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The bridge to possible

Architecting Next Generation Wireless Network with Catalyst Wi-Fi 6E Access Points

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BRKEWN-2024

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Cisco Webex App

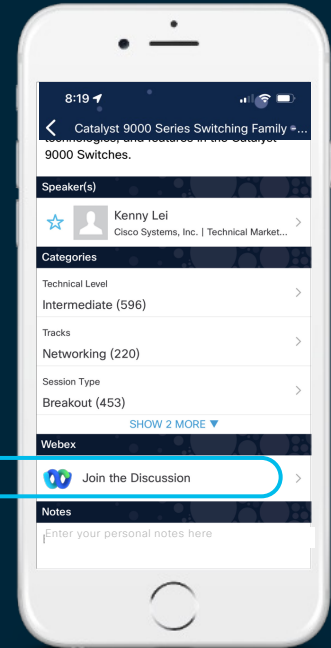
Questions?

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

How

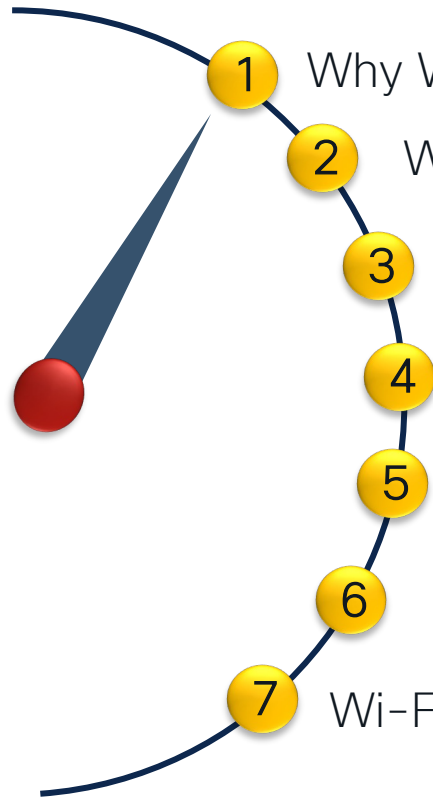
- 1 Find this session in the Cisco Live Mobile App
- 2 Click “Join the Discussion”
- 3 Install the Webex App or go directly to the Webex space
- 4 Enter messages/questions in the Webex space

Webex spaces will be moderated by the speaker until Thursday 22 December, 2022.



<https://cicolive.ciscoevents.com/cicolivebot/#BRKEWN-2024>

Agenda

- 
- 1 Why Wi-Fi 6E ?
 - 2 What is Wi-Fi 6E ?
 - 3 Security in Wi-Fi 6E
 - 4 Catalyst Wi-Fi 6E Access Points
 - 5 Access Point Deployment
 - 6 6 GHz RF Design
 - 7 Wi-Fi Network Design

Why Wi-Fi 6E?



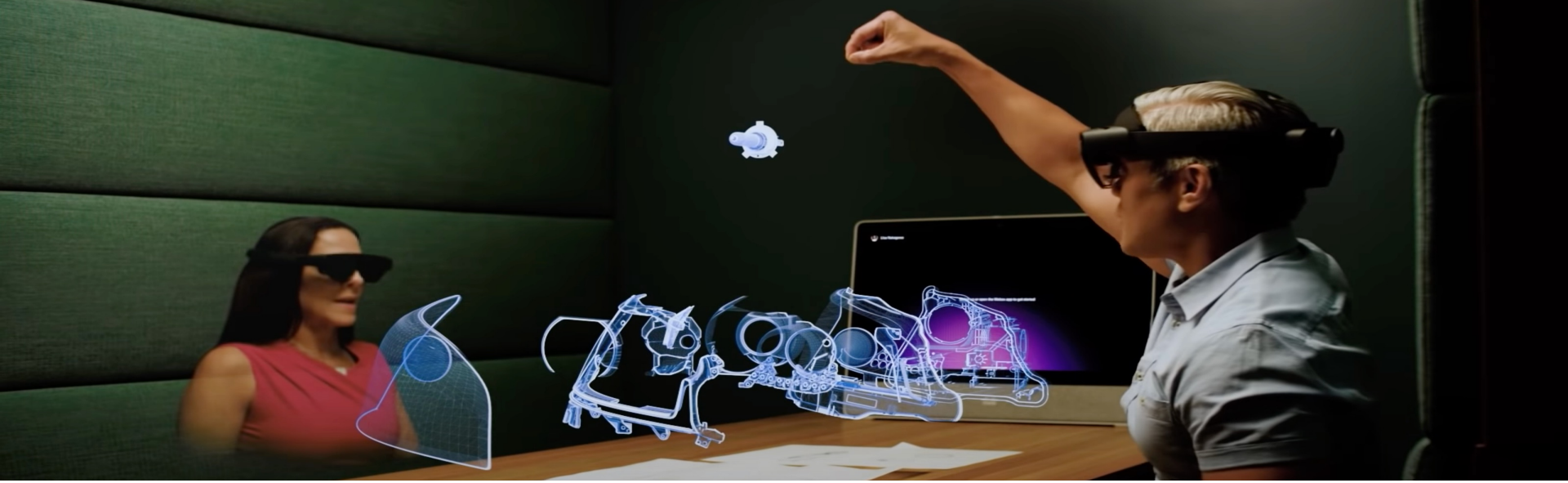




Immersive Experiences of Today...

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Webex Hologram <https://www.youtube.com/watch?v=YEx7h0NKnXE>

and Tomorrow...

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It's all About the Wireless Experience!

New Technology Trends > New Requirements :

- More IoT devices, M2M communication > high density and critical communication
- SLA-bound applications, video and delay sensitive apps > need for less latency, minimal jitter
- VR/AR and High-resolution video > more throughput

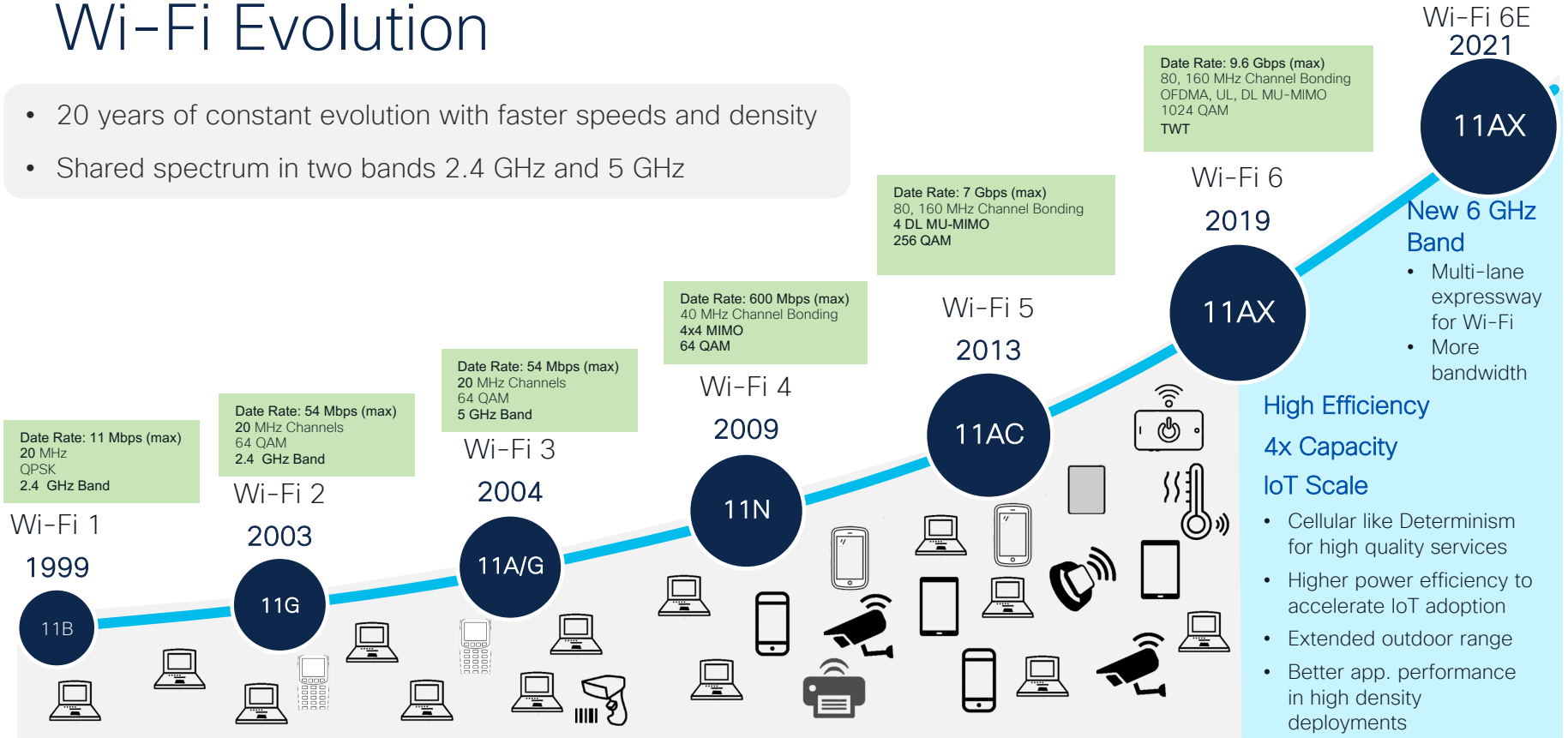


Wi-Fi 6 is all about efficiently use the spectrum...

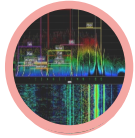
Service Level Agreement (SLA)
Internet of Things (IoT)
Machine to Machine (M2M)
Virtual reality/Augmented Reality (VR/AR)

Wi-Fi Evolution

- 20 years of constant evolution with faster speeds and density
- Shared spectrum in two bands 2.4 GHz and 5 GHz



Current Challenges



Channel Congestion



DFS Channels



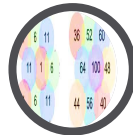
Shared Spectrum - Interferes



Legacy Devices



Too Many Devices



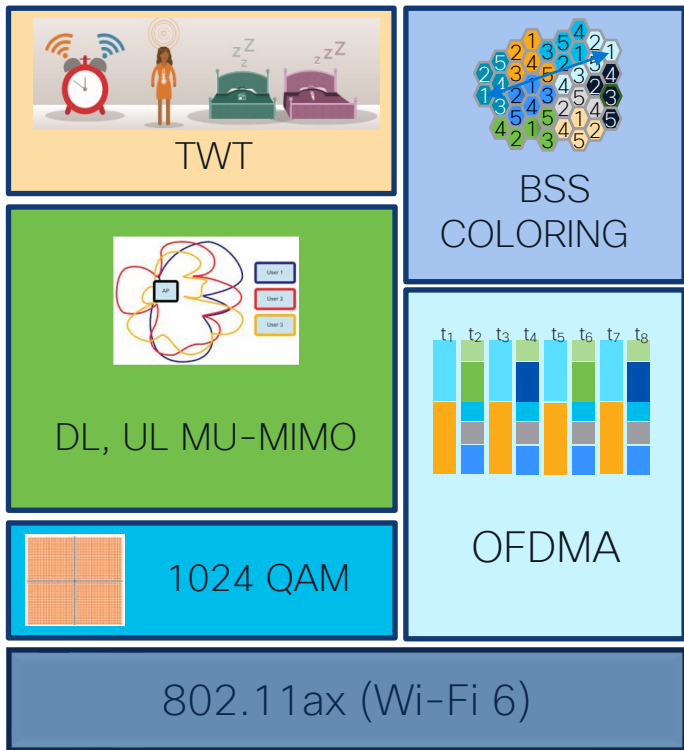
Limited Re-usable Channels

Before Wi-Fi - 6E



Wi-Fi 6E

Wi-Fi 6 and 6GHz are friends!



- 1 Additional Spectrum**
1200 MHz (5.925 to 7.125 MHz) – US
500 MHz (5.925 to 6.425) – EU
- 2 Security Upgrade**
WPA3 and OWE Mandatory
- 3 Clean RF**
(Fixed Mobile Service Operators in UNI-5 and UNI-7)
- 4 No Legacy (Slow) Devices**
Improves performance
- 5 6 GHz WLAN Discovery**
Airtime Efficiency
- 6 Wider RF Channels**
80 MHz channels are now a reality

With Wi-Fi – 6E



Are you Ready for Wi-Fi 6E?

Wi-Fi Network design

- Adoption/Migration
- WLAN/SSID design

RF design

- AP coverage
- AP density
- Site survey Tools

AP deployment

- AP specs
- Choose the AP model
- Power requirements
- Switching infrastructure

Setting the stage...

