

Wi-Fi 7 is Here. Are you ready?

CISCO Live !

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Sr. Technical Leader, Technical Marketing

Cisco Webex App

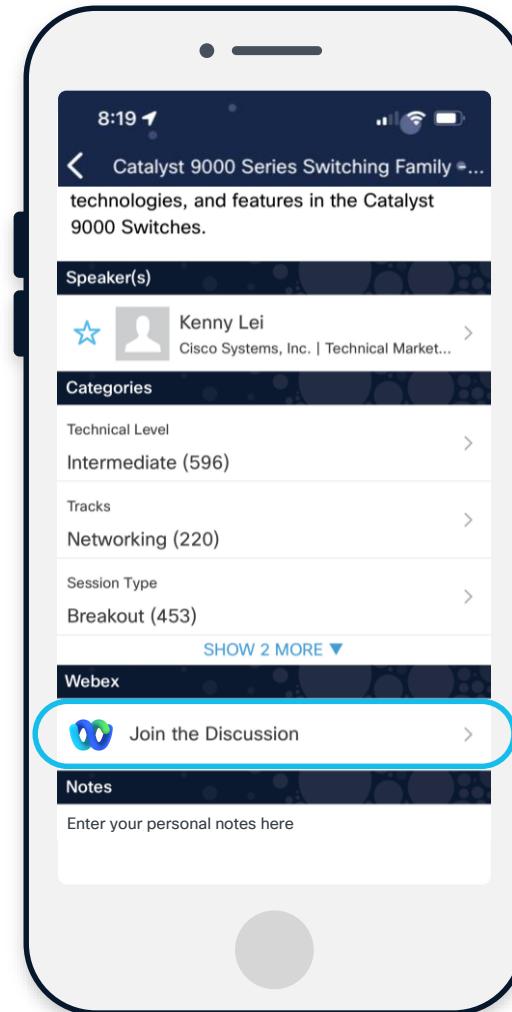
Questions?

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- 1 Find this session in the Cisco Live Mobile App
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Agenda



Why 6 GHz & Wi-Fi 7?



Get to know Wi-Fi 7



Cisco Wi-Fi 7 Product Portfolio

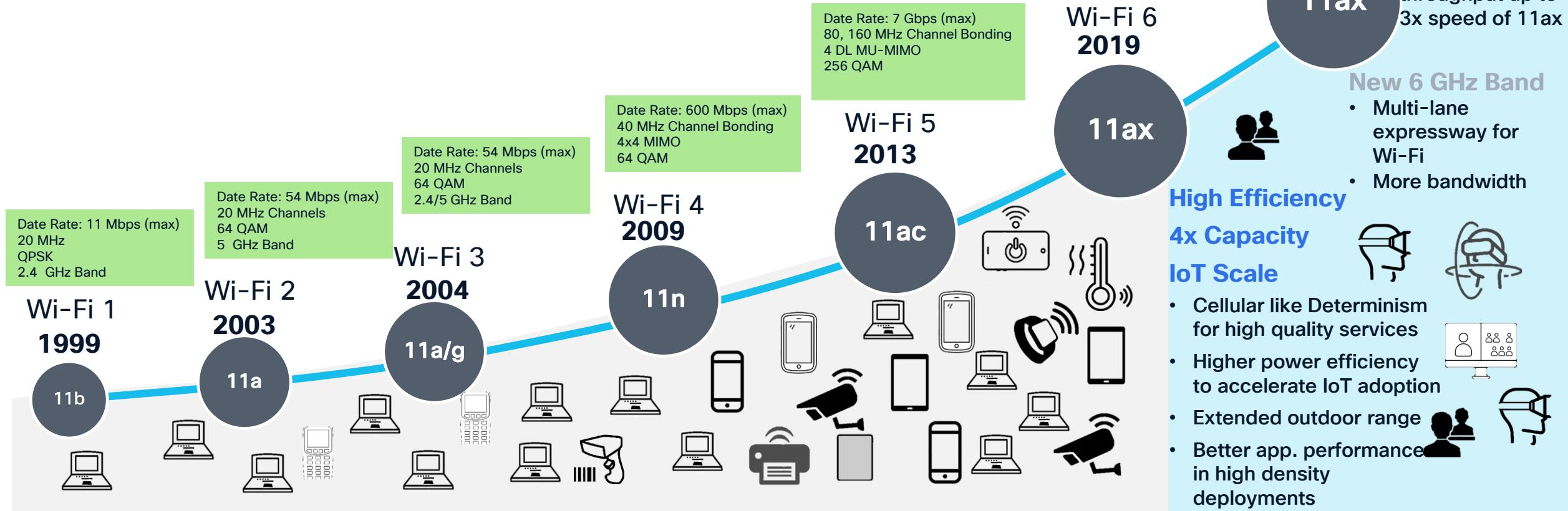


Deployment & Migration considerations

Why Wi-Fi 7 ?

Wi-Fi Evolution

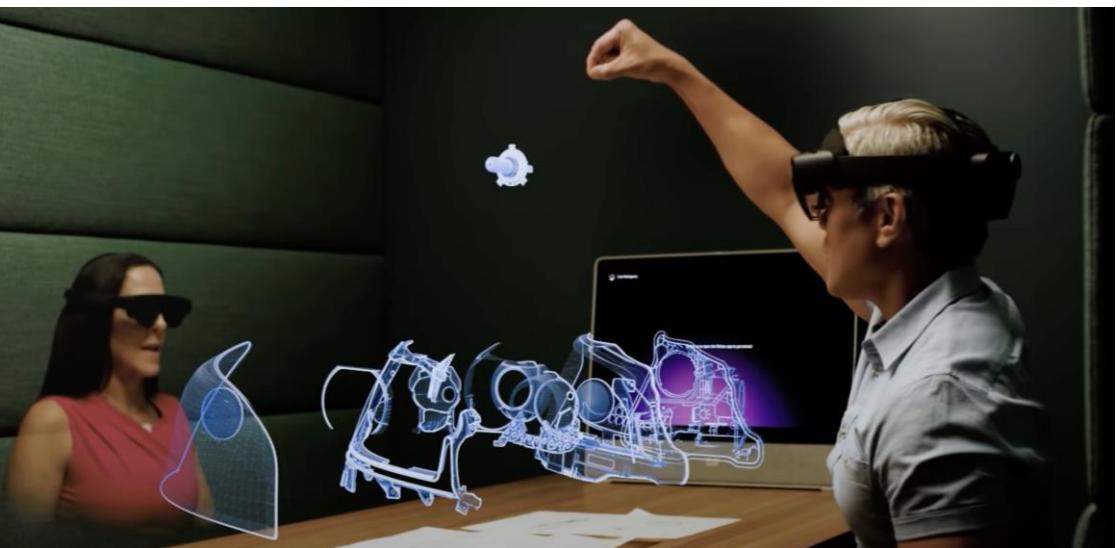
- 25 years of constant evolution with faster speeds and density
- Prior to 6E: Spectrum shared in two bands 2.4 and 5 GHz
- 6E and Above: Spectrum shared in three bands 2.4, 5 and 6 GHz





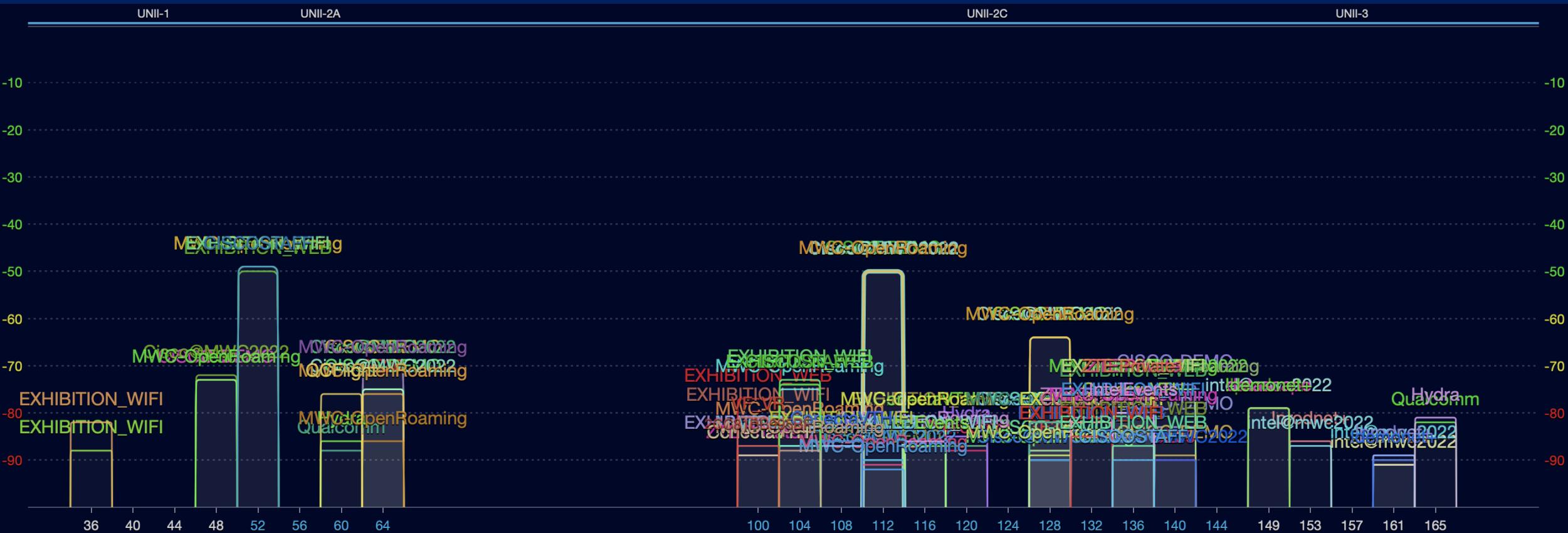
Wi-Fi

Meeting the Demands of a Hyperconnected World Bandwidth, Latency & Beyond

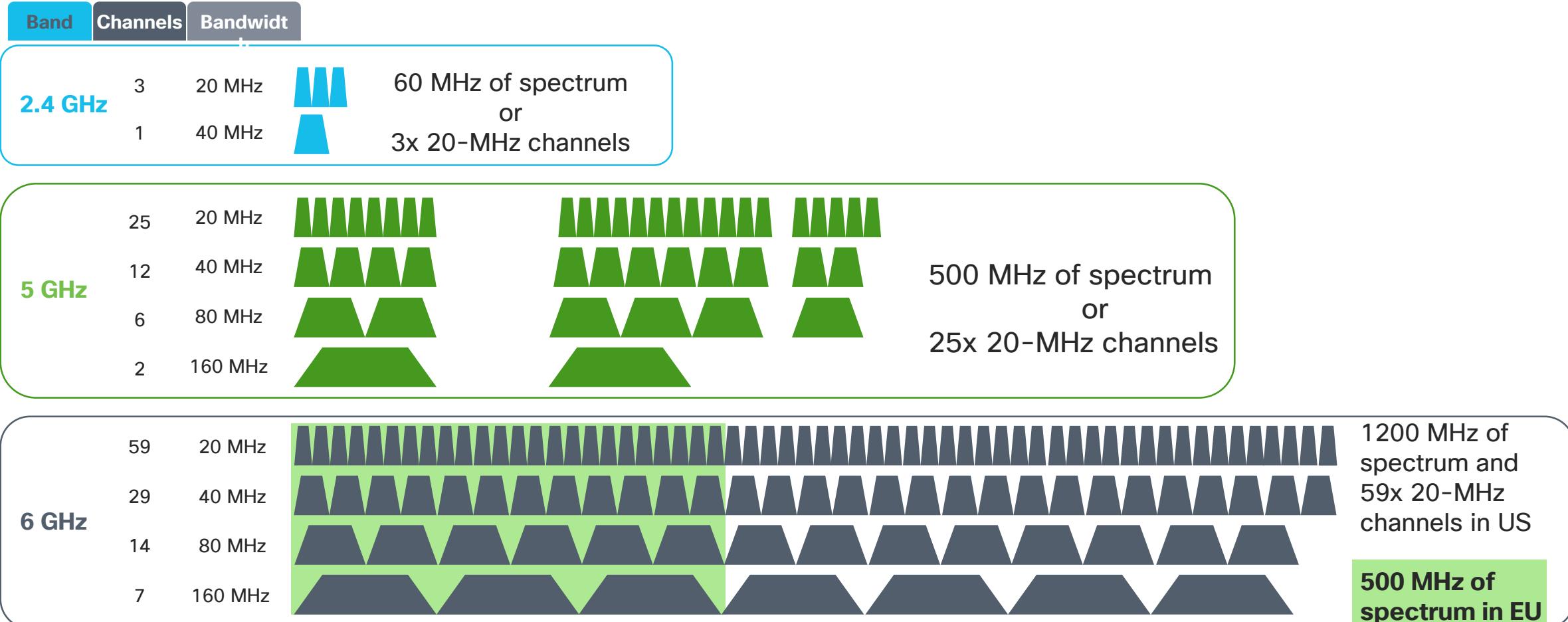


What is the problem?

- Existing 2.4 GHz and 5 GHz spectrum is congested
- Interference
- Limited re-usable channels
- No way to use 80 or 160 MHz channels



6 GHz Wi-Fi spectrum expansion: Available with Wi-Fi 6E & Wi-Fi 7 today!



Wi-Fi 7 Use Cases



What is Wi-Fi 7?

Wi-Fi 7 & IEEE 802.11be

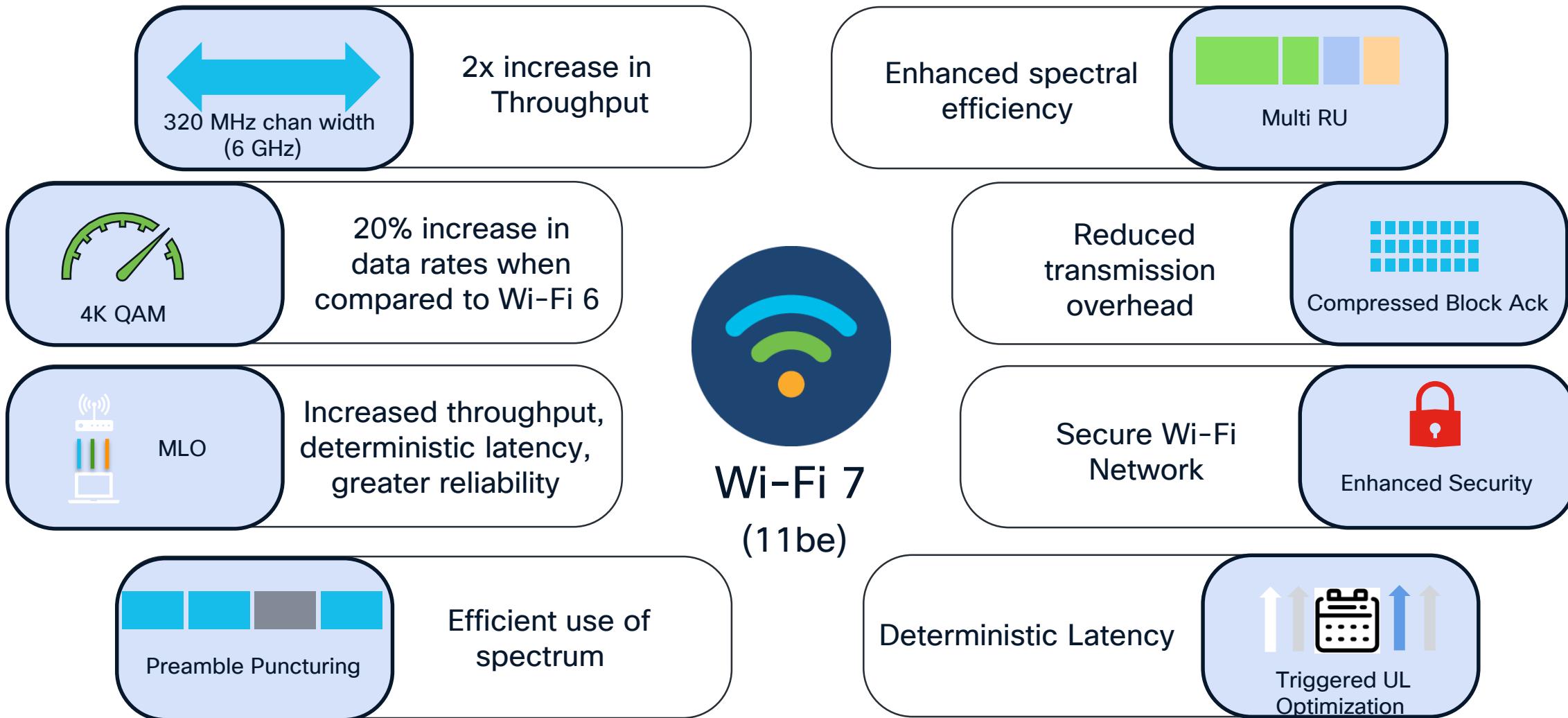
Wi-Fi 7 based on IEEE 802.11be amendment
termed as “Extremely High Throughput”

IEEE 802.11be final publication expected anytime.

Wi-Fi 7 R1 spec finalized in Jan '24. WFA certification for R1 in progress.
R2 expected Dec 2025.

