

Wi-Fi 7 is Here - Are you Ready?

cisco Live !

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Sr. Technical Leader, Technical Marketing

Cisco Webex App

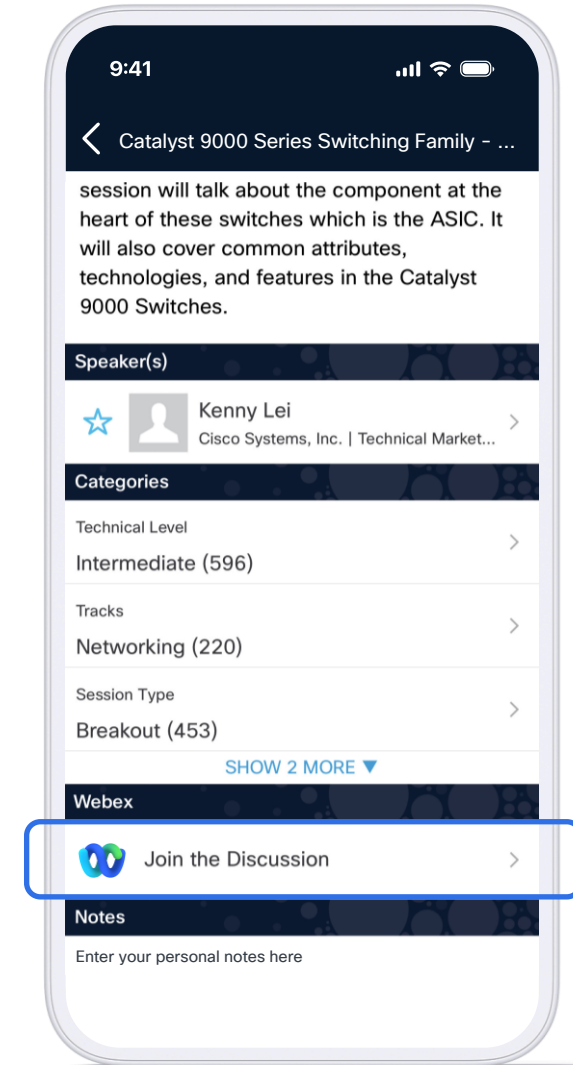
Questions?

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

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<https://ciscolive.ciscoevents.com/ciscolivebot/#BREWN-2025>

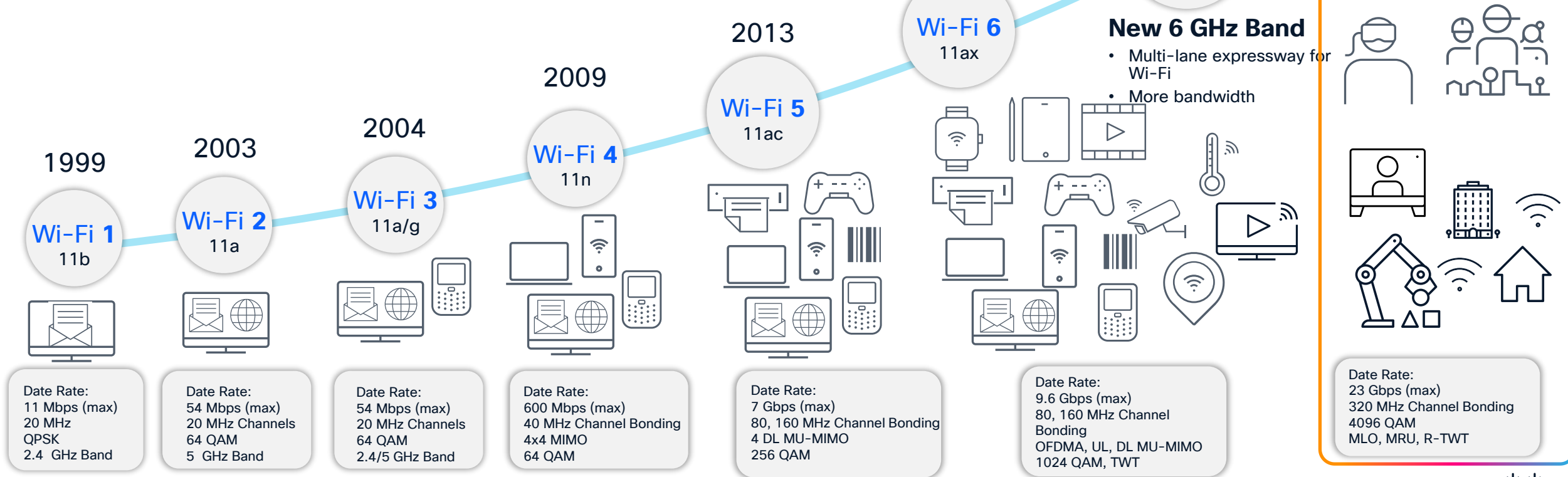
Agenda

- 01** Why 6 GHz & Wi-Fi 7?
- 02** Get to know Wi-Fi 7
- 03** Cisco Wi-Fi 7 Product Portfolio
- 04** Deployment & Migration considerations

Why Wi-Fi 7 ?

Wi-Fi Evolution

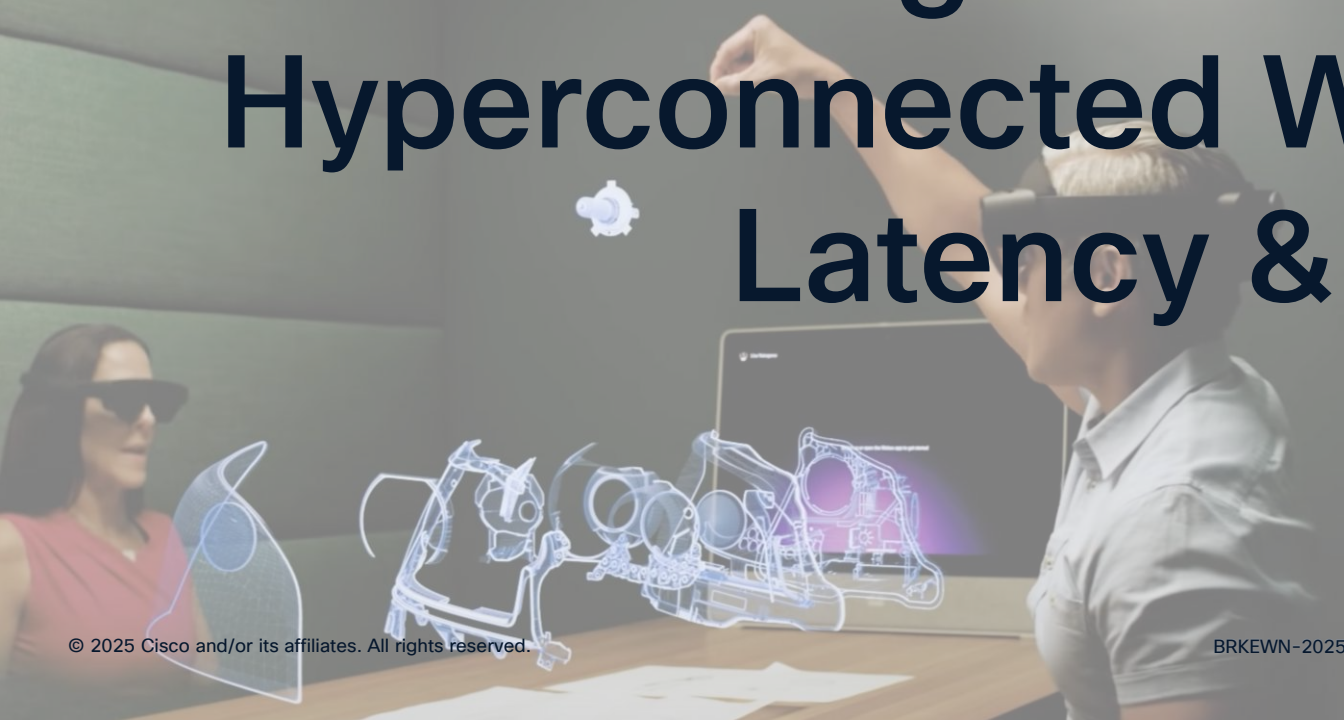
- 25 years of constant evolution with faster speeds and density
- Prior to 6E: Spectrum shared in two bands 2.4 and 5 GHz
- 6E and Above: Spectrum shared in three bands 2.4, 5 and 6 GHz





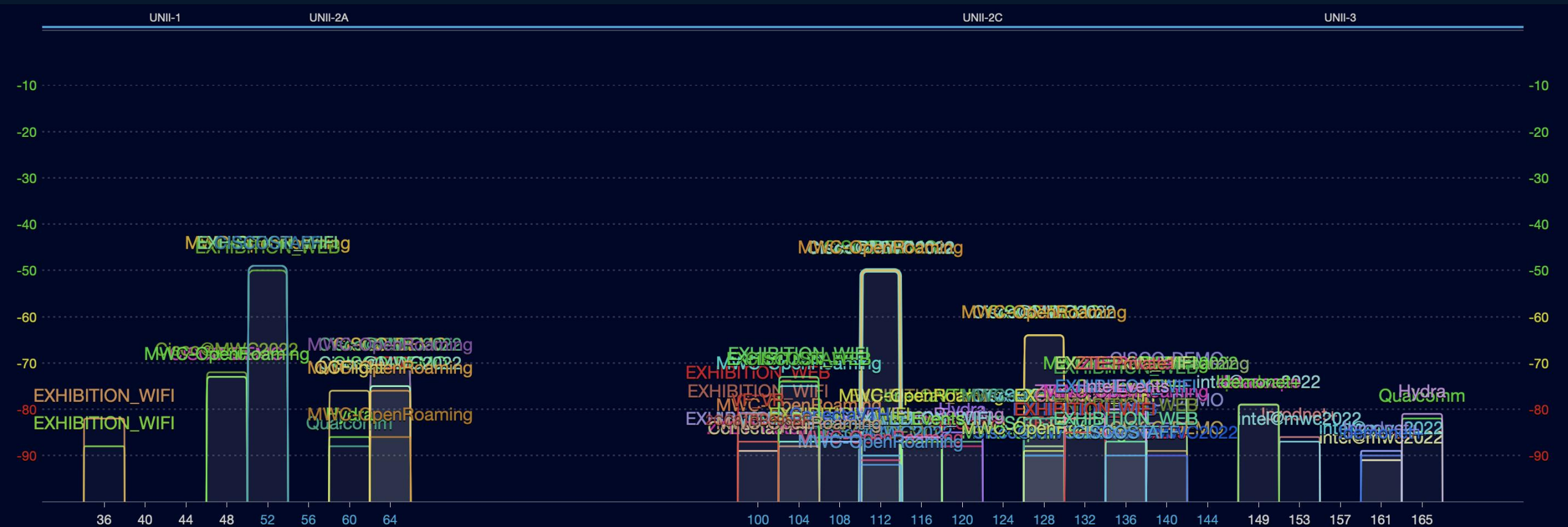
Wi-Fi

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

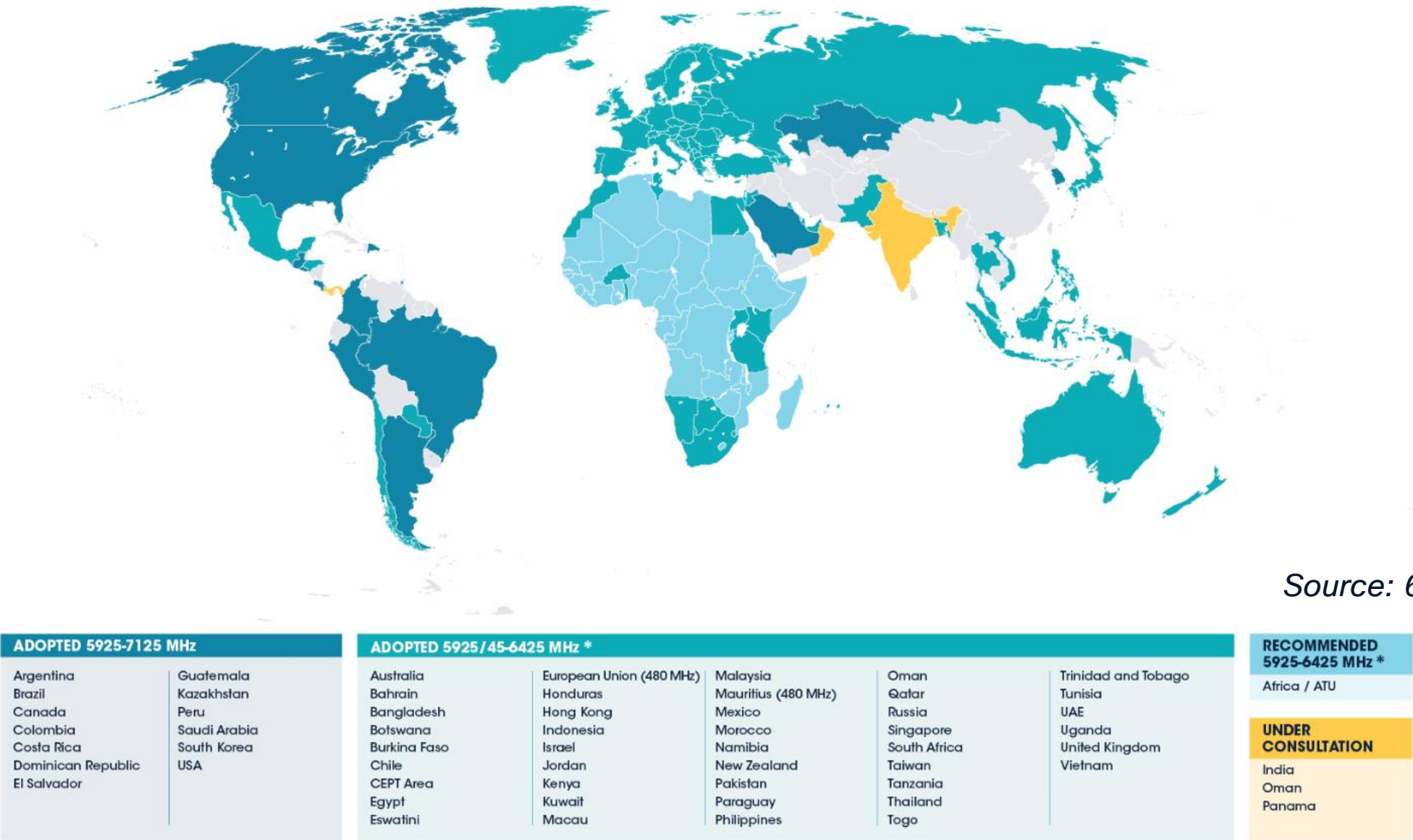


What is the problem?