- Regulatory considerations
- Protocol enhancements
- Wi-Fi 6E Security
- Client Ecosystem

AP = Access Point
RRM = Radio Resource Management (RRM)
RF = Radio Frequency (RF)
WLAN = Wireless LAN
SSID = Service Set Identifier

Setting the stage

Setting the stage

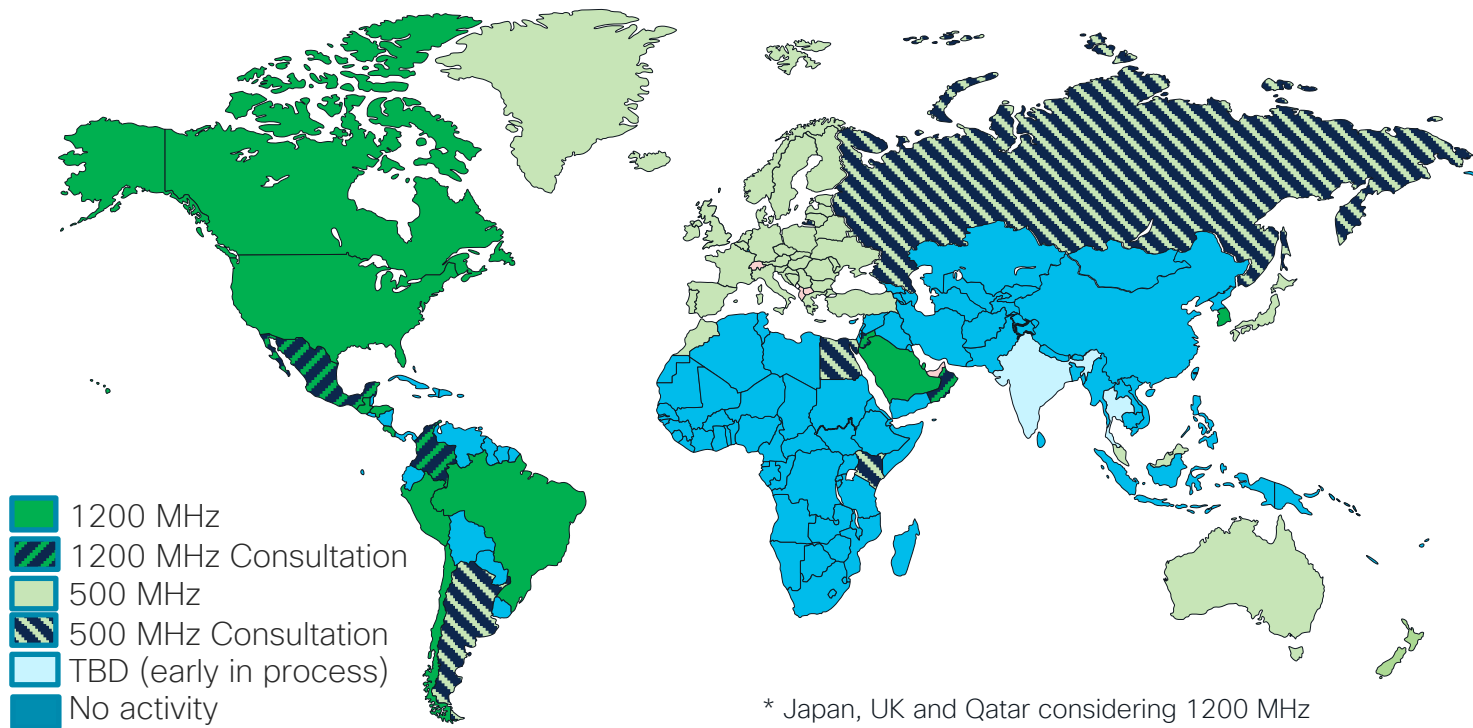
- Regulatory Considerations
- Protocol enhancements
- Wi-Fi 6E Security
- Client Ecosystem



Wi-Fi 6E - 6GHz Around the World

Global availability of 6 GHz band for Wi-Fi

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





Reference

6GHz will provide Wi-Fi room to grow

“...the 6 GHz band [is] an opportunity to begin considering... **spectrum sharing techniques** in order to provide access for new services in the band while maintaining access and protection for existing services.” – Innovation, Science and Economic Development Canada

2.4 GHz Channels			80 MHz
ISM Band	2407 + 5 X Ch. Number		Wavelength 12.5cm - 4.9" to 12.0cm - 4.7"
Channel	1	6	11
Center Freq	2.412	2.437	2.462

5 GHz Channels			500 MHz
Frequency	9000 + 5 X Ch. Number		Wavelength 5.8cm - 2.3" to 5.1cm - 2.0"
Radio Band	DFS Channels		DFS Channels
Center Freq	U-NII-1		U-NII-2a
20 MHz	36	40	44
40 MHz	38	46	48
80 MHz	42		58
160 MHz	50		114

6 GHz Channels			1,200 MHz
FCC - USA	5950 + 5 X Ch. Number		Wavelength 5.1cm - 2.0" to 4.2cm - 1.6"
Radio Band	5dBm/MHz - Net EIRP 18dBm		UNII-5
Center Freq	UNII-5		UNII-6
20 MHz	1	5	9
40 MHz	3	11	19
80 MHz	7		23
160 MHz	15		47

Standard Power AP			36dBm with Automated Frequency Coordination (AFC)	UNII-5	UNII-6	UNII-7	UNII-8
Radio Band	UNII-5		UNII-5	UNII-6	UNII-7	UNII-8	UNII-8
Center Freq	UNII-5		UNII-5	UNII-6	UNII-7	UNII-8	UNII-8
20 MHz	1	5	9	13	17	21	25
40 MHz	3	11	19	27	35	43	51
80 MHz	7		23	39	55	71	87
160 MHz	15		47	79			



6 GHz – New Device Classes

Wi-Fi 6E introduces new device classes for optimized capability



Low Power Indoor AP

- Indoor Only
- Integrated Antenna Required
- Can use the full 1200 MHz
- Wired Power



Standard Power AP

- Indoor or Outdoor
- Integrated or External Antenna
- UNII-5 and UNII-7 Only (US)
- Requires AFC



Very Lower Power AP

- Mobile Indoor or Outdoor
- Limited Range
- Can use the full 1200 MHz
- Does not require AFC



Client Devices

- Indoor or Outdoor
- Only Indoor under control of LPI AP
- 6 dBm lower power than AP

Regulations vary by country

Summary 6GHz Tx Requirements*



Reference

Mode	Country	Max Tx Power EIRP		Max PSD EIRP		Max Ch BW
	(Frequency Range MHz)	AP (dBm)	Client (dBm)	AP (dBm)	Client (dBm)	(MHz)
LPI	FCC (5925-7125)	30	24	5	-1	320
	ETSI (5945-6425)	23	23	10	10	
	UK (5925-6425)	24	24	11	11	No Max
	Australia (5925-6425)	24	24	11	11	
	New Zealand (5925-6425)	24	24	11	11	
	S Korea (5925-7125)	24	24	2	2	160
	HongKong (5925-6425)	24	24			
	Malaysia (5925-6425)	23	23	10	10	
	Brazil (5925-7125)	30	24	5	-1	
	ISED (5925-7125)	30	24	5	-1	
	Chile (5925-7125)	30	24	5	-1	
	Peru (5925-7125)	30	24	5	-1	
	UAE (5925-6425)	24	24			
	Saudi Arabia (5925-7125)	30	24	10	10	
	ATU (5945-6425) (Kenya/Uganda/Congo/Niger/Ghana)	23	23	10	10	
Morocco (5945-6425)	23	23				
SP	FCC (U-NII-5/7)	36 (21<30°)	30	23	17	320

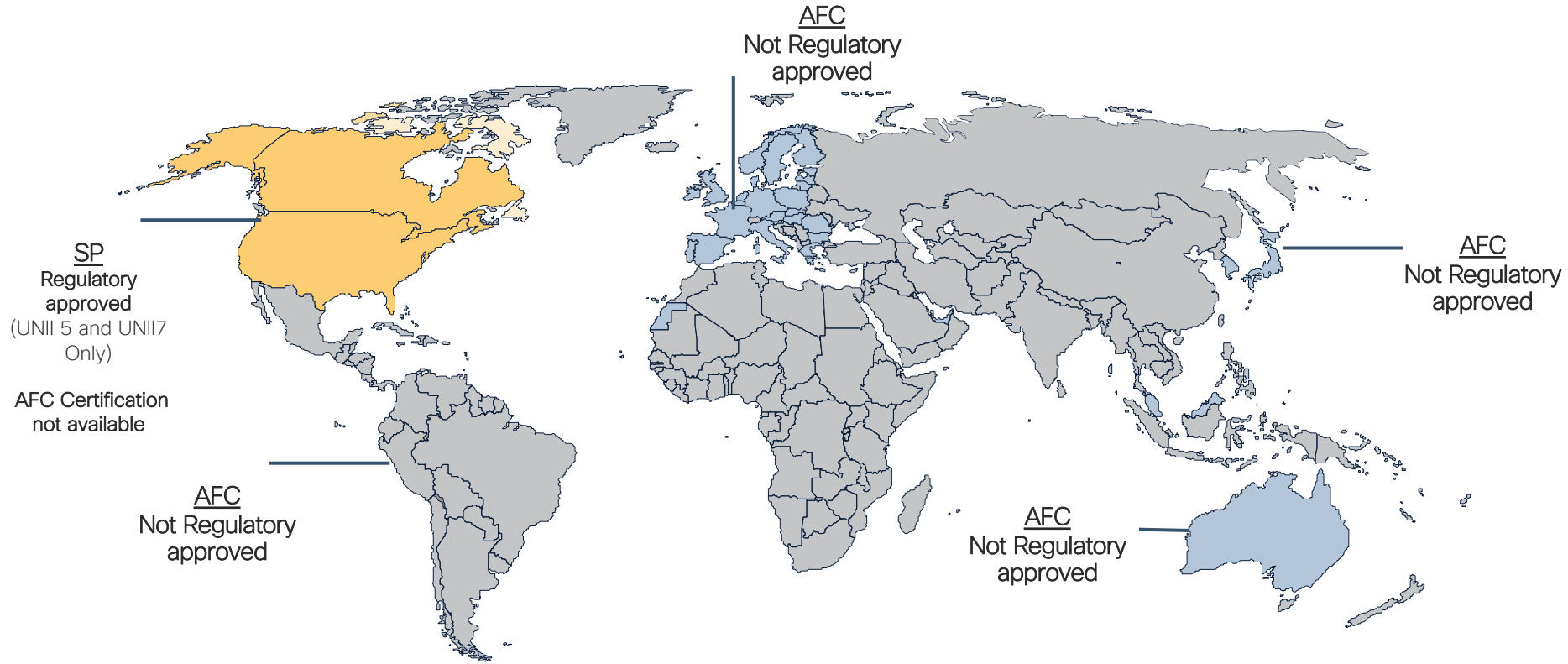
Summary 6GHz Tx Requirements*



Reference

Mode	Country	Max Tx Power EIRP		Max PSD EIRP		Max Ch BW
	(Frequency Range MHz)	AP (dBm)	Client (dBm)	AP (dBm)	Client (dBm)	(MHz)
LPI	FCC (5925-7125)	30	24	5	-1	320
	ETSI (5945-6425)	23	23	10	10	
	UK (5925-6425)	24				
	Australia (5925-6425)					
	UAE (5925-6425)	24	24	5	-1	
LPI	Australia (5925-6425)	24	24	11	11	
	New Zealand (5925-6425)	24	24	11	11	
	S Korea (5925-7125)	24	24	2	2	160
	HongKong (5925-6425)	23	23			
	Malaysia (5925-6425)	23	24	10	10	
SP	UAE (5925-6425)	24	24			
	Saudi Arabia (5925-7125)	30	24	10	10	
	ATU (5945-6425) (Kenya/Uganda/Congo/Niger/Ghana)	23	23	10	10	
	Morocco (5945-6425)	23	23			
	FCC (U-NII-5/7)	36 (21<30°)	30	23	17	320

External(SP)/Outdoor Antenna Wi-Fi 6E Status



SP
Regulatory approved
(UNII 5 and UNII 7 Only)

AFC Certification not available

AFC
Not Regulatory approved

AFC
Not Regulatory approved

AFC
Not Regulatory approved

AFC
Not Regulatory approved

AFC conditional approval in USA

Automated Frequency Coordination



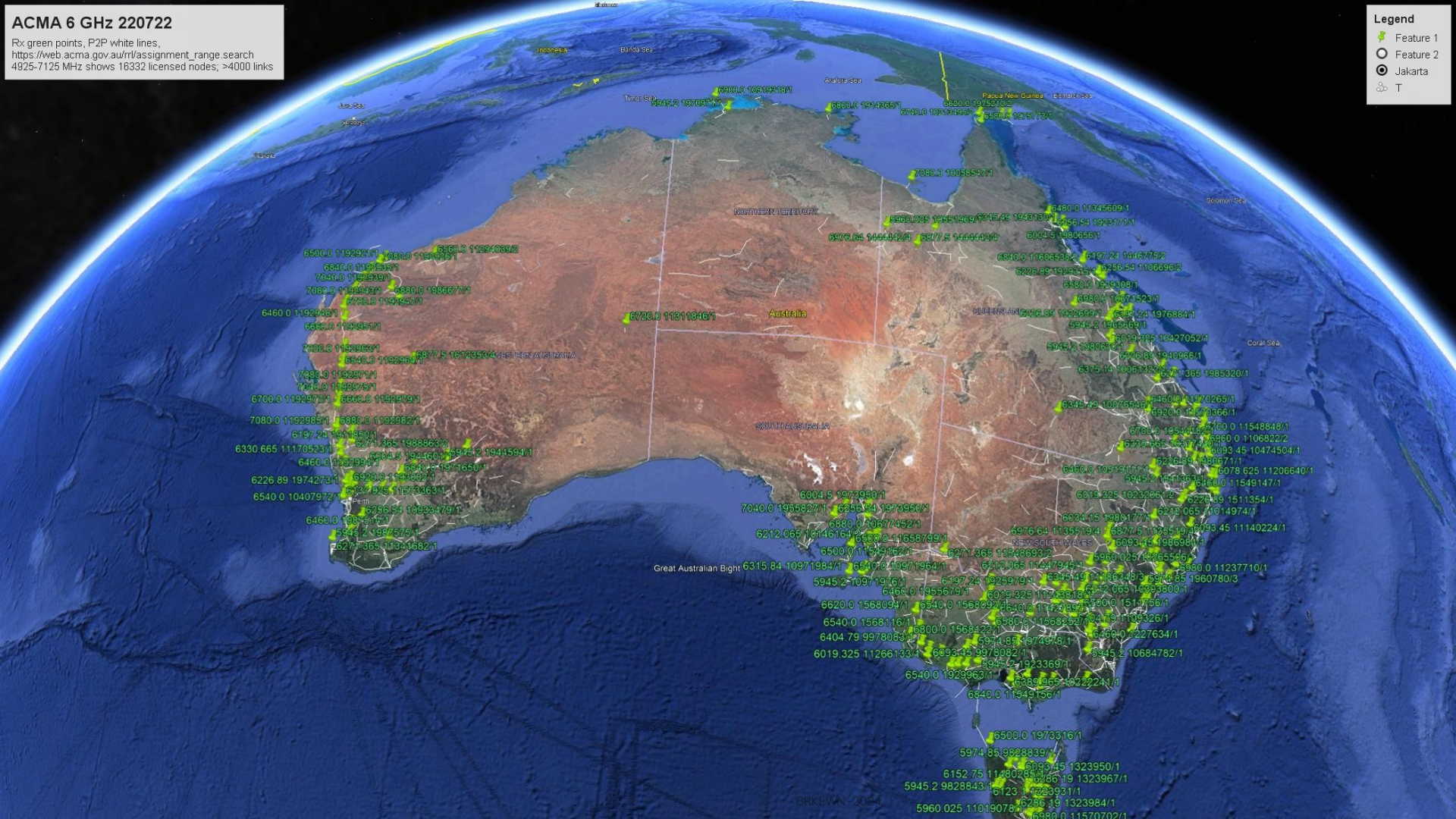
ID	Frequency	Emission Designator	Authorisation Date	T/R	Client	Licence	Site/Area
8274101	6.72 GHz	73MSD7WET	14/Apr/2022	R	Telstra Corporation Limited (39310)	11015100/2	Telstra Site DJAMBIDJIMBA NT 0872
8274100	6.72 GHz	73MSD7WET	14/Apr/2022	T	Telstra Corporation Limited (39310)	11015100/2	Telstra Radio Site Coonega, 24 km WSW of Mount Eclipse NT
8274065	6.019325 GHz	56MOG7W	05/Aug/2021	R	Optus Mobile Pty Limited (20017363)	11309311/1	Wellington Shire Council Site Mount Bodangora Near WELLINGTON NSW 2820
8274064	6.019325 GHz	56MOG7W	05/Aug/2021	T	Optus Mobile Pty Limited (20017363)	11309311/1	Optus Site Lulworth Park off Mitchell Hwy GEURIE NSW 2830
8274063	6.271365 GHz	56MOG7W	05/Aug/2021	R	Optus Mobile Pty Limited (20017363)	11309311/1	Optus Site Lulworth Park off Mitchell Hwy GEURIE NSW 2830
8274062	6.271365 GHz	56MOG7W	05/Aug/2021	T	Optus Mobile Pty Limited (20017363)	11309311/1	Wellington Shire Council Site Mount Bodangora Near WELLINGTON NSW 2820