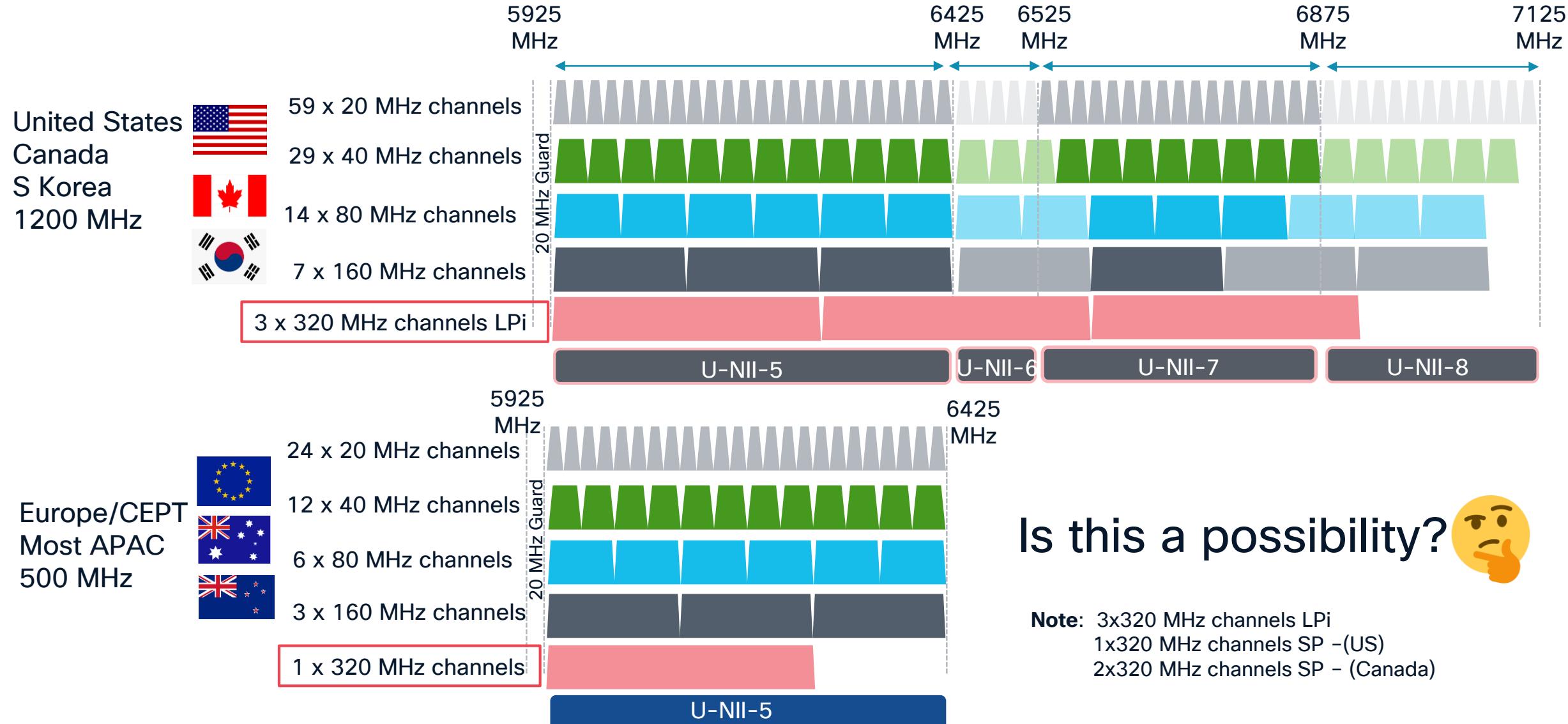
Cisco has been closely involved in development of Wi-Fi 7, and advocates
for thorough client interop testing

Wi-Fi 7 Rel 1 Features



Wi-Fi 7 Feature Overview

Wi-Fi 7 – 320 MHz channel width in 6 GHz



Is this a possibility? 🤔

Wi-Fi 7 4K-QAM

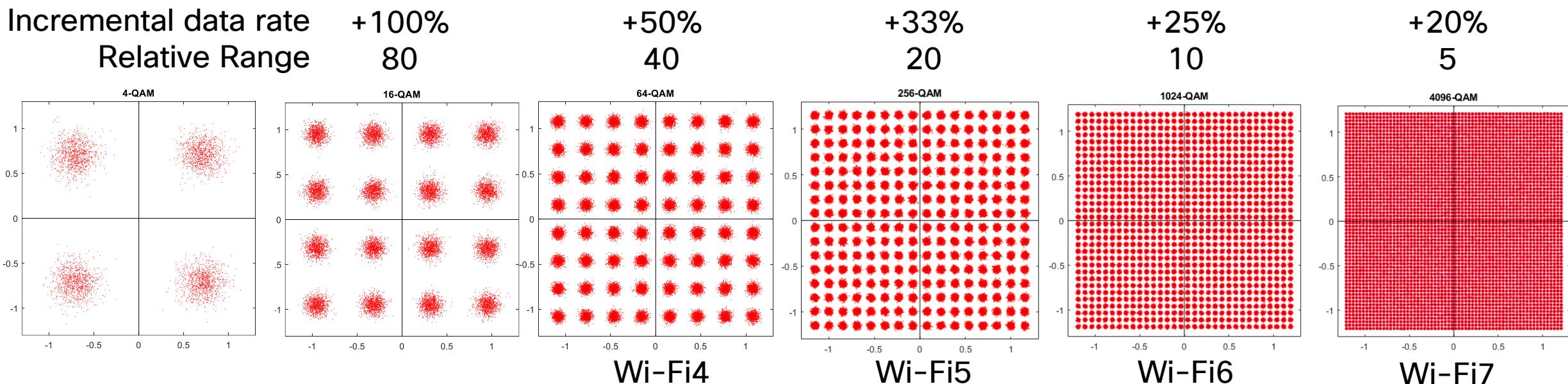
(MCS12/13) increases the peak PHY data rate

- MCS 12 and MCS 13 indicate a 4096-QAM constellation with a code rate of $\frac{3}{4}$ and $\frac{5}{6}$ respectively
- Very short range and most suited to a 1 antenna client with a multi-antenna AP (beamforming, MRC)

Need very high SNR for 4K QAM



Each increment in constellation size reduces range by approx. 50%





**MLO - Coolest Feature in
Wi-Fi 7 !!**

What's the coolest feature in Wi-Fi 7 ?

One of the coolest features of Wi-Fi 7 (802.11be) is **Multi-Link Operation (MLO)**.

Why it's cool:

MLO allows devices to connect over multiple bands (2.4 GHz, 5 GHz, and 6 GHz) *simultaneously*. That means:

- Faster speeds (by aggregating bandwidth across bands),
- Lower latency (by choosing the fastest path for each data packet),
- Better reliability (if one band gets congested or fails, others keep you connected).

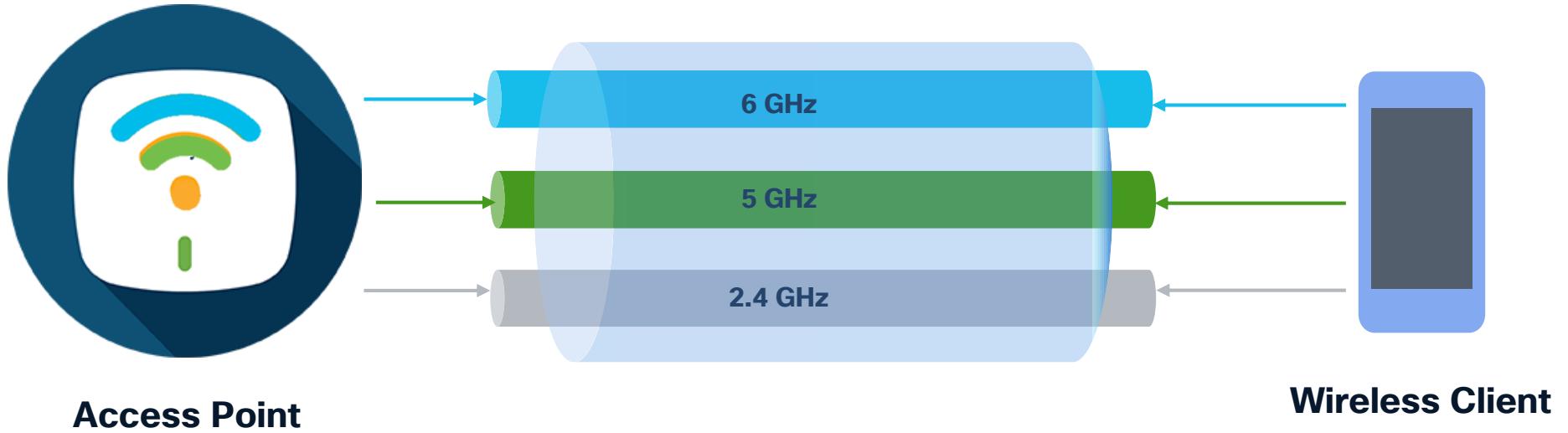
Bonus cool features:

- **320 MHz channel bandwidth** (double that of Wi-Fi 6) → massive throughput.
- **4096-QAM modulation** → higher data rates by encoding more bits per transmission.
- **Preamble puncturing** → allows use of cleaner parts of a channel even if part is interfered.

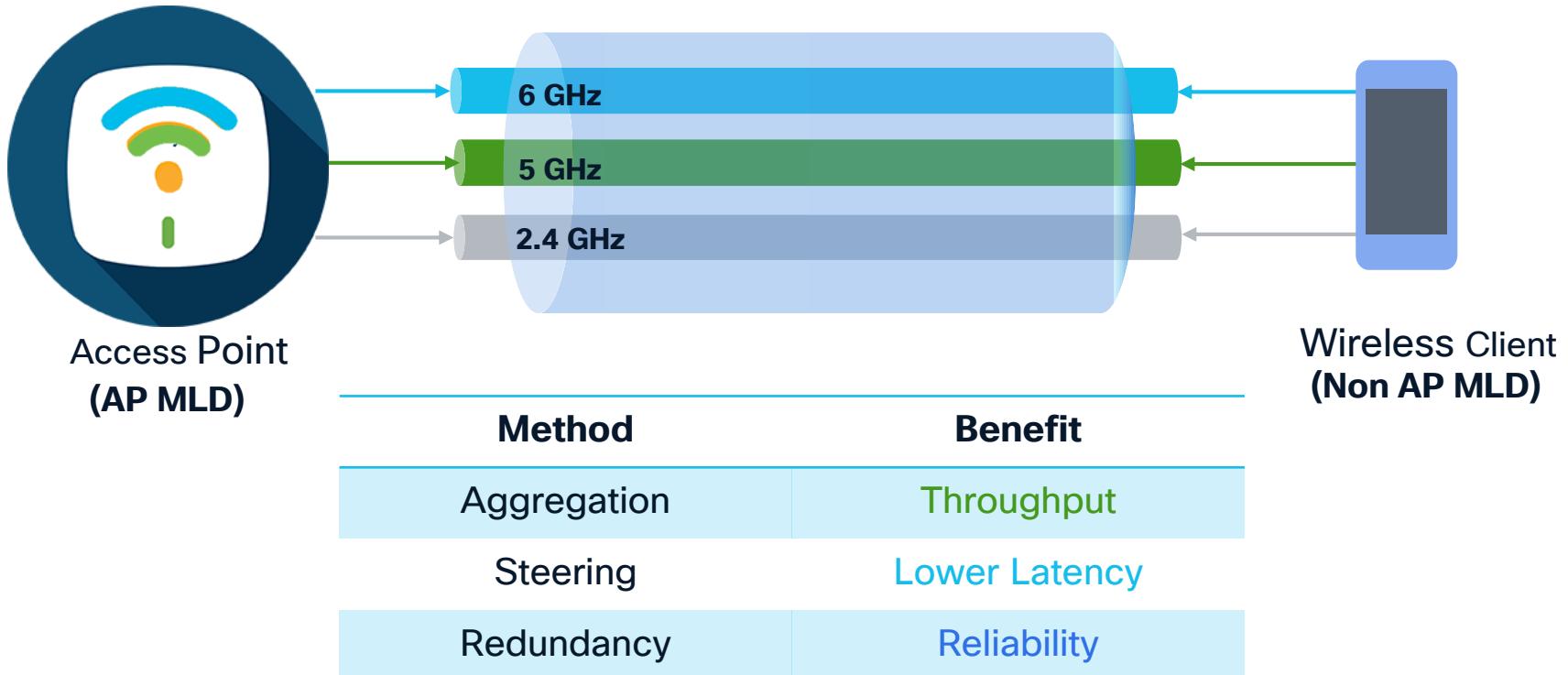
Wi-Fi 7 is all about **speed, responsiveness, and resilience**—ideal for VR, AR, gaming, and 4K/8K streaming.

Are you thinking of upgrading to a Wi-Fi 7 setup or just curious about the tech?

Wi-Fi Multilink (MLO)

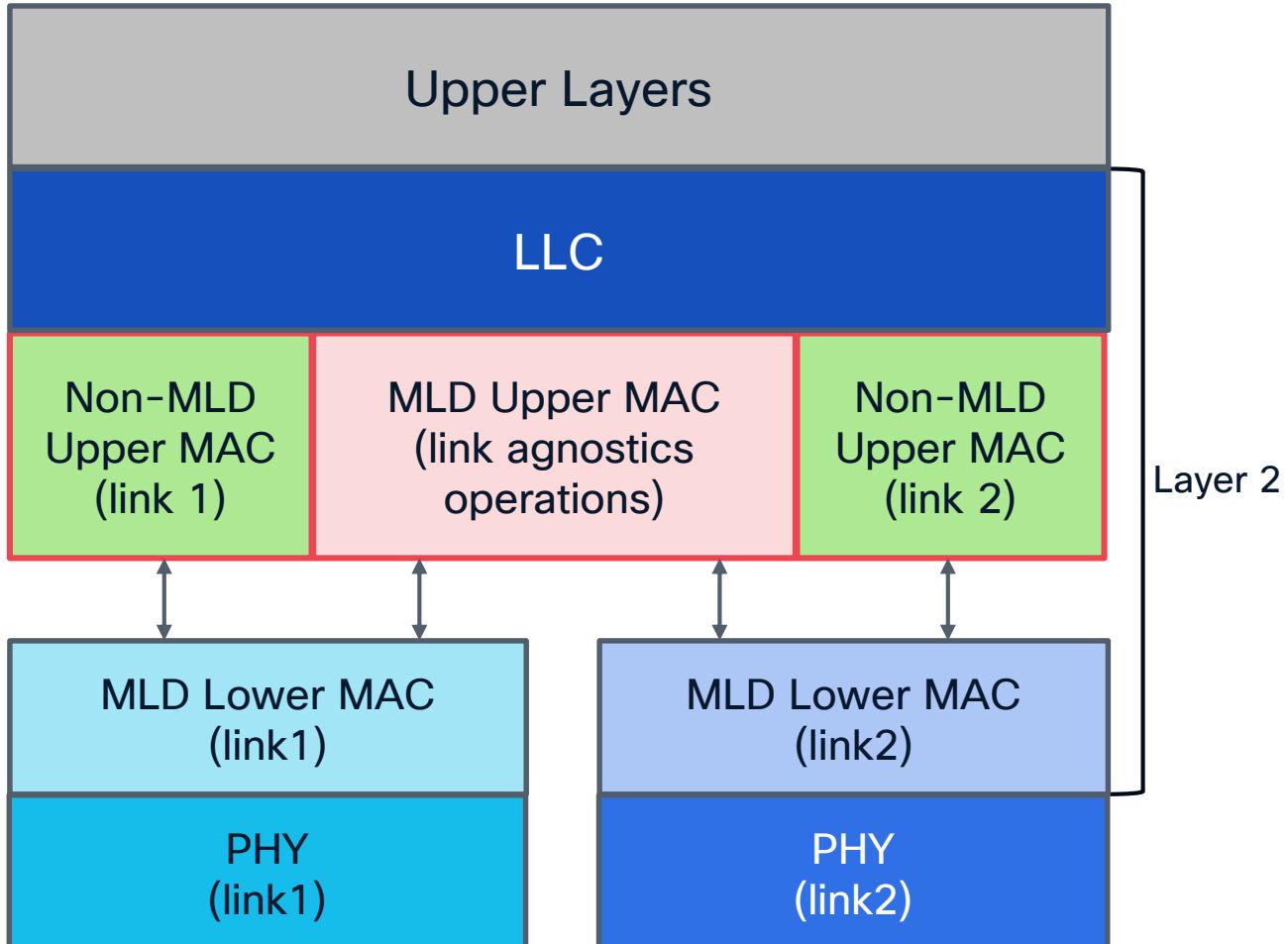


Wi-Fi 7 – Multilink (MLO)



MLD: Multi Link Device

Wi-Fi 7 MLD MAC layers



MLD upper MAC layer functions :

- Auth, (Re)association
- Security association
- SN assignment for unicast & groupcast frames
- Encryption/Decryption of unicast frames
- Power save buffering of unicast frames
- MLD level management frames
- Unified Block Ack scoreboard
- Packet re-ordering, replay detection
- Selection of MLD lower MAC for Tx

Non-MLD upper MAC layer functions:

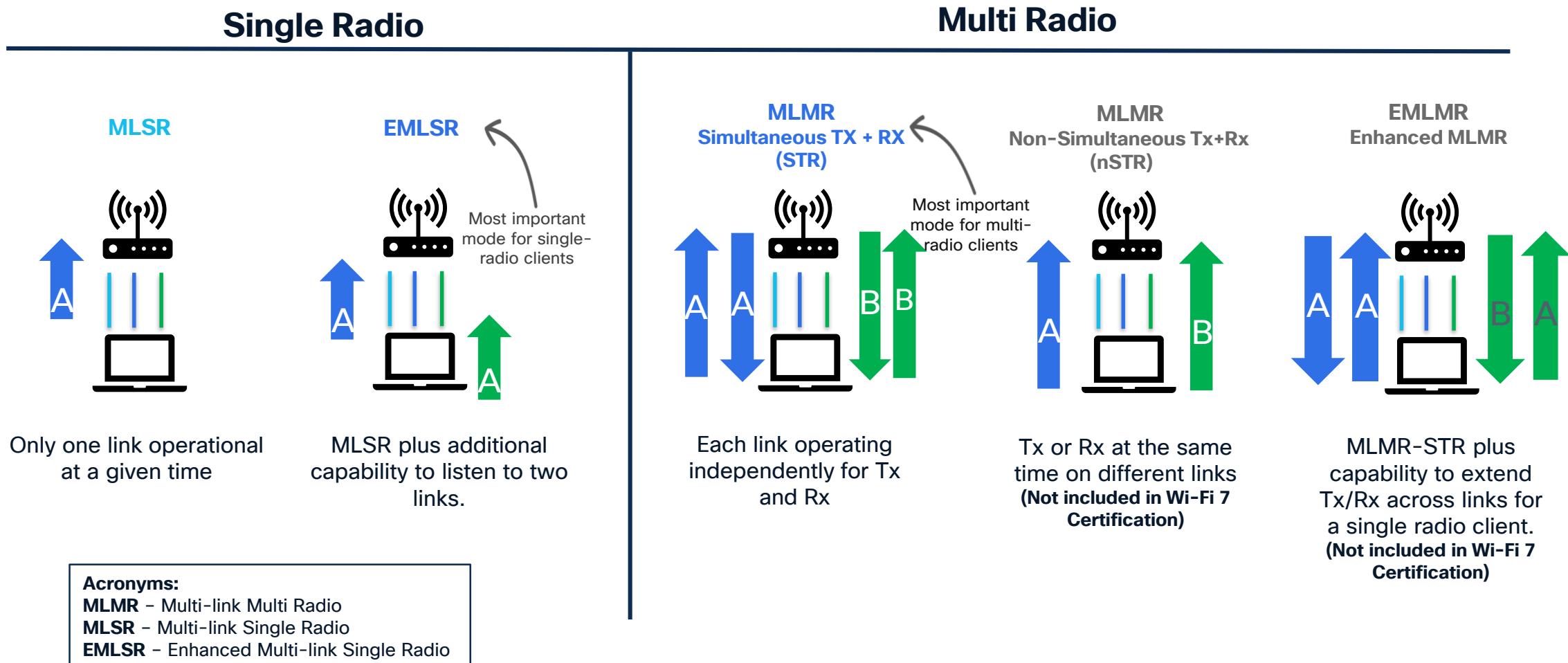
- Non-MLO peer operation (above MLD lower MAC)
- Link specific group keys
- Link specific encryption/decryption of groupcast
- Power save buffering of groupcast frames

MLD lower MAC layer functions:

- Link specific mgmt. frames (beacons)
- Control Frames (RTS, CTS, Ack,...)
- Power save state and mode
- Per-link Block Ack scoreboard

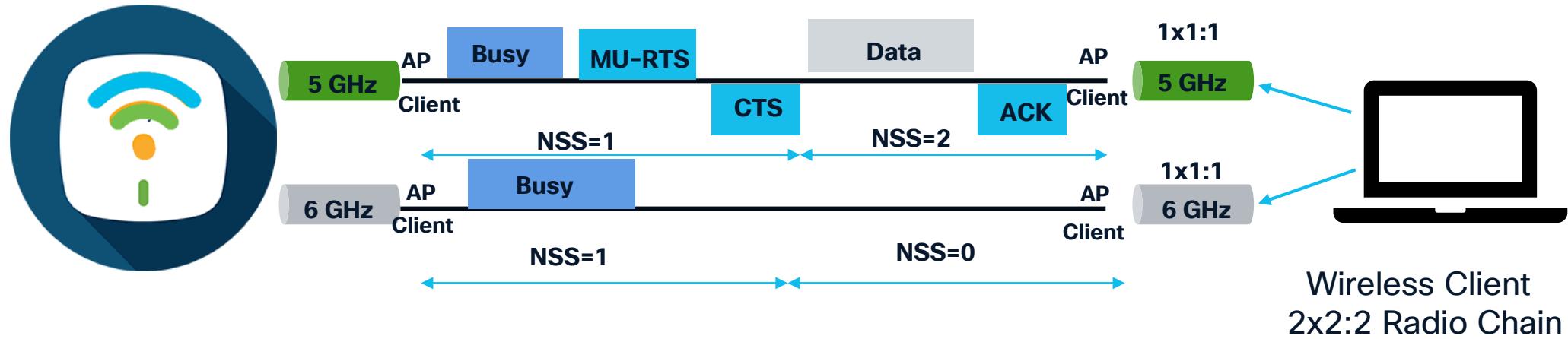
The many “modes” of MLO

...because clients have different hardware capabilities



Wi-Fi 7 – EMLSR operation

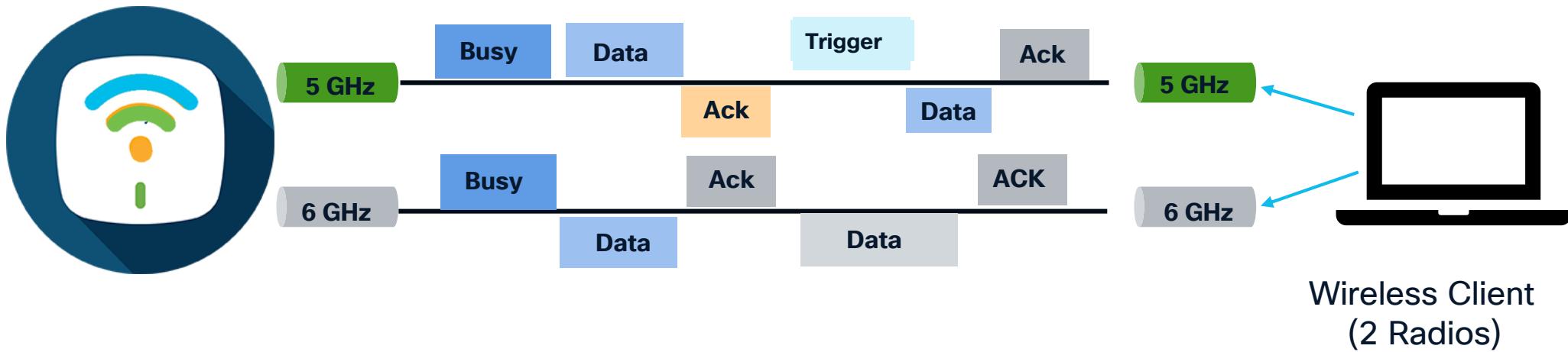
Downlink transmission from AP to EMLSR wireless client



- Single radio wireless clients with 2x2:2 radio listens to two channels
Example: 1x1:1 on 5 GHz and 1x1:1 on 6 GHz
- Switches to 2x2:2 during active data transmission on the channel with TXOP
- After TxOP, goes back to listening mode with 1x1:1 on each channel.

Wi-Fi 7 – MLMR – STR operation

Downlink transmission from AP to MLMR-STR wireless client



- Each link can transmit or receive independently
- Maximum throughput and performance

Wi-Fi 7 MLO modes



Reference

MLO Modes	Number of Radios	Characteristics
Multi-Link Single Radio (MLSR)	1	Tx/Rx over one link at a time
Enhanced Multi-Link Single Radio (EMLSR)	1	MLSR with additional capability to listen on multiple links simultaneously in low capability mode
Simultaneous Tx and Rx (STR)*	≥ 2	Simultaneous Tx/Tx, Rx/Rx or Tx/Rx on a pair of STR links independent of each other
Non-Simultaneous Tx and Rx (NSTR)*	≥ 2	Simultaneous Tx/Tx or Rx/Rx over a pair of links with careful alignment of PPDUs end time
Enhanced Multi Link Multi Radio (EMLMR)*	≥ 2	MLMR (STR) with additional capability to dynamically reconfigure spatial multiplexing support on each link

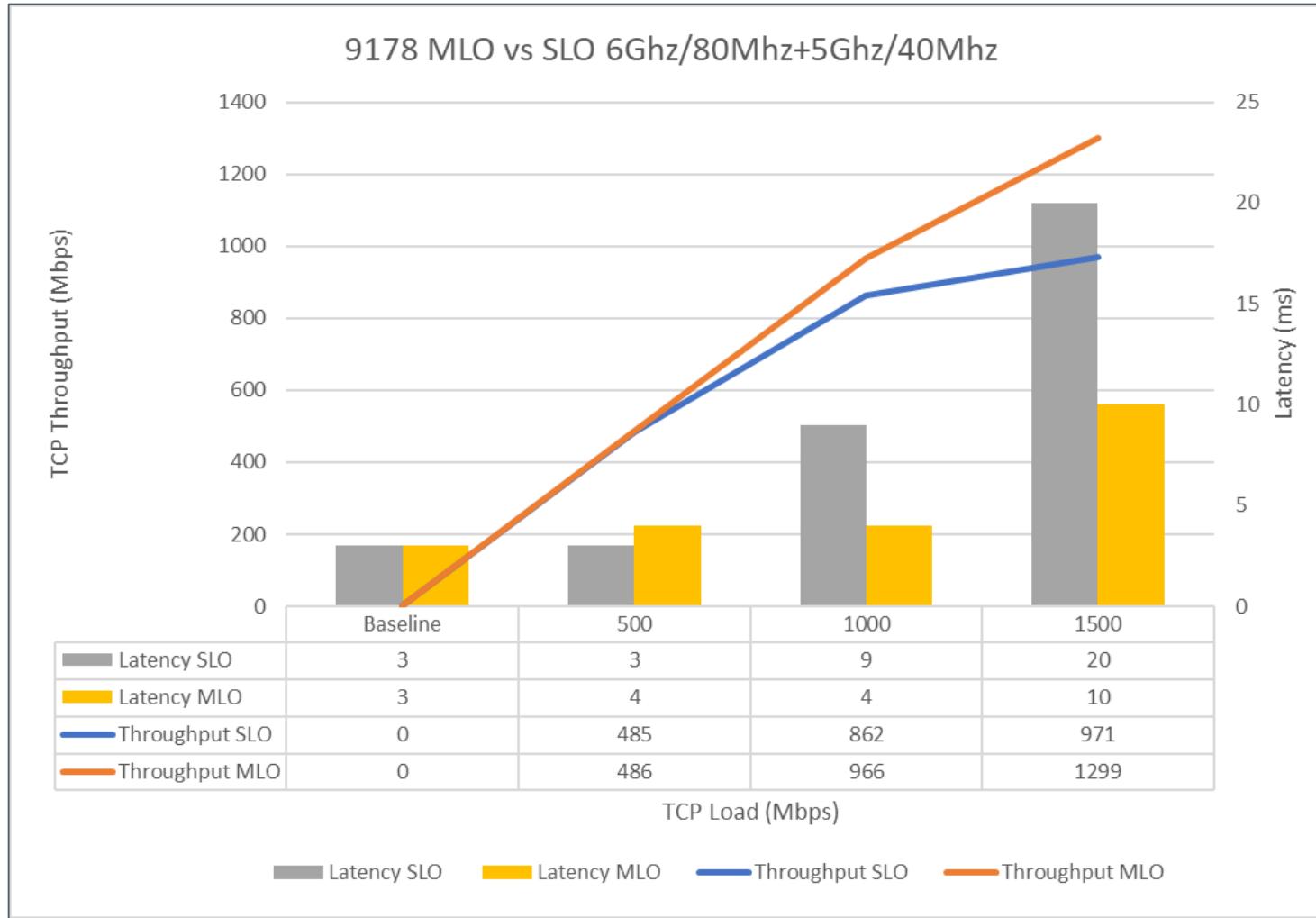
Requirement:

- MLSR is supported by all MLO devices.
- An AP MLD is required to support both EMLSR and STR .

* The last three modes are MLMR (Multi-Link Multi-Radio) operation modes. Only STR is part of Wi-Fi 7 R1. NSTR and EMLMR modes have significant implementation complexity and are not adopted in Wi-Fi 7.

MLO vs SLO Performance Comparison

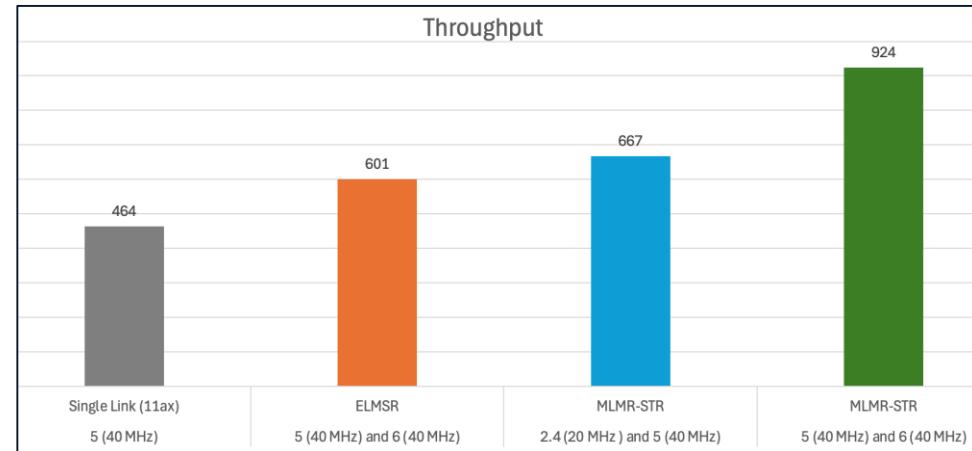
MLO Method: MLMR-STR



Observations from MLO

eMLSR

- Earlier drivers needed symmetric channel width
(Example: 5 + 6 on 80 MHz) for best performance.
- Latest drivers getting better with asymmetric channel width.



MLMR-STR

- Most clients do 2.4 + 5 or 2.4 + 6 due to band isolation
- Qualcomm FastConnect 7800 HBS (High Band Simultaneous) – 5 + 6 or 5 + 5.

Wireless technology

INCLUDED IN CURRENT CONFIGURATION

Qualcomm® FastConnect™ 6900 Wi-Fi 6E (2x2) Dual Band Simultaneous (DBS) and Bluetooth® 5.3 wireless card

ALTERNATE OPTIONS

Qualcomm® FastConnect™ 7800 Wi-Fi 7 (2x2) High Band Simultaneous (HBS) and Bluetooth® 5.4 wireless card



Wi-Fi 7 Client Detail with MLO

WLC

Client

360 View General QOS Statistics ATF Statistics Mobility History Call Statistics

This is an MLO Capable Client and is currently associated to 2 slots in the AP. Click [here](#) to view details

Counters and RF

Client Stats	Band : 5 GHz	Band : 6 GHz
AP Slot	AP Slot 1	AP Slot 3
Station Link MAC Address	1203.7f58.3486	0203.7f58.3486
BSSID	c414.a26e.d13f	c414.a26e.d138
Number of Bytes Received from Client	36423144	101666532
Number of Bytes Sent to Client	5950056727	10588199406
Number of Packets Received from Client	434122	1212808
Number of Packets Sent to Client	11007620	21023804
Number of Data Retries	103050	1042723
Number of RTS Retries	0	0
Number of Tx Total Dropped Packets	0	0
Number of Duplicate Received Packets	0	0
Number of Decrypt Failed Packets	0	0
Number of Mic Failed Packets	0	0
Number of Mic Missing Packets	0	0
Number of Policy Errors	0	0
Radio Signal Strength Indicator	-38 dBm	-25 dBm
Signal to Noise Ratio	58 dB	68 dB
Last Statistics Update	12/10/2024 13:29:34	12/10/2024 13:29:34

OK

Meraki

Overview Connections Performance Roaming Timeline Stored captures

Status associated since Jan 29 19:28

Location Status unknown

SSID wifi7-test

Access point CW9172H-OR [topology](#)

Splash N/A

Link 0 Signal 48dB (channel 1, 2.4 GHz)

Link 1 Signal 0dB (channel 157, 5 GHz)

Link 2 Signal 24dB (channel 101, 6 GHz)

Device type, OS Apple

Capable Wi-Fi standards 802.11be - 2.4, 5, and 6 GHz, Fastlane capable [details](#)

Tools [history](#) [packet capture](#) [disconnect client](#)

Notes

Client MLO Method

Example: MLMR-STR

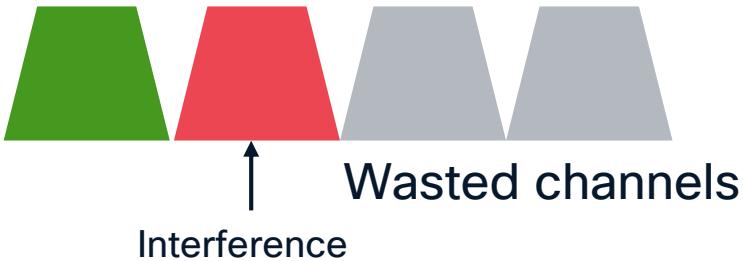
Client					
360 View	General	QOS Statistics	ATF Statistics	Mobility History	Call Statistics
Client Properties		AP Properties	Security Information	Client Statistics	QOS Properties
FlexConnect Authentication		N/A			
Number of links dropped due to downsizing		0			
Client Scan Report Time		Timer not running			
Max Client Protocol Capability		Wi-Fi 7 (802.11be)			
Wi-Fi to Cellular Steering		Implemented			
Cellular Capability		N/A			
Regular ASR support		DISABLED			
L3 Access		DISABLED			
Client Gateway IPv4 Address		20.20.21.1			
Enhanced Multi Link		None			
STR Capable		Yes			
No. of associated links		2			
Band		5 GHz, 2.4 GHz			
No. of Known links		2			
Mobility					

Example: EMLSR

Client					
360 View	General	QOS Statistics	ATF Statistics	Mobility History	Call Statistics
Client Properties		AP Properties	Security Information	Client Statistics	QOS Properties
VRF Name				N/A	
Central NAT				DISABLED	
11v DMS Capable				No	
QoS Map Capable				No	
FlexConnect Data Switching				N/A	
FlexConnect DHCP Status				N/A	
FlexConnect Authentication				N/A	
Number of links dropped due to downsizing				0	
Last idle time update				Never	
Client Scan Report Time				Timer not running	
Max Client Protocol Capability				Wi-Fi 7 (802.11be)	
Wi-Fi to Cellular Steering				Not implemented	
Cellular Capability				N/A	
Regular ASR support				DISABLED	
L3 Access				DISABLED	
Client Gateway IPv4 Address				20.20.21.1	
Enhanced Multi Link				EMLSR	
STR Capable				No	
No. of associated links				2	
Band				6 GHz, 2.4 GHz	
No. of Known links				2	

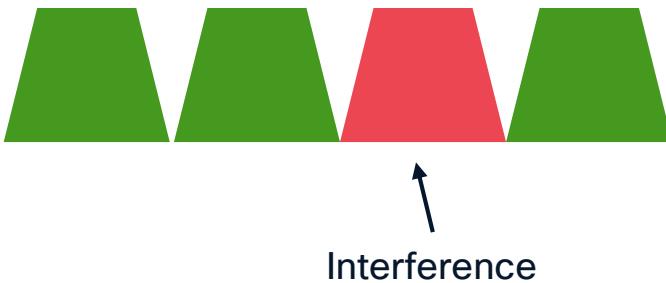
Wi-Fi 7 preamble puncturing

Without preamble puncturing:



Channel Width	Allowed Puncturing
80 MHz	20 MHz
160 MHz	20 or 40 MHz
320 MHz	40 or 80 MHz (or) 40 + 80 MHz

With preamble puncturing:

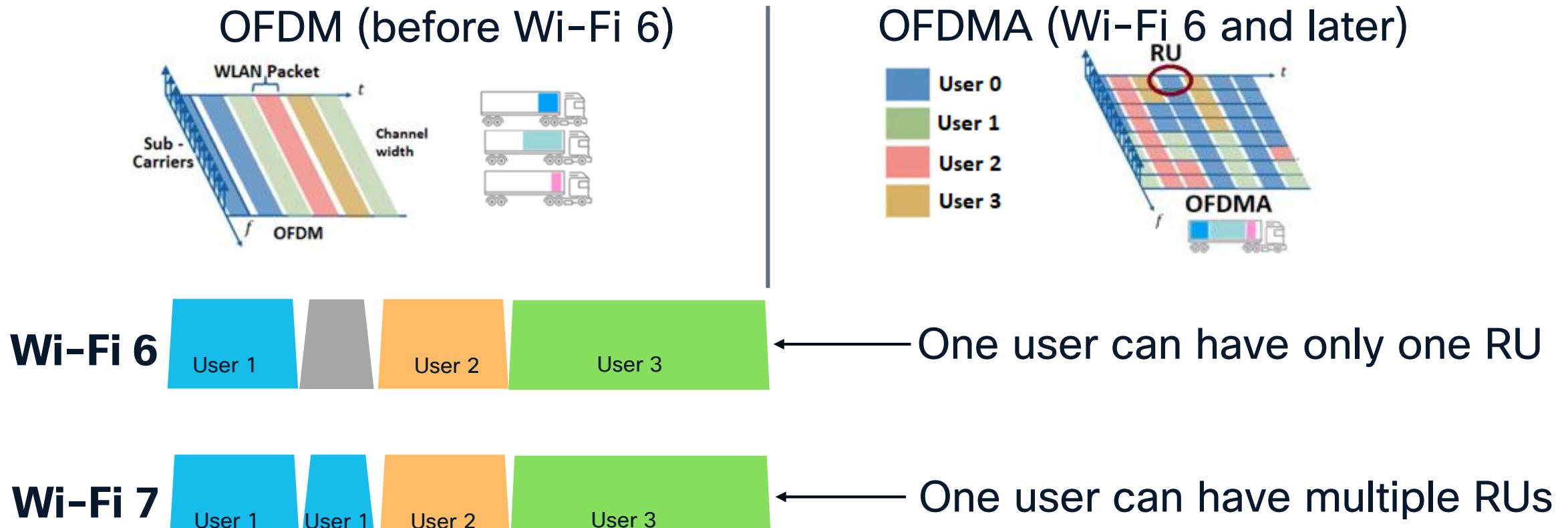


Puncturing allowed for 80 MHz channel width or wider



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Wi-Fi 7 multiple resource unit (MRU)