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

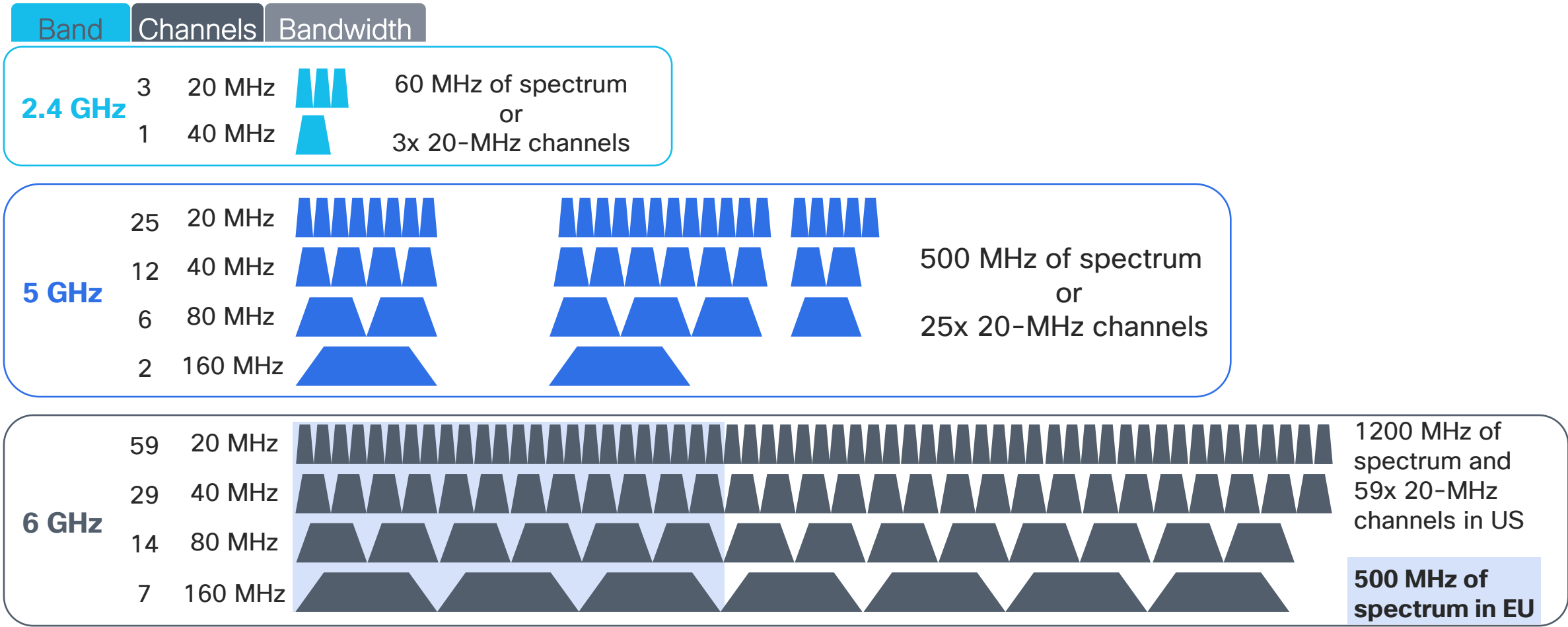


GLOBAL PROGRESS TOWARDS LICENCE-EXEMPT ACCESS TO THE 6 GHz BAND

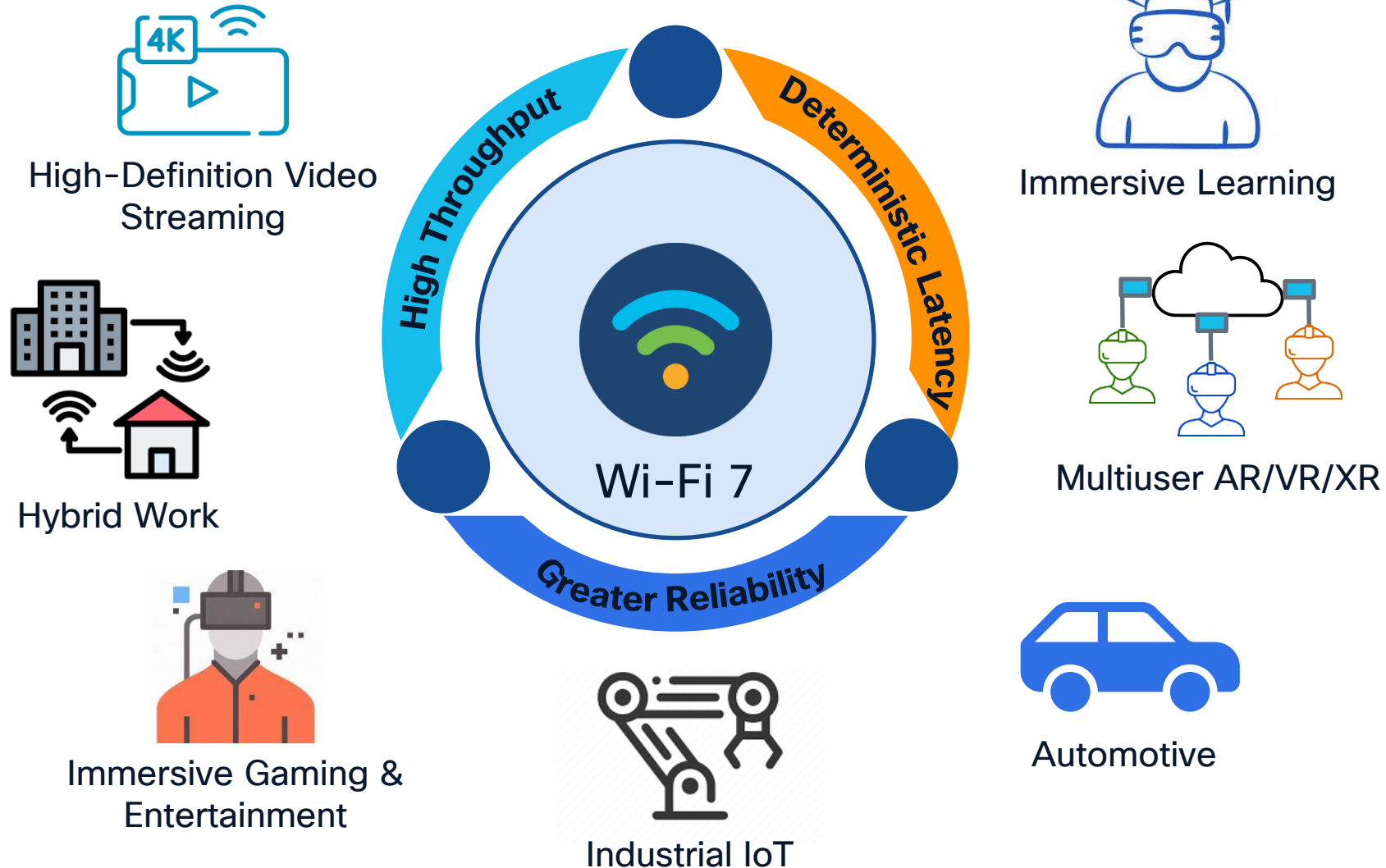


Source: 6ghz.info

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

1

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

2

IEEE 802.11be final publication complete.

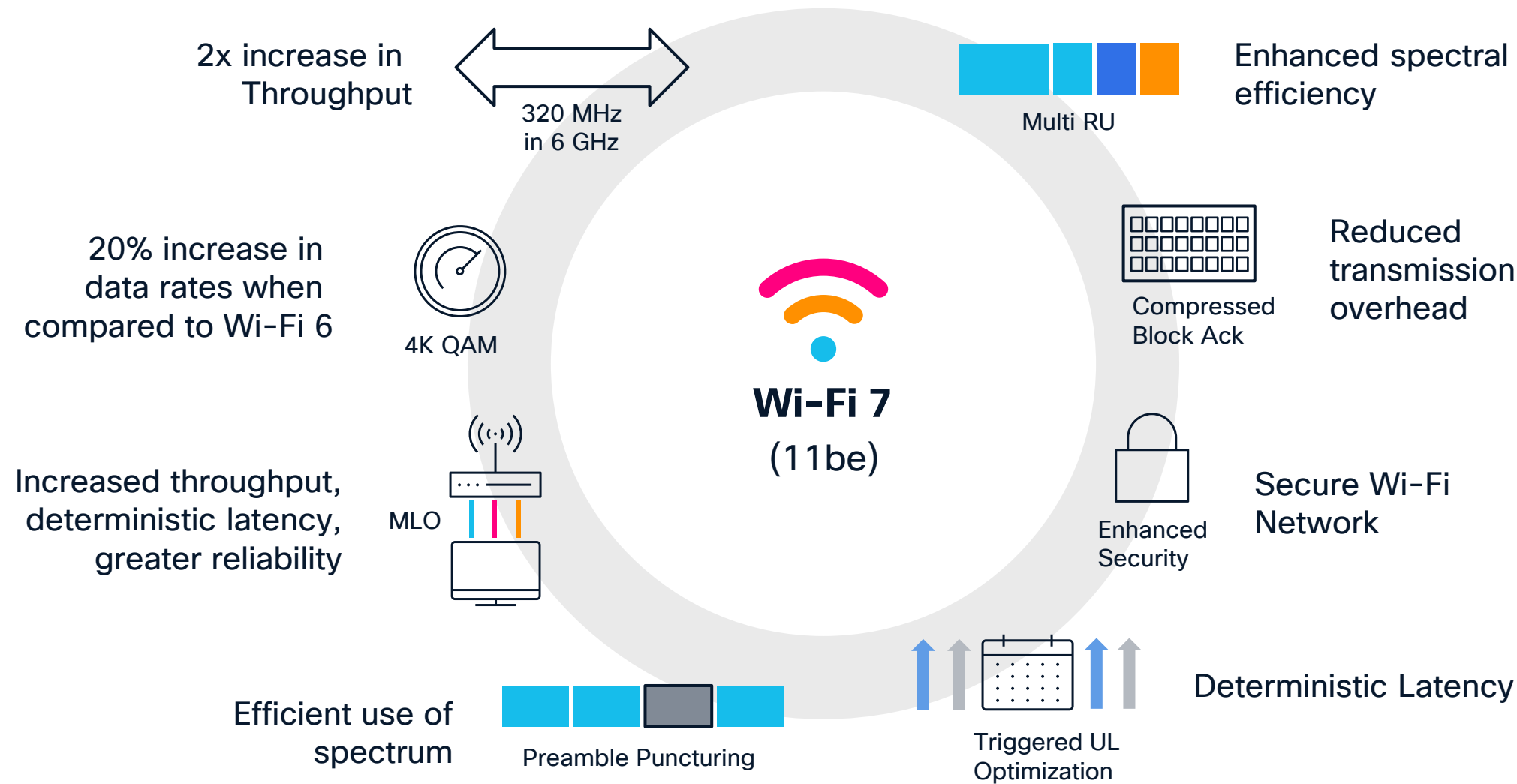
3

Wi-Fi 7 R1 spec finalized in Jan '24. WFA certification for R1 in progress.
R2 expected Jan 2026.

4

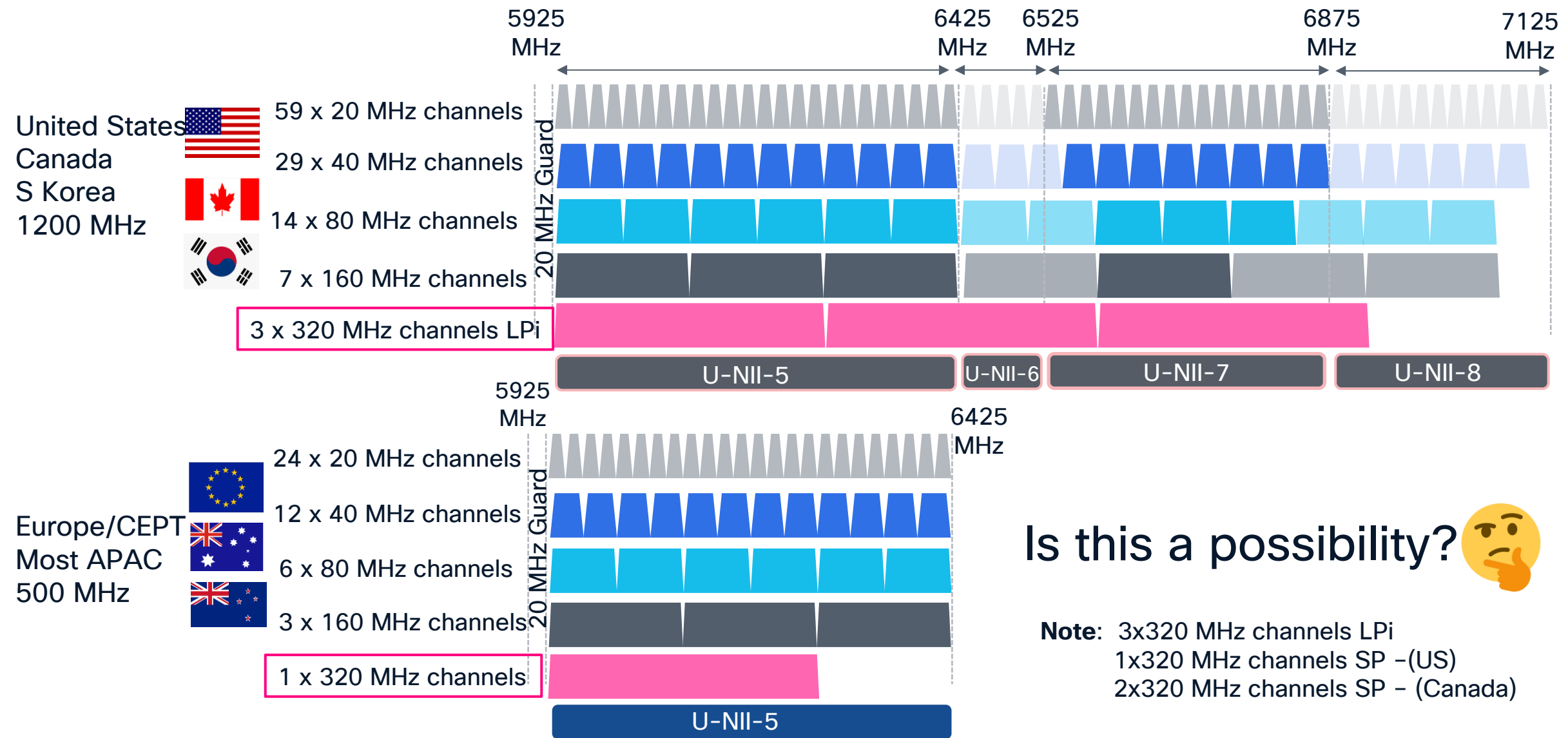
Cisco has been closely involved in development of Wi-Fi 7, and advocates for
thorough client interop testing

Wi-Fi 7 Features



Wi-Fi 7 Feature Overview

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



Is this a possibility? 🤔

Note: 3x320 MHz channels LPI
1x320 MHz channels SP –(US)
2x320 MHz channels SP – (Canada)

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%

Incremental data rate
Relative Range

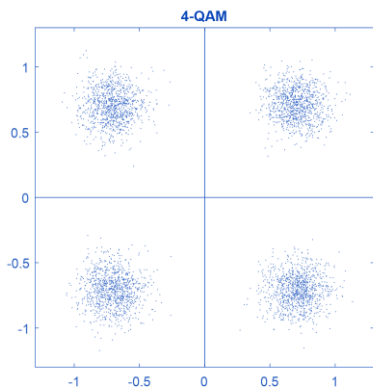
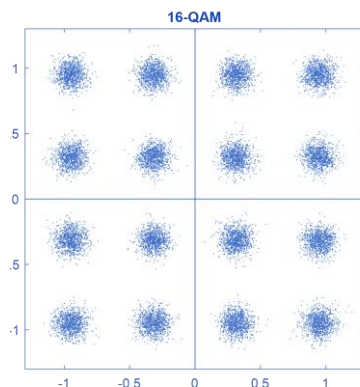
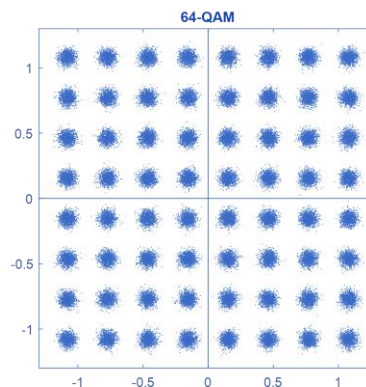
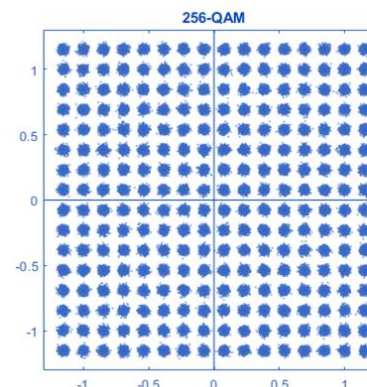
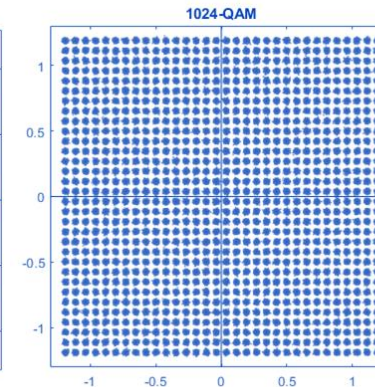
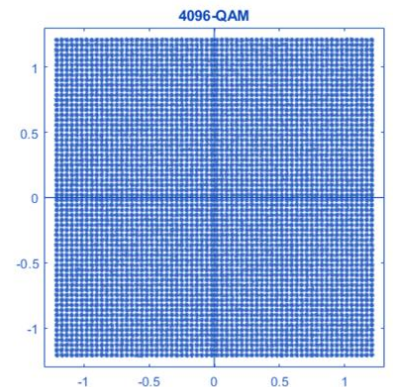
+100%
80