ACMA Register of Radiocommunications Licences



ACMA 6 GHz 22072

Rx green points, P2P white lines,
https://web.acma.gov.au/rf/assignment_range_search
4925-7125 MHz shows 16332 licensed nodes; >4000 lines



Legend

- Feature 1
- Feature 2
- Jakarta
- T

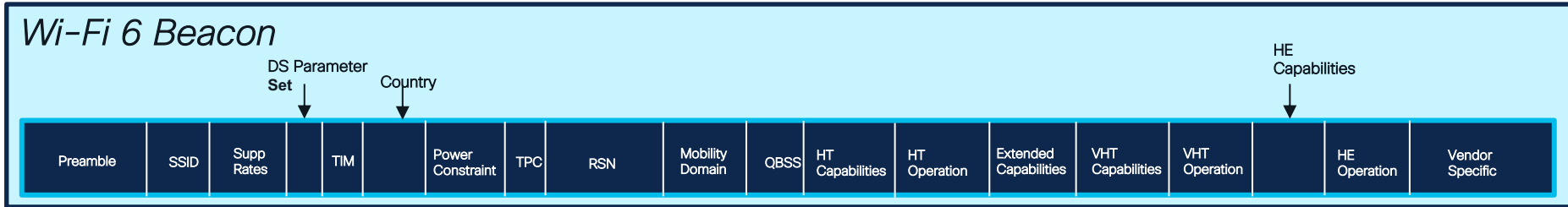
BRKEWN-2004



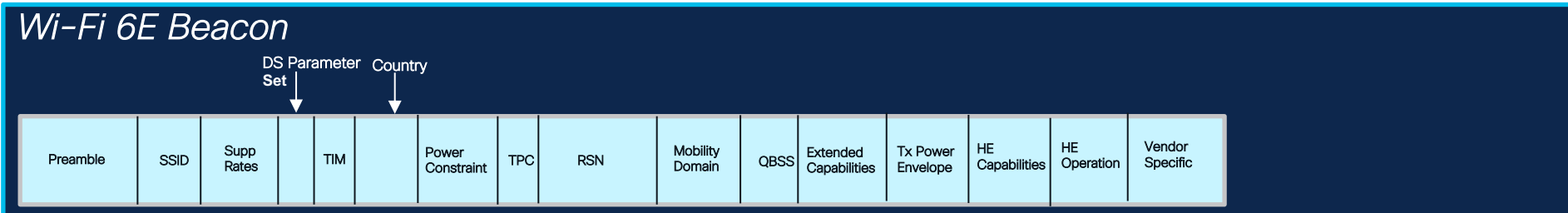
Wi-Fi 6E – Protocol Optimizations

Wi-Fi 6E Beacon Changes

Legacy HT/VHT Information Element Removed



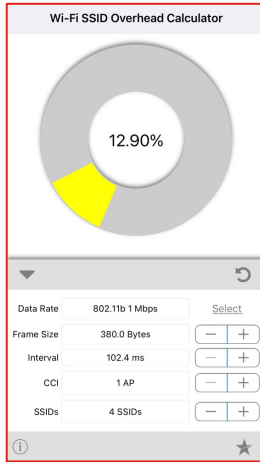
Comparison of Wi-Fi 6 and Wi-Fi 6E Beacon Frame



Reduced Beacon Size helps conserve AirTime

Multiple BSSID

- Capability originally specified in 802.11v
- Combines multiple SSID information in a single beacon frame



13% Overhead for 4 SSIDs with 1 AP



SSID: wpa3-owe
SSID: wpa3-SuiteB-GCMP256
SSID: wpa3-SuiteB-GCMP128



- Conserves Air Time
- Mandated in Wi-Fi 6E

Wireshark packet capture showing Multiple BSSID frame structure:

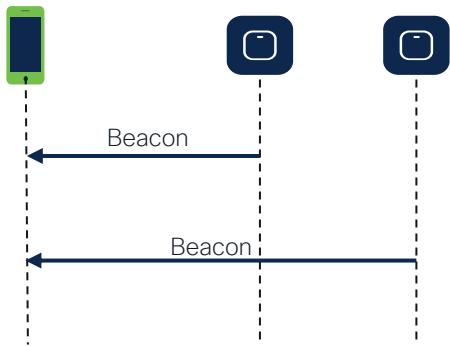
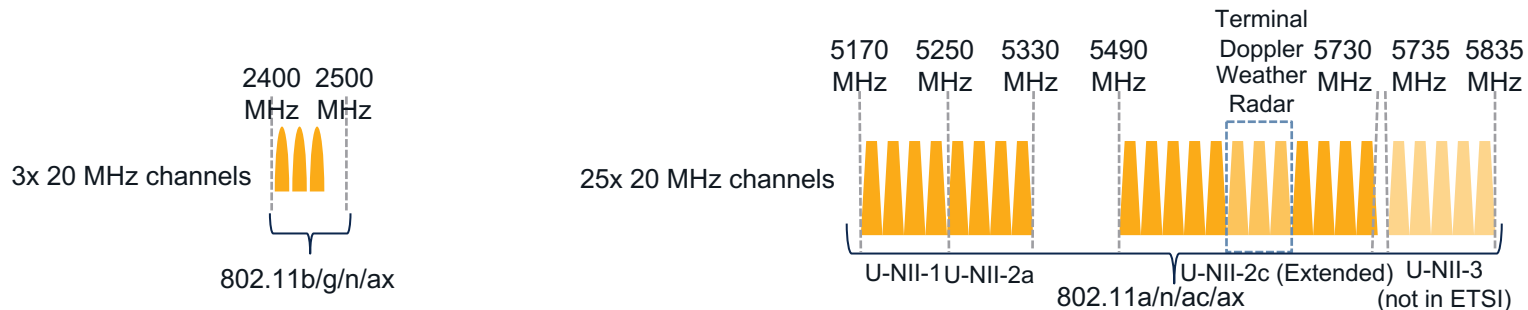
- Tag: SSID parameter set: wap3-owe
Tag Number: SSID parameter set (0)
Tag length: 8
SSID: wap3-owe (Transmitted BSSID)
- Tag: Multiple BSSID
Tag Number: Multiple BSSID (71)
Tag length: 121
MaxBSSID Indicator: 4
 - Sub-Element: Nontransmitted BSSID Profile
Subelement ID: 0
Subelement Length: 58
 - Tag: Non Transmitted BSSID Capability: 0x1511
 - Tag: SSID parameter set: wpa3-SuiteB-GCMP256 (Non Transmitted BSSID 1)
 - Tag: Multiple BSSID Index: 11
 - Tag: RSN Information
 - Sub-Element: Nontransmitted BSSID Profile
Subelement ID: 0
Subelement Length: 58
 - Tag: Non Transmitted BSSID Capability: 0x1511
 - Tag: SSID parameter set: wpa3-SuiteB-GCMP128 (Non Transmitted BSSID 2)
 - Tag: Multiple BSSID Index: 12
 - Tag: RSN Information



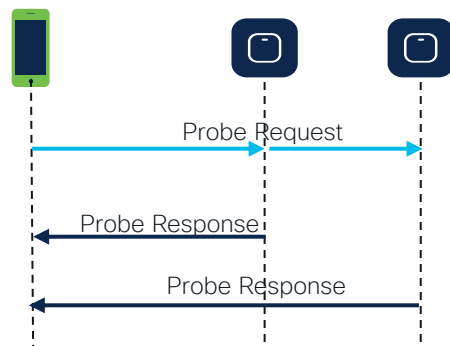
Wi-Fi 6E – AP Discovery

AP Discovery by Wireless Clients – Legacy Methods

- Hunt and seek method to scan Basic Service Sets or for APs

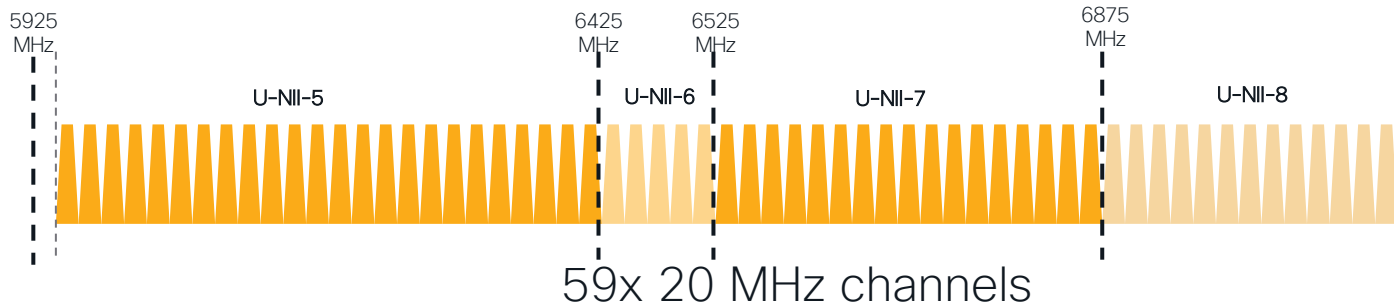


Passive Scanning



Active Scanning

Why won't Legacy Scanning Methods scale in 6 GHz ?



- A Whopping 59 x 20 MHz Channels!
- Wi-Fi Clients can send only Probe Requests on 20 MHz Channels
- 6 seconds to passive scan all 59 channels.

Wi-Fi 6E - New AP Discovery Mechanisms

Out of Band

Reduced Neighbor Report

Co-located Discovery



In Band

Passive Scan:

Fast Link Setup (FILS) Discovery Frames
Unsolicited Probe Response Frames

Active Scan:

Preferred Scanning Channels (PSC)



Reduced Neighbor Report

Co-located “Neighbor” 6 GHz radio information in Beacon and Probe Response of 2.4 and 5 GHz radios.