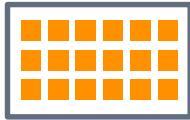


Resource unit (RU) is a unit to denote a group of subcarriers (tones) in OFDMA

Multiple RUs make efficient use of spectrum

Wi-Fi 7 - 512 Compressed Block Ack

Wi-Fi 6/6E



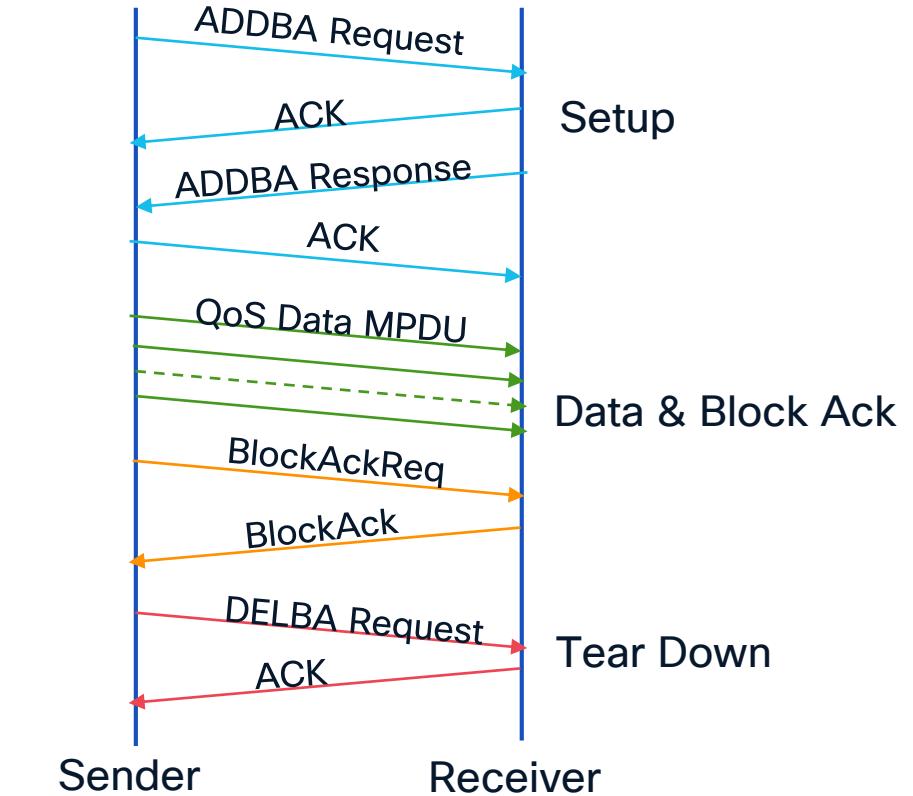
- Aggregation of upto **256** MPDUs in a single frame.
- Acknowledgement upto **256** MPDUs in a single Block Ack Frame

Wi-Fi 7



- Aggregation of upto **512** MPDUs in a single frame.
- Acknowledgement upto **512** MPDUs in a single Block Ack Frame

Block Ack frame exchange sequence



Reduces Protocol Overhead. Improve transmitter's performance at higher rates.

16 Spatial streams ?



- Won't be supported in Wi-Fi 7
- Will stay at max 8 spatial streams per Radio
- Public docs refer to 16 spatial streams

Wi-Fi 7 Client Eco System

Wi-Fi 7 Client Support

With Wi-Fi 7, you can enjoy multi-gigabit speeds on your Windows PC and experience up to 4x faster speeds than Wi-Fi 6 and Wi-Fi 6E, and close to 6x faster than Wi-Fi 5. You can also enjoy significantly lower latency, which improves the responsiveness and performance of real-time activities like gaming and video conferencing. Please note that performance may vary by manufacturer and hardware device capabilities.

Note: Wi-Fi 7 (Enterprise) is not currently supported in Windows 11.

Android



- Android 13 or greater
- Samsung S24, Pixel 8 or greater



iPhone/iOS



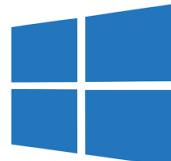
- iPhone 16/16 Pro ✓
- iPhone 16e ✗
- No 320 MHz support



Windows



- Windows11 24H2
- Predominantly Intel BE200, QCA 7800, MediaTek 7925
- Update your drivers
- !!WPA3-Enterprise (Requires dev version)



Windows Insider Build:
Canary Build : 27847+,
Dev & Beta Channel Builds: 26100*

Mac OS
iPad



- Not yet

macOS

Wi-Fi 7 Client behavior

From our observation ..



Reference

Feature	Windows (Intel BE200)	Windows (QCA 7850)	Google Pixel (8 and above)	Samsung S24 Ultra	MediaTek	Apple
OS	Windows 11 24H2	Windows 11 24H2	Latest release	Latest release	Windows 11 24H2	Latest release
Driver Ver	23.90.x	3.1.0.1314	Latest release	Latest release	5.4.0.2503	Latest release
EHT rates (MCS12/13)	Yes	Yes	Yes	Yes	Yes	No
MLO Links	2	2	2	3	3	3
MLSR	Yes	Yes	Yes	Yes	Yes	Yes
eMLSR	Yes	No	Yes	No	Yes	No
MLMR-STR	No	Yes (HBS - 5+6)	Yes	Yes	Yes	No
MRU	Yes	Yes	Yes	Yes	Yes	Yes
320 MHz	Yes	Yes	Yes	Yes	No	No
Preamble Puncturing	Yes	Yes	Yes	Yes	Yes	Yes

Cisco's Wi-Fi 7 AP Portfolio

Journey towards Unified Product ..



Wi-Fi 6



1 SKU per model



17+ SKUs per model



Wi-Fi 6E



- Day0 Separate SKUs (~10)
- Initial management Mode determined at purchase.
- Post-purchase/Day N option to migrate
- Separate lead time/RMA/license
- Same Warranty



Wi-Fi 7
Global Use AP



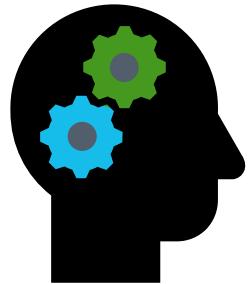
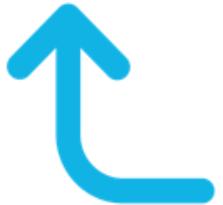
- Today! Lets talk about it

One Cisco Wireless Access Point

Global Use AP, Unified Product, Single SKU



Cisco Catalyst Management Mode
C9800 & Catalyst Center Stack



Meraki Management Mode
MR Dashboard Stack

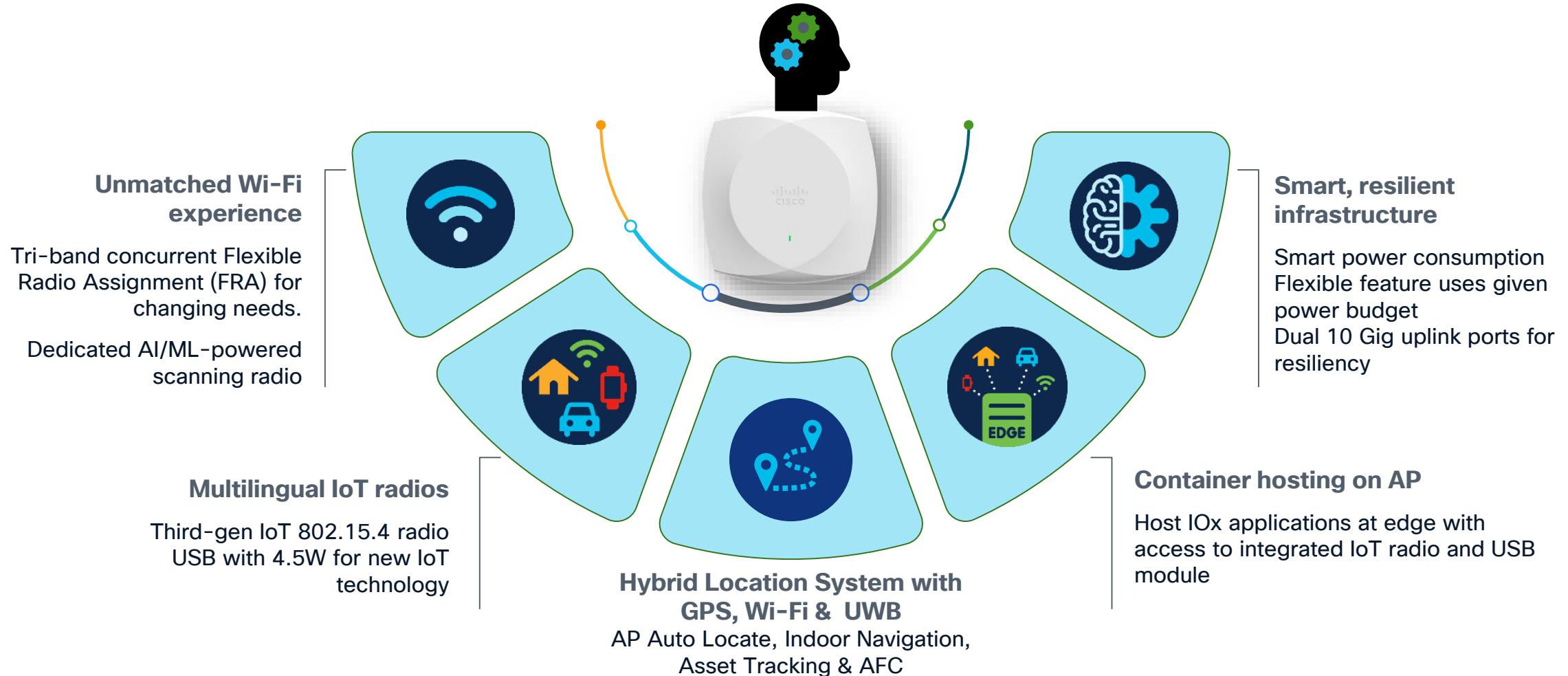


Join any stack on Day 0, based on Intent
Management Mode Change from Day 1 to N

Cisco Wireless Wi-Fi 7 series access points

Premium, multilingual AP platform for the future-ready digital enterprise

**Unified Product, Single SKU, Global Use AP
Catalyst On-Prem or Meraki Cloud Ready**



Cisco Wi-Fi 7 for every operational scale

NEW



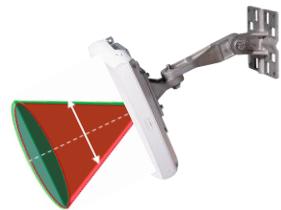
CW9172

6 Spatial Streams
Omnidirectional
Ceiling mount and
Wall Plate form factor



CW9176I

12 Spatial Streams
Omnidirectional
10Gbps, GPS, UWB



CW9176D1

12 Spatial Streams
Integrated Directional
10Gbps, GPS, UWB



CW9178

16 Spatial Streams
Omnidirectional
2x 10Gbps, GPS, UWB

Wi-Fi 7 | Global Use AP | Unified License | Automated, intelligent radio frequency with AI -RRM

Industry's first Wi-Fi 7 access point for large venues

Launching at Cisco Live!!

CW9179F

Wi-Fi that reaches everywhere

Wi-Fi 7 speed and performance
for everyone in the audience and
more

Designed for every venue

Indoor/Outdoor, concourse-ready and
multi-use all-in-one, integrated access point

Configurable and flexible installation

Comprehensive coverage to get the best
value from your install



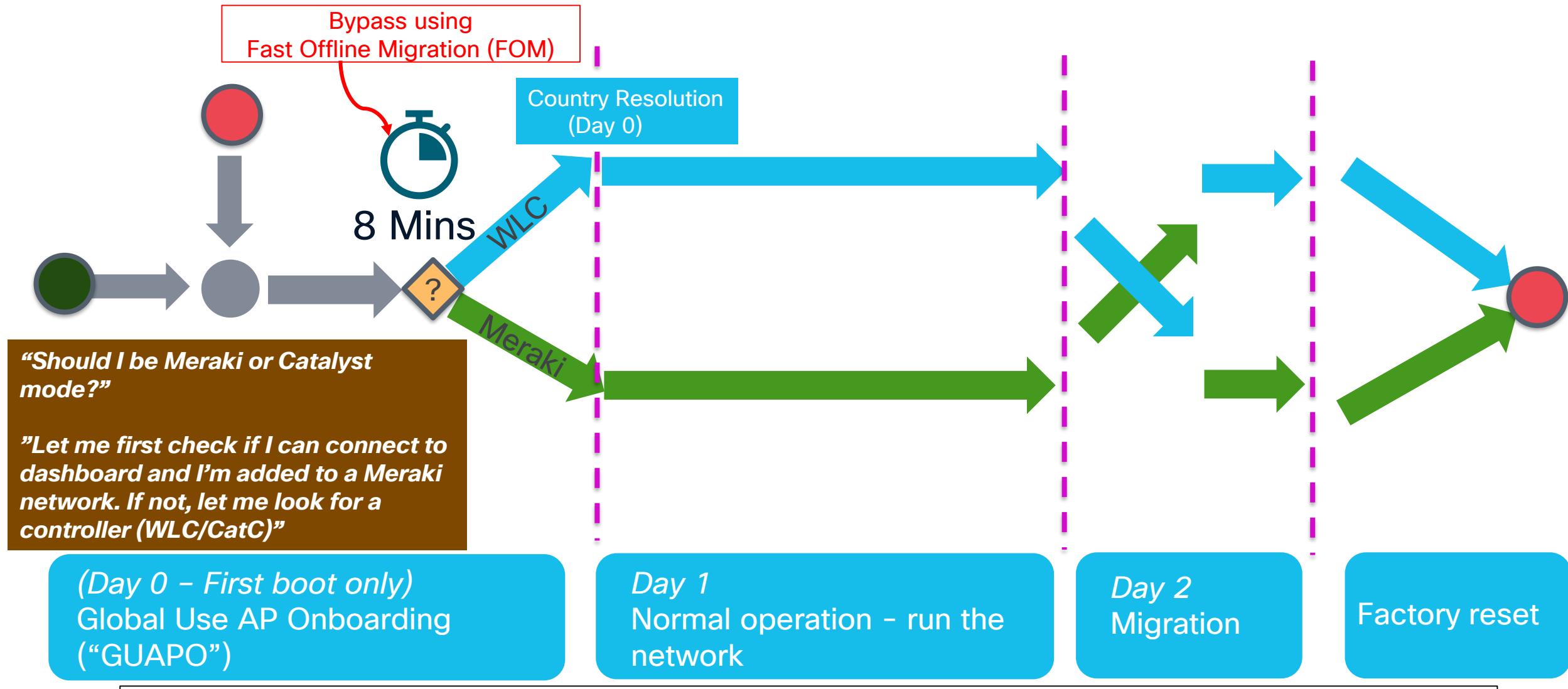
Indoor/outdoor flexibility ☀️

Unique “front-and-back” concept ☀️

Software controllable beam switching

Global Use AP

Map of a Global Use AP's journey

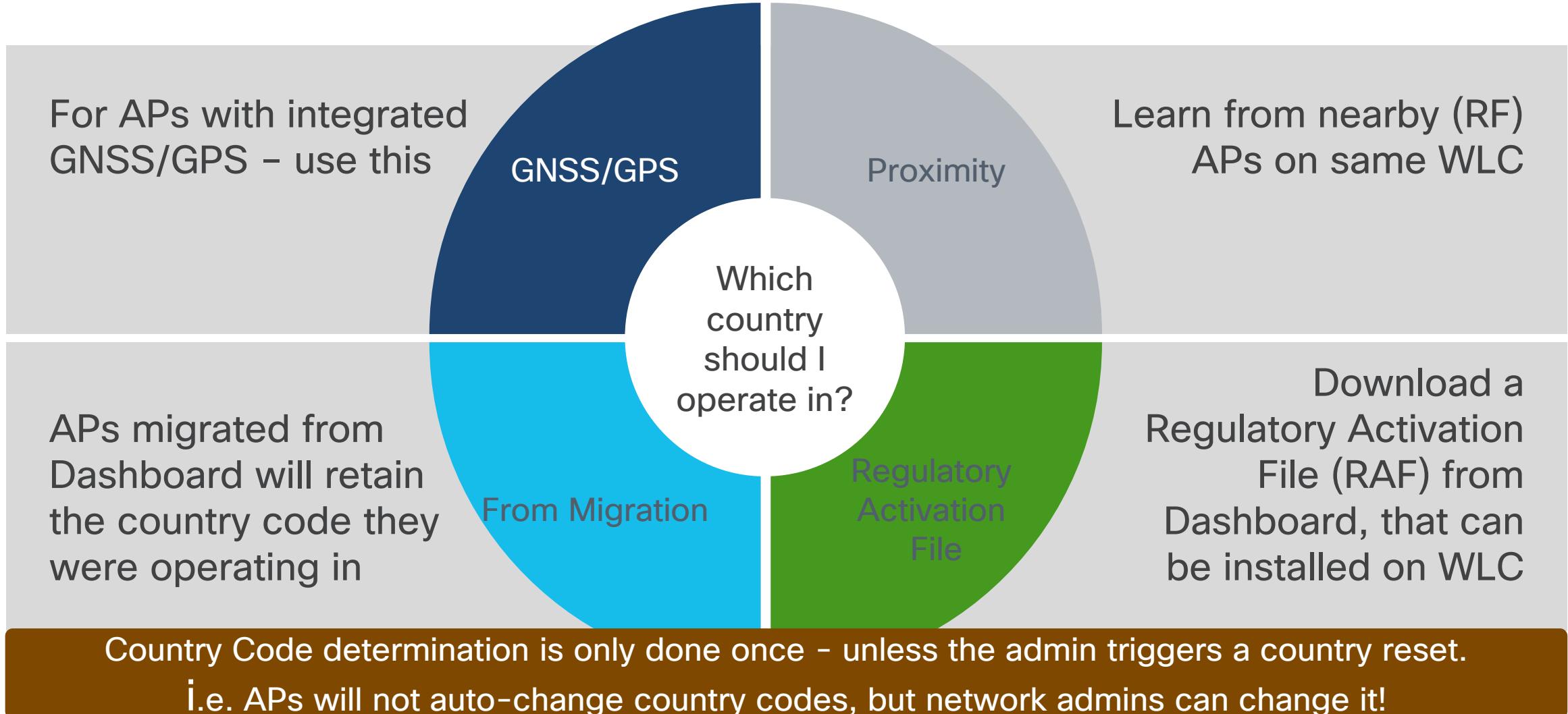


Let's zoom in on “Country Code”