+50%
40

+33%
20

+25%
10

+20%
5



Wi-Fi4

Wi-Fi5

Wi-Fi6

Wi-Fi7

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:

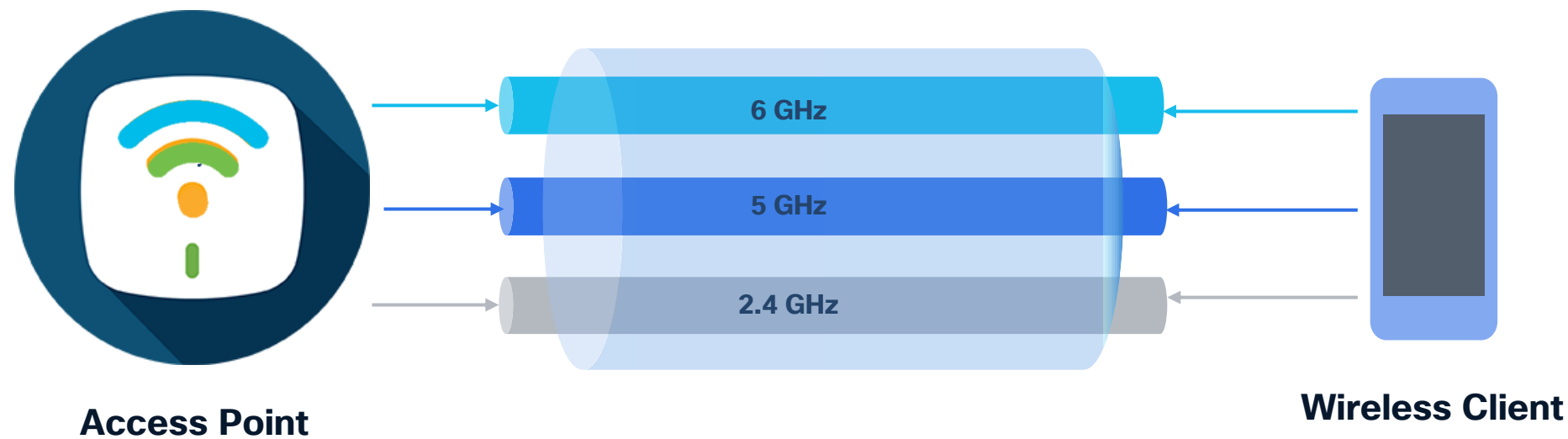
- **320 MHz channel bandwidth** (double that of Wi-Fi 6) → massive throughput.
- **4096-QAM modulation** → higher data rates by encoding more bits per transmission.
- **Preamble puncturing** → allows use of cleaner parts of a channel even if part is interfered.

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

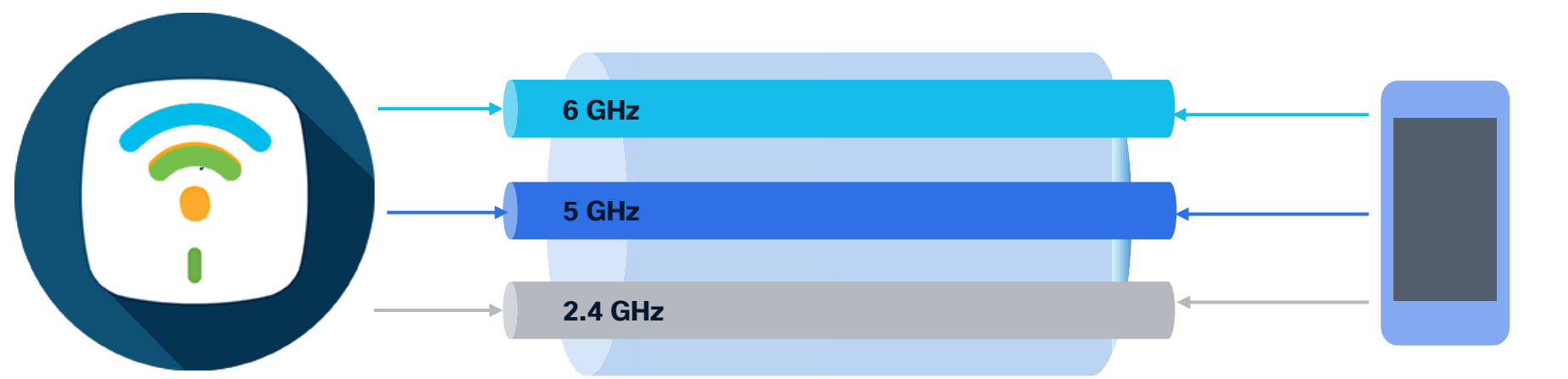
Are you thinking of upgrading to a Wi-Fi 7 setup or just curious about the tech?



Wi-Fi Multilink (MLO)



Wi-Fi 7 – Multilink (MLO)



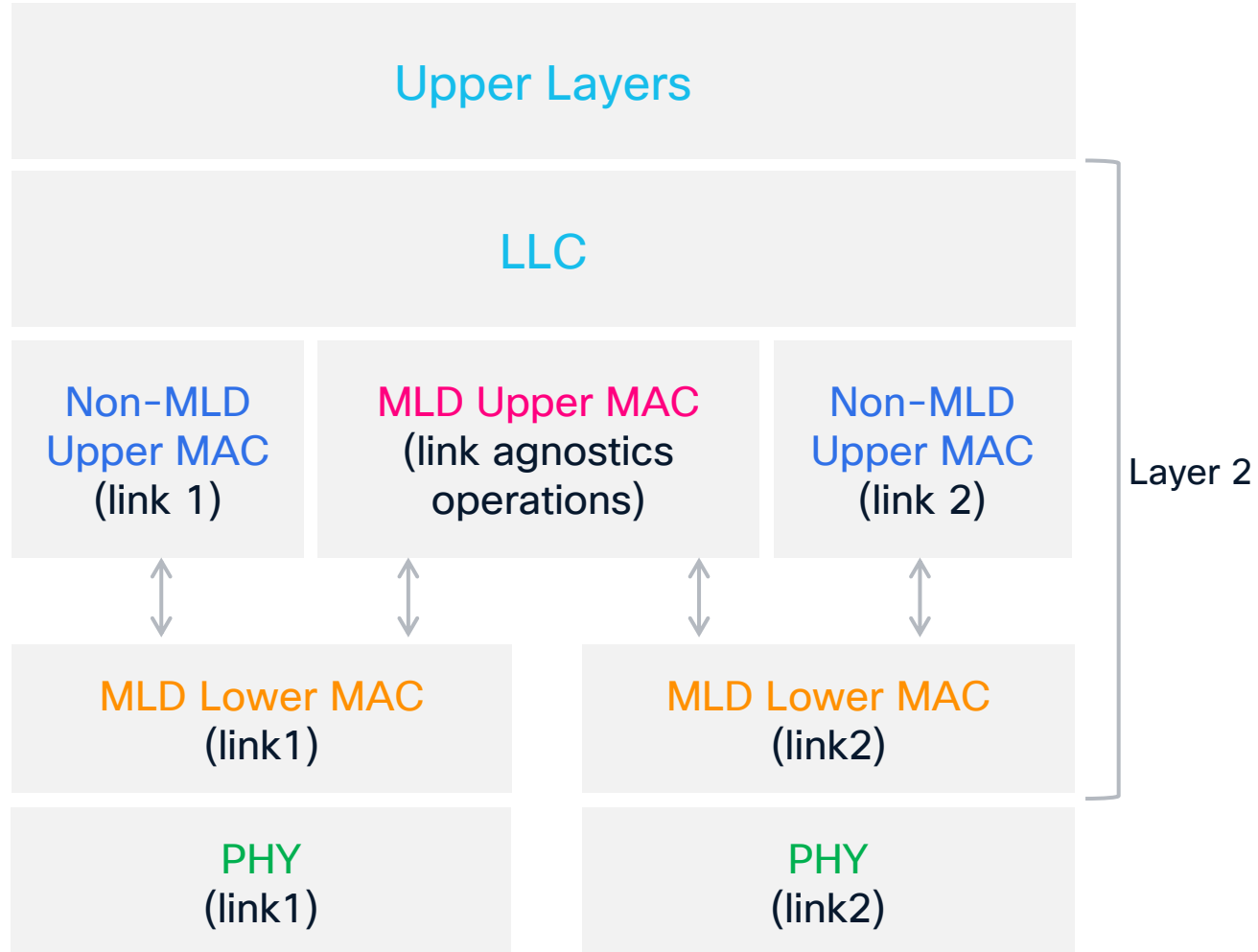
Access Point
(AP MLD)

Wireless Client
(Non AP MLD)

Method	Benefit
Aggregation	Throughput
Steering	Lower Latency
Redundancy	Reliability

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:

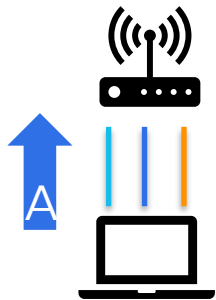
- Link specific mgmt. frames (beacons)
- Control Frames (RTS, CTS, Ack,...)
- Power save state and mode
- Per-link Block Ack scoreboard

The many “modes” of MLO

...because clients have different hardware capabilities

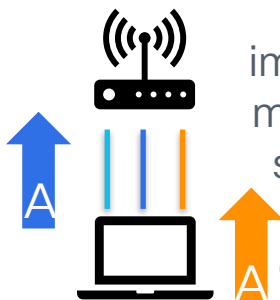
Single Radio

MLSR



Only one link operational at a given time

EMLSR



MLSR plus additional capability to listen to two links

Most important mode for single-radio clients

Acronyms:

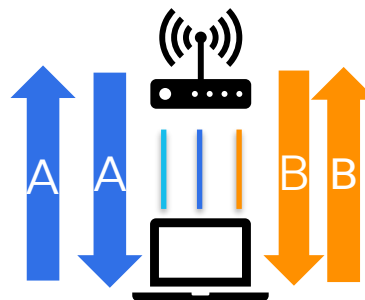
MLMR – Multi-link Multi Radio

MLSR – Multi-link Single Radio

EMLSR – Enhanced Multi-link Single Radio

Multi Radio

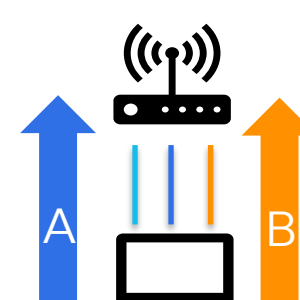
MLMR Simultaneous TX + RX (STR)



Each link operating independently for Tx and Rx

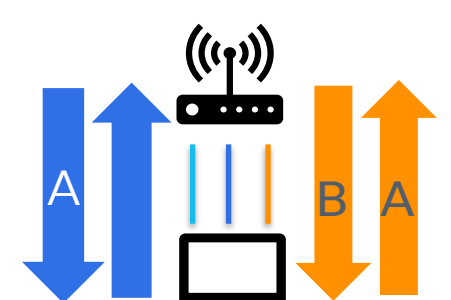
Most important mode for multi-radio clients

MLMR Non-Simultaneous Tx+Rx (nSTR)



Tx or Rx at the same time on different links
(Not included in Wi-Fi 7 Certification)

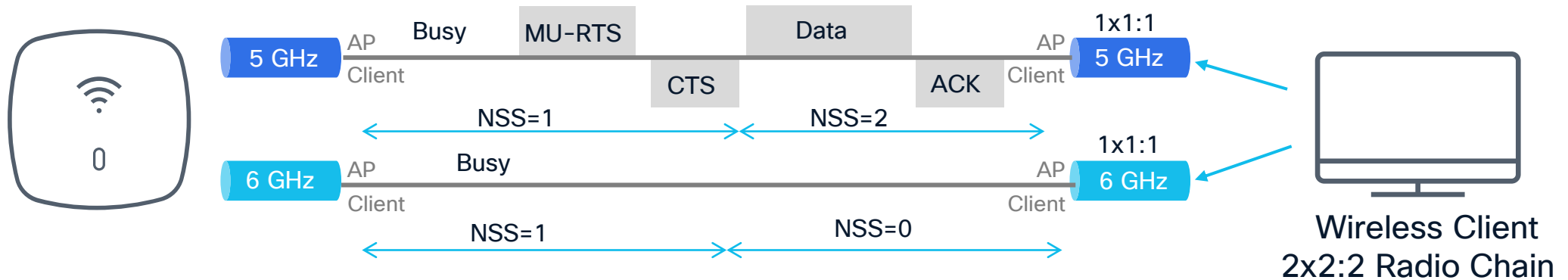
EMLMR Enhanced MLMR



MLMR-STR plus capability to extend Tx/Rx across links for a single radio client.
(Not included in Wi-Fi 7 Certification)

Wi-Fi 7 – EMLSR Operation

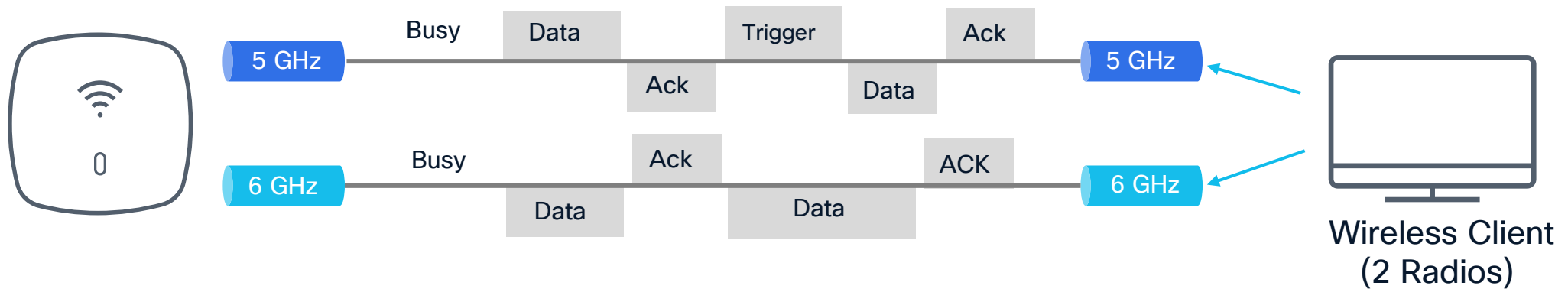
Downlink Transmission from AP to EMLSR Wireless Client



- 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



MLO Modes	Number of Radios	Characteristics	Reference
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 PPDU's end time	
Enhanced Multi Link Multi Radio (EMLMR)*	>= 2	MLMR (STR) with additional capability to dynamically reconfigure spatial multiplexing support on each link	