SSID: blizzard
5GHz Channel: 36
2.4GHz Channel: 1



Probe Request

Probe Response: blizzard
RNR :
blizzard_wpa3
channel 69 (6 GHz)

SSID: blizzard_wpa3
6GHz Channel: 69



```
wlan.fc.type_subtype == 5
```

No.	Time	Source	Destination	Protocol	Lengt	Signal	st	Authentication	Info
5	14:31:03.851	68:7d:b4:5e:5f:4f	68:2c:7b:cb:42:d6	802.11	525	-35dBm			Probe Response, SN=9, Flags=.....C, BI=100, SSID=cvoice
8	14:31:03.871	68:7d:b4:5e:5f:4f	68:2c:7b:cb:42:d6	802.11	525	-35dBm			Probe Response, SN=10, Flags=.....C, BI=100, SSID=cvoice
10	14:31:03.910	68:7d:b4:5e:5f:4f	98:01:a7:ec:5f:b6	802.11	525	-34dBm			Probe Response, SN=11, Flags=.....C, BI=100, SSID=cvoice
11	14:31:03.912	68:7d:b4:5e:5f:4f	98:01:a7:ec:5f:b6	802.11	525	-34dBm			Probe Response, SN=11, Flags=.....C, BI=100, SSID=cvoice
12	14:31:03.913	68:7d:b4:5e:5f:4f	98:01:a7:ec:5f:b6	802.11	525	-34dBm			Probe Response, SN=11, Flags=.....C, BI=100, SSID=cvoice
13	14:31:03.913	68:7d:b4:5e:5f:4f	98:01:a7:ec:5f:b6	802.11	525	-35dBm			Probe Response, SN=11, Flags=.....C, BI=100, SSID=cvoice
14	14:31:03.914	68:7d:b4:5e:5f:4e	98:01:a7:ec:5f:b6	802.11	514	-34dBm			Probe Response, SN=5, Flags=.....C, BI=100, SSID=cal-psk
15	14:31:03.915	68:7d:b4:5e:5f:4e	98:01:a7:ec:5f:b6	802.11	514	-35dBm			Probe Response, SN=5, Flags=.....C, BI=100, SSID=cal-psk
16	14:31:03.916	68:7d:b4:5e:5f:4e	98:01:a7:ec:5f:b6	802.11	514	-34dBm			Probe Response, SN=5, Flags=.....C, BI=100, SSID=cal-psk
17	14:31:03.917	68:7d:b4:5e:5f:4e	98:01:a7:ec:5f:b6	802.11	514	-35dBm			Probe Response, SN=5, Flags=.....C, BI=100, SSID=cal-psk

▼ Tag: Reduced Neighbor Report
Tag Number: Reduced Neighbor Report (201)

▼ neighbor AP information
.....00 = TBTT Information Field: 0
.....1 = TBTT Filtered Neighbor AP: 1
.....0000 = TBTT Information Count: 0

Channel Number: 69

▼ TBTT Information
Neighbor AP TBTT Offset: 255
BSSID: 687db45e5f40
Short SSID: 0x4f27e7b9
▼ BSS Parameters: 0x4e
.....0 = OCT Recommended: False
.....1 = Same SSID: True
.....1.. = Multiple BSSID: True
.....1... = Transmitted BSSID: True
.....0 = Member of ESS with 2.4/5 GHz Co-located AP: False
.....0... = Unsolicited Probe Responses: False
.....1... = Co-located AP: True
.....0... = Reserved: 0x0
PSD Subfield: 254dBm/MHz

▼ TBTT Information
Neighbor AP TBTT Offset: 255
BSSID: 687db45e5f40
Short SSID: 0x4f27e7b9
▼ BSS Parameters: 0x4e
.....0 = OCT Recommended: False
.....1 = Same SSID: True
.....1.. = Multiple BSSID: True
.....1... = Transmitted BSSID: True
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.....0... = Reserved: 0x0
PSD Subfield: 254dBm/MHz

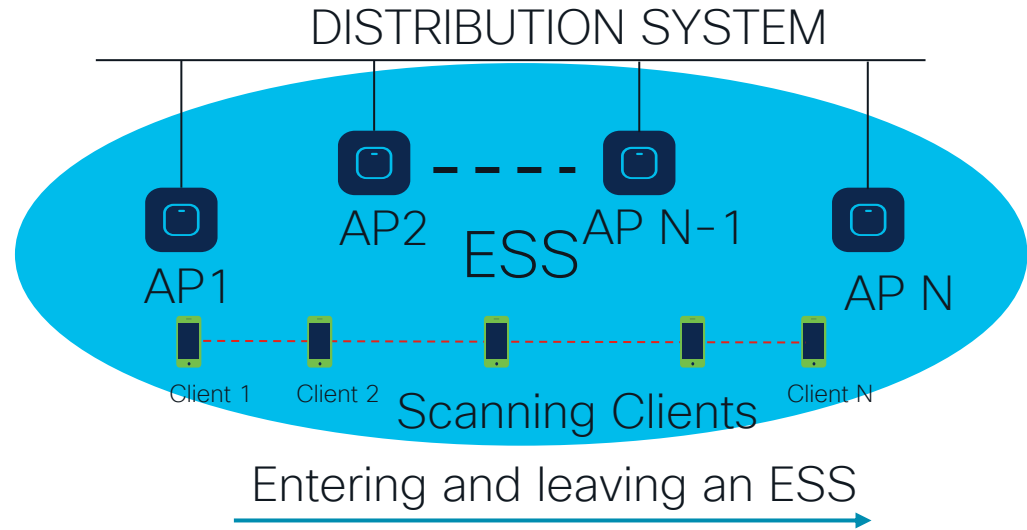


Wi-Fi 6E Inband AP Discovery



Fast Initial Link Setup (FILS)

- Part of IEEE 802.11ai Standard
- Addresses Improvement in :
 - Network and BSS Discovery
 - Authentication and Association
 - DHCP and IP address setup



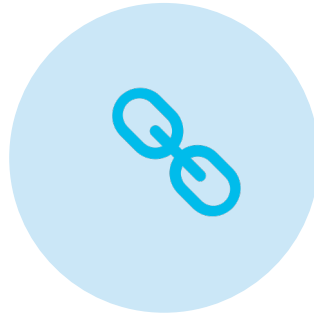
802.11ax in 6 GHz adopted FILS Discovery Frame to speed up AP D

FILS Discovery Frames helps AP Discovery Faster

Reduces AirTime Utilization by Management Frames



SMALLER BEACONS THAT IS TRANSMITTED MORE FREQUENTLY (APPROX. 20 MSEC), CONSUMES LESS AIR TIME.

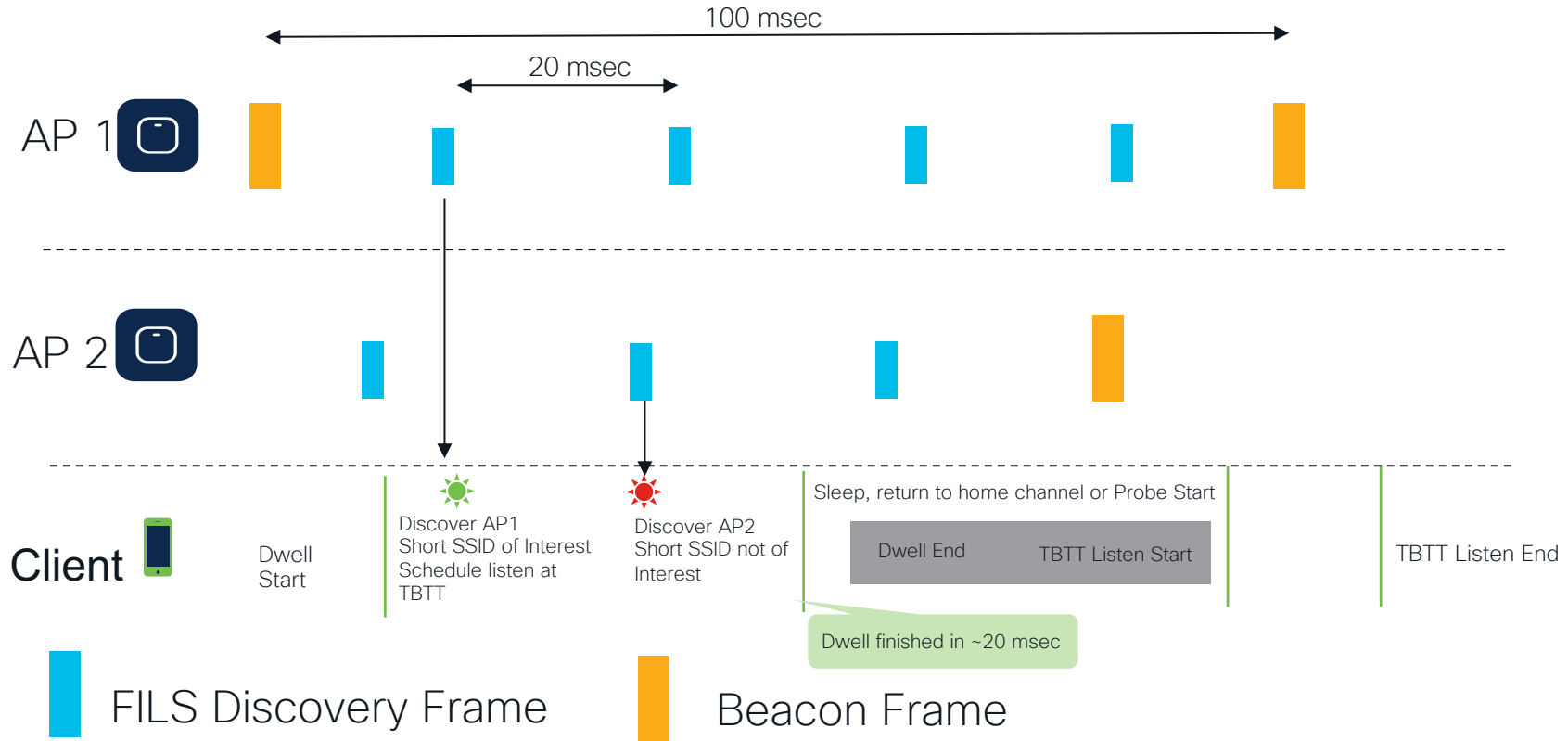


CONTAINS INFORMATION FOR THE CLIENT TO DECIDE ON THE AP TO CONNECT (SHORT SSID, CHANNEL, TBTT ETC)



REDUCES PROBE REQUEST OVERHEAD

Fast Initial Link Setup (FILS) Discovery Frames



FILS Discovery Frame - Packet Capture

wlan.fixed.publicact == 0x22

No.	Time	Source	Destination	Protocol	Length	Signal	Info
1	16:57:45.318	68:7d:b4:5e:5f:41	ff:ff:ff:ff:ff:ff	802.11	154	-43dBm	Action, SN=3947, Flags=.....C
2	16:57:45.339	68:7d:b4:5e:5f:41	ff:ff:ff:ff:ff:ff	802.11	680	-43dBm	Beacon frame, SN=3948, Flags=.....C, BI=100, SSID=wap3-owe, SSID=wpa3-SuiteB-GCMP2
3	16:57:45.359	68:7d:b4:5e:5f:41	ff:ff:ff:ff:ff:ff	802.11	154	-43dBm	Action, SN=3949, Flags=.....C
4	16:57:45.379	68:7d:b4:5e:5f:41	ff:ff:ff:ff:ff:ff	802.11	154	-43dBm	Action, SN=3950, Flags=.....C
5	16:57:45.399	68:7d:b4:5e:5f:41	ff:ff:ff:ff:ff:ff	802.11	154	-43dBm	Action, SN=3951, Flags=.....C
6	16:57:45.420	68:7d:b4:5e:5f:41	ff:ff:ff:ff:ff:ff	802.11	154	-43dBm	Action, SN=3952, Flags=.....C

Frame 3: 154 bytes on wire (1232 bits), 154 bytes captured (1232 bits) on interface 0

- ▶ Radiotap Header v0, Length 56
- ▶ 802.11 radio information
- ▶ IEEE 802.11 Action, Flags:C
- ▼ IEEE 802.11 wireless LAN
 - ▼ Fixed parameters
 - Category code: Public Action (4)
 - Public Action: FILS Discovery Request (0x22)
 -1..... = Short SSID Indicator: 1
 -0..... = AP-CSN Presence Indicator: 0
 -0..... = ANO Presence Indicator: 0
 -0..... = Channel Center Frequency Segment 1 Presence: 0
 -0..... = Primary Channel Presence Indicator: 0
 -0..... = RSN Info Presence Indicator: 0
 -1..... = Length Presence Indicator: 1
 -0..... = MD Presence Indicator: 0
 - 00..... = Reserved: 0
 - Timestamp: 0x00000000f48cffe
 - Beacon Interval: 100
 - Short SSID: 0x4fa04e3e
 - FD Capability: 4/04
 -0..... = ESS: 0
 -0..... = Privacy: 0

Broadcast Action Frames

Contains Short SSID, Channel, TBTT etc

Transmitted every 20 msec

Unsolicited Broadcast Probe Response



Reduces Probe Request
Overhead



Broadcast probe
response every 20 msec



Contains detailed
information as a Beacon

Helps Avoid Probe Storm

Unsolicited Broadcast Probe Response – Packet Capture

No.	Time	Source	Destination	Protocol	Length	Info
1	16:36:27.556	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550	Beacon frame, SN=2635, Flags=.....C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=wpa...
2	16:36:27.577	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550	Probe Response, SN=2636, Flags=.....C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
3	16:36:27.597	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550	Probe Response, SN=2637, Flags=.....C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
4	16:36:27.618	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550	Probe Response, SN=2638, Flags=.....C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
5	16:36:27.638	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550	Probe Response, SN=2639, Flags=.....C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
7	16:36:27.659	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	599	Beacon frame, SN=2640, Flags=.....C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=wpa...
7	16:36:27.679	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550	Probe Response, SN=2641, Flags=.....C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
8	16:36:27.700	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550	Probe Response, SN=2642, Flags=.....C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
9	16:36:27.720	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550	Probe Response, SN=2643, Flags=.....C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
10	16:36:27.741	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550	Probe Response, SN=2644, Flags=.....C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
11	16:36:27.761	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	599	Beacon frame, SN=2645, Flags=.....C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=wpa...
12	16:36:27.782	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550	Probe Response, SN=2646, Flags=.....C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
13	16:36:27.802	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550	Probe Response, SN=2647, Flags=.....C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
14	16:36:27.822	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550	Probe Response, SN=2648, Flags=.....C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
15	16:36:27.843	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550	Probe Response, SN=2649, Flags=.....C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
16	16:36:27.863	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	599	Beacon frame, SN=2650, Flags=.....C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=wpa...