WLC
only

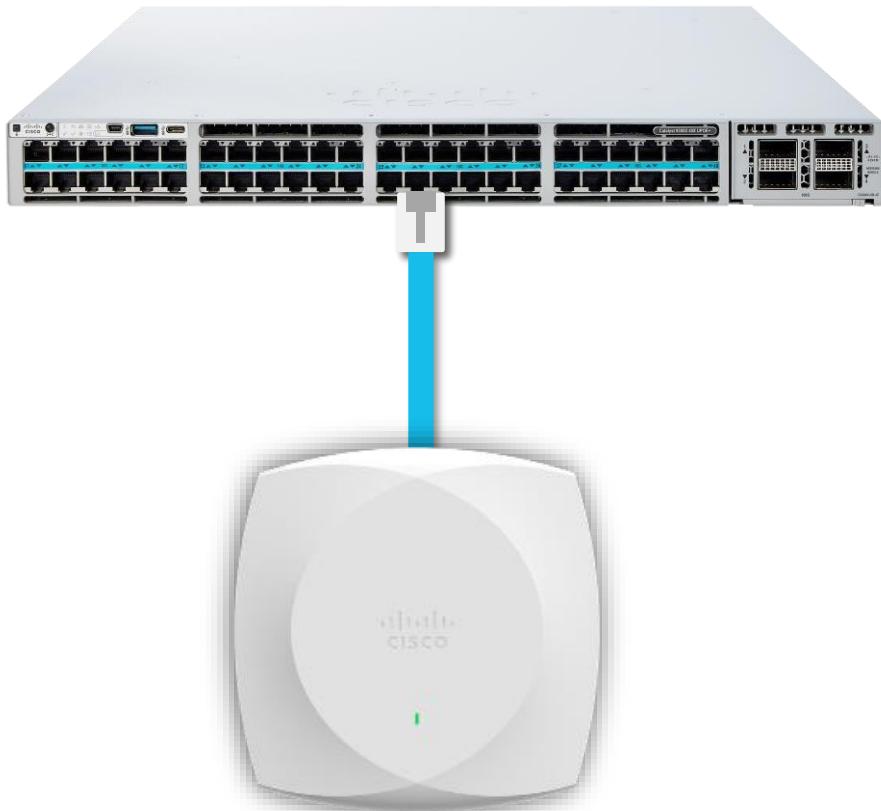


When APs are in WLC mode, APs will determine their Country Code in one of the following ways



Network Infrastructure

Cisco Wireless AP to switch connection



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

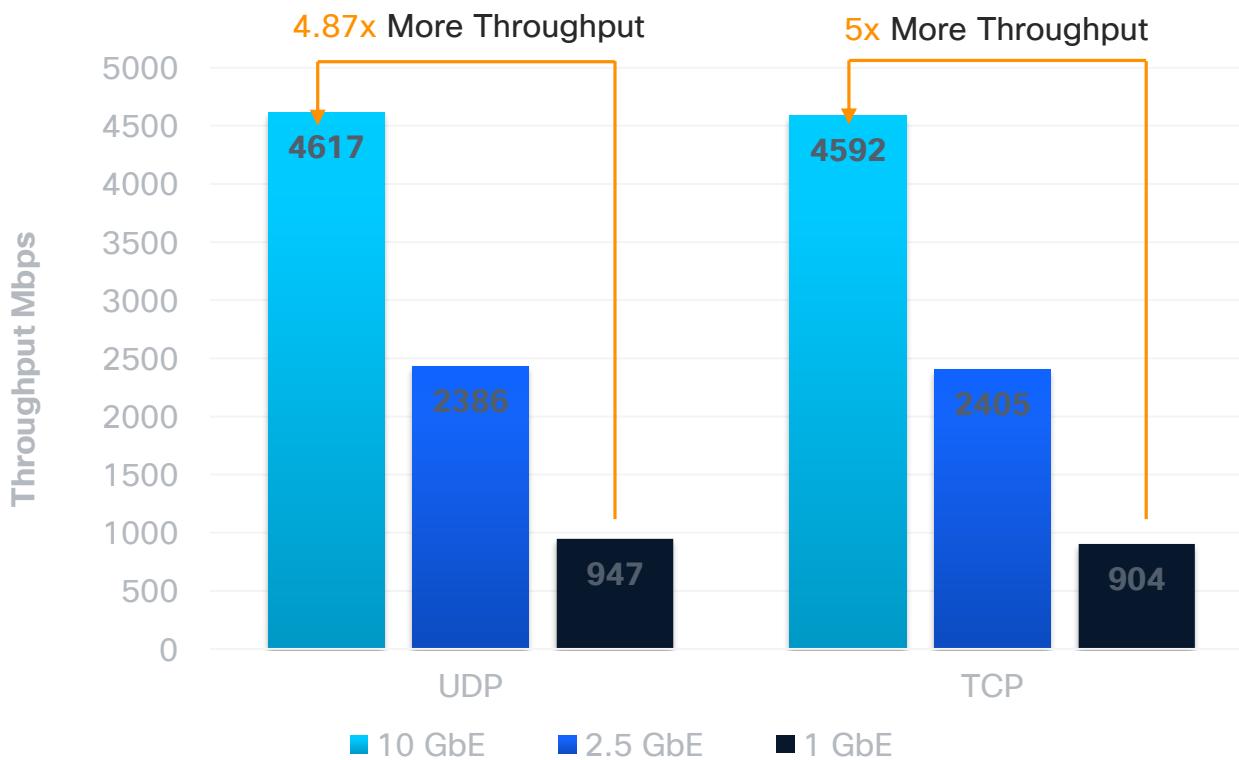
MGig switchport is recommended as Wi-Fi 6E/7 speed may exceed 1 Gbps

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

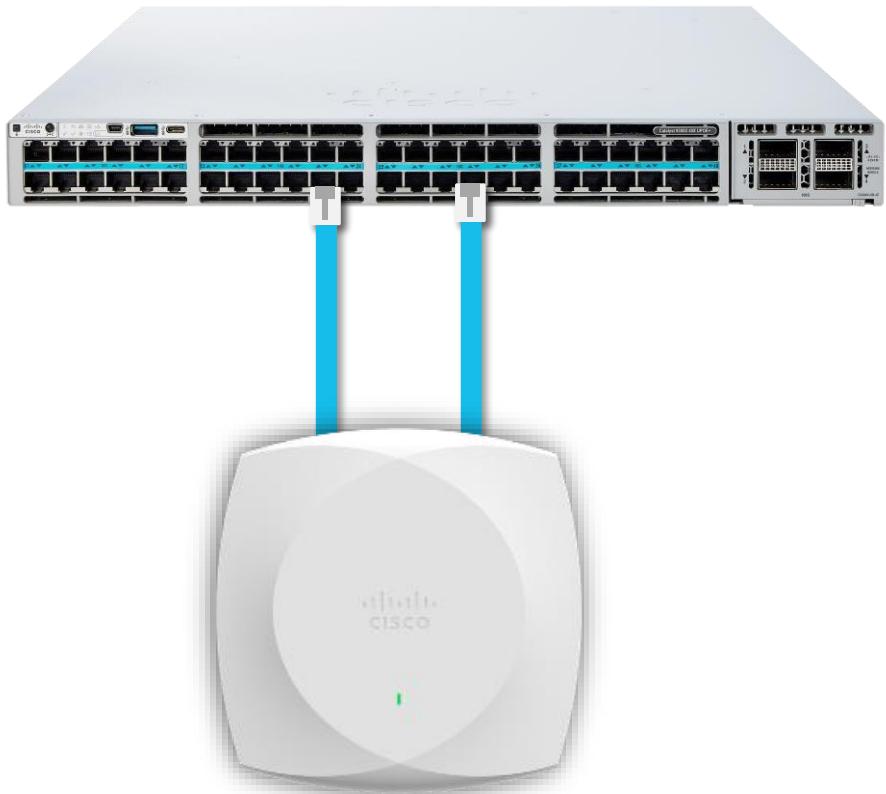
CDP = Cisco Discovery Protocol
LLDP = Link Layer Discovery Protocol
Cat = Category (of ethernet cable)

Cisco 9176 mGig Results

2.4 (20 MHz), 5 (160 MHz), 6 (320 MHz)



CW9178 to switch connection



AP CW9178

CW9178 has two mGig uplink ports

Dual port is for PoE power and uplink redundancy with hitless failover

Switchport and AP can be configured for LAG or standalone ports (default)

Non-LAG : Single & Dual Homed
LAG : Single Homed

mGig = multi gigabit ethernet
PoE = Power over Ethernet
LAG = Link Aggregation Group

Power Considerations

AP Power Consumption



Power Allocated

48.3 W

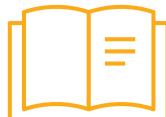
Power Consumed

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



Recap of Power Over Ethernet Standards

Spec	Known as	Class	Min PSE Output Power	Min PD Input Power
Type 1 IEEE 802.3af	PoE	Class 1	4 W	3.84 W
		Class 2	7 W	6.49 W
		Class 3	15.4 W	12.95 W
Type 2 IEEE 802.3at	PoE +	Class 4	30 W	25.5 W
Type 3 IEEE 802.3bt	PoE++, Cisco UPOE	Class 5	45 W	40 W
		Class 6	60 W	51 W
Type 4 IEEE 802.3bt	Cisco UPOE+	Class 7	75 W	62 W
		Class 8	90 W	71.3 W

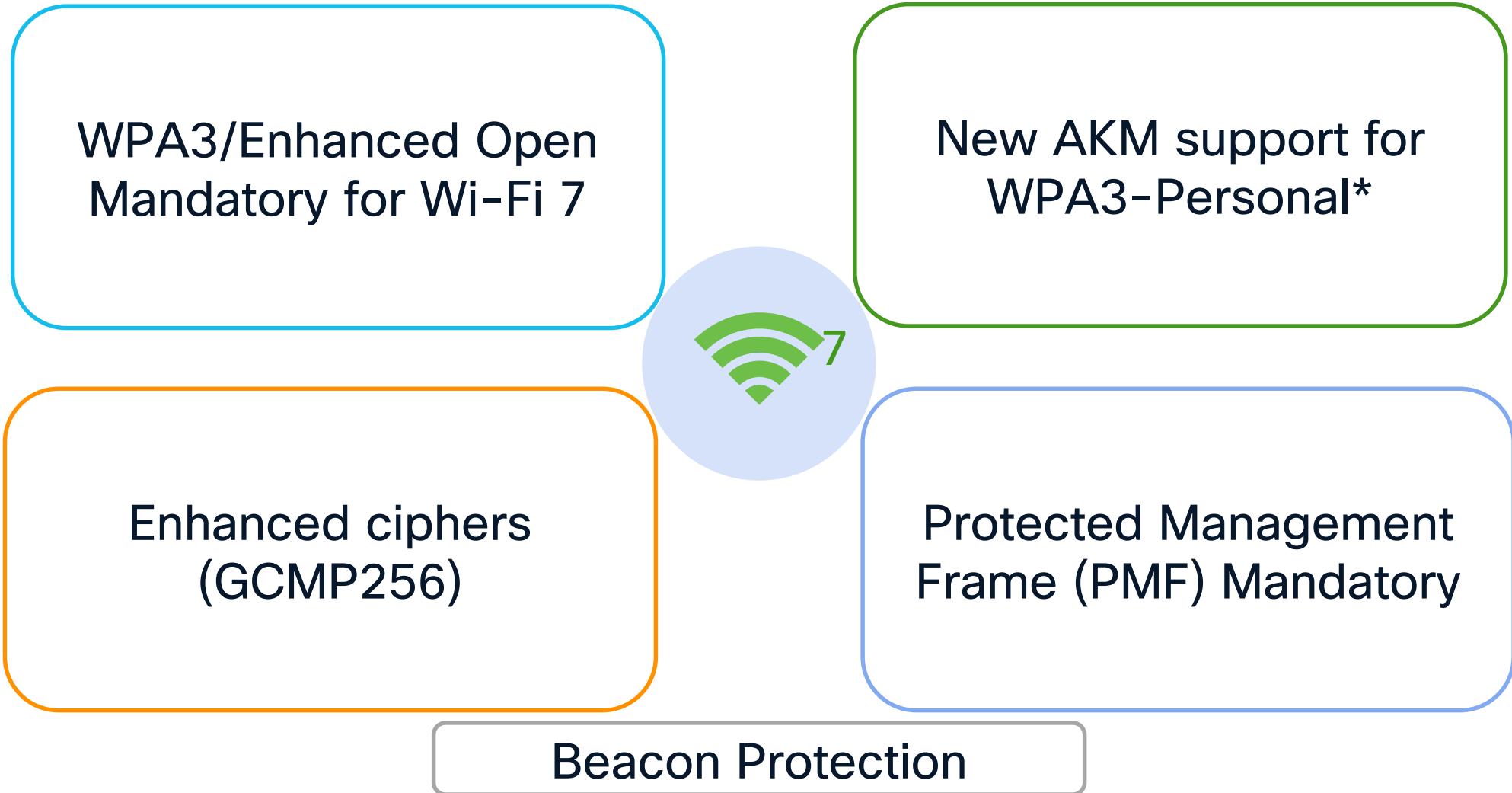
**CW9178I - IEEE 802.3bt (Class 6) - 60 W
(For Full Operation including USB)**

**CW9176I/D1 & CW9172I- IEEE 802.3bt (Class 5) - 45 W
(For Full Operation including USB)**

**CW9172I & H - IEEE 802.3at (Class 4) -30W
(Class 5- For Full AP Operation including PoE out)**

WLAN Security

Wi-Fi 7 Security



* New enhancements in Wi-Fi 7, when compared to Wi-Fi 6E

Wi-Fi 7 Security



Reference

Wi-Fi 7 brings new AKM support for WPA3-SAE and new increased ciphers for ALL WPA3 /OWE mandatory for EHT (11be MCS rates) & MLO

Cipher: GCMP 256 – Better Encryption & Speed; AKM: Better security

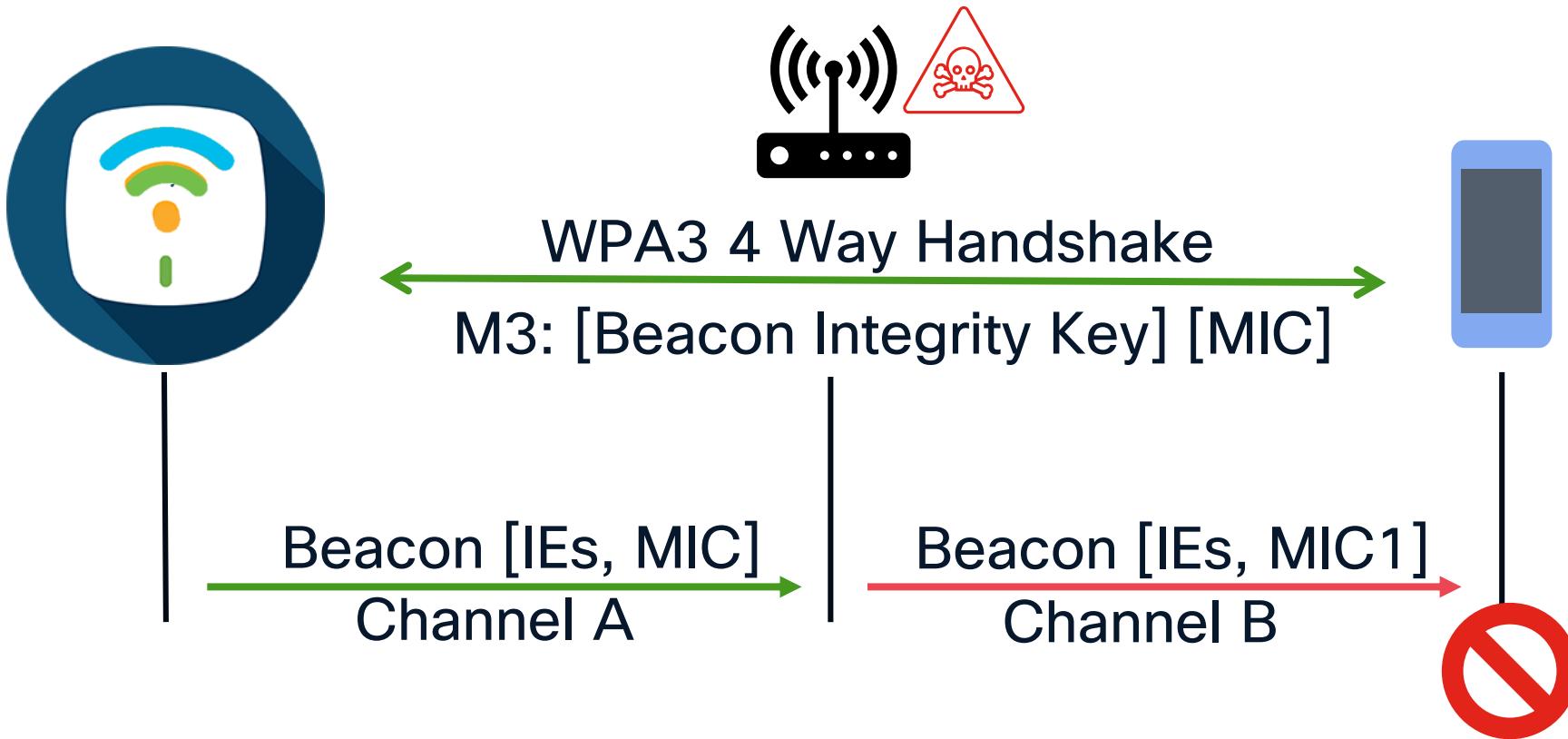
Legacy (Wi-Fi 5)	Wi-Fi 6	Wi-Fi 6E (6 GHz)	Wi-Fi 7
Open	Open (OWE support required)	Enhanced Open (AKM: OWE) (Cipher: CCMP128)	Enhanced Open (AKM: OWE) (Cipher: CCMP128 and GCMP256)
WPA1/WPA2/WPA3 Transition WPA3-Personal, PMF Optional	WPA2/WPA3 Transition/ WPA3-Personal, PMF Optional (WPA 2 - AKM - PSK, FT+PSK, PSK (SHA-256)) (WPA 3 - AKM - SAE, FT+SAE) (Cipher: CCMP 128 or AES)	WPA3-Personal, PMF Mandatory (AKM: SAE, FT+SAE) (Cipher: CCMP128 or AES)	WPA3-Personal, PMF Mandatory (AKM: SAE-EXT-KEY, FT-SAE-EXT-KEY) (Cipher: CCMP128 and GCMP256)
WPA1/WPA2/WPA3 Transition/ WPA3-dot1x (Enterprise), PMF Optional	WPA2/WPA3 Transition/ WPA3-dot1x (Enterprise), PMF Optional (AKM 802.1x, FT+802.1x & 802.1x-SHA256, 802.1x-SuiteB) (Cipher: AES, CCMP 128, GCMP128 GCMP256)	WPA3 Enterprise, PMF Mandatory (AKM: FT+802.1x, 802.1x-SHA256, 802.1x-SuiteB) (Cipher: CCMP128, GCMP 128 & GCMP 256)	WPA3 Enterprise, PMF Mandatory (AKM: FT+802.1x, 802.1x-SHA256, 802.1x-SuiteB) (Cipher: CCMP128, GCMP128 & GCMP 256)

Clients connecting to lower security, can connect to 2.4 & 5 GHz bands of Wi-Fi 7 AP, but restricted to 11ax or earlier. No 11be rates & MLO

Note: All devices since 2018 are required to support WPA3, regardless of generation

Wi-Fi 7 Beacon Protection

Beacons protected with an Integrity Check



Prevents beacon forging by attacker

Early days – Relaxed Implementation

```
> Tag: SSID parameter set: "zealand-mlo-2-5"
> Tag: Supported Rates 6(B), 9, 12(B), 18, 24(B), 36, 48, 54, [Mbit/sec]
> Tag: Power Capability Min: 8, Max: 25
> Tag: Supported Channels
< Tag: RSN Information
  Tag Number: RSN Information (48)
  Tag length: 22
  RSN Version: 1
  > Group Cipher Suite: 00:0f:ac (Ieee 802.11) AES (CCM)
  Pairwise Cipher Suite Count: 1
  > Pairwise Cipher Suite List 00:0f:ac (Ieee 802.11) AES (CCM)
    Auth Key Management (AKM) Suite Count: 1
  > Auth Key Management (AKM) List 00:0f:ac (Ieee 802.11) SAE (SHA256)
  > RSN Capabilities: 0x00c0
  PMKID Count: 0
  PMKID List
> Tag: HT Capabilities (802.11n D1.10)
> Tag: Extended Capabilities (12 octets)
> Tag: VHT Capabilities
> Ext Tag: HE Capabilities
< Ext Tag: Multi-Link (802.11be D3.0)
  Ext Tag length: 135 (Tag len: 136)
  Ext Tag Number: Multi-Link (802.11be D3.0) (107)
  > Multi-Link Control: 0x0100 Basic
  > Common Info
    Subelement ID: Per-STA Profile (0x00)
    Subelement Length: 122
  > Per-STA Profile 1
    Basic STA Profile Count: 1
    STA Profiles LinkIds: 0
  > Ext Tag: EHT Capabilities (802.11be D3.0)
  ...
```

- Relaxed implementation (in the early days) to allow all client implementation
- Stricter enforcement going forward.

