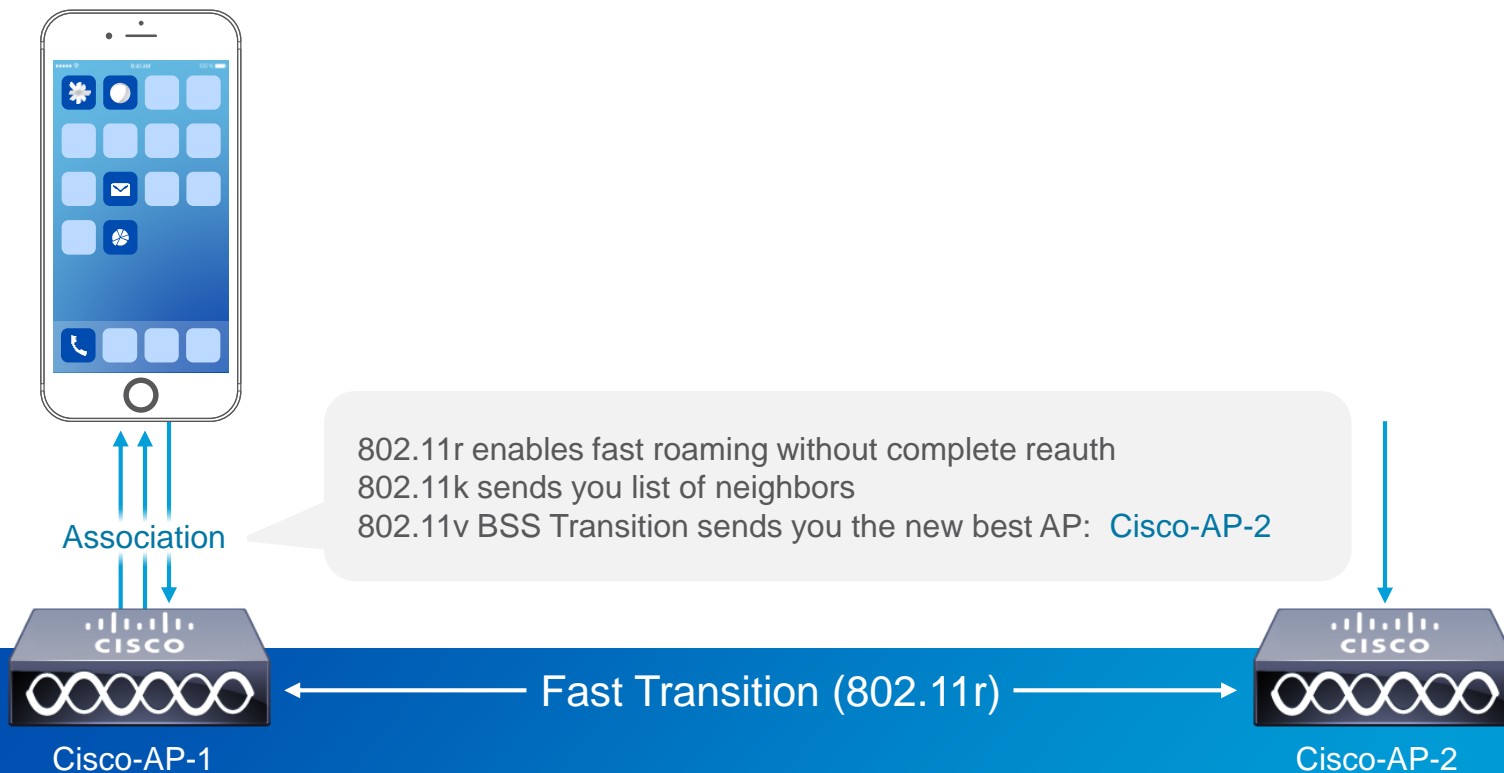
Optimized Roaming reduces management overhead by up to 50%