Frame 2: 550 bytes on wire (4400 bits), 550 bytes captured (4400 bits) on interface 0

- ▶ Radiotap Header v0, Length 56
- ▶ 802.11 radio information
- ▶ IEEE 802.11 Probe Response, Flags:C
- ▶ IEEE 802.11 wireless LAN
 - ▶ Fixed parameters (12 bytes)
 - ▶ Tagged parameters (454 bytes)
 - ▶ Tag: SSID parameter set: wpa3-sae
 - ▶ Tag: Supported Rates and BSS Membership Selectors 6.0(B), 9, 12.0(B), 18, 24(B), 36, 48, 54, [Mbit/sec]
 - ▶ Tag: Country Information: Country Code US, Environment Unknown (0x04)
 - ▶ Tag: Power Constraint: 0
 - ▶ Tag: TPC Report Transmit Power: 23, Link Margin: 0
 - ▶ Tag: Extended Supported Rates and BSS Membership Selectors BSS requires support for direct hashing to elements in SAE, [Mbit/sec]
 - ▶ Tag: QSS Load Element 802.11e CCA Version
 - ▶ Tag: Multiple BSSID
 - ▶ Tag: RM Enabled Capabilities (5 octets)
 - ▶ Tag: Extended Capabilities (11 octets)
 - ▶ Ext Tag: HE Capabilities (IEEE Std 802.11ax/D2.0)
 - ▶ Ext Tag: HE Operation (IEEE Std 802.11ax/D2.0)
 - ▶ Ext Tag: 6GHz Band Capabilities
 - ▶ Ext Tag: Spatial Reuse Parameter Set
 - ▶ Ext Tag: MU EDCA Parameter Set
 - ▶ Tag: Vendor Specific: (null): WMM/WME: Parameter Element
 - ▶ Tag: Vendor Specific: (null): Unknown
 - ▶ Tag: Vendor Specific: (null)

Broadcast frames

Transmitted every 20ms

Carry Multiple BSSID

Contains all information needed for association

New Probe Restrictions in 6 GHz Band



Clients cannot do blind probing.
(Broadcast destination address using Wildcard SSID and BSSID not allowed)



Clients must wait at least the duration of minimum probe delay interval (approx. 20 msec)

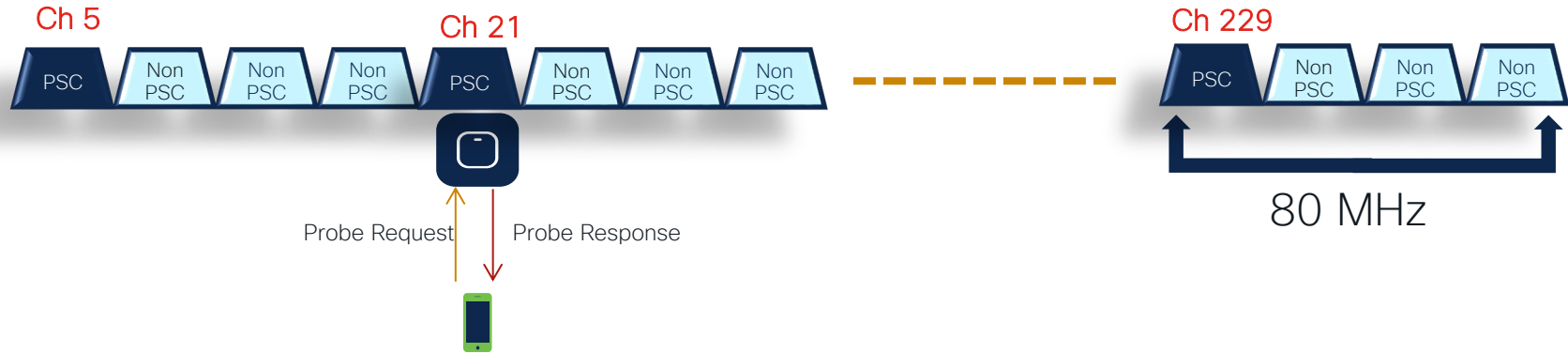


Probe responses are always broadcast.

Broadcast probe requests and probes with wildcard SSID create probe storm and impacts performance

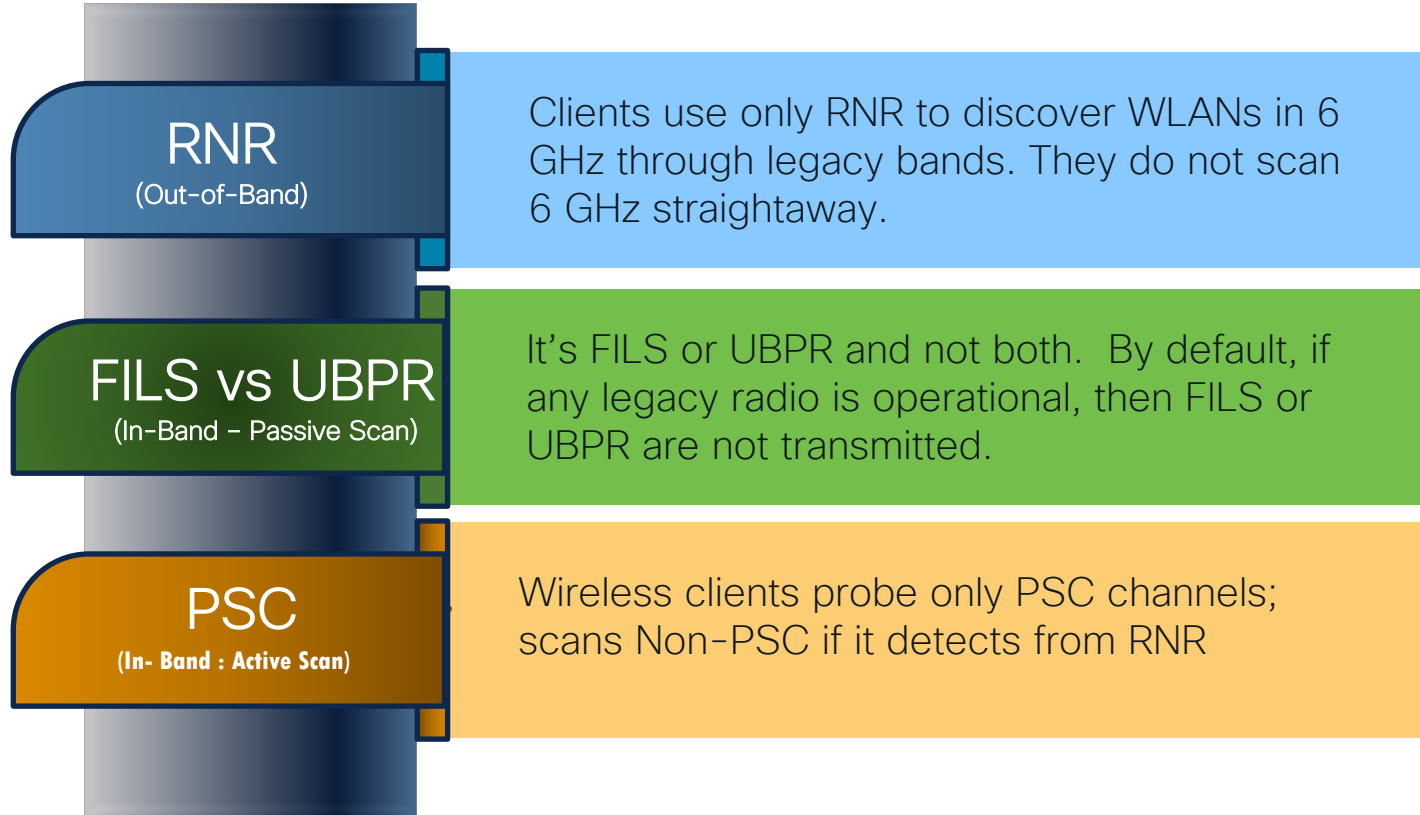
Preferred Scanning Channels (PSC)

- Every fourth 20MHz channel designated for active probing by Wi-Fi 6E Clients; restricts scanning to 15 channels, instead of 59.
- PSC channels serve as the primary channel for channel bonding in 80 MHz



PSC Channel List:
5, 21, 37, 53, 69, 85, 101, 117, 133, 149, 165, 181, 197, 213 and 229

Key Takeaways



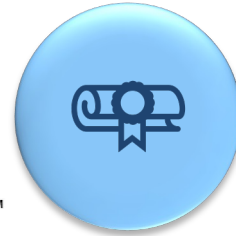


Wi-Fi 6E – Security

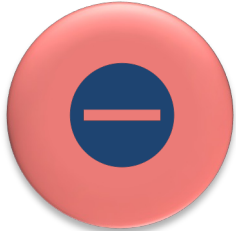
Wi-Fi 6E Security



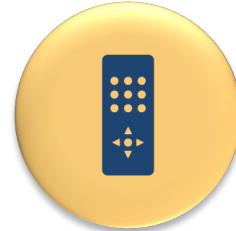
Wi-Fi 6E uplevels security with WPA3 and OWE



WPA3 and Enhanced Open Security made mandatory for Wi-Fi 6E certification.



No backward compatibility with Open and WPA2 Security.



Requires Protected Management Frame (PMF) in both AP and Clients.



Wi-Fi 6E – Client Eco System

Wi-Fi 6E Client Device Eco System

Wide range of client support ..

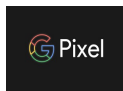
Upgrade to Windows 11!
Update the Wi-Fi driver and Bios!!



Samsung Galaxy Ultra S21/S22



Samsung Galaxy Z Fold



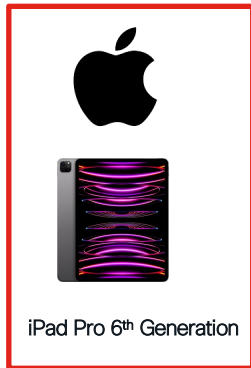
Google Pixel 6 /Pro



XIAOMI



Xiaomi Mi 11 /Ultra



iPad Pro 6th Generation



ASUS Zenfone 8 and 8 Flip



Motorola Edge (2021)

Samsung Galaxy Tab S8, S8+



Laptops with Intel AX210/AX211/AX411 Chipset



Chromebook



Redmagic 6s Pro



Zebra TC53/58



Wi-Fi 6E Chipsets



And more getting added.....

Wi-Fi 6E/WPA3 Client Security Matrix



Reference

Protocol	Encryption	AKM	FT-OTA	FT-ODS	Intel AX210	Qualcomm HSPv2 WCN6855	Samsung /Google Android	Apple iPhone (11,12,13) (6GHz Not Supported)	Apple MacBook (6 GHz Not supported)
OWE	AES-CCMP128	OWE	N/A	N/A	Supported	Supported	Supported	Not Supported	Not Supported
SAE	AES-CCMP128	SAE 6GHz: H2E Only	Supported	Supported	Supported: H2E only SAE-FT: Windows does not support. SAE-FT: Linux supports it. (No limitation on AX210)	Supported	Supported: H2E only SAE-FT: Galaxy S21 Ultra, Galaxy Z Fold 3 has capable to support, but currently it is disabled. Can be enabled by usermode fw on protos only.	Supported H2E - iOS 16	Supported

Note: Client Security Matrix with AP Mode as Local

Wi-Fi 6E/WPA3 Client Security Matrix



Reference

Protocol	Encryption	AKM	EAP Method	FT-OTA	FT-ODS	Adaptive	Intel AX210	Qualcomm HSPv2 WCN6855	Samsung / Google Android	Apple (iPhone 11, 12, 13) 6 GHz Not Supported	Apple MacBook (6 GHz Not Supported)
Enterprise	AES-CCMP128	802.1x-SHA256	PEAP/FAS/TLS	Supported	Supported	Supported	Supported: SHA256 & FT-OTA Not-Supported: EAP-FAST, FT-ODS,	Supported	Supported: SHA256 & FT-OTA Not-Supported: EAP-FAST Not-Supported: FT-ODS	Not supported	Not Supported
Enterprise	GCMP128	SuiteB-1X	PEAP/FAS/TLS			Not Supported	Not-Supported	Not-Supported	Not-Supported	Not Supported	Not Supported
Enterprise	GCMP256	SuiteB-192	TLS			Not Supported	Supported: GCMP256 Not-Supported: EAP-FAST & FT(both FT-OTA & FT-ODS)	Supported: GCMP256	Supported: GCMP256 & FT-OTA Not-Supported: FT-ODS	Supported	Only supported on M1

AP Deployment

Setting the stage

- Regulatory Considerations
- Wi-Fi 6E Security
- Client Ecosystem

AP Deployment

- AP Specs
- Power Requirements
- Switching Infrastructure



Catalyst Wi-Fi 6E Access Points

Cisco Catalyst 9136 Series Access Points

Mission-critical Wi-Fi 6E technology starting from Cisco IOS® XE 17.7.1

Cisco® Catalyst® 9136 Series

Concurrent tri-radio with 16 spatial streams



Hexa-radio architecture

1. 2.4-GHz serving radio (slot 0): 4x4:4SS
2. 5-GHz serving radio (slot 1 + slot 2): 8x8:8SS
3. Dual 5-GHz serving radio (slot 1 or slot 2*): 4x4:4SS
4. 6-GHz serving radio (slot 3): 4x4:4SS
5. Dedicated AI/ML-driven scanning radio
6. 2.4-GHz IoT radio



Dual PoE for power redundancy

- 2x 5 Multigigabit (mGig) PoE ports
- 802.3 Link Aggregation – up to 5-Gbps uplink



Internet of Things capabilities

- Built-in environmental sensors
- Application hosting technology
- USB port with 9W power output

Analytics with Cisco DNA Center 2.3.2

Extending Cisco's intent-based network

Location and IoT with Cisco Spaces

CISCO Live!