Wi-Fi 7 WLAN Design Considerations

What options would you have?

1

"All-In" Option: Reconfigure the existing WLAN to WPA3, one SSID for all radio policies (2.4/5/6 GHz) – **Most unlikely**

2

"Multiple SSIDs" Option: Redesign your SSIDs, adding specific SSID/WLAN with specific security settings – **Most flexible**

3

"One SSID" Option: Use Transition Modes to support multiple security – **Most conservative**

Wi-Fi 7 APs can broadcast SSIDs with lower security; No 11be rates & MLO

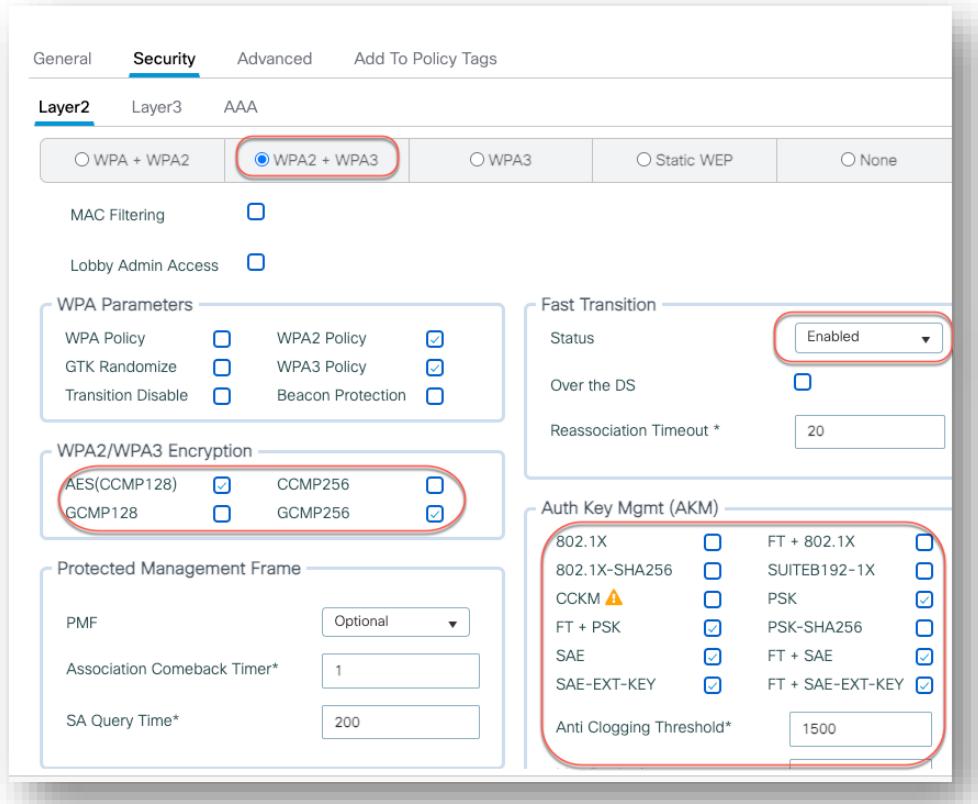
Option 3 – One SSID

Wi-Fi 7 WLAN Design Considerations – Option 3

Personal (PSK/SAE) SSID

Requirements: AKM 24 or 25, Cipher – CCMP128 and GCMP 256

Recommendation: WPA3 Transition Mode (a.k.a WPA2 + WPA3 Mixed Mode)



- L2 security set to **WPA2+ WPA3**. AKM configured with **PSK, SAE and SAE-EXT-KEY. PMF as Optional**.

- Wi-Fi 7 clients connect with WPA3/SAE-EXT-KEY/PMF.
- Wi-Fi 6E clients connect with WPA3/SAE/PMF.
- Wi-Fi 6 clients that support WPA3 connect with WPA3/SAE/PMF in 2.4/5 GHz bands.
- Legacy clients connect with WPA2 in 2.4/5 GHz bands.

- If there are very old clients that still uses WPA1, then the recommendation is to have those clients in a separate SSID.

Note: Wi-Fi 7 needs AKM 24 or 25 as per spec. From our experience with different wireless clients, they do MLO/11be rates even with AKM 8 & 9.

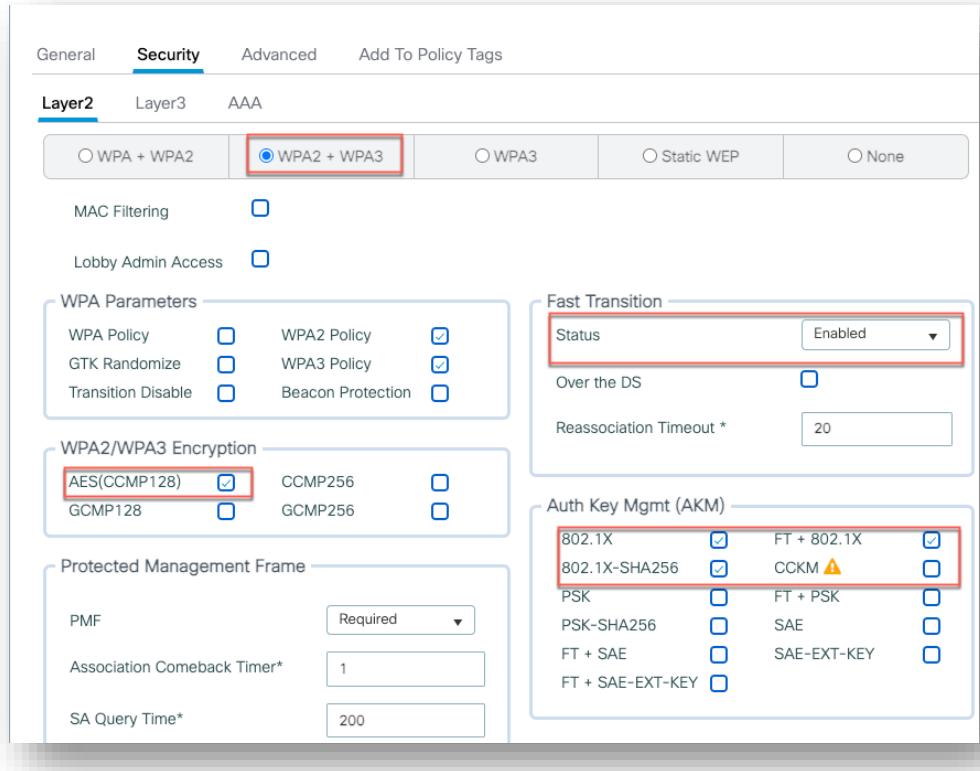
AKM 8: SAE, AKM 9: FT-SAE, AKM 24- SAE-EXT-KEY, AKM 25- FT-SAE-EXT-KEY

Wi-Fi 7 WLAN Design Considerations – Option 3

Enterprise (dot1x) SSID

Requirements: AKM 3, 5 Cipher – CCMP 128 (Most common deployments)

Recommendation: WPA3 Transition Mode (a.k.a WPA2 + WPA3 Mixed Mode)



- L2 security set to **WPA2+ WPA3**. AKM configured with **802.1x-SHA256** and **802.1x (SHA1)**. **PMF as Optional**.
- For clients that support WPA3, configure WPA3 Enterprise. Wi-Fi 7 clients will use the settings to connect to any band with MLO.
- For clients that don't support WPA3, configure a WPA2 profile.

Note: There are chances some old clients with outdated driver, could have connectivity issues. Test the clients in your environment.

Note: WPA3-SuiteB will require a separate SSID, per specification.

Wi-Fi 7 WLAN Design Considerations

What about OWE Transition ?

The AP's BSS Configuration shall not allow Wi-Fi Enhanced Open Transition Mode (i.e., where the OWE Transition Mode element is included in Beacons and Probe responses) (**WPA3 Spec v3.4, Section 11.3**)

OWE Transition is not valid with 6 GHz and Wi-Fi 7

General Security Advanced

Layer2 Layer3 AAA

To review the necessary considerations for ensuring WLAN compatibility with Wi-Fi 7 security [click here](#).

WPA + WPA2 WPA2 + WPA3 WPA3 Static WEP None

MAC Filtering

Lobby Admin Access

WPA Parameters

WPA Policy WPA2 Policy
GTK Randomize WPA3 Policy
Transition Disable Beacon Protection

WPA2/WPA3 Encryption

AES(CCMP128) CCMP256
GCMP128 GCMP256

Protected Management Frame

PMF Required

Fast Transition

Status Disabled
Over the DS
Reassociation Timeout * 20

Auth Key Mgmt (AKM)

FT + 802.1X 802.1X-SHA256
OWE SAE
FT + SAE SAE-EXT-KEY
FT + SAE-EXT-KEY

General Security Advanced Add To Policy Tags

Profile Name* owe

SSID* owe

WLAN ID* 4

Status **ENABLED**

Broadcast SSID **ENABLED**

Radio Policy ⓘ Show slot configuration

6 GHz Status **ENABLED** WPA3 Enabled Dot11ax Enabled

5 GHz Status **ENABLED**

2.4 GHz Status **ENABLED** 802.11b/g Policy 802.11b/g

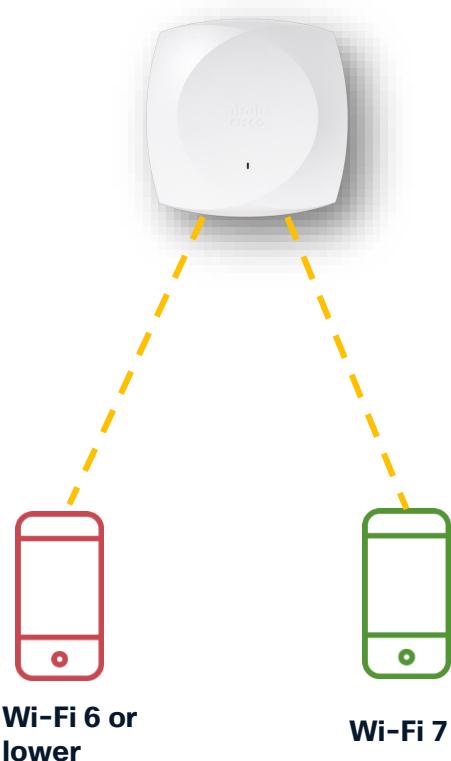
Some 6E/Wi-Fi 7 clients may not be able to discover or connect to OWE Transition in 6 GHz.



Note: WLC Config allows OWE Transition today

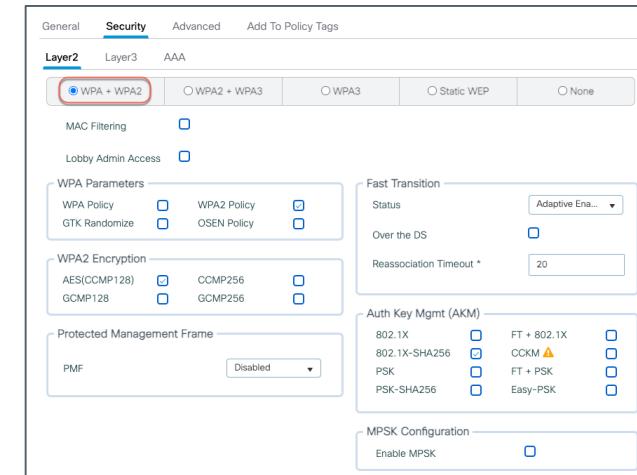
Client join behavior with Wi-Fi 7 AP

Scenario 1: AP Broadcasting WPA2/Open WLANs



- Configure client profile with WPA2 or Open (depending on WLAN security)
- Clients can associate only on 2.4 & 5 GHz radios
- Wi-Fi 7 clients join as 11ax capable.
- No MLO functionality, 11be rates

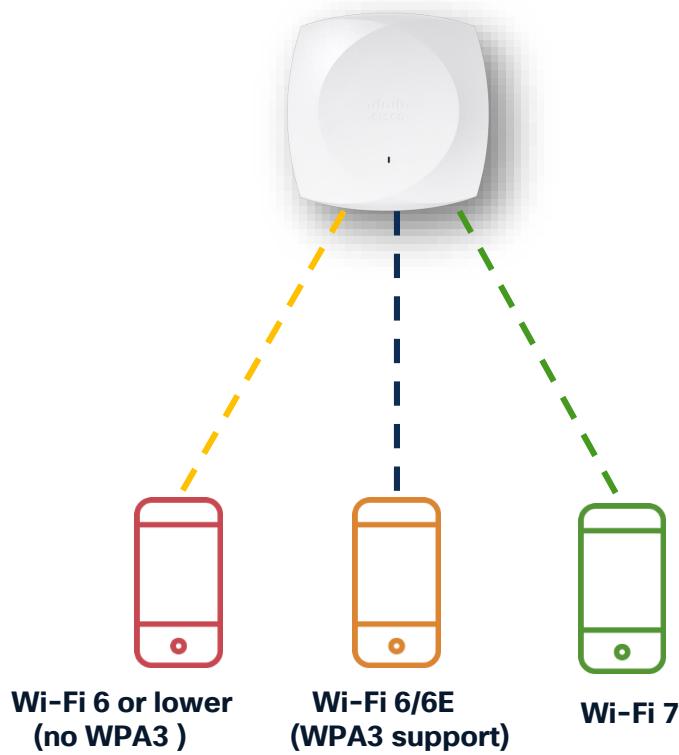
Example Config:



Backward compatible, clients lose Wi-Fi 7 Functionality, no 6 GHz

Client join behavior in Wi-Fi 7 AP

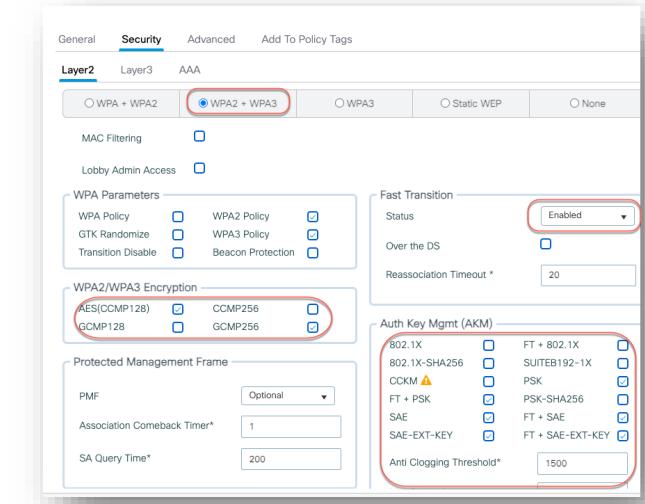
Scenario 2: AP Broadcasting WPA3 Transition WLANs (with all required AKMs and Ciphers enabled)



Client Profile:

1. WPA2 setting on Wi-Fi 6 or lower (without WPA3 support)
2. WPA3 setting on Wi-Fi 6 clients (with WPA3 support)
3. WPA3 setting on Wi-Fi 6E and Wi-Fi 7 Clients.

Example Config:



Wi-Fi 7 Clients join as 11be; MLO functionality

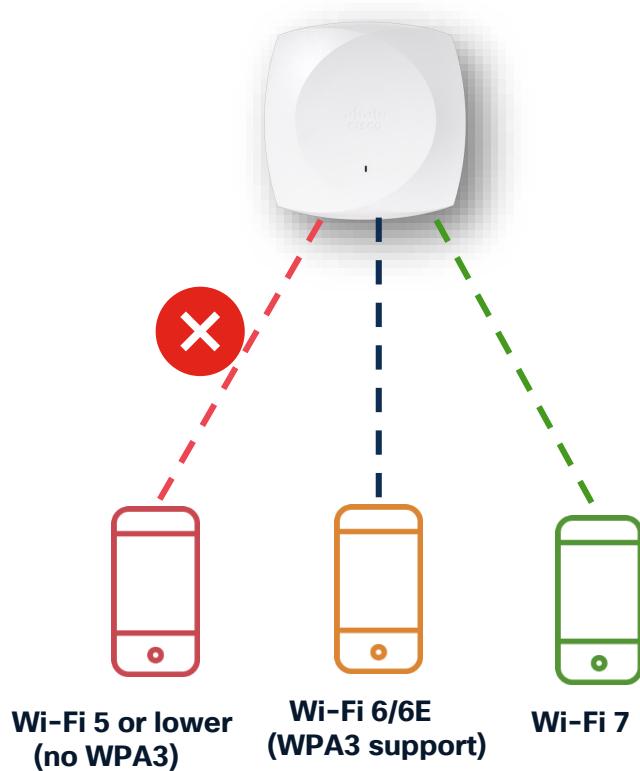
Wi-Fi 6E Clients join as 11ax (prefer 6 GHz band)

Wi-Fi 6 Clients join as 11ax (with WPA3)

Wi-Fi 6 or lower may join as WPA2 (11ax, 11ac and so on) in 2.4/5 GHz bands

Client join behavior in Wi-Fi 7 AP

Scenario 3: AP Broadcasting WPA3/OWE only WLANs



Client Profile:

1. WPA2 setting on Wi-Fi 6 or lower (without WPA3 support)
2. WPA3 setting on Wi-Fi 6 (with WPA3 support)
3. WPA3 setting on Wi-Fi 6E and Wi-Fi 7 Clients.