Legacy client **cannot** join the same SSID where 11r is enabled

Legacy client that does not support 11r/k/v **can** join the same SSID

I recognize that you are an Apple device 11r is enabled for you

802.11k, 802.11v are on by default

Association

Non-Cisco-AP

Cisco-AP
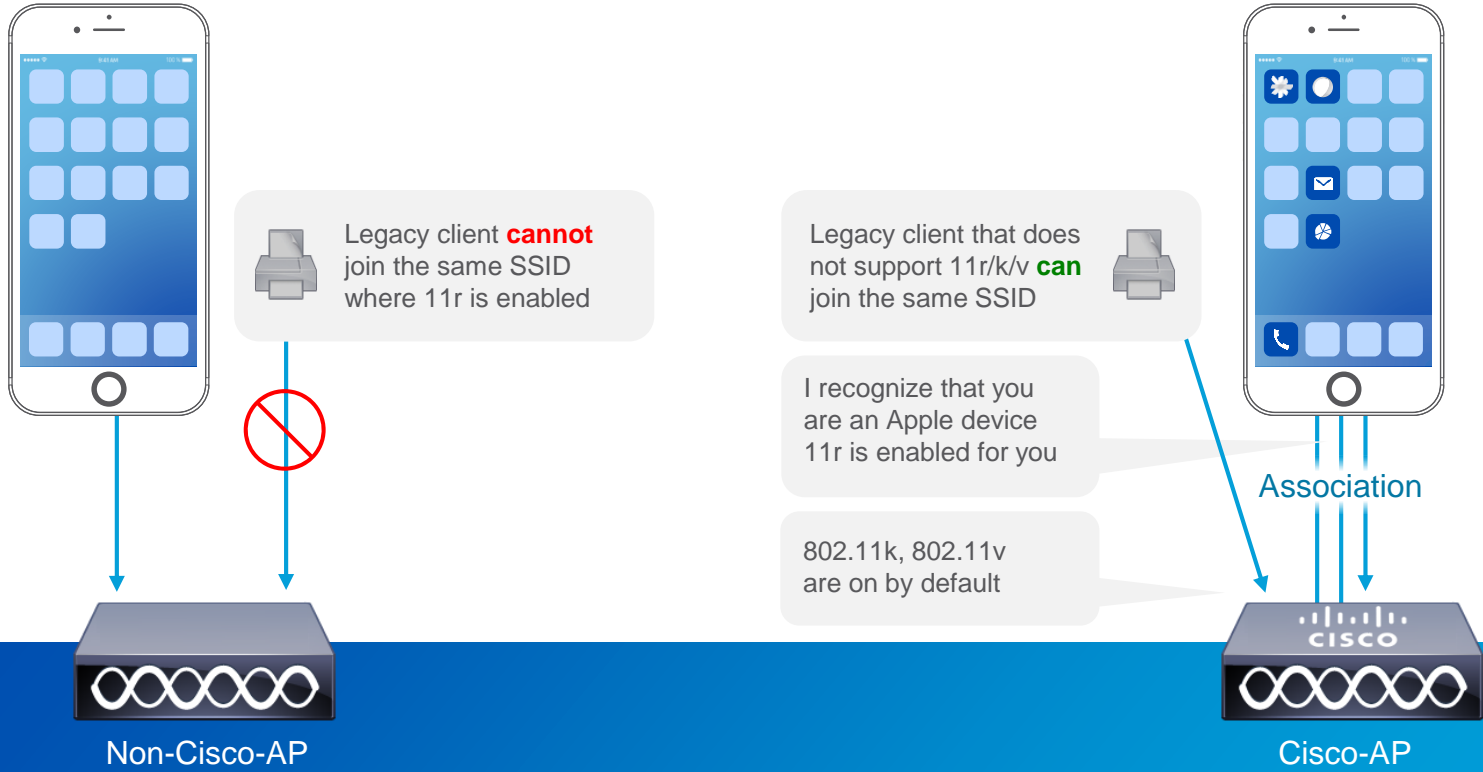
What happens Today?