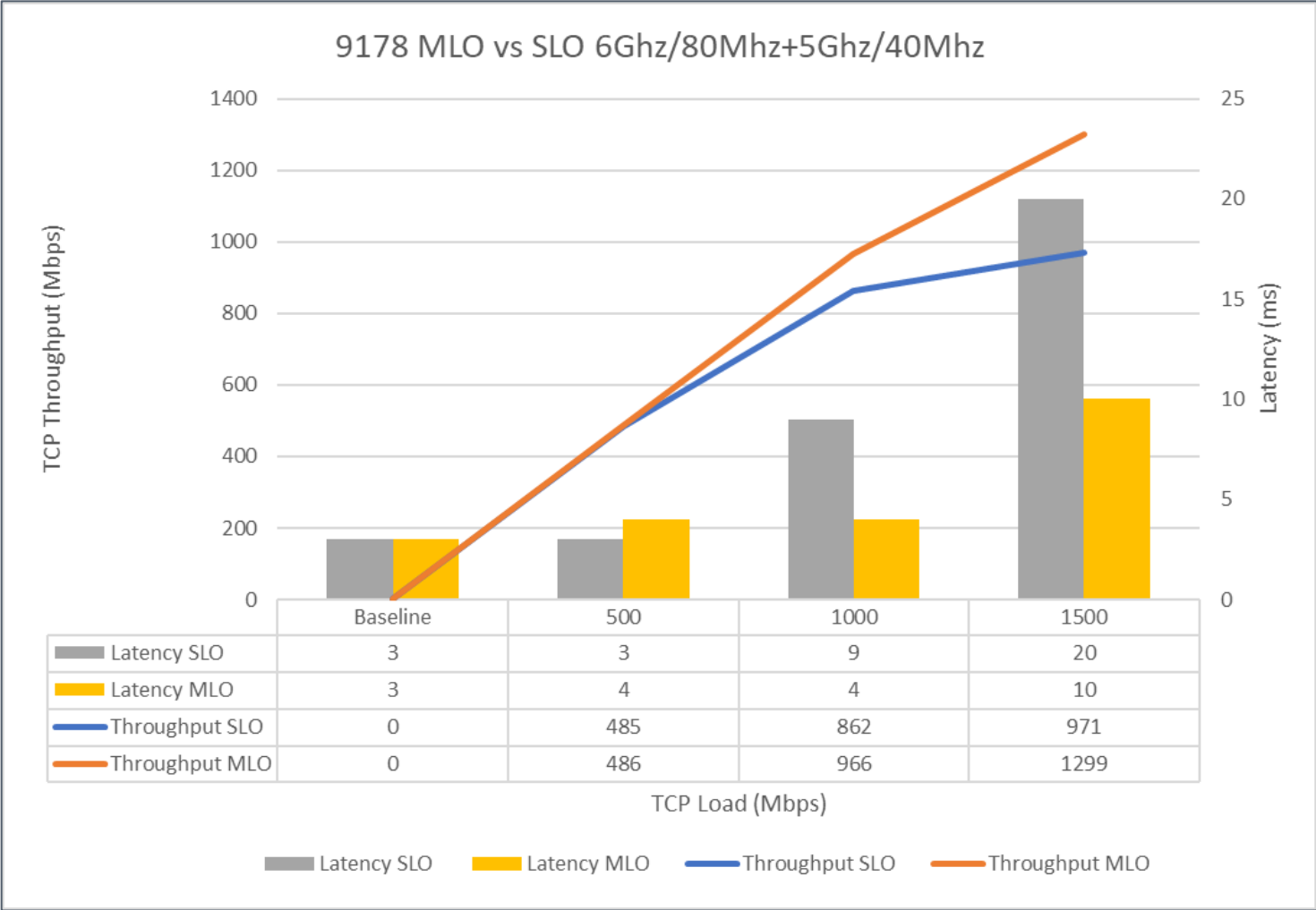
Requirement:

- 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

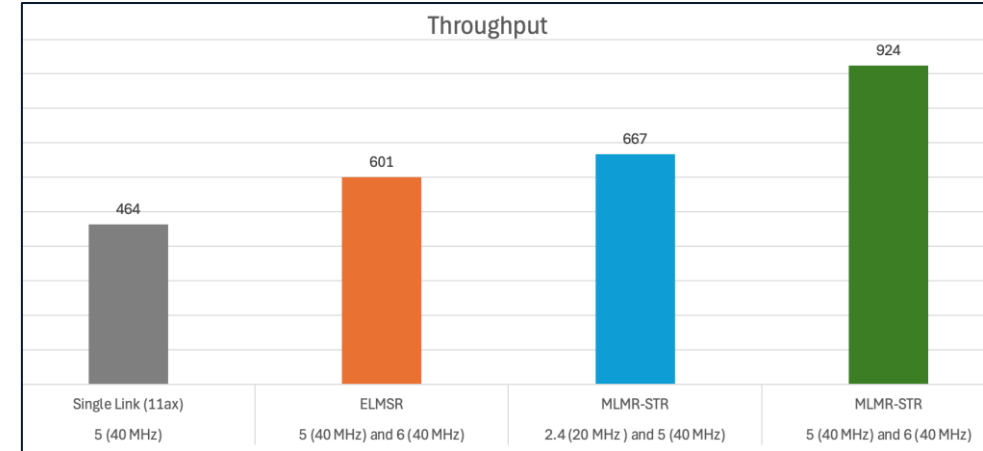
MLO Method: MLMR-STR



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



Demo

MLO Client Behavior

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

Meraki

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

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

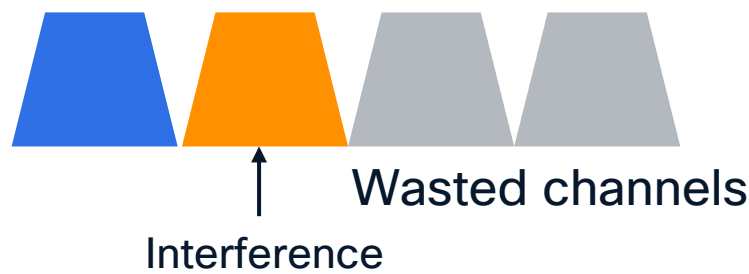
Mobility

Example: EMLSR

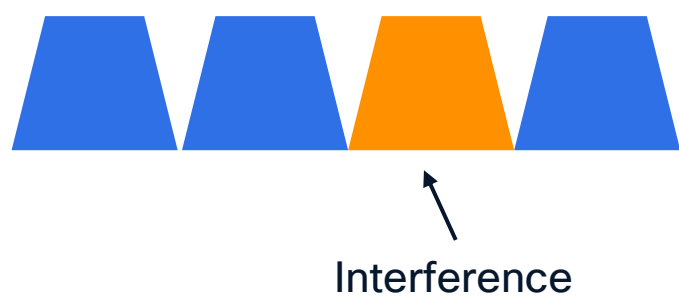
Client					
360 View	General	QOS Statistics	ATF Statistics	Mobility History	Call Statistics
Client Properties	AP Properties	Security Information	Client Statistics	QOS Properties	
VRF Name		N/A			
Central NAT		DISABLED			
11v DMS Capable		No			
QoS Map Capable		No			
FlexConnect Data Switching		N/A			
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:



With 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

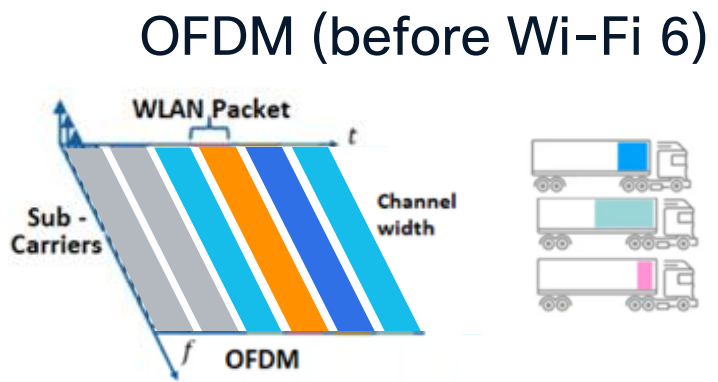
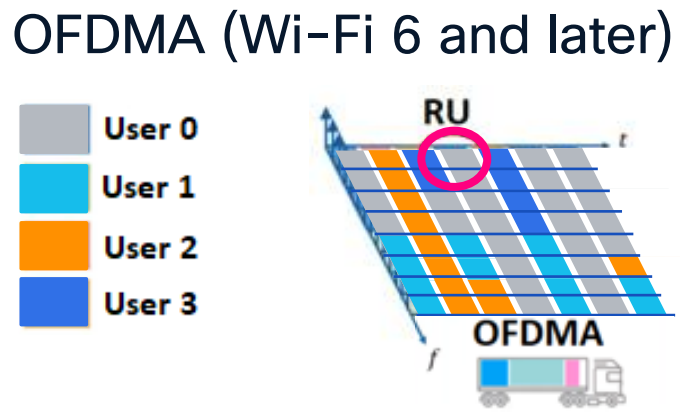
Puncturing allowed for 80 MHz channel width or wider



Demo

Preamble Puncturing

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



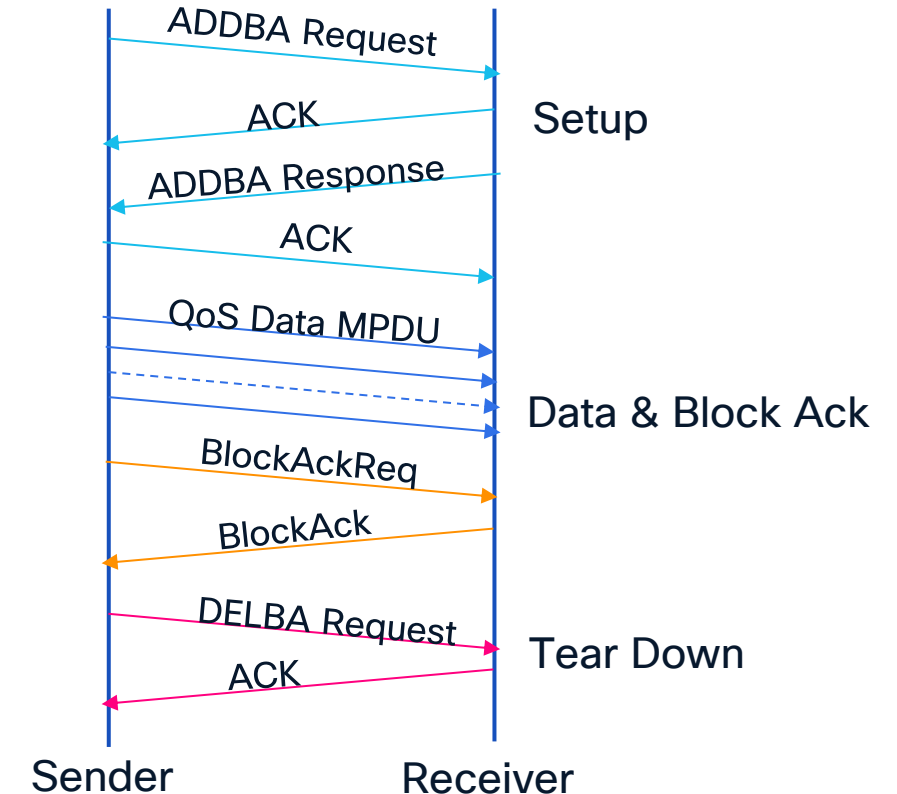
- Aggregation of upto **256** MPDUs in a single frame.
- Acknowledgement upto **256** MPDUs in a single Block Ack Frame

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.

Wi-Fi 7 Client Eco System

Wi-Fi 7 Client Support

What's new in Windows 11, version 25H2

Windows 11, version 25H2 includes all the features and capabilities delivered as part of [continuous innovation](#) to Windows 11. now enabled by default.

Version 25H2 includes [Wi-Fi 7 enterprise connectivity](#). It also offers customers the [ability to remove select preinstalled Microsoft store apps](#) using policies.

Android

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



iPhone/iPad

- iPhone 16/17 Pro 
- iPad Pro (M5) 
- No 320 MHz support

 iPhone

Windows

- Windows 11 24H2
- Predominantly Intel BE200, QCA 7800, MediaTek 7925
- Update your drivers



Wi-Fi 7 Enterprise – 24H2
(26120.4520+)

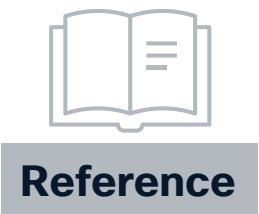
Mac OS

- Not yet

macOS

Wi-Fi 7 Client behavior

From our observation ...



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	Yes
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 ...

0%

Wi-Fi 6



1 SKU per model



17+ SKUs per model

75%

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

100%

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 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

Unmatched Wi-Fi experience

Tri-band concurrent Flexible
Radio Assignment (FRA) for
changing needs.

Dedicated AI/ML-powered
scanning radio

Multilingual IoT radios

Third-gen IoT 802.15.4 radio
USB with 9W for new IoT technology



Smart, resilient infrastructure

Smart power consumption
Flexible feature uses given
power budget
Dual 10 Gig uplink ports for
resiliency