Example Config:

General		Security		Advanced	Add To Policy Tags
		Layer2	Layer3	AAA	
<input type="radio"/> WPA + WPA2		<input type="radio"/> WPA2 + WPA3	<input checked="" type="radio"/> WPA3	<input type="radio"/> Static WEP	<input type="radio"/> None
MAC Filtering		<input type="checkbox"/>			
Lobby Admin Access		<input type="checkbox"/>			
WPA Parameters		<input type="checkbox"/> WPA Policy <input type="checkbox"/> WPA2 Policy <input checked="" type="checkbox"/> WPA3 Policy <input type="checkbox"/> Beacon Protection			
GTK Randomize		<input type="checkbox"/> GTK Randomize <input type="checkbox"/> WPA2 Policy <input checked="" type="checkbox"/> WPA3 Policy <input type="checkbox"/> Beacon Protection			
Transition Disable		<input type="checkbox"/> Transition Disable			
WPA2/WPA3 Encryption		<input checked="" type="checkbox"/> AES(CCMP128) <input type="checkbox"/> CCMP256 <input type="checkbox"/> GCMP128 <input type="checkbox"/> GCMP256			
Protected Management Frame		<input type="checkbox"/> PMF <input type="checkbox"/> Association Comeback Timer* <input type="checkbox"/> SA Query Time*			
Fast Transition		<input type="checkbox"/> Status <input type="checkbox"/> Over the DS <input type="checkbox"/> Reassociation Timeout*			
Auth Key Mgmt (AKM)		<input type="checkbox"/> FT + 802.1X <input type="checkbox"/> 802.1X-SHA256 <input type="checkbox"/> OWE <input type="checkbox"/> SAE <input type="checkbox"/> FT + SAE <input type="checkbox"/> SAE-EXT-KEY <input type="checkbox"/> FT + SAE-EXT-KEY			

Wi-Fi 7 Clients join as 11be; MLO functionality

Wi-Fi 6E Clients join as 11ax (prefer 6 GHz band)

Wi-Fi 6 Clients join as 11ax (with WPA3) in 2.4/5GHz bands.

Wi-Fi 5 or lower without WPA3 cannot join the WLAN.

Wi-Fi 7 Client Roam Behavior - Personal

Wi-Fi 7



Wi-Fi 6E



Wi-Fi 6



Wi-Fi 6



WLAN Profile:
WPA3 Personal, AKM: FT/SAE-EXT-KEY, Cipher: AES, GCMP256

Wi-Fi 7 Client

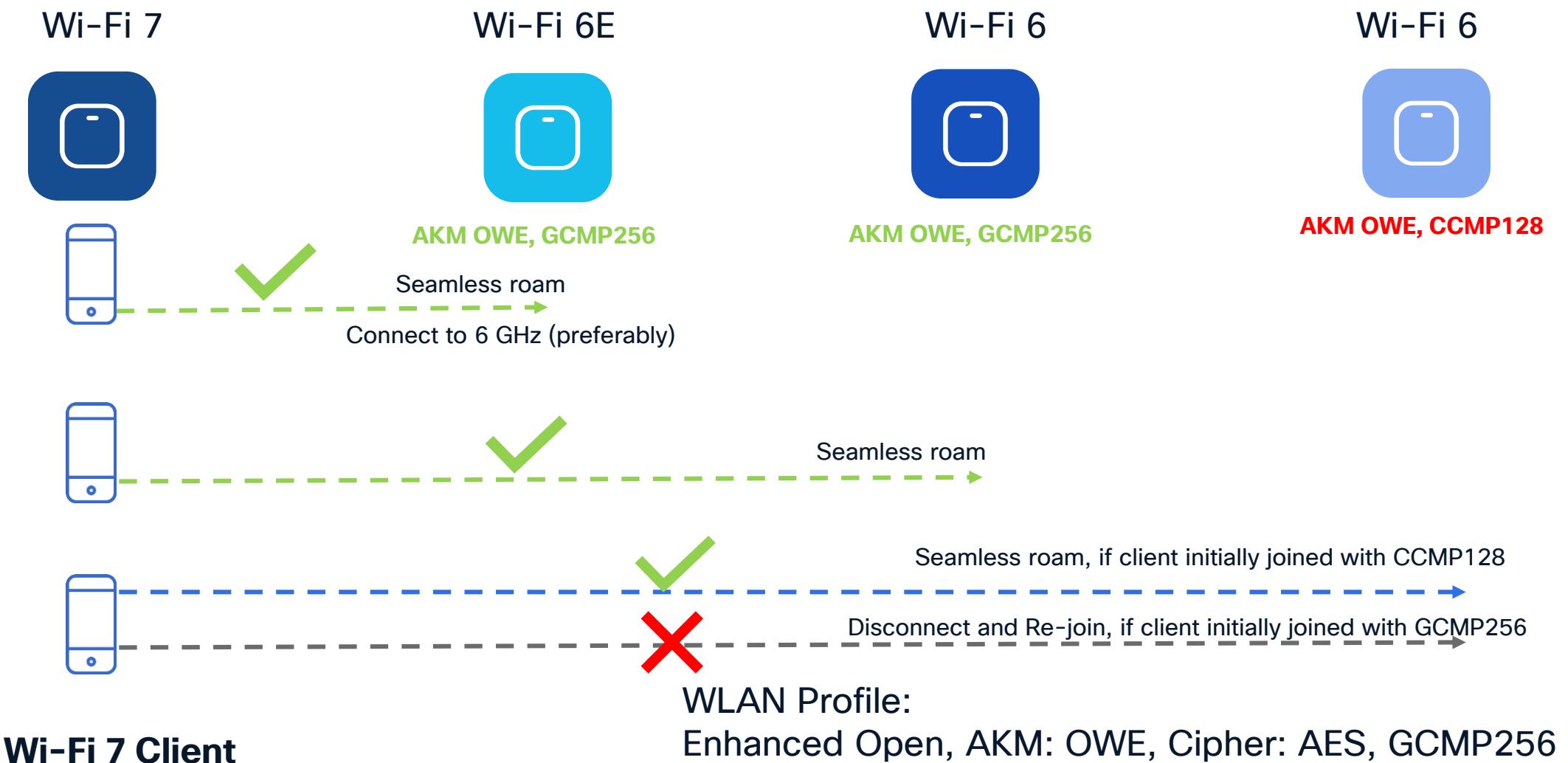
Roam from a Wi-Fi 7 to Wi-Fi 6 AP

Frame	Time	Source	Destination	Type	Description
8	0.016576	CiscoMeraki_6f:a4:ef	e6:60:17:bb:21:a8	802.11	142 Authentication, SN=1457, FN=0, Flags=.....C
9	0.019246	e6:60:17:bb:21:a8	CiscoMeraki_6f:a4:ef	802.11	332 Association Request, SN=424, FN=0, Flags=.....C, SSID="W7_WPA3_SAE_SAE_EXT"
10	0.037983	CiscoMeraki_6f:a4:ef	e6:60:17:bb:21:a8	802.11	337 Association Response, SN=0, FN=0, Flags=.....C
11	0.045633	c6:14:a2:6f:a4:f0	e6:60:17:bb:21:a8	EAPOL	233 Key (Message 1 of 4)
12	0.059657	e6:60:17:bb:21:a8	c6:14:a2:6f:a4:f0	EAPOL	243 Key (Message 2 of 4)
13	0.062713	c6:14:a2:6f:a4:f0	e6:60:17:bb:21:a8	EAPOL	407 Key (Message 3 of 4)
14	0.063834	e6:60:17:bb:21:a8	c6:14:a2:6f:a4:f0	EAPOL	211 Key (Message 4 of 4)
15	13.648237	Intel_bb:21:a5	Cisco_04:bb:ef	802.11	96 Authentication, SN=431, FN=0, Flags=.....C
16	13.650020	Cisco_04:bb:ef	Intel_bb:21:a5	802.11	96 Authentication, SN=1698, FN=0, Flags=.....C
17	13.652665	Intel_bb:21:a5	Cisco_04:bb:ef	802.11	318 Reassociation Request, SN=432, FN=0, Flags=.....C, SSID="W7_WPA3_SAE_SAE_EXT"
18	13.661113	Cisco_04:bb:ef	Intel_bb:21:a5	802.11	306 Reassociation Response, SN=0, FN=0, Flags=.....C
19	13.669498	Cisco_04:bb:ef	Intel_bb:21:a5	EAPOL	221 Key (Message 1 of 4)
20	13.682679	Intel_bb:21:a5	Cisco_04:bb:ef	EAPOL	247 Key (Message 2 of 4)
21	13.684558	Cisco_04:bb:ef	Intel_bb:21:a5	EAPOL	375 Key (Message 3 of 4)
22	13.686704	Intel_bb:21:a5	Cisco_04:bb:ef	EAPOL	199 Key (Message 4 of 4)
23	38.803082	e6:60:17:bb:21:a8	CiscoMeraki_6f:a4:ef	802.11	108 Authentication, SN=441, FN=0, Flags=.....C
24	38.809969	CiscoMeraki_6f:a4:ef	e6:60:17:bb:21:a8	802.11	108 Authentication, SN=1844, FN=0, Flags=.....C
25	38.812473	e6:60:17:bb:21:a8	CiscoMeraki_6f:a4:ef	802.11	354 Reassociation Request, SN=442, FN=0, Flags=.....C, SSID="W7_WPA3_SAE_SAE_EXT"

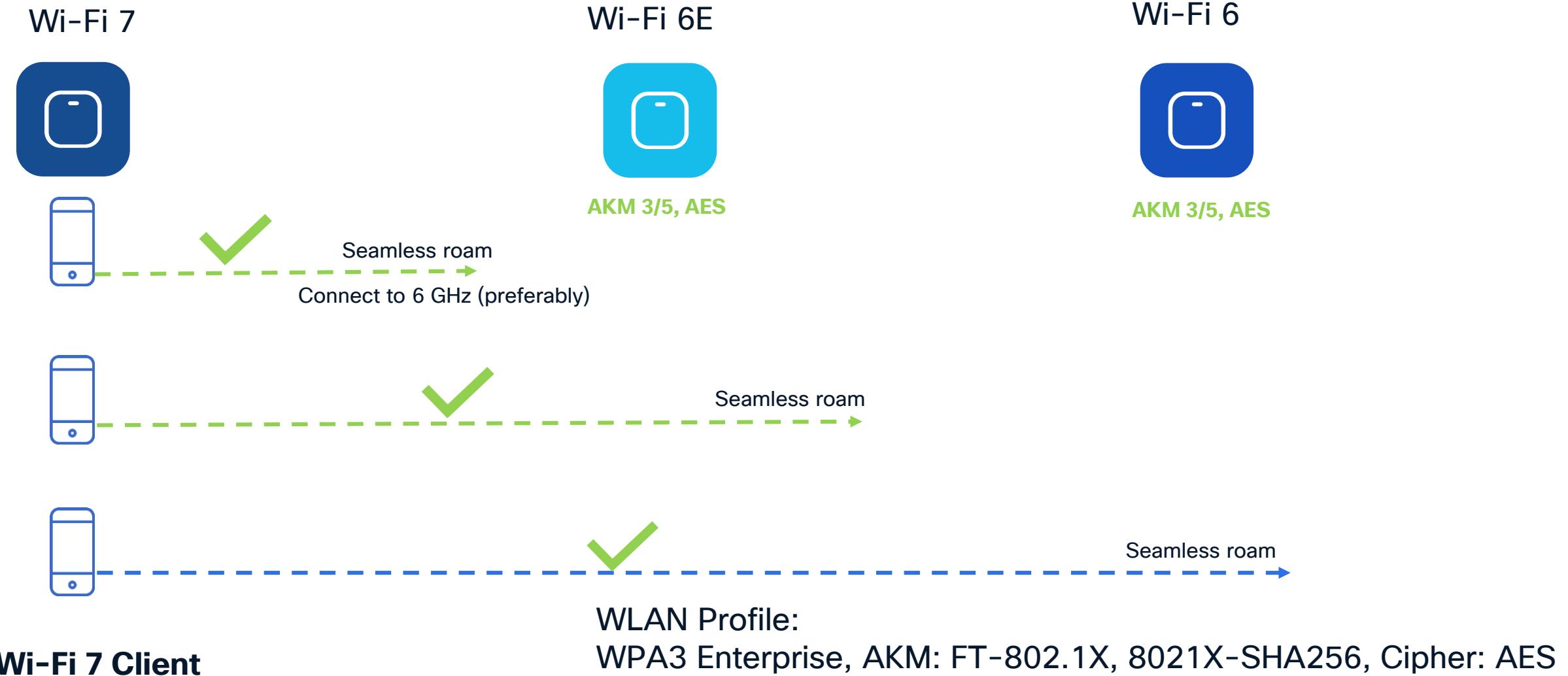
Internet II, Src: CISCO_04:BB:EF (10.0.2.15), Dst: ECFE8ECEEE00_20:8A:00 (00:50:70:20:8A:00)
Internet Protocol Version 4, Src: 9.3.35.40, Dst: 9.2.41.103
User Datagram Protocol, Src Port: 5555, Dst Port: 5000
Wireshark/OmniPeek encapsulated IEEE 802.11
02.11 radio information
IEEE 802.11 Reassociation Request, Flags:C
IEEE 802.11 Wireless Management
 Fixed parameters (10 bytes)
 Tagged parameters (218 bytes)
 > Tag: SSID parameter set: "W7_WPA3_SAE_SAE_EXT"
 > Tag: Supported Rates 6, 9, 12, 18, 24, 36, 48, 54, [Mbit/sec]
 > Tag: Power Capability Min: 0, Max: 15
 > Tag: HT Capabilities (802.11n D1.10)
 > Tag: RSN Information
 Tag Number: RSN Information (48)
 Tag length: 42
 RSN Version: 1
 > Group Cipher Suite: 00:0f:ac (Ieee 802.11) GCMP (256)
 Pairwise Cipher Suite Count: 1
 > Pairwise Cipher Suite List 00:0f:ac (Ieee 802.11) GCMP (256)
Auth Key Management (AKM) Suite Count: 1
 Auth Key Management (AKM) Suite List 00:0f:ac (Ieee 802.11) GCMP (256)
Packets: 53

Wi-Fi 7 Client doing a seamless roam to a Wi-Fi 6 AP; as long as AKM and Cipher matches

Wi-Fi 7 Client Roam Behavior - OWE



Wi-Fi 7 Client Roam Behavior - Enterprise



Wi-Fi 6E and 7 Security

Enterprise



Reference

WPA Type*	Security (AKM)	Fast Transition	PMF	AES-128	GCMP-256***	Compatibility	Notes
WPA3-Enterprise	802.1x-SHA256	ALL	✓	✓	✓	Wi-Fi 6E Wi-Fi 7	GCMP-256 for Future
WPA3-Enterprise	FT+802.1x**	Enabled	✓	✓	✓	Wi-Fi 6E Wi-Fi 7	GCMP-256 for Future
WPA3-Enterprise	FT+802.1x** 802.1x-SHA256	Enabled	✓	✓	✓	Wi-Fi 6E Wi-Fi 7	GCMP-256 for Future
WPA3-Enterprise	SUITEB-192-1x	Disabled	✓	✗	✓	Wi-Fi 6E Wi-Fi 7	
WPA2-Enterprise WPA3-Enterprise	802.1x 802.1x-SHA256	ALL	Optional	✓	✓	Transition Wi-Fi 6E^ Wi-Fi 7^	GCMP-256 for Future Allows legacy clients on 2.4/5 GHz ^In 6GHz PMF broadcasted as Mandatory Compatibility Focus
WPA2-Enterprise	802.1x	Adaptive Disabled	Disabled	✓	✗	Legacy (No 6E & 7)	No 802.11be, no 6GHz

* Enable Beacon Protection

** still uses SHA256, even if not explicit in its naming

*** GCMP256 not supported in C9105, C9115 & C9120

AKM - Authentication and Key Management

SHA256 - Secure Hash Algorithm (SHA) 256 bit

PMF - Protected Management Frame

Wi-Fi 6E and 7 Security

Personal



Reference

WPA Type*	Security (AKM)	Fast Transition	PMF	AES-128	GCMP-256***	Compatibility	Notes
WPA3-Personal	SAE-EXT-KEY	Disabled	✓	✓	✓	Wi-Fi 7	AES-128 allowed in 17.15.1 GCMP-256 Mandatory in 17.18.1
WPA3-Personal	SAE-EXT-KEY FT-SAE-EXT-KEY	Enabled	✓	✓	✓	Wi-Fi 7	AES-128 allowed in 17.15.1 GCMP-256 Mandatory in 17.18.1
WPA3-Personal	SAE SAE-EXT-KEY	Disabled	✓	✓	✓	Wi-Fi 6 Wi-Fi 6E Wi-Fi 7	Transition may need H2E/HNP Support for clients without SAE-EXT-KEY
WPA2-Personal WPA3-Personal	PSK, SAE, SAE-EXT-KEY	Disabled	Optional	✓	✓	Legacy Wi-Fi 6E Wi-Fi 7	Transition may need H2E/HNP AES-128 allowed in 17.15.1 GCMP-256 Mandatory in 17.18.1
WPA2-Personal WPA3-Personal	PSK, FT-PSK, SAE, FT-SAE, SAE-EXT-KEY, FT-SAE-EXT-KEY	Enabled	Optional	✓	✓	Legacy Wi-Fi 6E^ Wi-Fi 7^	Transition may need H2E/HNP AES-128 allowed in 17.15.1 GCMP-256 Mandatory in 17.18.1
WPA2-Personal WPA3-Personal	PSK, SAE	Disabled	✓	✓	✗	Legacy Wi-Fi 6E No Wi-Fi 7	No 802.11be, 6GHz supported
WPA2-Personal	PSK	Disabled	✗	✓	✗	Legacy (No 6E & 7)	No 802.11be, no 6GHz

* Enable Beacon Protection

** SAE H2E required for 6 GHz and Wi-Fi 7

*** GCMP256 not supported in C9105, C9115 & C9120

Wi-Fi 6E and 7 Security

Enhanced Open



Reference

WPA Type*	Security (AKM)	Fast Transition	PMF	AES-128	GCMP-256***	Compatibility	Notes
Enhanced Open	OWE	Disabled	✓	✓	✓	Wi-Fi 6E Wi-Fi 7	AES-128 allowed in 17.15.1 GCMP-256 Mandatory in 17.18.1
Enhanced Open	OWE	Disabled	✓	✓	✗	Wi-Fi 6E No Wi-Fi 7	No 802.11be, but 6 GHz supported
Enhanced Open	OWE Transition	Disabled	NA	✓	✗	Legacy No Wi-Fi 6E No Wi-Fi 7	No 802.11be and No 6 GHz Requires 2 SSIDs

*** GCMP256 not supported in C9105, C9115 & C9120

AKM - Authentication and Key Management
OWE - Opportunistic Wireless Encryption
PMF - Protected Management Frame

Wi-Fi 7 Client WPA3 Support Matrix



Reference

WPA3	Intel Windows	QCA Windows	Samsung S24	Pixel 9 Pro	iPhone	Chromebook BE200	MediaTek
OWE+MLO	Supported	Supported	Supported	Supported	Supported	Supported	Supported
SAE+MLO	Supported	Supported	Supported	Supported	Supported	Supported	Supported
SAE-EXT+MLO	Supported	Supported	Supported	Supported	Supported	Supported	Supported
802.1x+MLO	Not Supported	Not Supported	Supported	Supported	Supported	Supported	Not Supported
FT SAE+MLO	Not Supported	Not Supported	Supported	Not Supported	Supported	Supported	Not Supported
FT SAE-EXT+MLO	Not Supported	Not Supported	Supported	Not Supported	Supported	Supported	Not Supported
FT 802.1x+MLO	Not Supported	Not Supported	Supported	Not Supported	Supported	Supported	Not Supported

Note: Windows support available in Win 11 dev version.