IT cannot prioritize business-critical real-time traffic all the way from clients to the destination

Today IT Administrators can classify traffic ONLY at the access point. This implies:

- Inability to prioritize between the client and the AP

- Burden on IT administrator to manage the applications across the enterprise

Fast lane Configuration Profiles

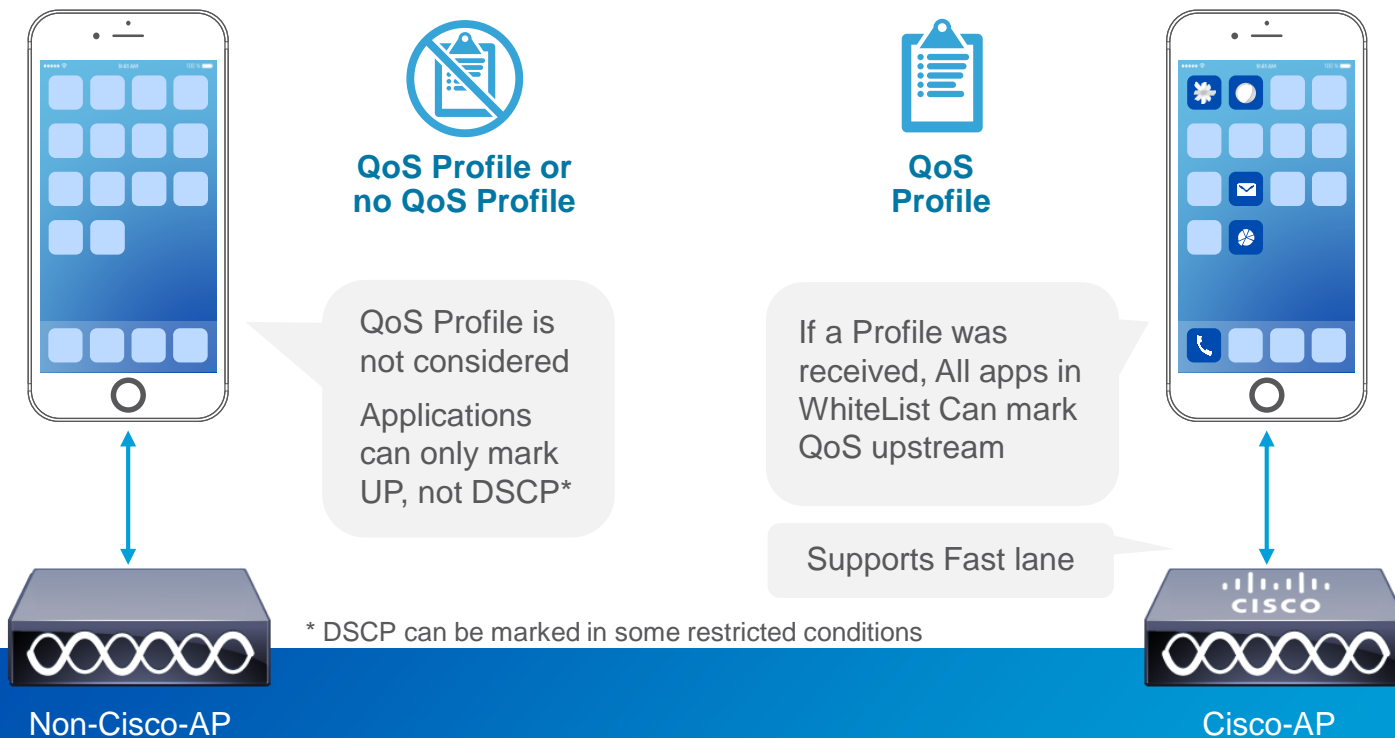A QoS configuration profile will ONLY be acted upon on a iOS 10 device