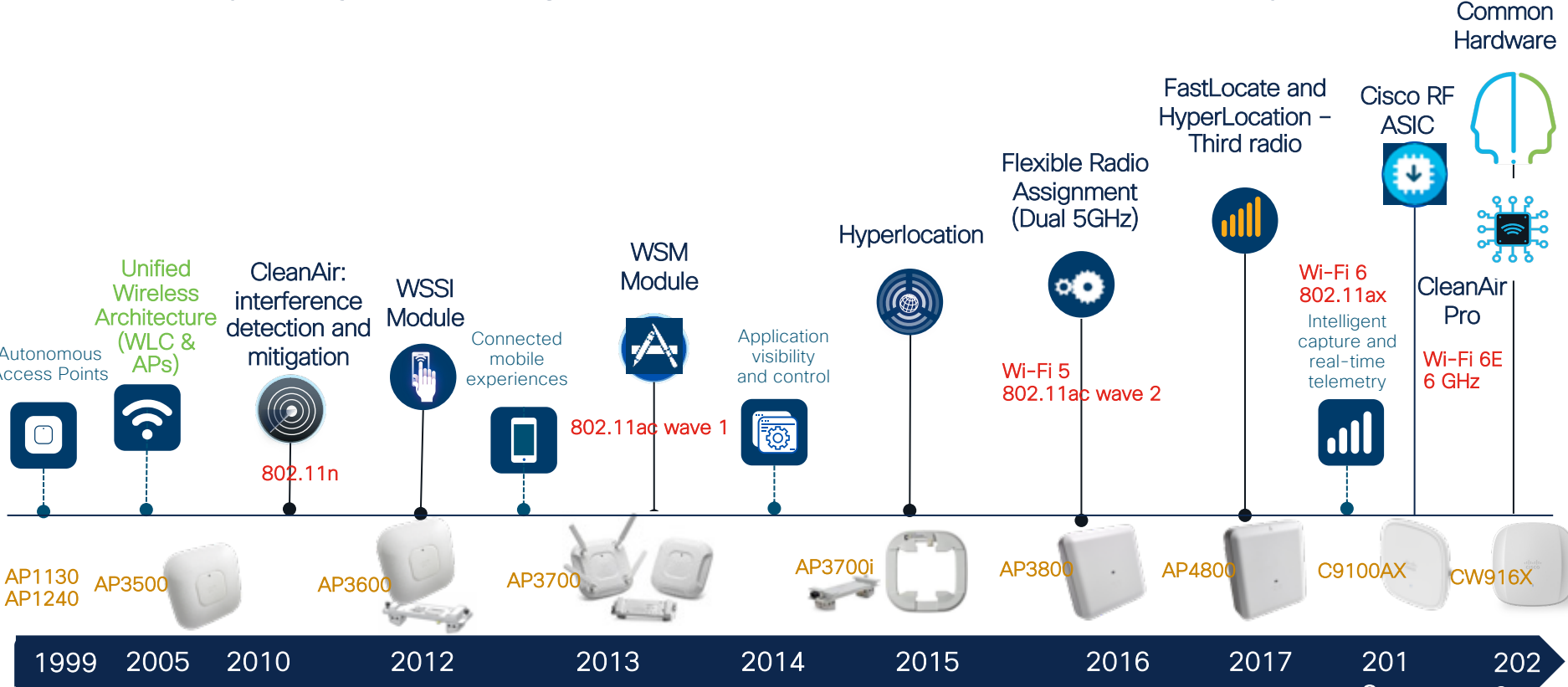
*The slot 2 radio in 4x4 will be supported in a future software release.

#CiscoLiveAPJC BRKEWN-2024

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Cisco Wi-Fi innovations

For every major change in WLAN over the last 20+ years



One Product – Two Management Modes



Cisco DNA Management Mode
C9800 & DNAC Stack

Meraki Management Mode
MR Dashboard Stack



Cisco Wi-Fi 6E Portfolio

Common Platforms will have CW PIDs

MR and C series APs are not convertible

One Product – Two Management Modes

CW9162



- 2x2 + 2x2 + 2x2
- 2.5 Gbps mGig
- Power Options: PoE, DC Power
- Scanning Radio
- IoT ready + Bluetooth 5.x
- Standard Bracket

CW9164



- 2x2, 4x4, 4x4
- 2.5 Gbps mGig
- Power Options: PoE, DC Power
- Scanning Radio
- IoT Ready + Bluetooth 5.x
- Standard Bracket

CW9166



- 4x4 + 4x4, 4x4 (XOR 5/6)
- 5 Gbps mGig
- Power Options: PoE, DC Power
- IoT ready + Bluetooth 5.x
- Scanning Radio
- Environmental Sensor
- Common XOR Architecture
- Standard Bracket

MR57



- 4x4 + 4x4, 4x4 (XOR 5/6)
- Dual 5 Gbps mGig with failover
- Power Options: PoE, DC Power
- IoT ready + Bluetooth 5.x
- Scanning Radio
- XOR Architecture (High/Low band)
- Standard Bracket

C9136



- 4x4 + 8x8 + 4x4 or 4x4+4x4+4x4+4x4
- Dual 5 Gbps mGig with failover
- Power Options: PoE, DC Power
- IoT ready + Bluetooth 5.x
- Scanning Radio
- Environmental Sensor
- XOR Architecture (macro/meso)
- Standard Bracket

Cisco Catalyst Wireless 6E Access Points

Ideal for Small to Medium-sized deployments

Best In Class, Flexibility

Mission Critical,
Performance



CW9162

- 2x2 + 2x2 + 2x2
- 2.5 Gbps mGig
- Power Options: PoE, DC Power
- IoT ready + Bluetooth 5.x
- Partial iCAP
- USB – 4.5 W

★ Available with IOS-XE 17.9.2



CW9164

- 2x2, 4x4, 4x4
- 2.5 Gbps mGig
- Power Options: PoE, DC Power
- IoT Ready + Bluetooth 5.x
- Partial iCAP
- USB – 4.5 W



CW9166

- 4x4 + 4x4 + 4x4 (XOR 5/6)
- 5 Gbps mGig
- Power Options: PoE, DC Power
- IoT ready + Bluetooth 5.x
- Environmental Sensor
- Full Packet Capture (iCAP)
- Zero-Wait DFS*
- USB – 4.5W



C9136

- 4x4, 8x8, 4x4 (or) 4x4, 4x4+4x4, 4x4
- Dual 5 Gbps mGig, active fail over
- PoE Redundancy
- IoT ready
- Bluetooth 5.x
- Environmental Sensor
- Full Packet Capture (iCAP)
- Zero-Wait DFS*
- USB – 9W

*Available in Future

Full radio capability (6 GHz @ LPI) on single 30W PoE+

Dedicated Radio for CleanAir Pro

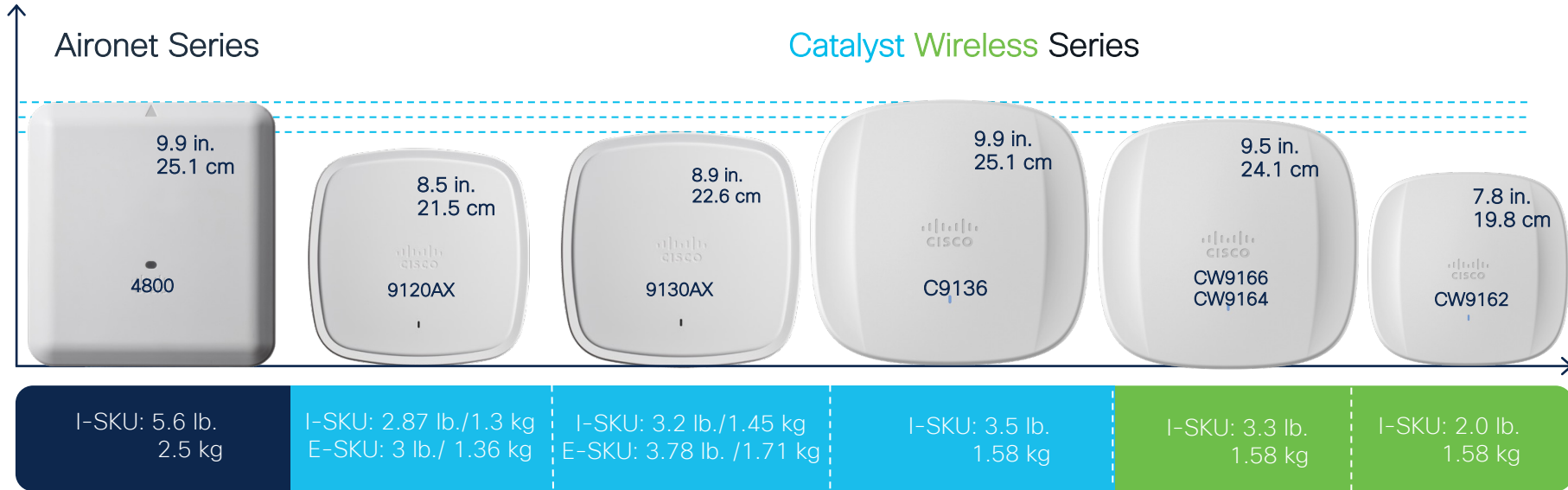
Same Bracket, Industrial Design

AP Power Optimization

USB

Indoor Access Point Dimensions

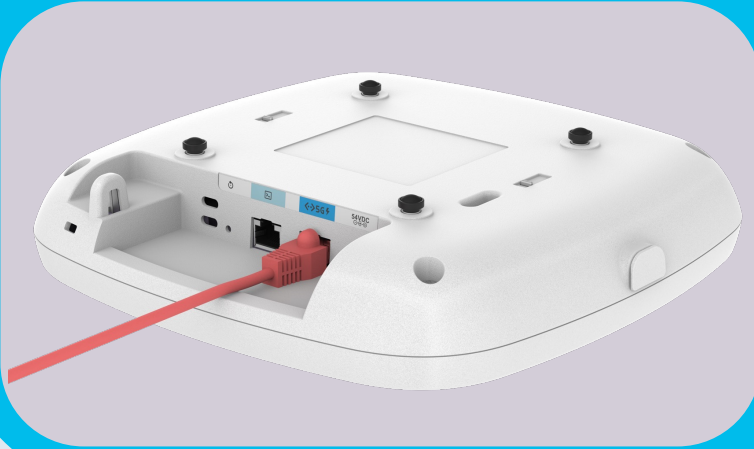
Wi-Fi 6E - Similar in size but significantly more capabilities