Container hosting on AP

Host IOx applications at edge with
access to integrated IoT radio and USB
module

**Hybrid Location System with
GNSS/GPS, Wi-Fi & UWB**
AP Auto Locate, Indoor Navigation,
Asset Tracking & AFC

Wi-Fi 7 for every operational scale



CW9172H

6 Spatial Streams
2.5 Gig
Hospitality



CW9174E

8/10 Spatial Streams
5 Gig
External antennas
Dec 2025



CW9176D1

12 Spatial Streams
10 Gig
Integrated Directional
UWB



CW9179F

16 Spatial Streams
10 Gig
LPV/Stadium



CW9171I

4 Spatial Streams
2.5 Gig
Omnidirectional
Dec 2025



CW9172I

6 Spatial Streams
2.5 Gig
Omnidirectional



CW9174I

8/10 Spatial Streams
5 Gig
Omnidirectional
Dec 2025



CW9176I

12 Spatial Streams
10 Gig
Omnidirectional
UWB



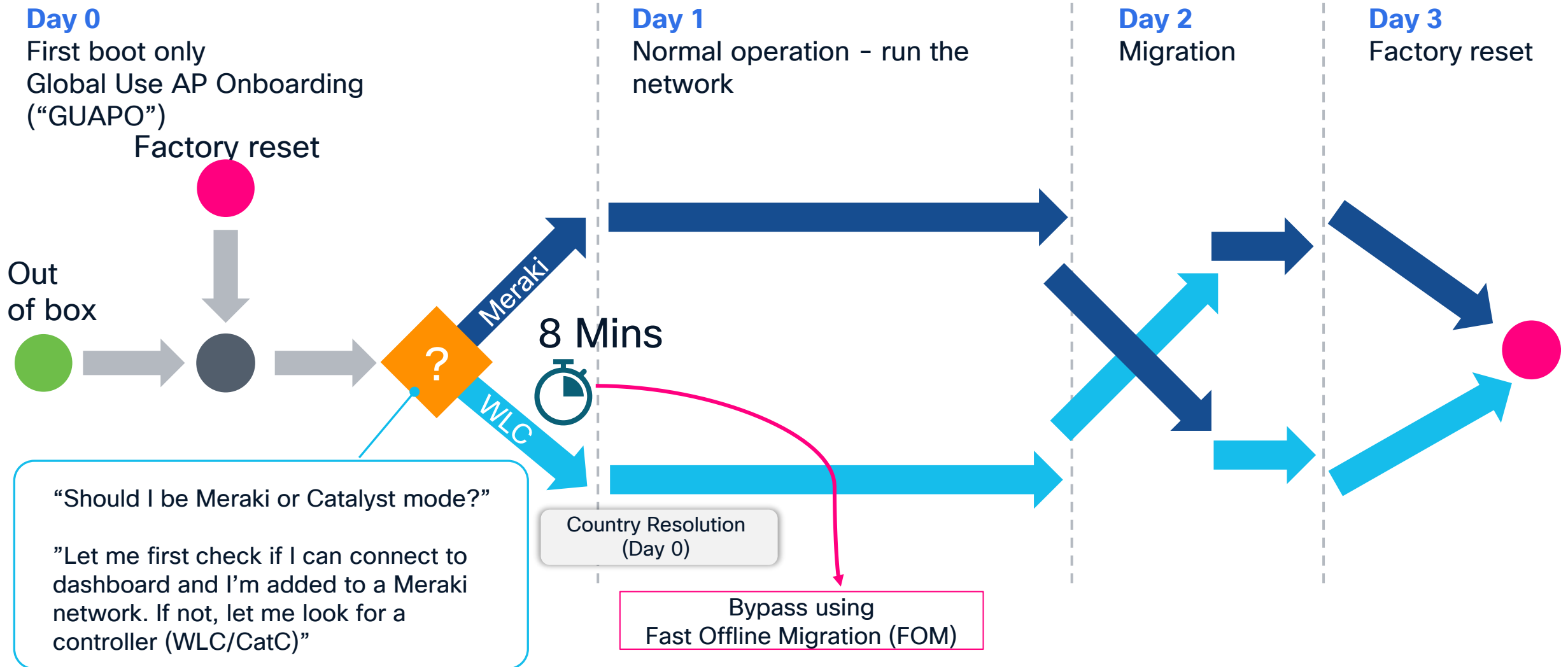
CW9178I

16 Spatial Streams
10 Gig
Omnidirectional
UWB

Wi-Fi 7 | Global Use AP | Unified License | AI Optimized

Global Use AP

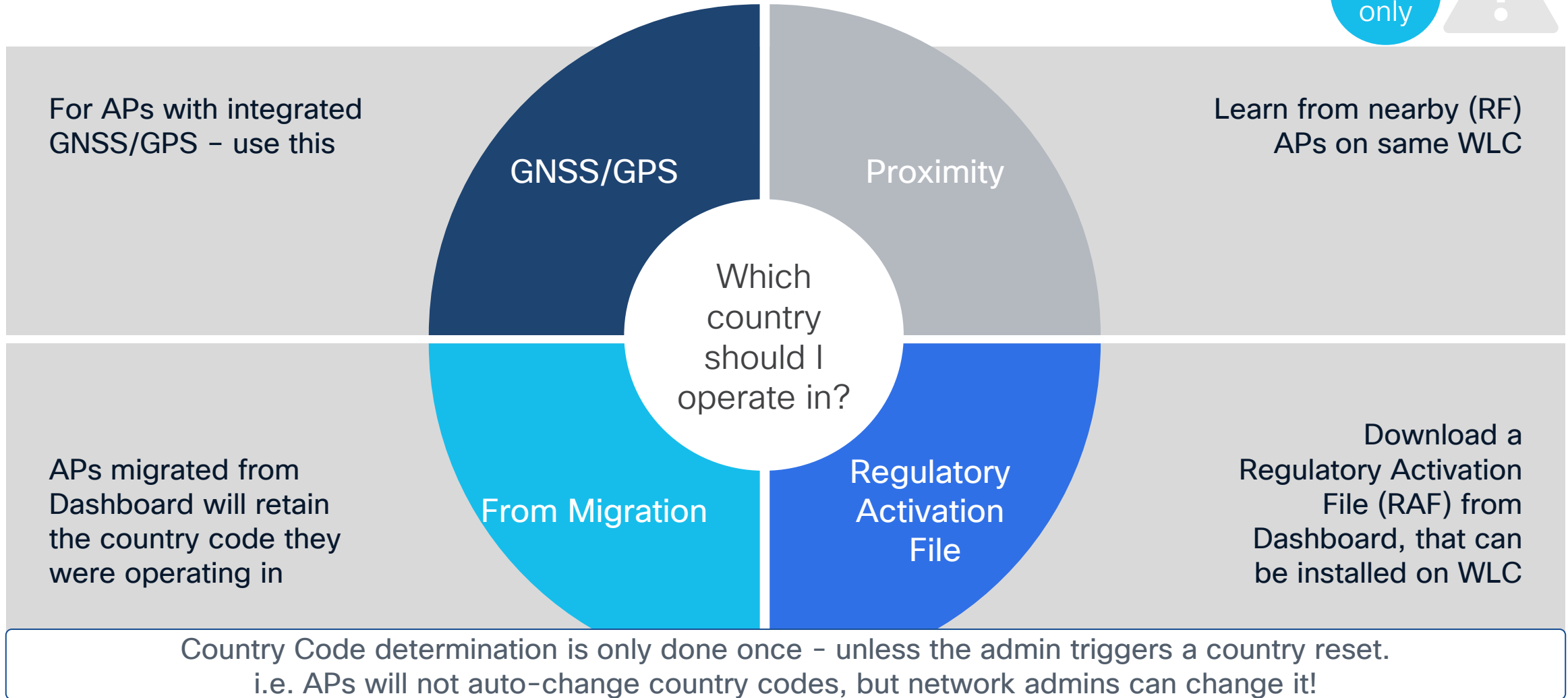
Map of a Global Use AP's journey



GUAP Deployment Guide: https://www.cisco.com/c/en/us/td/docs/wireless/access_point/technical-reference/global-use-ap-dg.html

Let's zoom in on “Country Code”

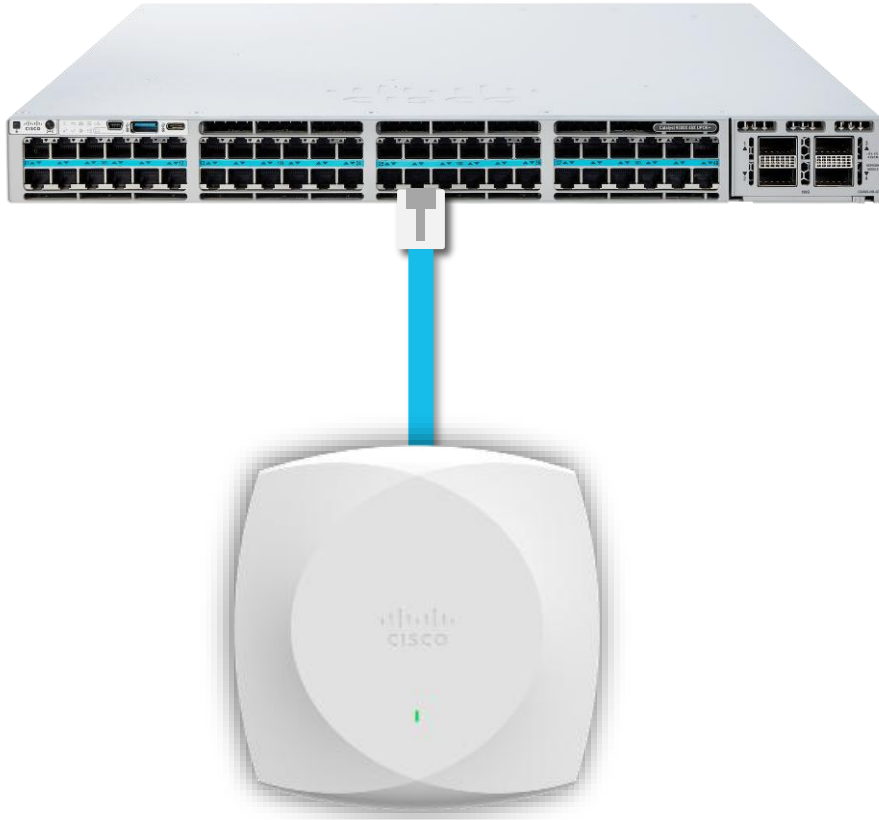
When APs are in WLC mode, APs will determine their Country Code in one of the following ways



GUAP Deployment Guide: https://www.cisco.com/c/en/us/td/docs/wireless/access_point/technical-reference/global-use-ap-dg.html

Network Infrastructure

Cisco Wireless AP to switch connection



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

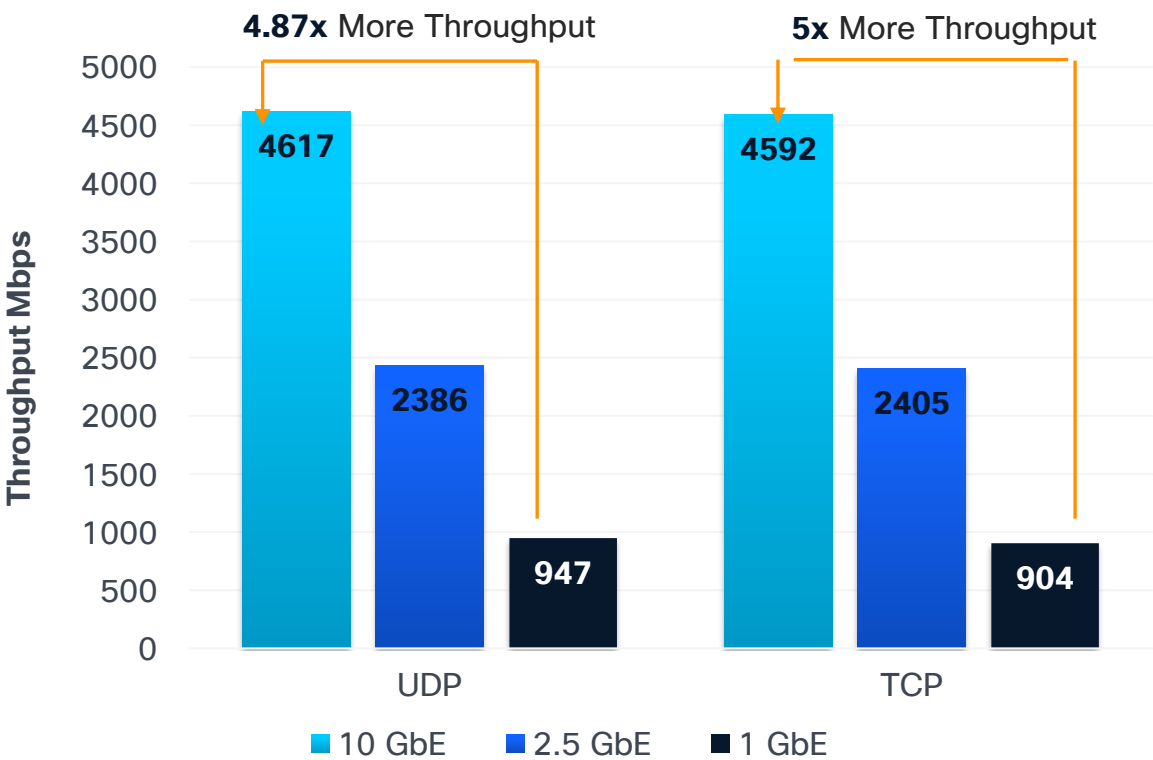
MGig switchport is recommended as Wi-Fi 6E/7 speed may exceed 1 Gbps

Cabling: Cat 6A required.

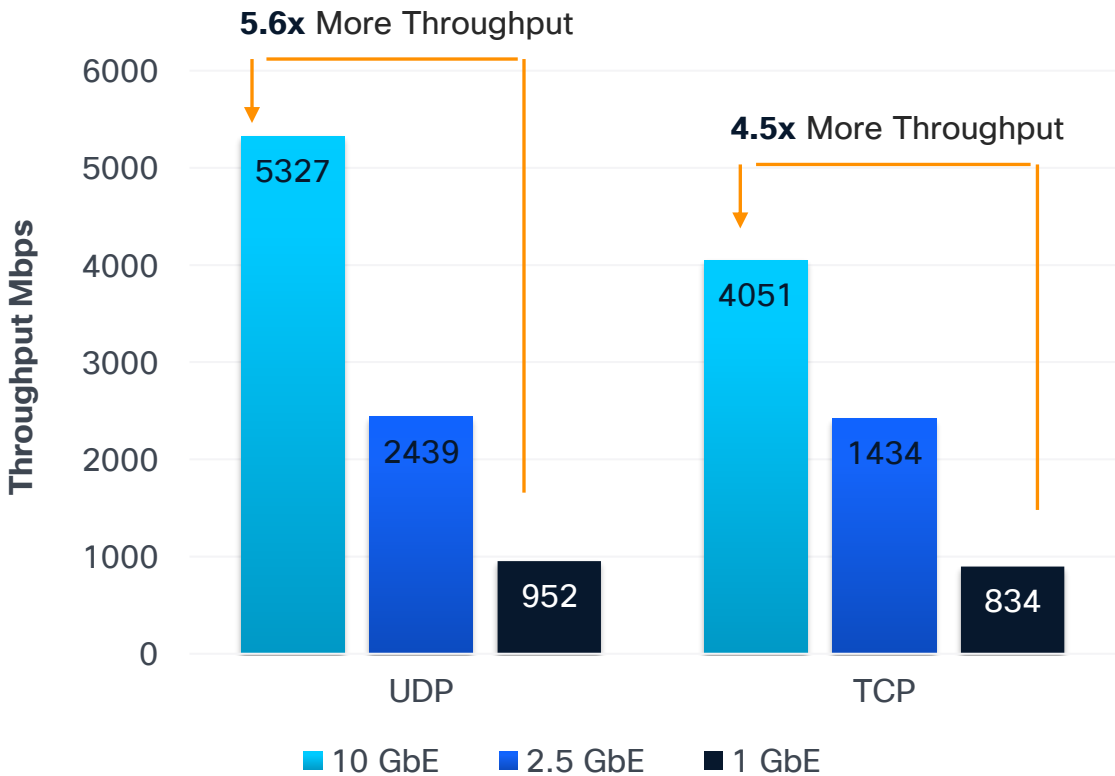
CDP = Cisco Discovery Protocol
LLDP = Link Layer Discovery Protocol
Cat = Category (of ethernet cable)

Cisco 9176 mGig Results

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



3 Clients



10 Clients

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



Reference

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

PoE Requirements



CW9179F



CW9178I

IEEE 802.3bt Type 3, Class 6
(For full operation)

IEEE 802.3at Type 2, Class 4
(Reduced Spatial Streams,
Ethernet @2.5 G, No USB)



CW9176I & D1

IEEE 802.3bt Type 3, Class 5
(For full operation)

IEEE 802.3at Type 2, Class 4
(Reduced Spatial Streams,
Ethernet @2.5 G, No USB)



CW9174I & E

IEEE 802.3bt Type 3, Class 5
(For full operation)

IEEE 802.3at Type 2, Class 4
(Ethernet @2.5 Gig, No USB)



CW9172I



CW9172H

IEEE 802.3bt Type 3, Class 5
(For full operation)

IEEE 802.3at Type 2, Class 4
(No USB, No PoE Out)

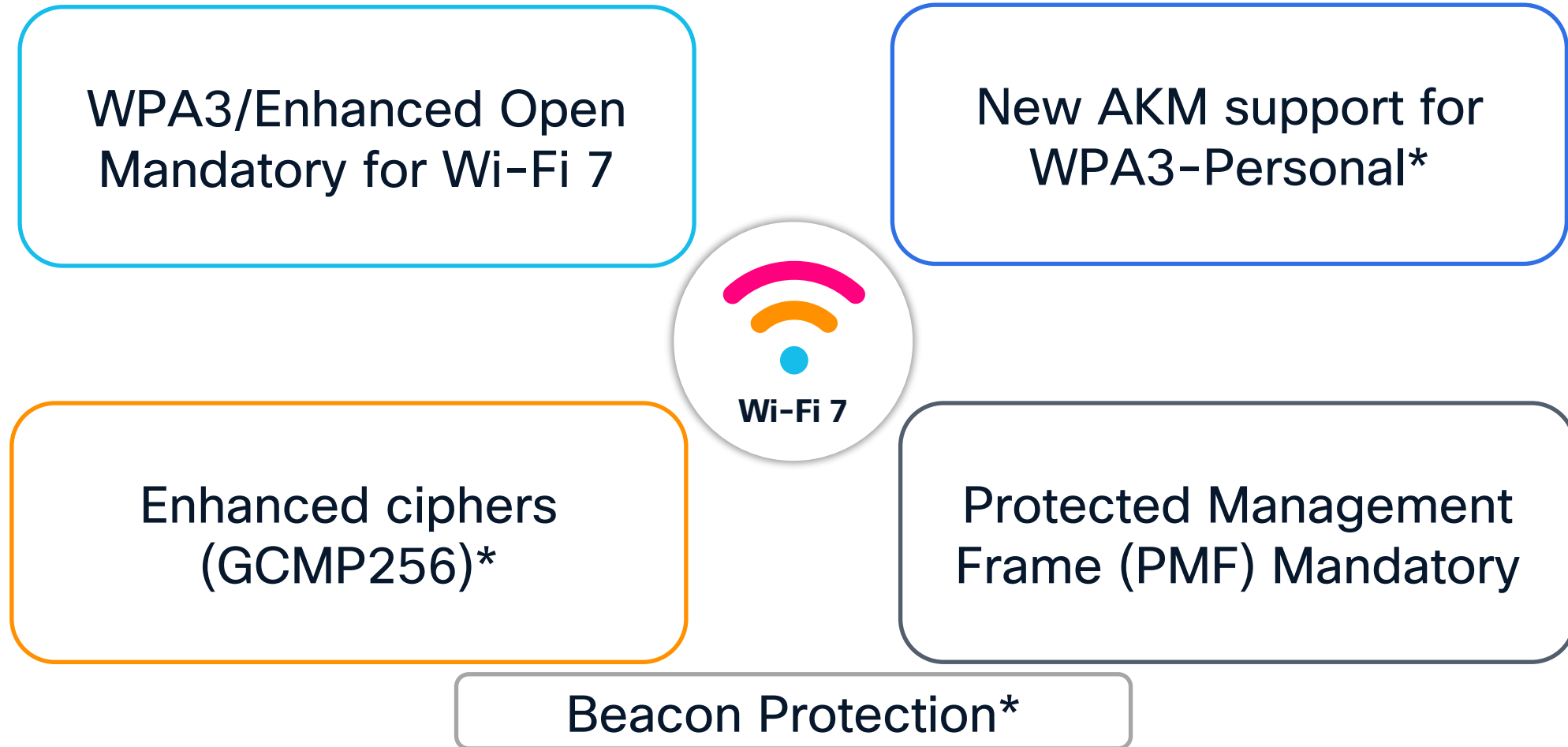


CW9171I

IEEE 802.3at Type 2, Class 4
(For full operation)