Uses standard Apple iOS configuration profiling techniques (MDM, email, Web-based)
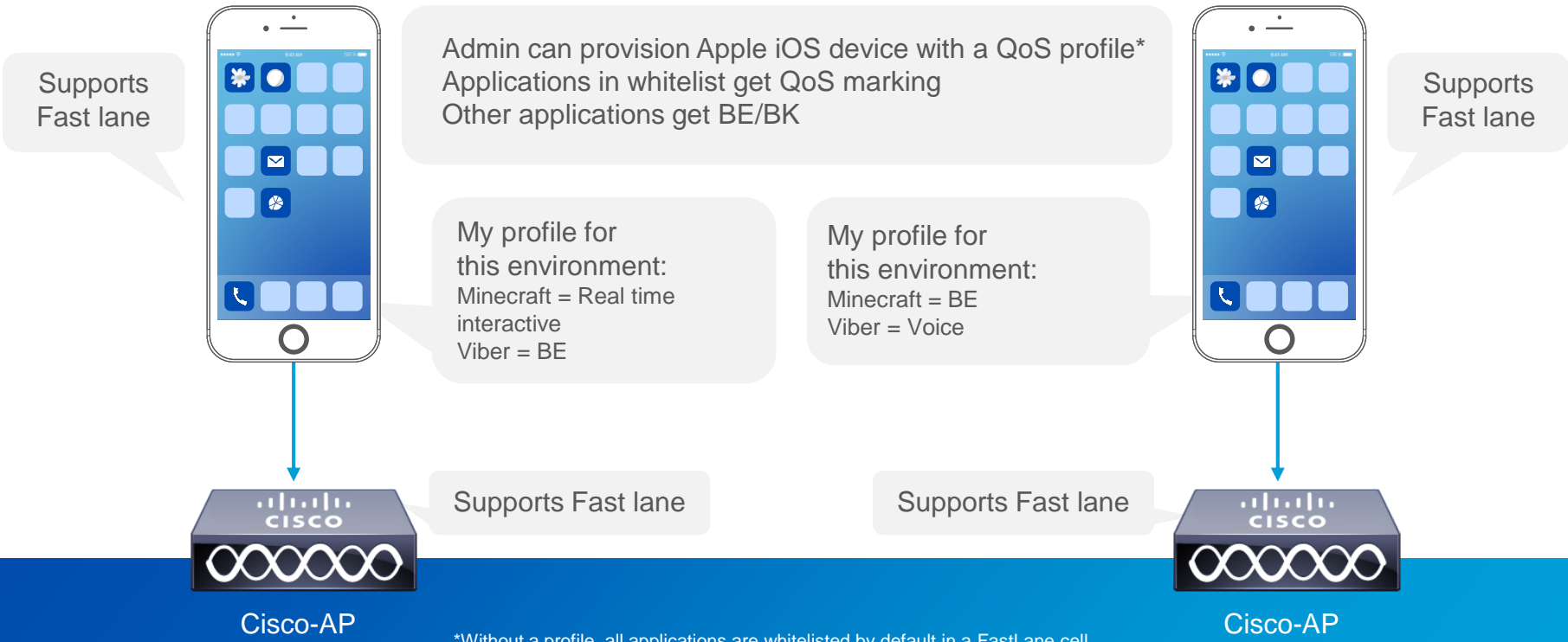
- The profile lists "whitelisted" applications in a dictionary file
- Whitelisted applications are allowed to mark QoS (DSCP/UP) upstream
- 'Non-Whitelisted' applications receive only BE/BK marking upstream

Used in Combination with Cisco and Apple mutual detection

Fast lane only applies to Cisco and Apple Deployments

QoS Profile or no QoS Profile

QoS Profile

QoS Profile is not considered

Applications can only mark UP, not DSCP*

If a Profile was received, All apps in WhiteList Can mark QoS upstream

Supports Fast lane

* DSCP can be marked in some restricted conditions

Non-Cisco-AP

Cisco-AP

Fast lane enables network administrator to prioritize applications per your environment

Supports
Fast lane

Admin can provision Apple iOS device with a QoS profile*
Applications in whitelist get QoS marking
Other applications get BE/BK

Supports
Fast lane

My profile for
this environment:
Minecraft = Real time interactive
Viber = BE

My profile for
this environment:
Minecraft = BE
Viber = Voice

Supports Fast lane

Supports Fast lane

Cisco-AP

Cisco-AP

*Without a profile, all applications are whitelisted by default in a FastLane cell

**FastLane does NOT override apps QoS, it either allow the app QoS or apply BE