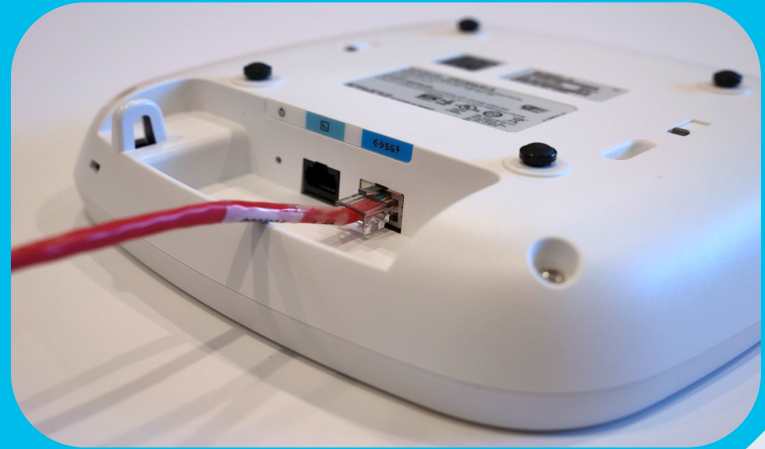
Catalyst C9136/CW9166/9164/9162

Enhanced cabling experience

C9136/CW66/64/62- Lowered Edge



C9130 - Higher Edge and Smaller Area

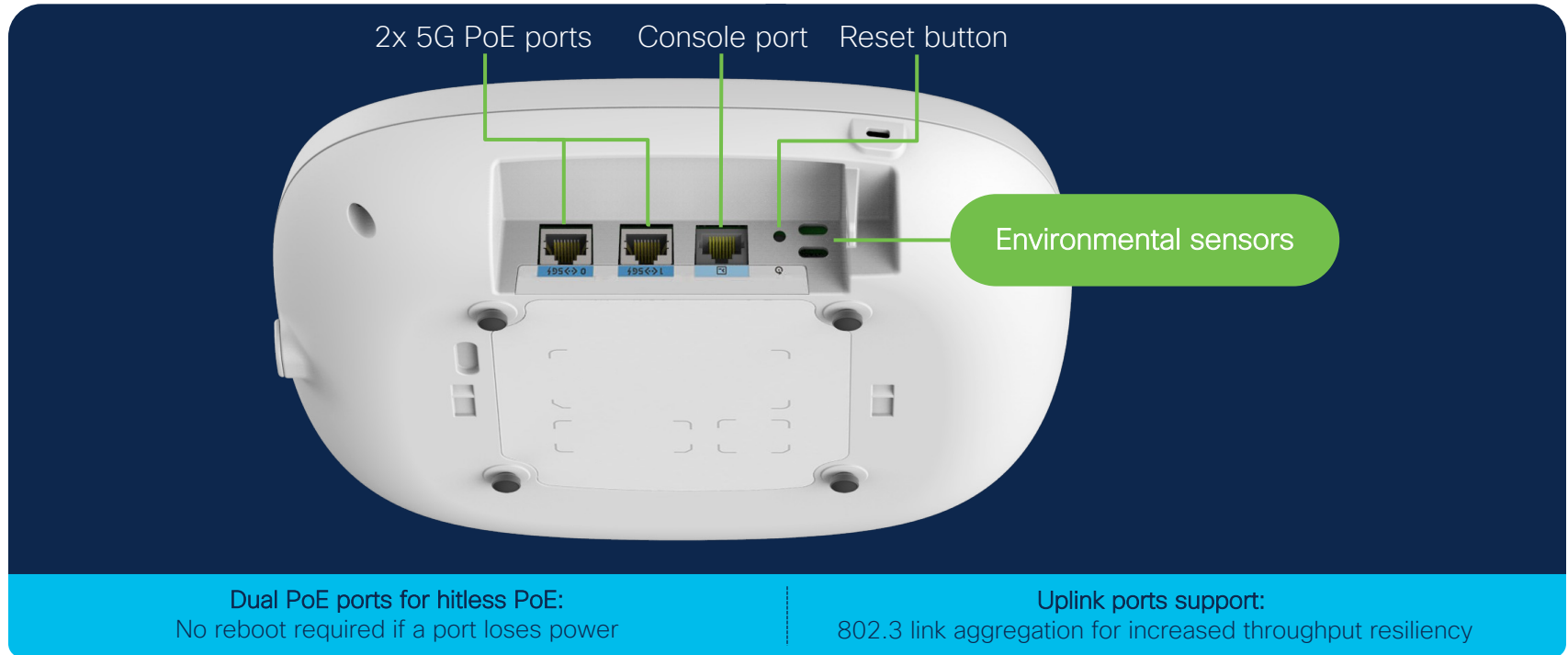


Larger Recessed Area
Allow Wires not to be Bent During Connection

More Easily Accessible Port
Allow for Better Deployment Experience

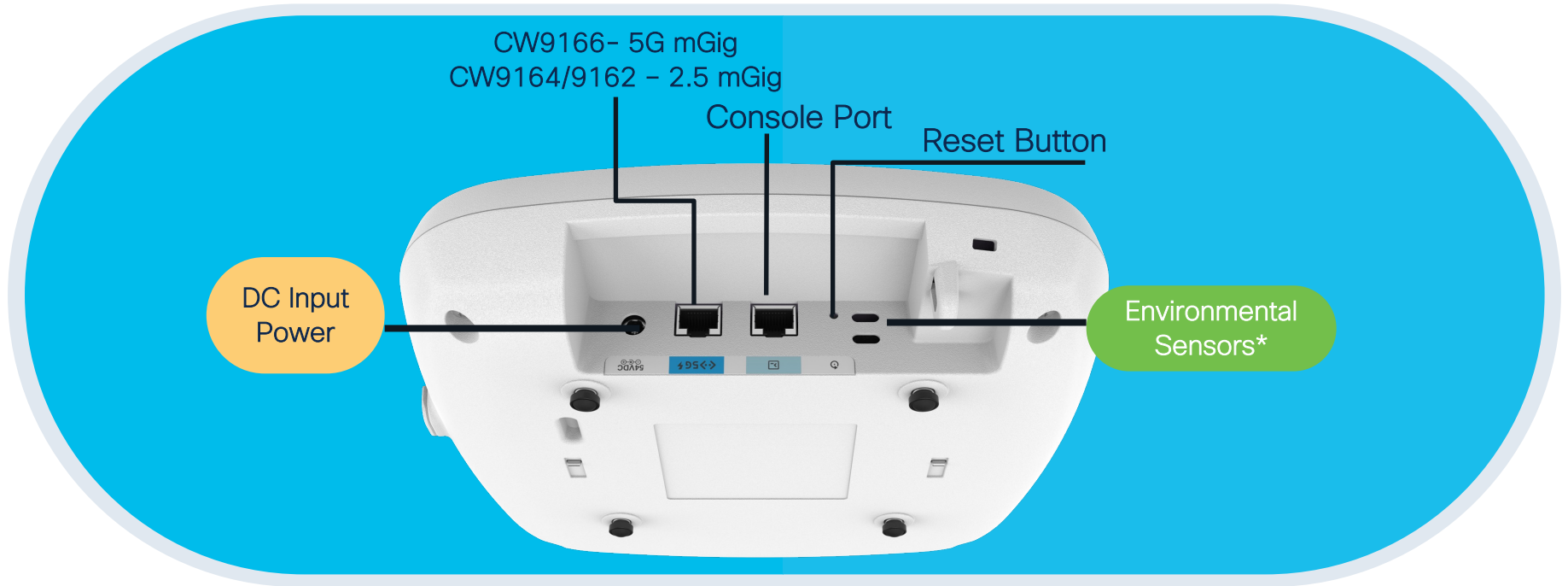
Catalyst 9136 ports

Ports and connections



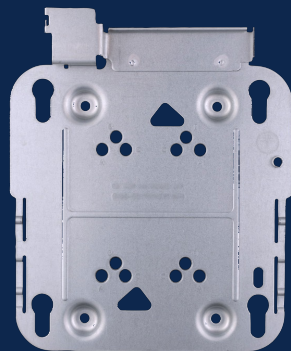
Catalyst CW9166/64/62

Ports and connections



* Environmental Sensors Available only in CW9166

AIR-AP-BRACKET-1 photos



Front side

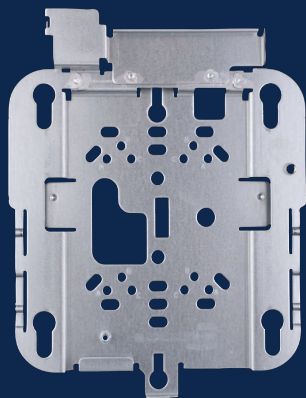


AP mounted

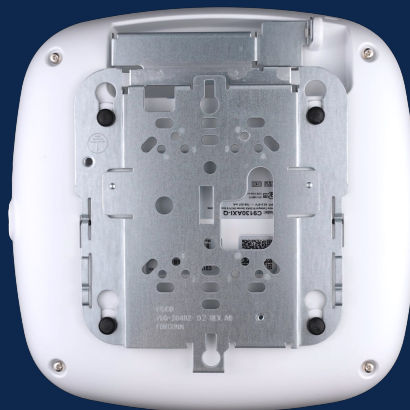


Back side

AIR-AP-BRACKET-2 photos



Front side



AP mounted



Back side

Conversion overview



Done from C9800 WLC

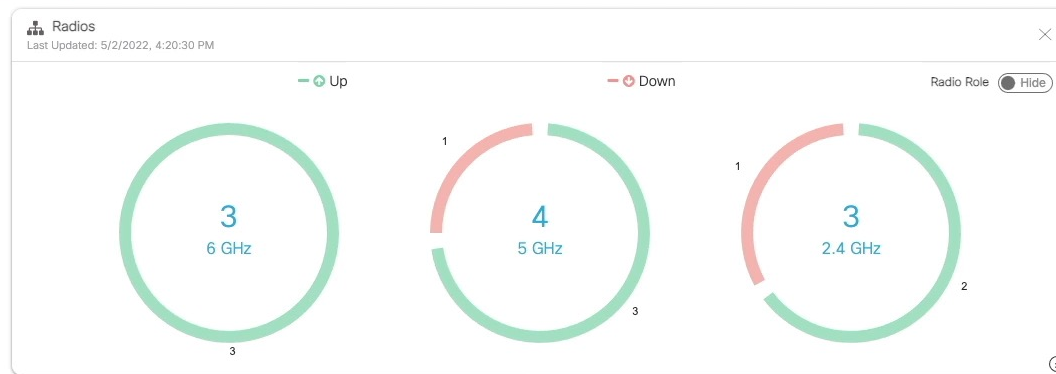


Call Meraki Support
(Needs license)

Dashboard

Network 6 GHz: 3 5 GHz: 3 2.4 GHz: 3	Wireless LANs 4 0	Access Points 3 0 0 Not Joined	Clients Active: 1 Excluded: 0 Sleeping: 0	Rogues APs: 190 Clients: 59 Ad-Hoc: 1	Interferers 5 GHz: 0 2.4 GHz: 5
--	--------------------------------	---	---	---	--

Overview



Top Access Points
 Last Updated: 5/2/2022, 4:20:30 PM

Sort by: APs With Highest Client Count

Ad... Sta...	AP Name	AP MAC	Clients	Data Usage	Throughput
✓	CW91661-1	10f9.20fe.1ea0	1	215 MB	2.9 Kbps

Top WLANs
 Last Updated: 5/2/2022, 4:20:30 PM

Sort by: WLANs With Highest Client Count

WLAN Name	ID	Clients	Data Usage
dot1x1	2	1	215 MB
dot1x2	3	0	52 KB

Client Device Types
 Last Updated: 5/2/2022, 4:20:29 PM

BRK2024

System Information
 Last Updated: 5/2/2022, 4:20:30 PM

- Hostname: C9800-CL
- Device Uptime: 6 hours, 18 minutes
- System Time: 16:17:31.084 Pacific Mon May 2 2022
- Device Type: C9800-CL

IoT & Environmental Sensors

Catalyst 9136/9166I have three built-in environmental sensors with full Cisco Spaces integration



AP Product	IOS-XE Release
Catalyst 9166I	17.9.1



Air quality



The built-in Gas Sensor Module will enable the reading of Total Volatile Organic Compound (TVOC) concentration and Indoor Air Quality (IAQ) rating.



Humidity



The built-in module is a fully calibrated sensor with the ability to measure the relative humidity in the air.



Temperature



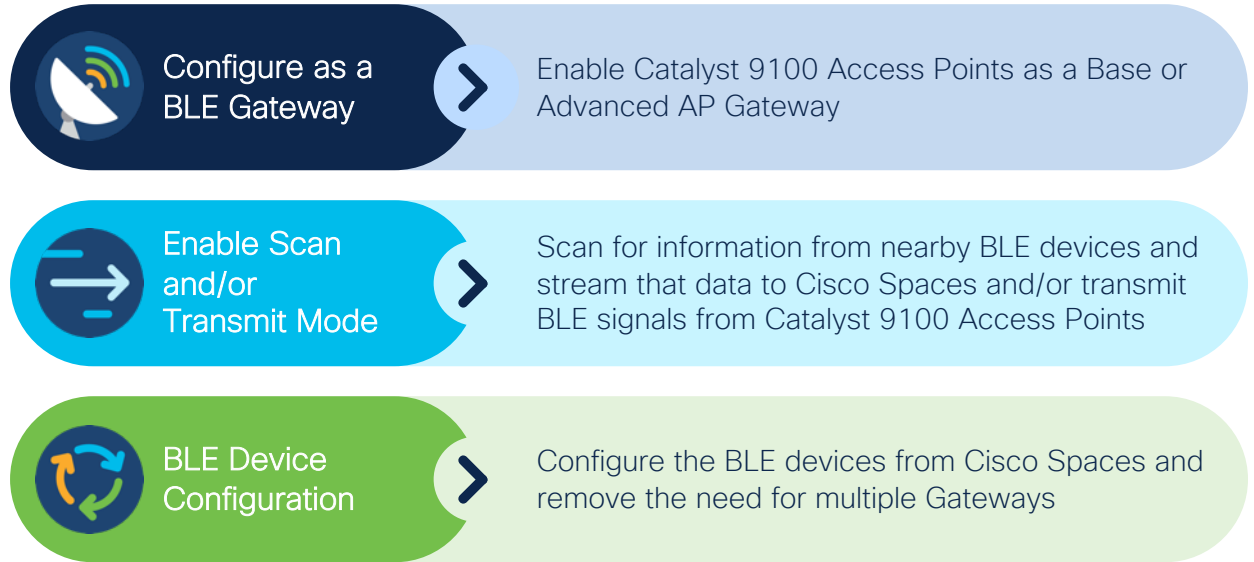
The built-in module can also capture the temperature to provide a reading of the environment remotely.

Note: The temperature generated by the AP will be considered during temperature and IAQ readings.

Catalyst 9100 Series Access Points have a built-in IoT radio which integrates with Cisco Spaces



AP Product	IOS-XE Release
CW9164/9166I	17.9.1
CW9162I	17.9.2/17.10.1





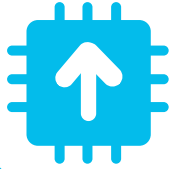
CleanAir™ Pro

RF Excellence



Cisco CleanAir™ Pro

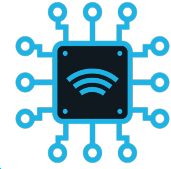
15 years of RF Excellence and Counting...



Cisco CleanAir™

RF-ASIC - SaGE Based Excellence

- Purpose built for 2.4 and 5 GHz
- Designed for many common consumer devices – in 2005



Cisco CleanAir™ Pro

Evolution into 6 GHz

- Full 2.4, 5 and 6 GHz Band support
- Multiradio Architecture
- AI/ML driven Scan Radio
- ML Based Interference Classification – On the AP

Cisco CleanAir Pro™

The Evolution of Cisco Wi-Fi Excellence into 6 GHz



Spectrum Based Features

- 6 GHz Spectrum Analysis (iCap)
- 6 GHz RRM enhancements
- FastLocate

*Classification & Reporting

- ML based interference classifier
- RF Interference Detection Reports
- Air Quality Index Reports

Above & Beyond

- AFC integration**
- ML driven Dynamic Interference signature updates & capture**
- IoT Radio integration**

6E Ready

- 6E Packet capture (iCap)
- WIDS/WIPS/Rogue Detection

IOS-XE 17.7
DNAC 2.3.2 (Frey)

Great for client device testing and validation

IOS-XE 17.8
DNAC 2.3.3 (Guardian)

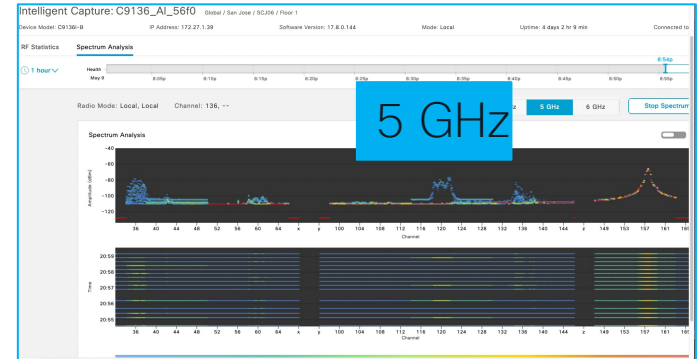
Spectrum Insight is foundational
for great Wi-Fi

IOS-XE 17.9 *2.4 and 5 GHz only
DNAC 2.3.4 (Groot)

IOS-XE 17.10 6 GHz Detection

CleanAir™ Pro and Cisco DNA Center Assurance iCAP Spectrum for 6 GHz!