WLAN Security

Wi-Fi 7 Security



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

Wi-Fi 7 Security

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

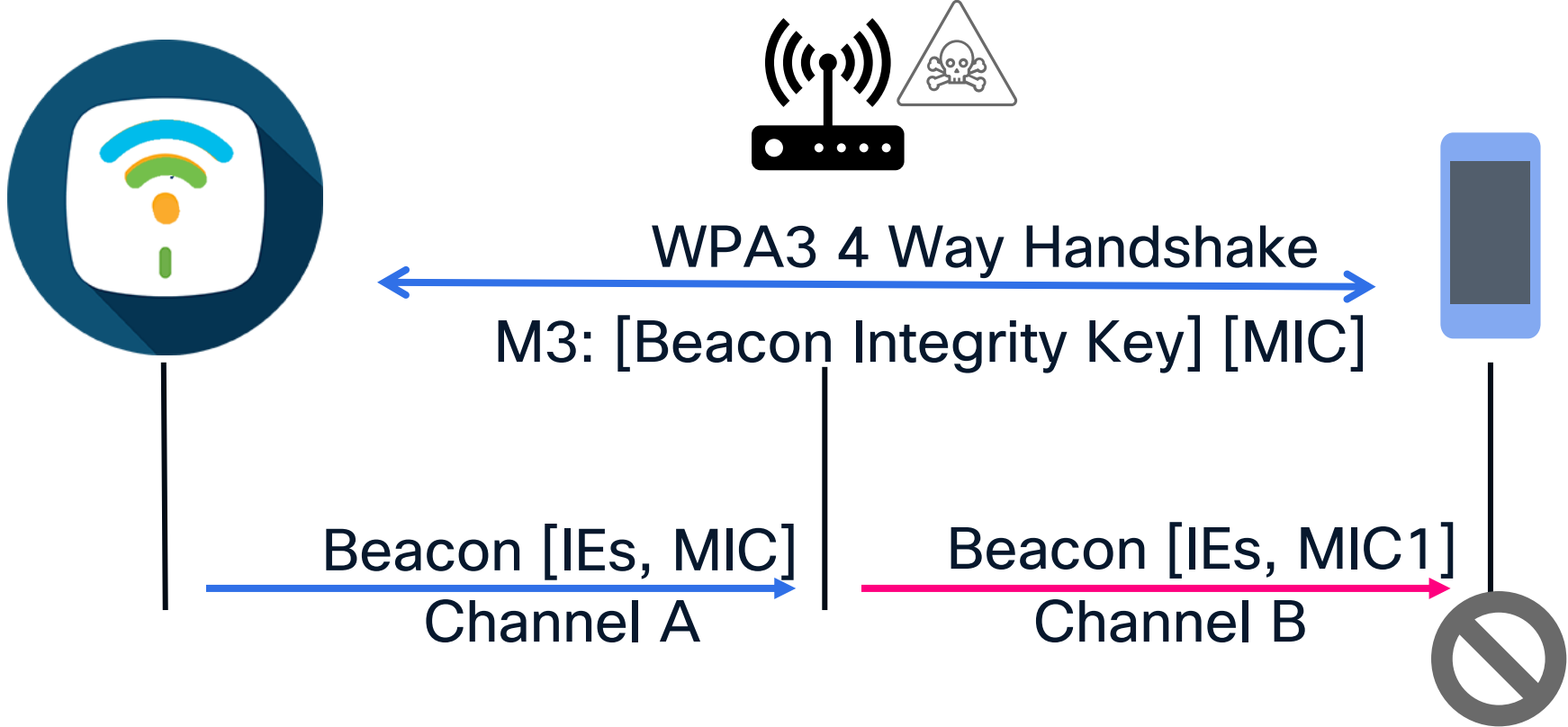
Legacy (Wi-Fi 5)	Wi-Fi 6	Wi-Fi 6E (6 GHz)	Wi-Fi 7
Open	Open (OWE support required)	Enhanced Open (AKM: OWE) (Cipher: CCMP128)	Enhanced Open (AKM: OWE) (Cipher: CCMP128 and GCMP256)
WPA1/WPA2/WPA3 Transition WPA3-Personal, PMF Optional	WPA2/WPA3 Transition/ WPA3-Personal, PMF Optional (WPA 2 – AKM – PSK, 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
v 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 D1.0)
> Tag: Extended Capabilities (12 octets)
> Tag: VHT Capabilities
> Ext Tag: HE Capabilities
v 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)
> Tag: Vendor Specific: Microsoft Corp.: WMM/UMF: Information Element
```

- 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 typical**

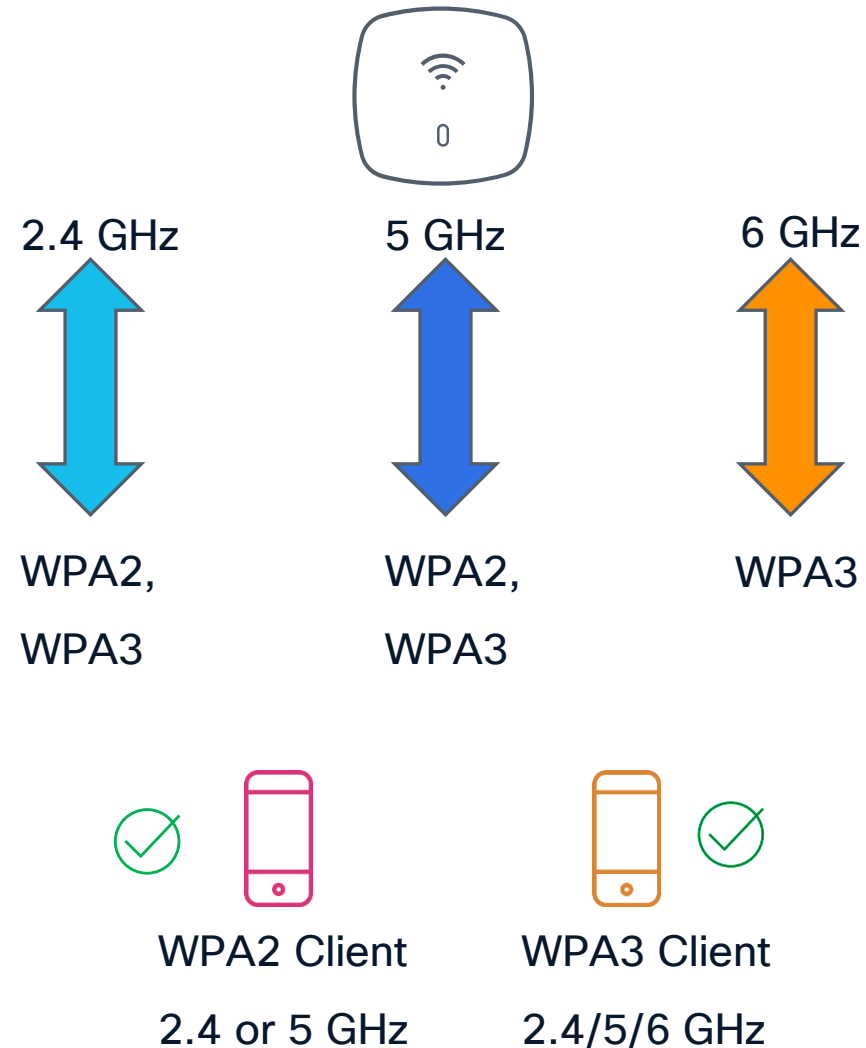
Wi-Fi 7 APs can broadcast SSIDs with lower security; No 11be rates & MLO

Option 3 – One SSID

What is WPA3 Transition Mode ?

WLAN configured for :

- WPA2 + WPA3
- Multiple AKMs
- Multiple Ciphers
- PMF allowed



Accommodates Wireless Clients with different security capabilities and standards

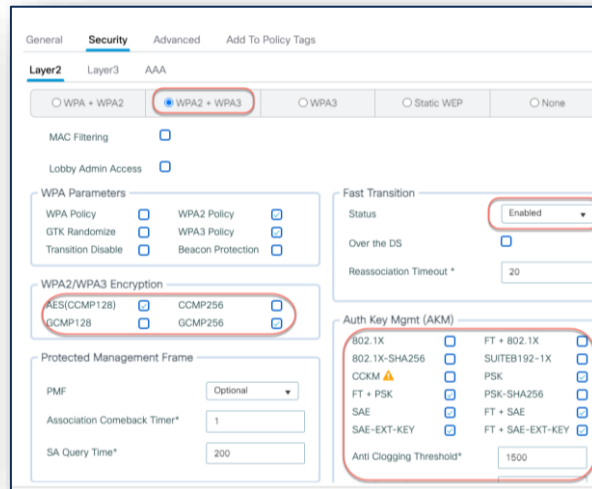
Wi-Fi 7 WLAN Design Considerations – Option 3

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)

C9800

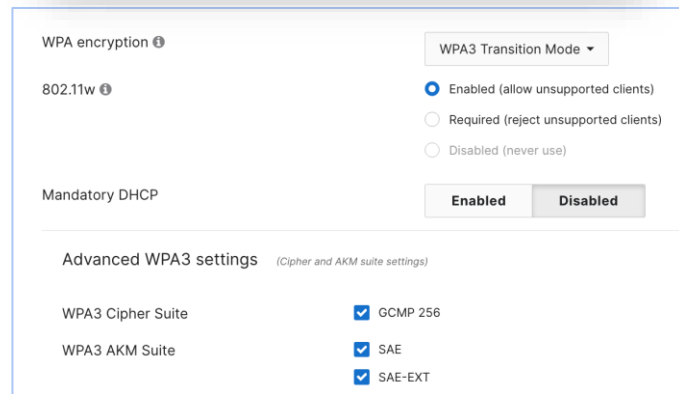


The screenshot shows the 'Security' configuration page for a Cisco C9800 switch. The 'WPA2 + WPA3' option is selected under the 'WPA Parameters' section. The 'WPA2/WPA3 Encryption' section shows 'AES(CCMP128)' and 'GCMP128' selected. The 'Protected Management Frame' section shows 'PMF' set to 'Optional'. The 'Fast Transition' section shows 'Status' set to 'Enabled'. The 'Auth Key Mgmt (AKM)' section shows '802.1X-SHA256', 'FT + PSK', 'SAE', and 'SAE-EXT-KEY' selected.

- 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.

Meraki



The screenshot shows the 'WPA encryption' configuration page for a Cisco Meraki switch. The 'WPA3 Transition Mode' is set to 'Enabled (allow unsupported clients)'. The 'Mandatory DHCP' is set to 'Enabled'. The 'Advanced WPA3 settings' section shows 'WPA3 Cipher Suite' set to 'GCMP 256' and 'WPA3 AKM Suite' set to 'SAE' and 'SAE-EXT'.

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)

C9800

The image shows the 'Security' configuration page for a Cisco C9800 switch. The 'Layer2' tab is selected. Under 'WPA2+WPA3', the 'WPA Policy' checkbox is checked. In the 'WPA2/WPA3 Encryption' section, 'AES(CCMP128)' is selected. In the 'Protected Management Frame' section, 'PMF' is set to 'Required'. In the 'Auth Key Mgmt (AKM)' section, '802.1X' and '802.1X-SHA256' are checked, and 'FT + 802.1X' is also checked. The 'Fast Transition' status is set to 'Enabled'.

Meraki

The image shows the 'WPA encryption' configuration page in the Meraki dashboard. The 'WPA3 Transition Mode' dropdown is set to 'WPA3 Transition Mode'. The '802.11w' checkbox is checked, and the 'Mandatory DHCP' checkbox is also checked. Under 'Advanced WPA3 settings', the 'WPA3 Cipher Suite' is set to 'GCMP 256'.

- 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

The screenshot shows the 'Security' tab of the Cisco C9800 configuration interface. Under 'Layer2', the 'WPA3' radio button is selected and highlighted with a red box. In the 'WPA2/WPA3 Encryption' section, 'AES/CCMP128' and 'GCMP256' are both checked. In the 'Auth Key Mgmt (AKM)' section, 'FT + 802.1X', 'OWE', and 'FT + SAE' are all checked, with 'OWE' highlighted by a red box.

C9800