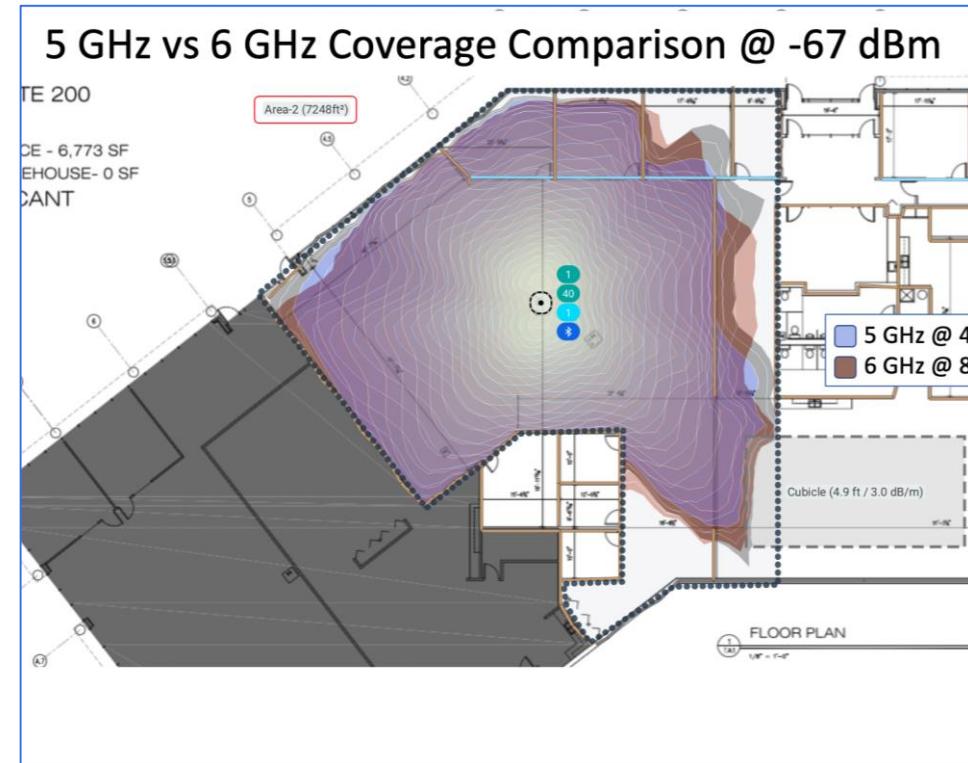
RF Design

Designing for Wi-Fi 7

Advanced RF Tuning in Cisco Wireless - Become an Expert While Getting a Little Help from Cisco AI.
[BRKEWN-3413], June 11th, 10.30 A.M to 12 P.M by Jim Florwick

Design considerations:

- 6 GHz Band
- 320 MHz channel width
- MLO
- Client Density and Application
- Hardware & Antenna Differences



Wi-Fi 7 site planning is very much like Wi-Fi 6E (6 GHz) or Wi-Fi 6 (5 GHz)

Migration

Wi-Fi 7 Software Support Matrix



Reference

IOS-XE 17.15.2 or later
Catalyst Center 2.3.7.6
(for configuration)
Catalyst Center 2.3.7.9
(for maps & assurance)



CW9178/
CW9176

MR 31.1.5.1 or later

IOS-XE 17.15.2b or later
Catalyst Center 3.1.3



CW9172I

MR 31.1.5.1 or later

IOS-XE 17.17.1 or later
Catalyst Center 3.1.3

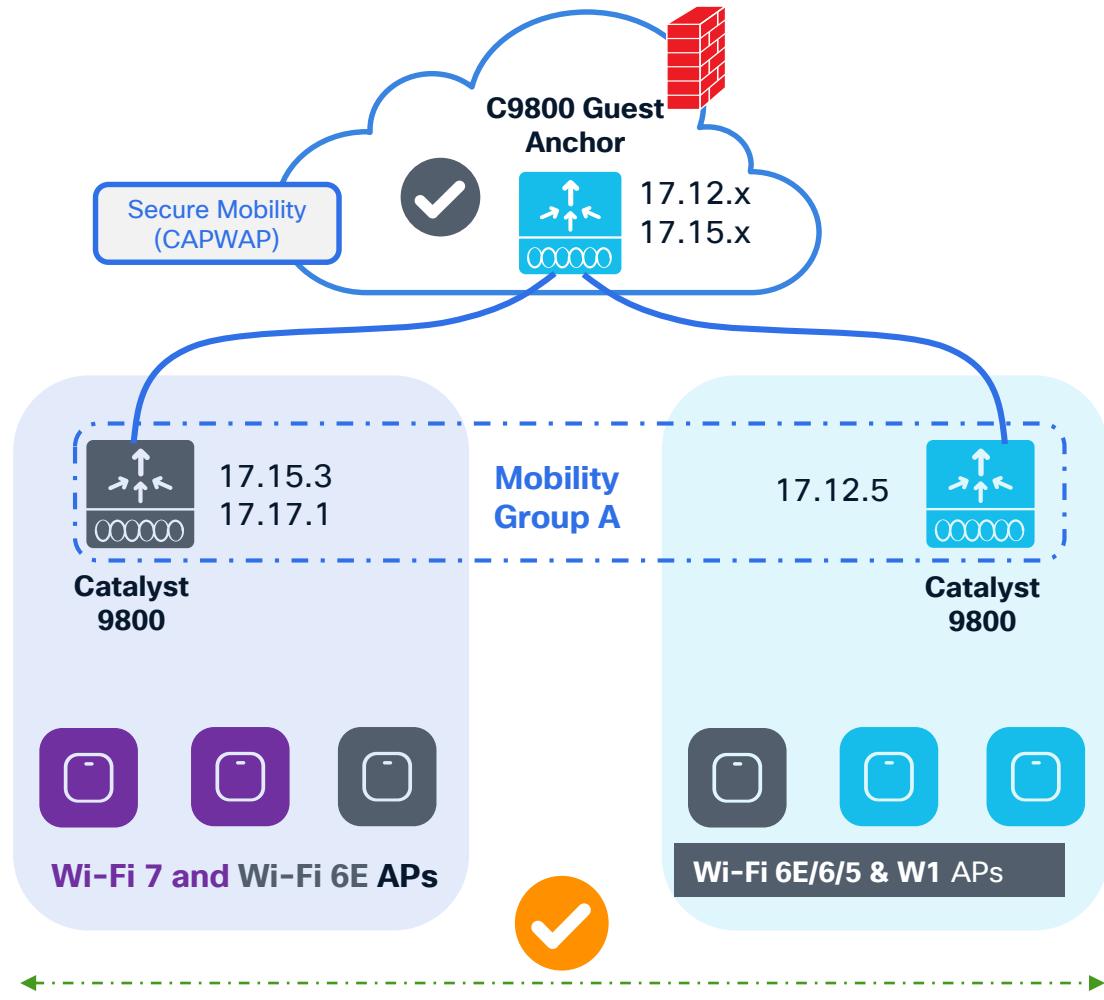


CW9172H

MR 31.1.6.1 or later

How do I start adopting Wi-Fi 7?

Answer: Inter Release Controller Mobility (IRCM)



Scenario 1: If you're in IOS-XE 17.12.x code

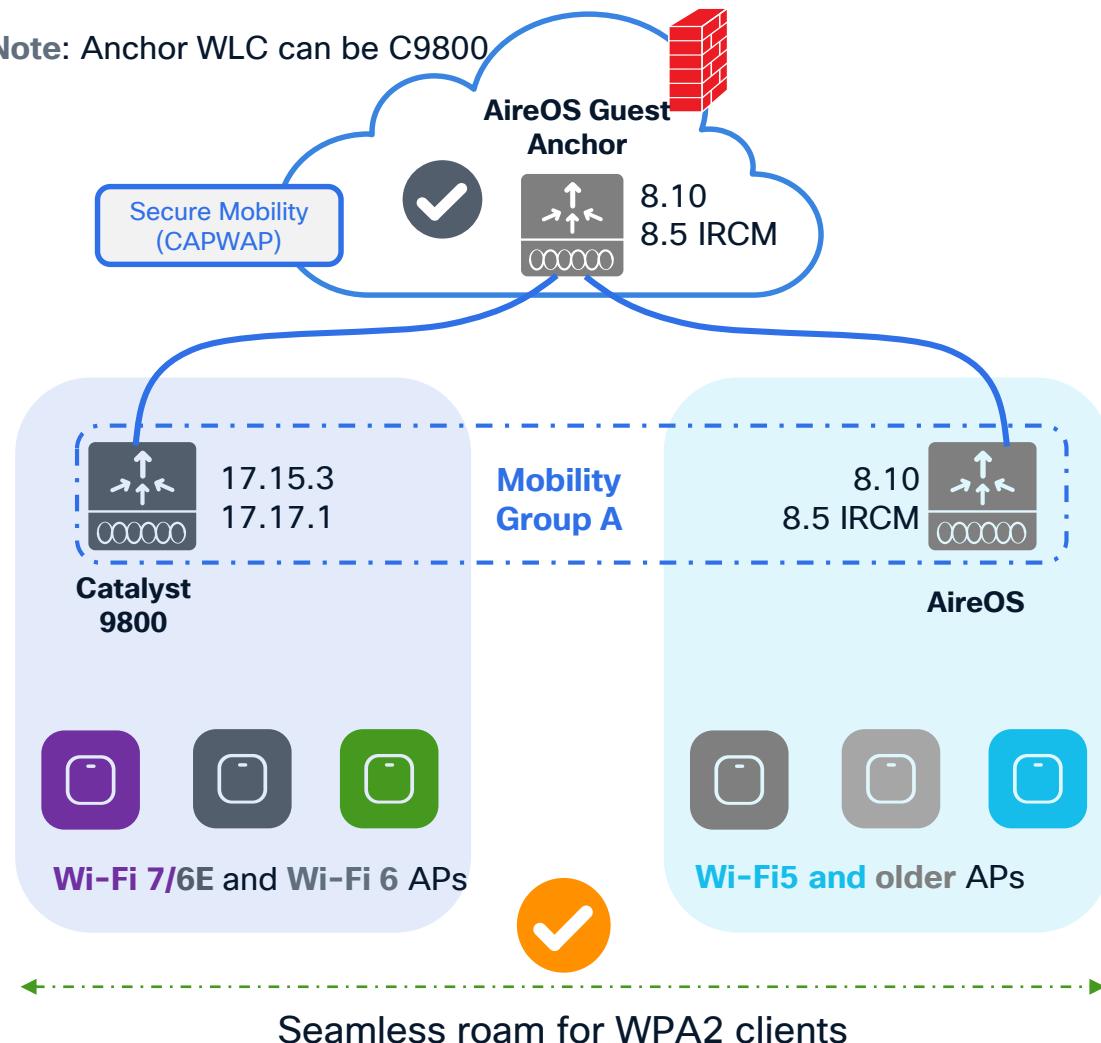
- If you have already started your C9800 journey... & Wave 1 APs are still present (1700/2700/3700).
- Introduce new AP hardware on the new supported IOS XE release and support seamless roaming and Guest Anchor with existing C9800 networks
- The release combinations shown have been tested at scale, check IRCM deployment guide*
- Fast & secure roam will only be supported if the WLAN profile is the same on the two WLCs
- Note: Anchor can be on AireOS as well (8.10 or 8.5 IRCM latest)

(*): https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_c9800_wireless_controller-aireos_ircm_dg.html

How do I start adopting Wi-Fi 7?

Answer: Inter Release Controller Mobility (IRCM)

Note: Anchor WLC can be C9800



Legacy Controller Supports IRCM

- Introduce new Wi-Fi 7 AP hardware on the new C9800 and support seamless roaming and Guest Anchor with existing networks
- This method allows the smooth coexistence of both controllers, with RF areas migrated as needed, without any overnight switchover.
- Things to consider:
 - If the controller is limited to 8.5 (5508, 8510), we will need a special IRCM version (8.5.182.104), to connect them to IOS-XE
 - Best to split the RF network into different areas, configuring different RF group names between the legacy and IOS-XE controllers.
 - Always configure the primary/secondary controller name in access points. The new controllers will reject unsupported APs, but if any AP could work in both controller types, this will avoid APs joining the wrong one, or flip-flopping between them, until the migration is ready to proceed
 - Fast & secure roam will only be supported if the WLAN profile is the same on the two WLCs

(*) https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_c9800_wireless_controller-aireos_ircm_dg.html

Summary

Deploying and migrating to Wi-Fi 7

Key considerations & requirements

Power considerations

Recommendation:
802.3bt (Cisco UPOE) is the suggested power input for full operation of AP

802.3at (PoE+) and 802.3af (PoE) are also supported by the CW9178I/CW9176I&D/CW9172I &H

Security requirements

Mandatory:
WPA3 is mandatory for 11be rates and MLO.

WPA3 was not required for prior Wi-Fi generations (6 and below); hence, it must be top of mind.

Multigigabit switching

Recommendation:
Use a Multigigabit switch with 10G Capability.

Better user experiences with speeds beyond 1 Gbps. Cat 6/6A cabling recommended,

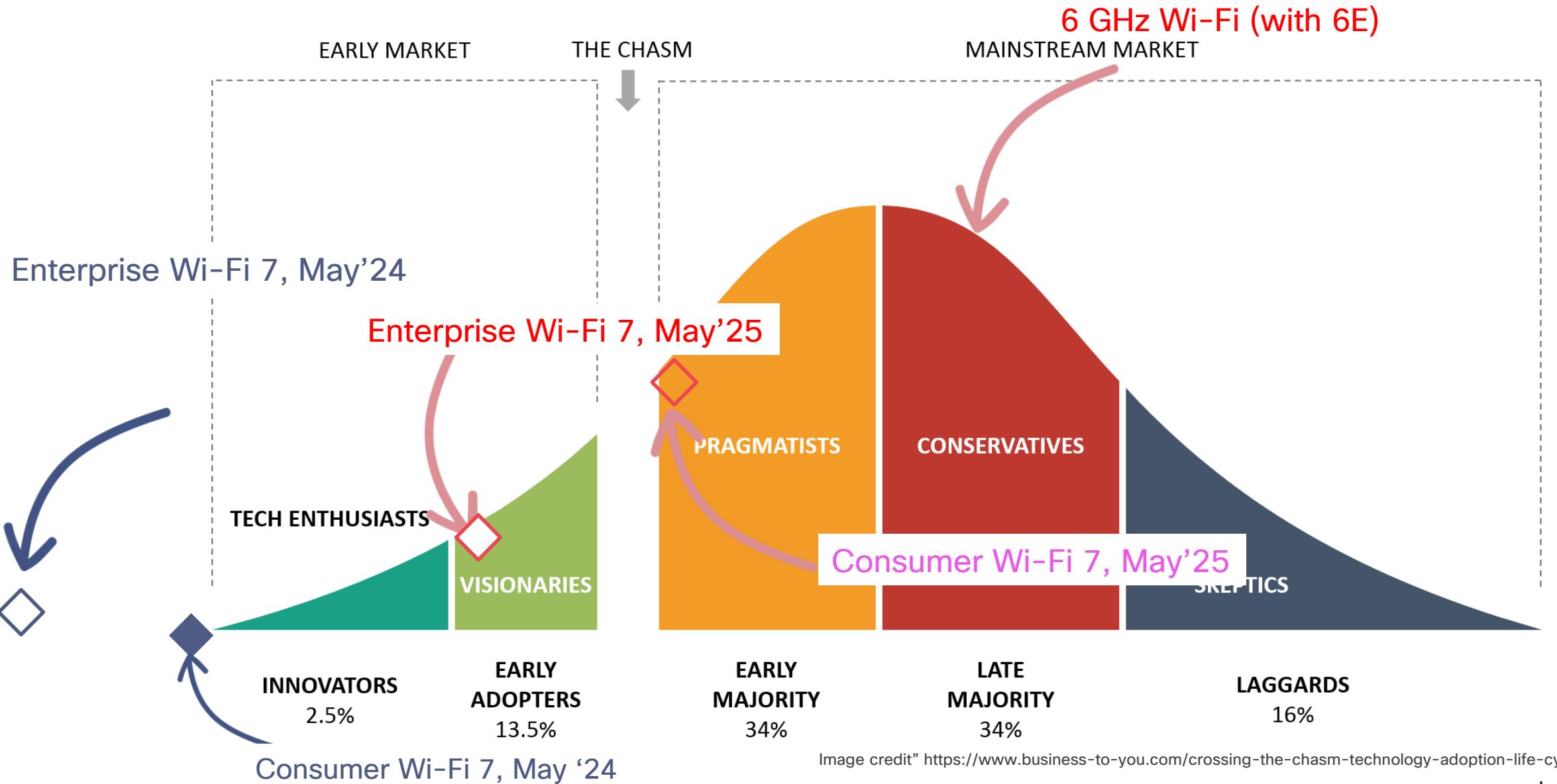
Wireless coverage

Recommendation:
Ensure uniform cell size for 5 and 6 GHz cells. 2.4 & 5 GHz does not need a new site survey

Review the current RF coverage of 5 GHz network to achieve similar coverage for 6 GHz network.

Review Global Use AP Functionality; especially for WLC Management Mode Deployments

Wi-Fi 7 for enterprise - revisited



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