The screenshot shows the 'General' tab of the Cisco Meraki configuration interface. The 'Profile Name' is 'owe'. The 'SSID' is 'owe'. The 'WLAN ID' is '4'. The 'Status' is 'ENABLED'. The 'Broadcast SSID' is 'ENABLED'. The 'Radio Policy' is set to '6 GHz', '5 GHz', and '2.4 GHz', all of which are 'ENABLED'. The '802.11b/g Policy' is set to '802.11b/g'.

Meraki

The screenshot shows the 'Security' tab of the Cisco Meraki configuration interface. The 'SSID (name)' is 'Open-Meraki'. The 'SSID status' is 'Enabled'. The 'Security' dropdown is set to 'Open (no encryption)'. There are two warning messages: 'This SSID will not broadcast on the 6 GHz band. Use OWE to enable this band.' and 'Wi-Fi 7 requires high wireless security encryption. Selected encryption type does not meet the requirement. Please check documentation for more details.'

The screenshot shows the 'Advanced WPA3 settings' section of the Cisco Meraki configuration interface. The 'WPA3 Transition Mode' is set to 'Open-Meraki'. The 'WPA3 Cipher Suite' is set to 'GCMP 256'. The 'Mandatory DHCP' is set to 'Enabled'. There is a warning message: 'Certain Cipher suite and AKMs are required for capable APs to operate in 802.11be (Wi-Fi 7) mode. Please refer to documentation for more details.'

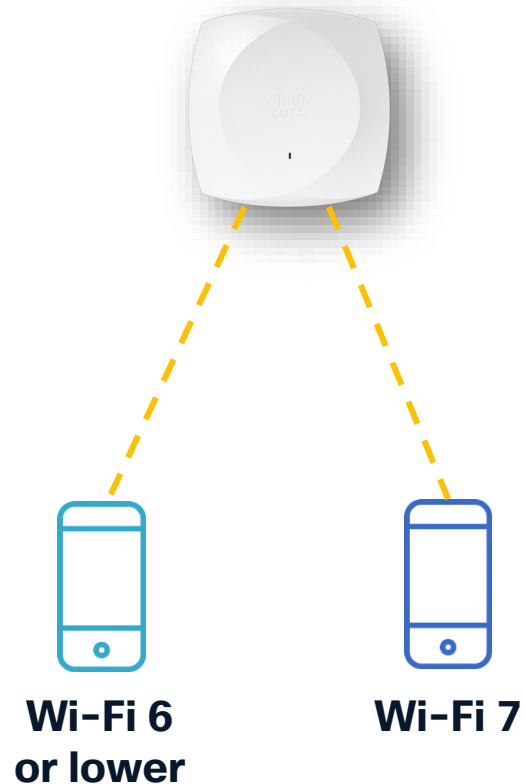
Some 6E/Wi-Fi 7 clients may not be able to discover or connect to OWE Transition in 6 GHz.



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:

General Security Advanced Add To Policy Tags

Layer2 Layer3 AAA

☒ WPA + WPA2 ☐ WPA2 + WPA3 ☐ WPA3 ☐ Static WEP ☐ None

MAC Filtering ☐

Lobby Admin Access ☐

WPA Parameters

WPA Policy ☐ WPA2 Policy ☒

GTK Randomize ☐ OSEN Policy ☐

WPA2 Encryption

AES(CMP128) ☒ CCMP256 ☐

GCMP128 ☐ GCMP256 ☐

Protected Management Frame

PMF

Fast Transition

Status

Over the DS ☒

Reassociation Timeout *

Auth Key Mgmt (AKM)

802.1X ☐ FT + 802.1X ☐

802.1X-SHA256 ☒ CCKM ☐

PSK ☐ FT + PSK ☐

PSK-SHA256 ☐ Easy-PSK ☐

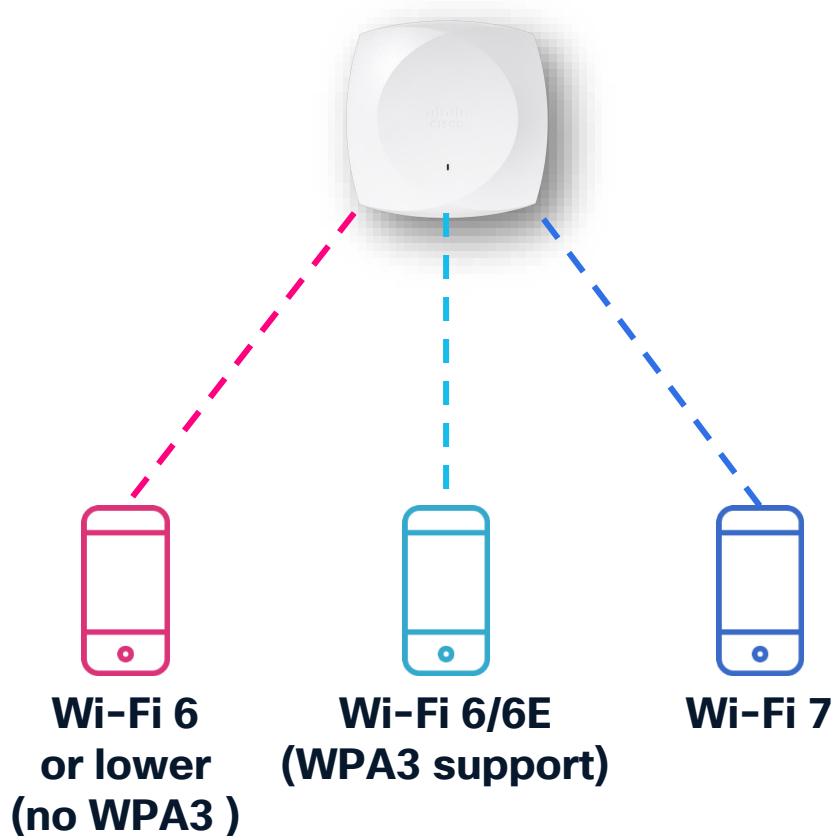
MPSK Configuration

Enable MPSK ☒

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

Client join behavior in Wi-Fi 7 AP

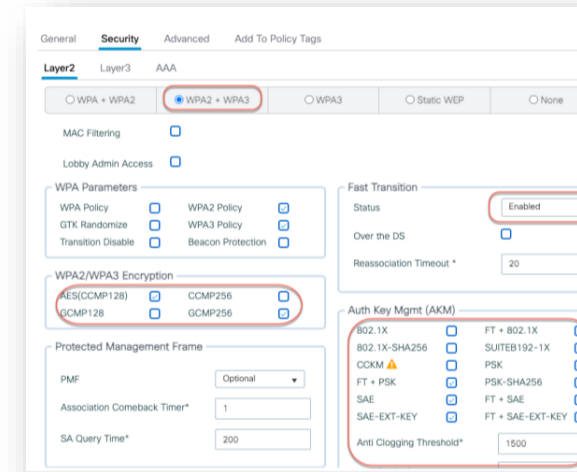
Scenario 2: AP Broadcasting WPA3 Transition WLANs (with all required AKMs and Ciphers enabled)



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.

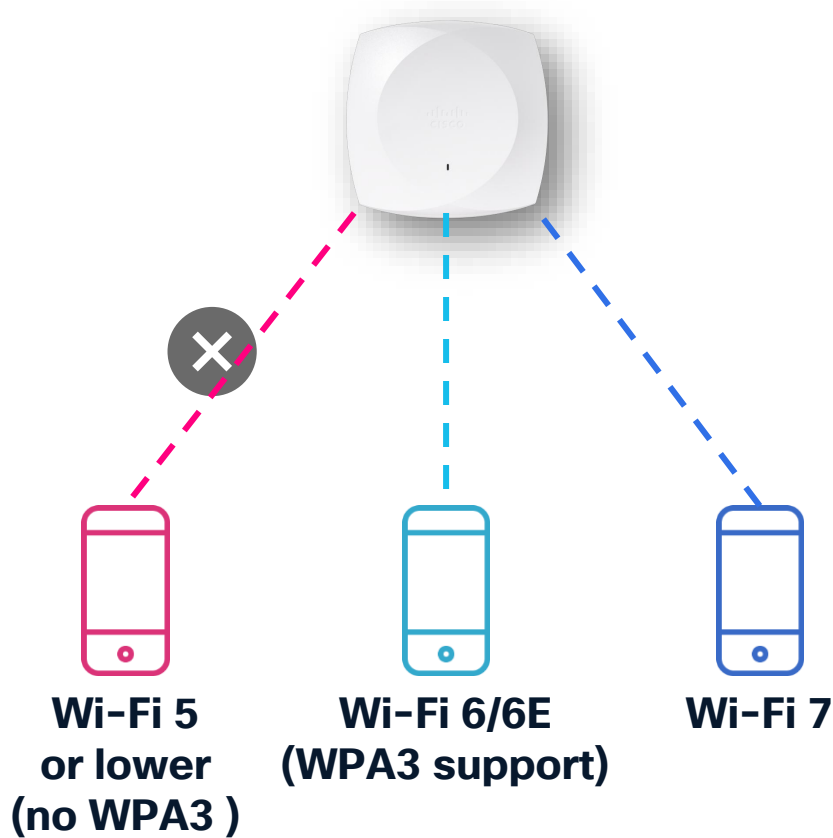
Example Config:



- 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

☐ 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(COMP128) ☒ CCMP256 ☐

GCMP128 ☐ GCMP256 ☐

Protected Management Frame

PMF Required

Association Comeback Timer* 1

SA Query Time* 200

Fast Transition

Status Adaptive Ena...

Over the DS ☐

Reassociation Timeout* 20

Auth Key Mgmt (AKM)

FT + 802.1X ☐ 802.1X-SHA256 ☒

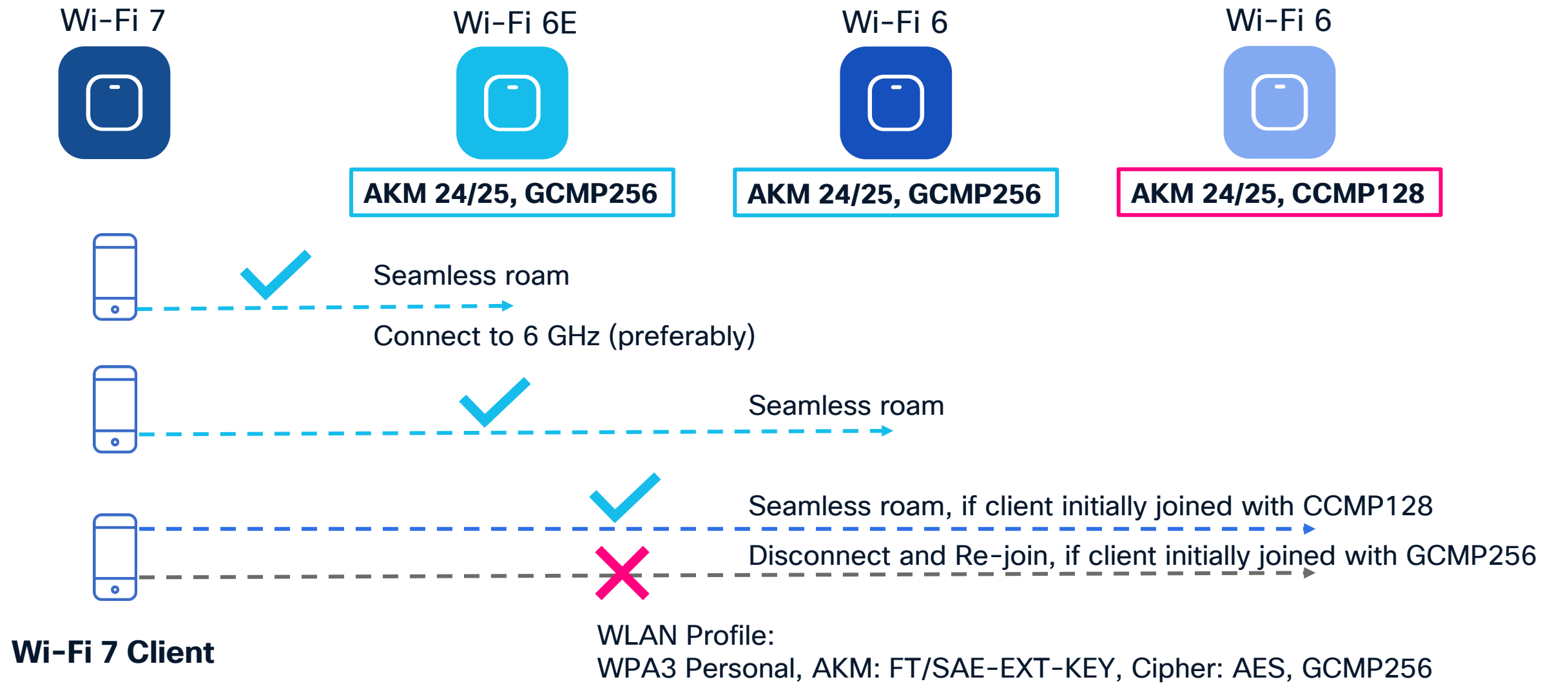
OWE ☐ SAE ☐

FT + SAE ☐ SAE-EXT-KEY ☐

FT + SAE-EXT-KEY ☐

- 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 6 or lower may join as WPA3 cannot join the WLAN

Wi-Fi 7 Client Roam Behavior - Personal



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

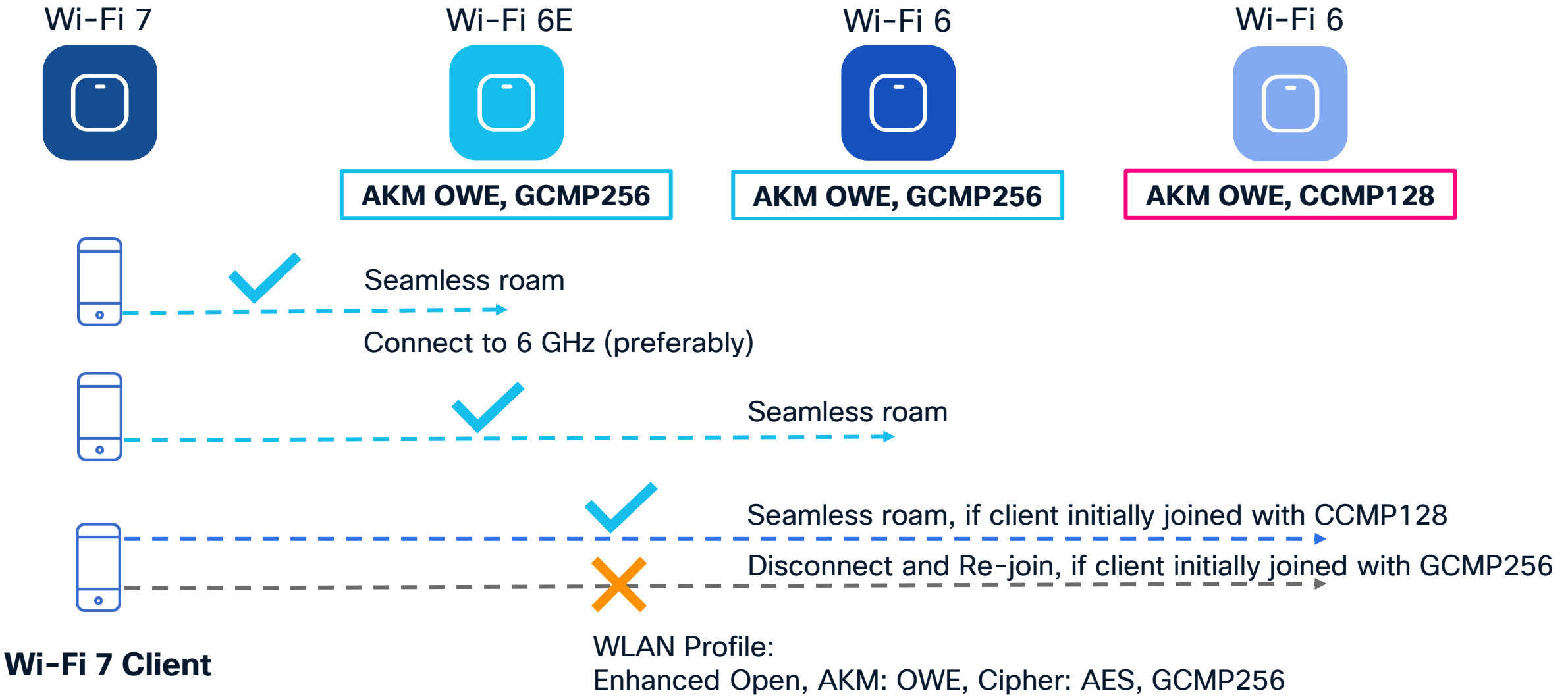
```
8 0.016576 CiscoMeraki_6f:a4:ef e6:60:17:bb:21:a8 802.11 142 Authentication, SN=1457, FN=0, Flags=.....C
9 0.019246 e6:60:17:bb:21:a8 CiscoMeraki_6f:a4:ef 802.11 332 Association Request, SN=424, FN=0, Flags=.....C, SSID="W7_WPA3_SAE_SAE_EXT"
10 0.037983 CiscoMeraki_6f:a4:ef e6:60:17:bb:21:a8 802.11 337 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 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
802.11 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) List 00:0f:ac (Ieee 802.11) SAE (GROUP KEY)

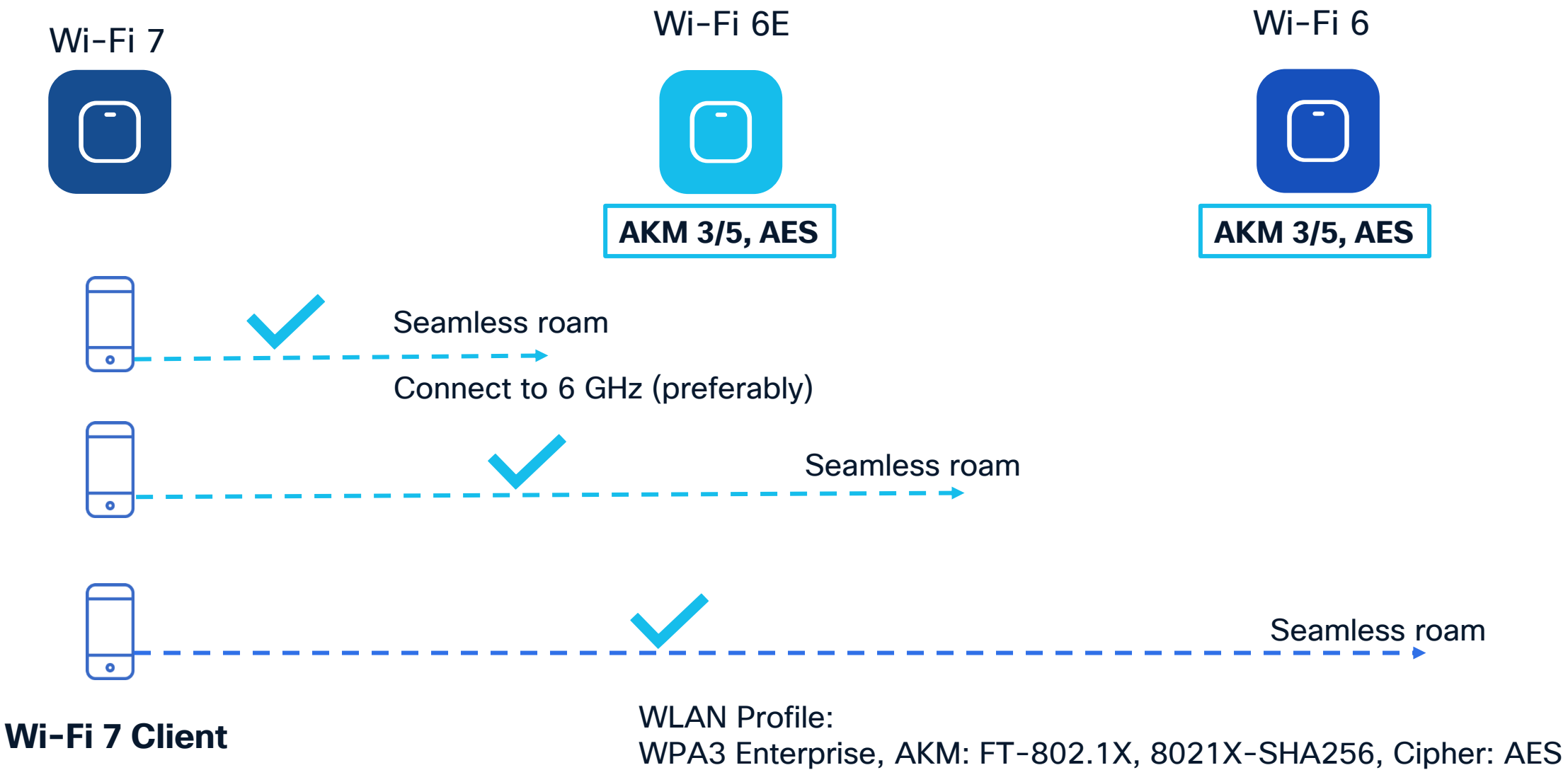
sae-ext-key-wifi7-wifi6-AP(1).pcap Packets: 53
```

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 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	Supported	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.

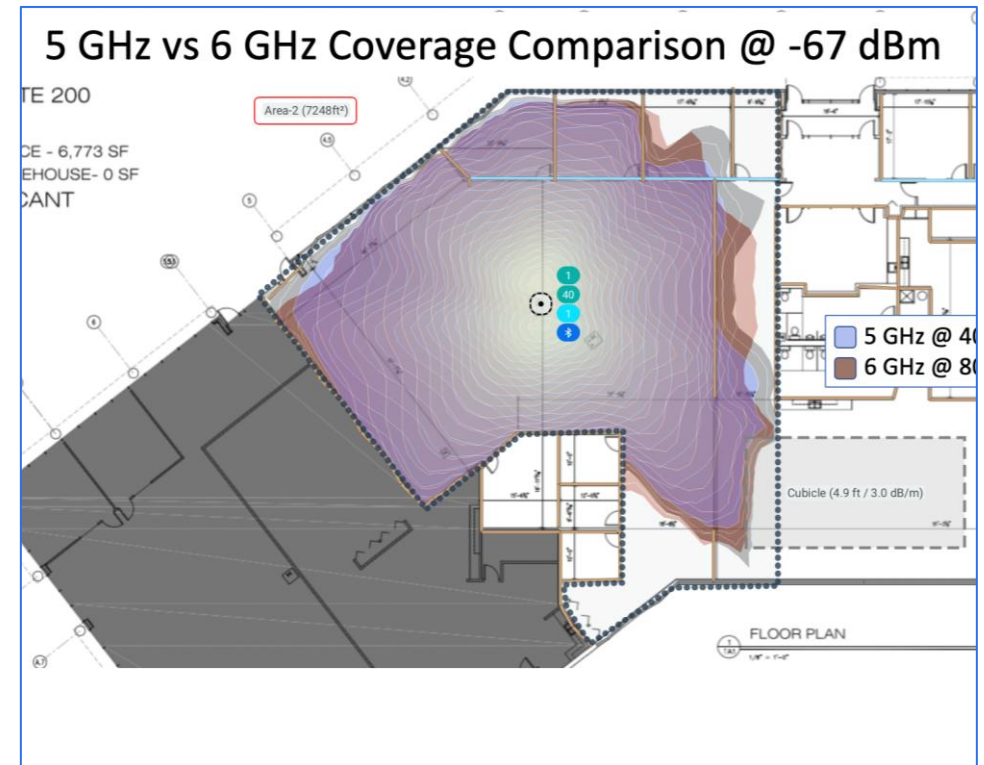
RF Design

Designing for Wi-Fi 7

Advanced RF Tuning in Cisco Wireless – Become an Expert While Getting a Little Help from Cisco AI.
[BRKEWN-3413], Cisco Live On-demand Library

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

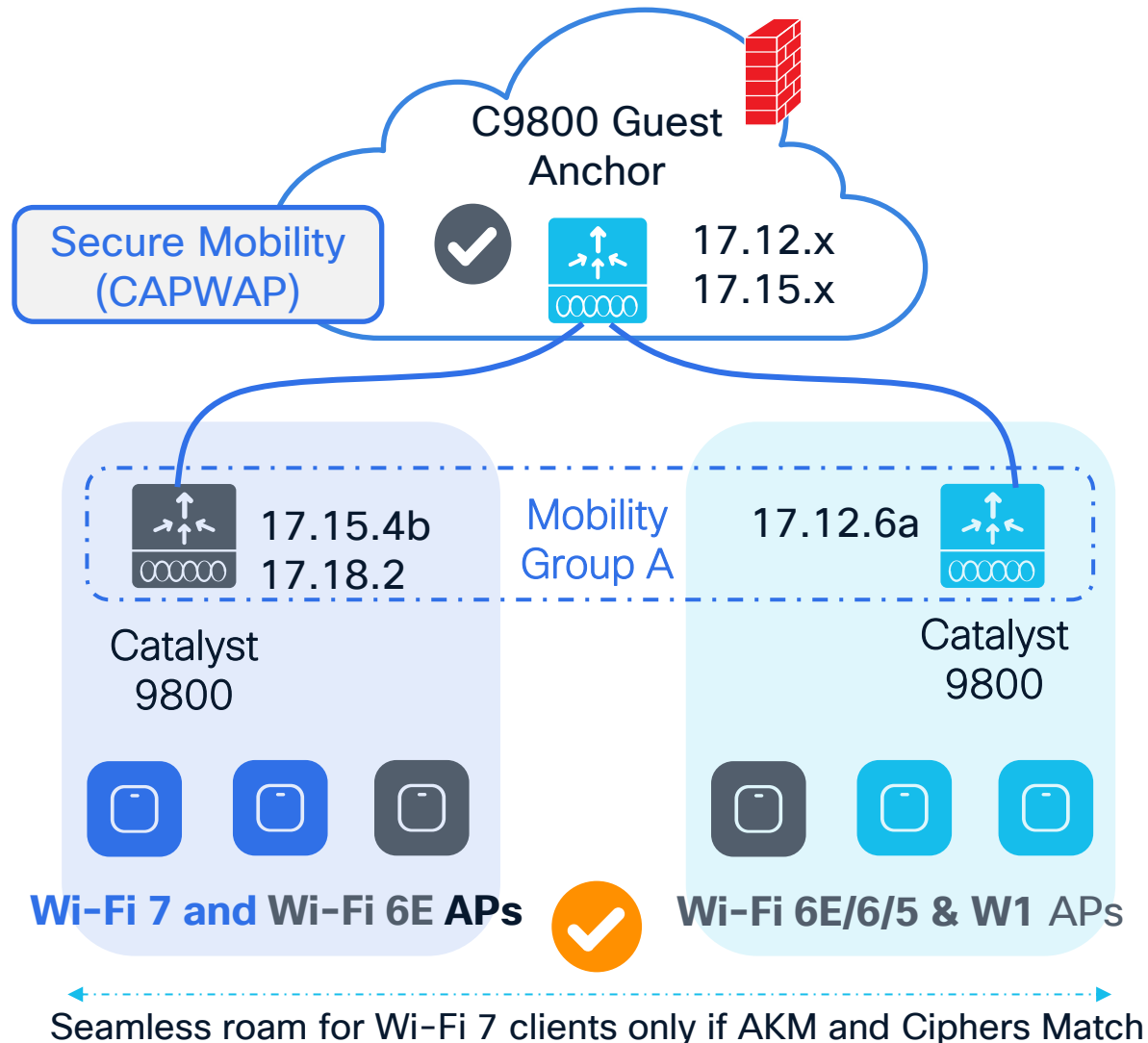


Reference

IOS-XE 17.18.1 or later Catalyst Center 2.3.7.10+ / 3.1.5+	 CW9179F	MR 31.1.7 or later
IOS-XE 17.15.2 or later Catalyst Center 2.3.7.6 (for configuration) Catalyst Center 2.3.7.9 (for maps & assurance)	 CW9178I CW9176I & D1	MR 31.1.5.1 or later
IOS-XE 17.18.2 or later Catalyst Center 2.3.7.11 / 3.2.3	 CW9174I & E	MR 32.1.5 or later
IOS-XE 17.15.2b or later Catalyst Center 2.3.7.10	 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
IOS-XE 17.18.2 or later Catalyst Center 2.3.7.11 / 3.2.3	 CW9171I	MR 32.1.5 or later

How do I start adopting Wi-Fi 7?

Answer: Inter Release Controller Mobility (IRCM)



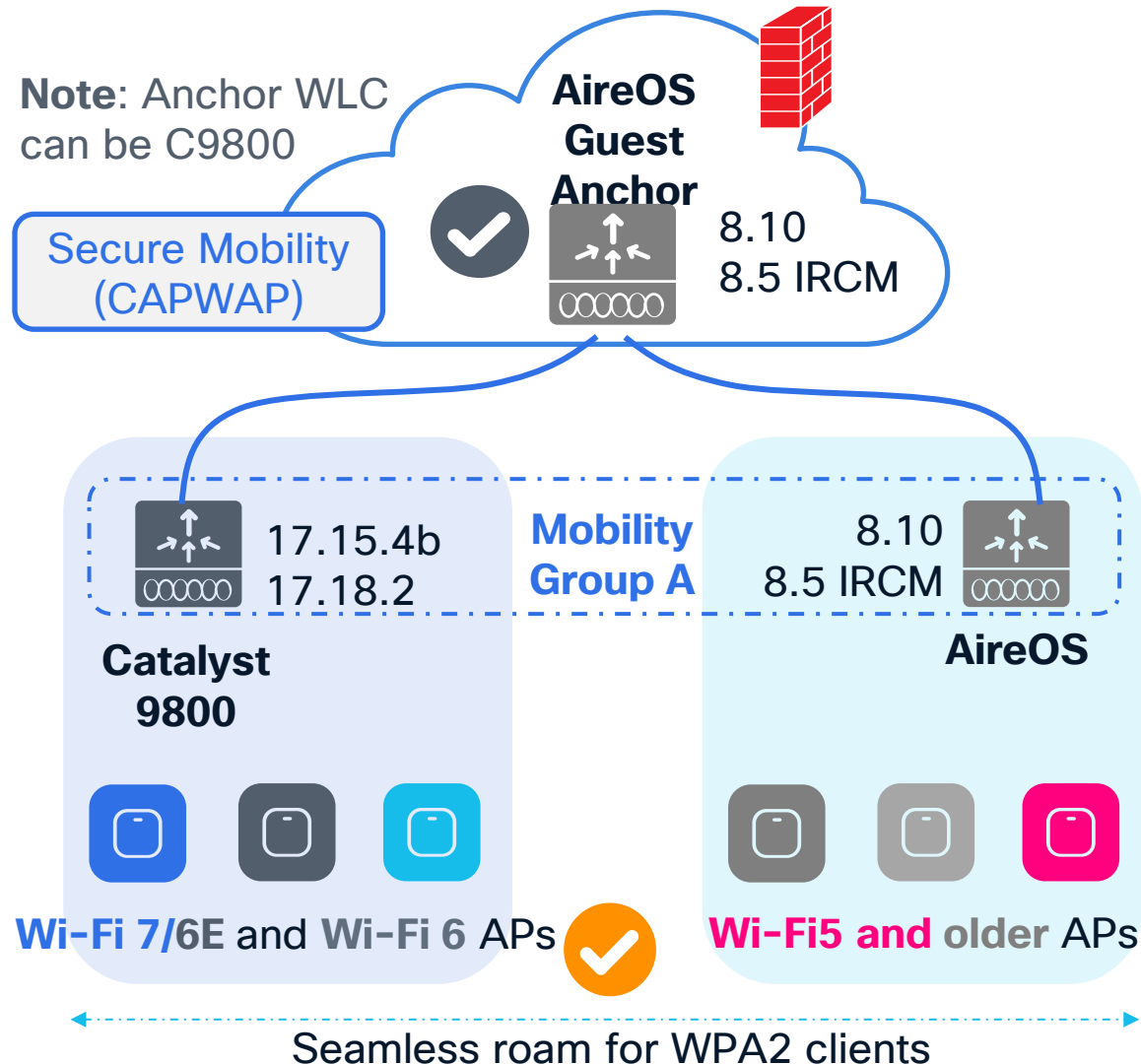
Scenario 1: If you're in IOS-XE 17.12.x code

- 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)



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-aios_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,

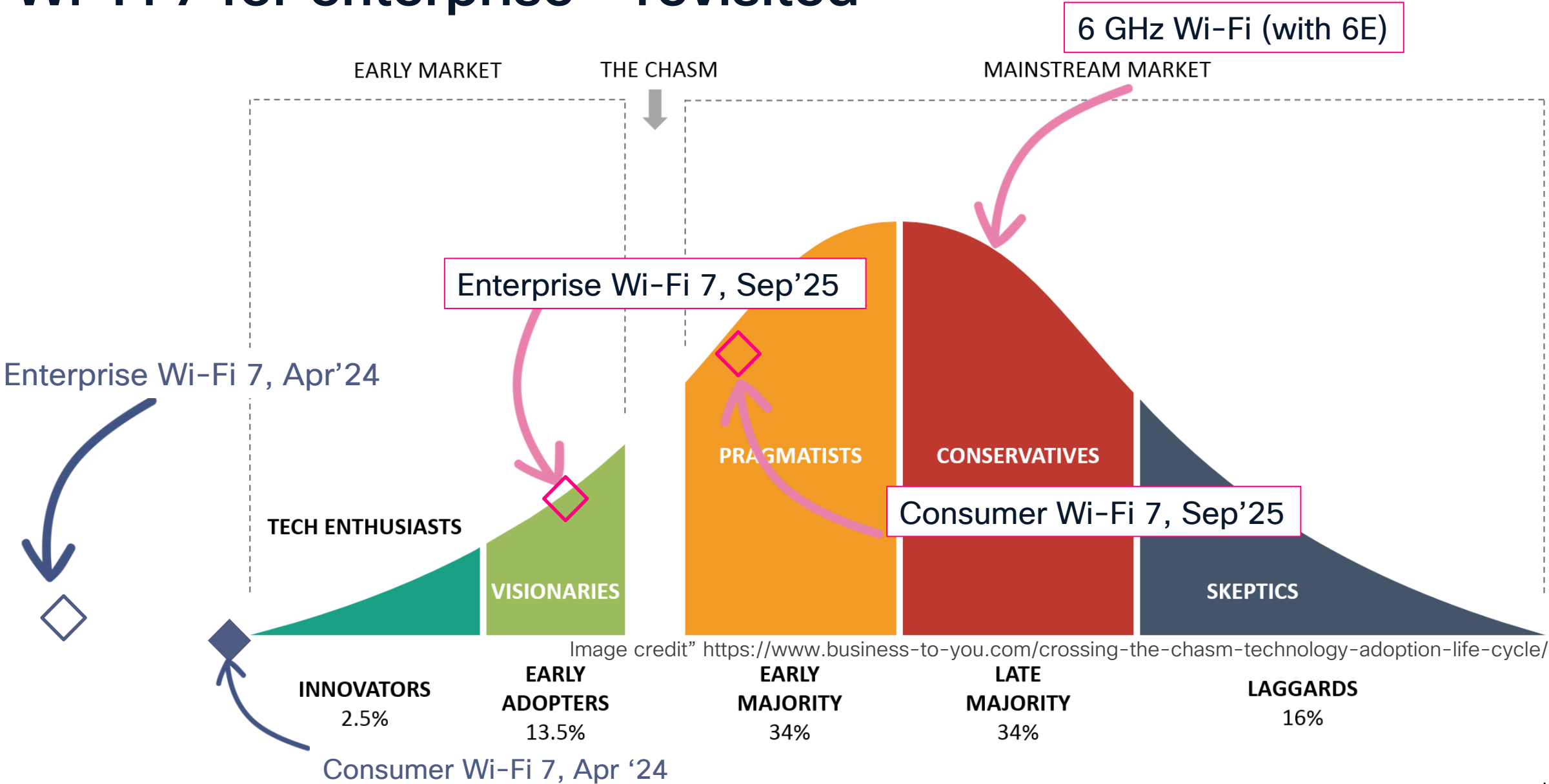
Wireless coverage

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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