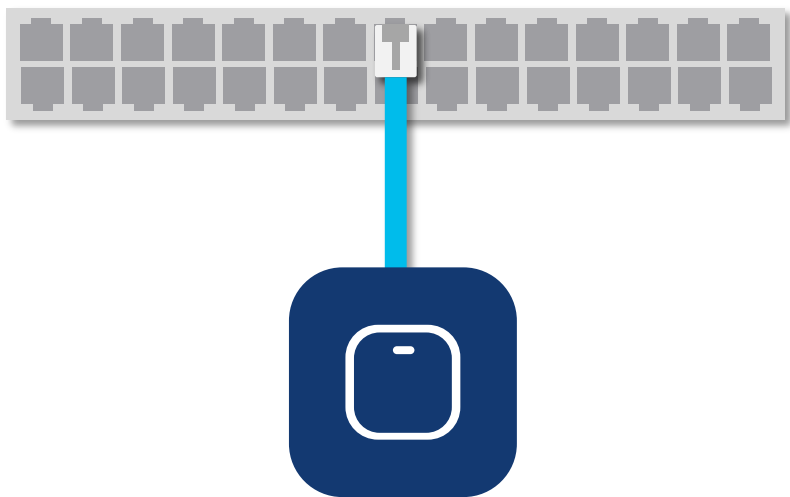
- Enabled with the first release
- iCAP Spectrum allows viewing of raw Spectrum from CleanAir Pro enabled Catalyst APs
- 2.4, 5 and 6 GHz spectrum available on demand!
- IOS-XE 17.8 and Cisco DNA Center 2.3.2 w/Assurance required



Catalyst AP to switch connection



Catalyst AP to Switch connection



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

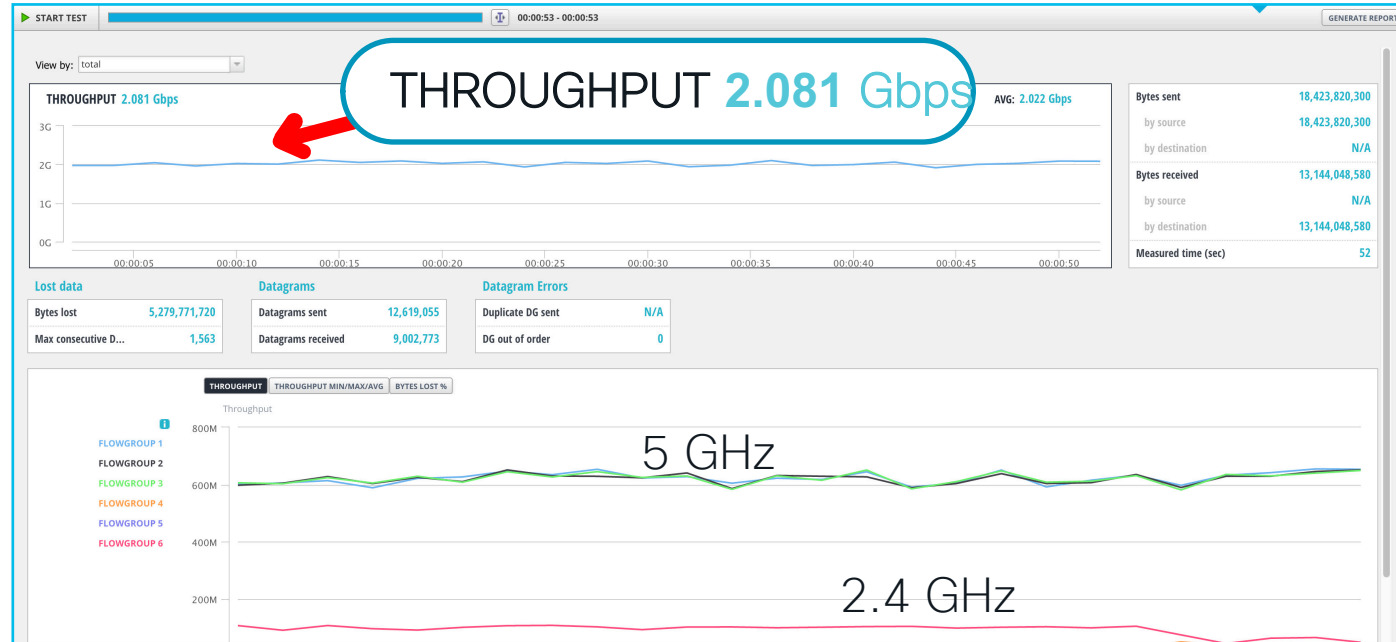
MGig switchport is recommended as Wi-Fi 6/6E speed may exceed 1 Gbps

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

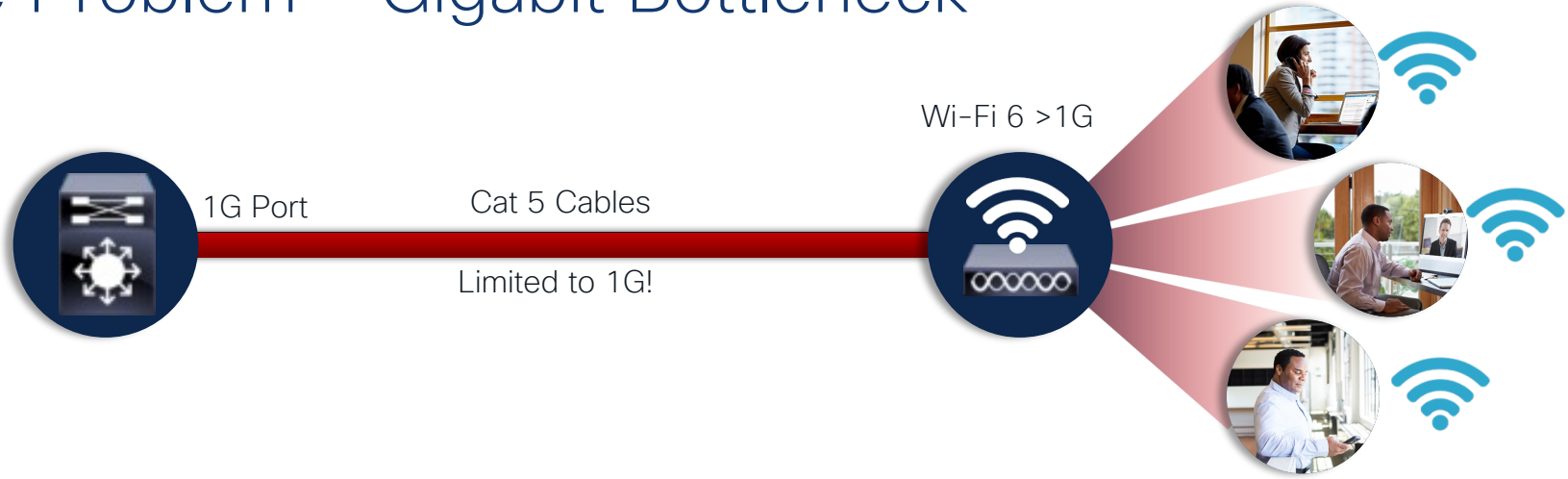
CDP = Cisco Discovery Protocol
LLDP = Link Layer Discovery Protocol
Cat = Category (of ethernet cable)

Wi-Fi 6 needs 80 MHz for + 1 Gbps

3x Intel AX200 on 2.4 GHz @20 MHz and 3 x Intel AX200 on 5 GHz at 80 MHz



The Problem - Gigabit Bottleneck

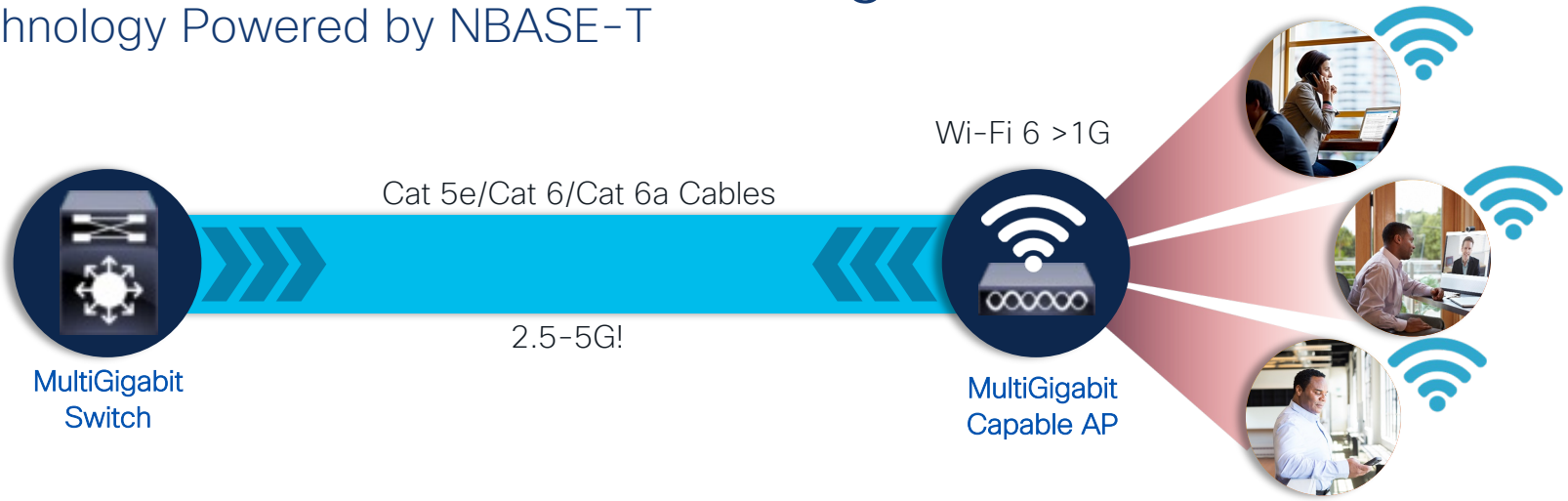


Existing Gigabit infrastructure is insufficient to handle .11x growth beyond 1Gbps

Gigabit Ethernet has been around since 1999 and had become the bottleneck for next gen access

Market needed an innovative technology to support >1Gbps over existing cables

The Solution – Cisco MultiGigabit Technology Powered by NBASE-T



Is a game-changing innovation allowing enterprise networks to evolve beyond 1G

Enables 2.5 and 5* Gbps up to 100m on legacy cables;
Fully 802.3bz compliant

** When bundled 30-50m length*

Supports all PoE standards up to 90W

Delivers up to 5X Speeds in Enterprise without replacing Cabling Infrastructure



Reference

MultiGigabit Cabling Investment Protection

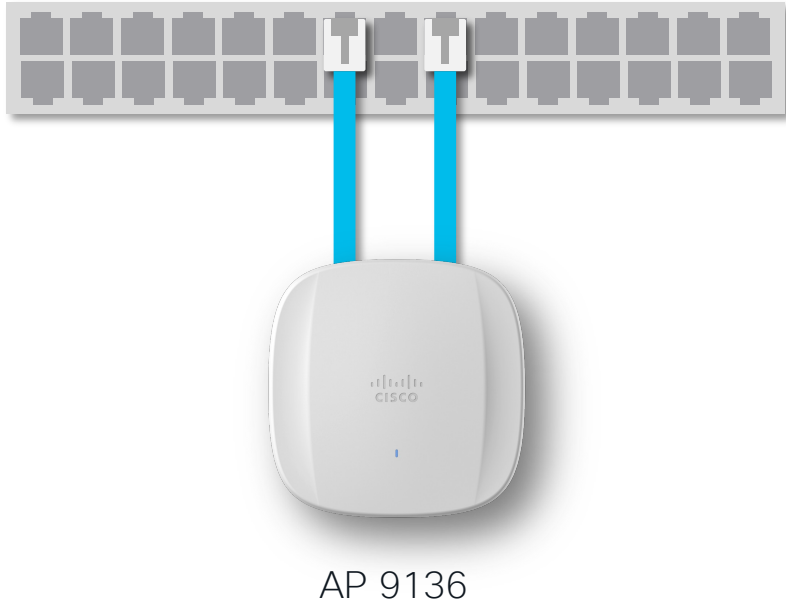
Auto-negotiable Speeds – Interoperates with legacy ports at 100 Mbps and higher

Brownfield Deployments can leverage existing Cat5e cables, extending ROI, and supporting speeds at 2.5G and 5G at a distance of 100m

Greenfield Deployments with Cat6a Will Support 10G – They can also support speeds at 2.5G and 5G at a distance of 100m

Cable Type	1G	2.5G	5G	10G
Cat5e	✓	✓	✓	NA
Cat6	✓	✓	✓	55 m
Cat6a	✓	✓	✓	✓

Catalyst AP 9136 to Switch connection



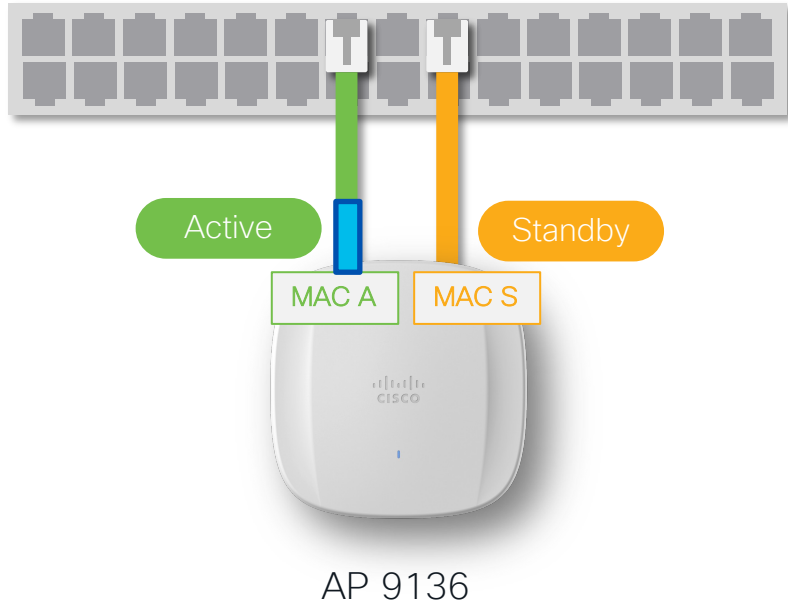
C9136 has two mGig uplink ports

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

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

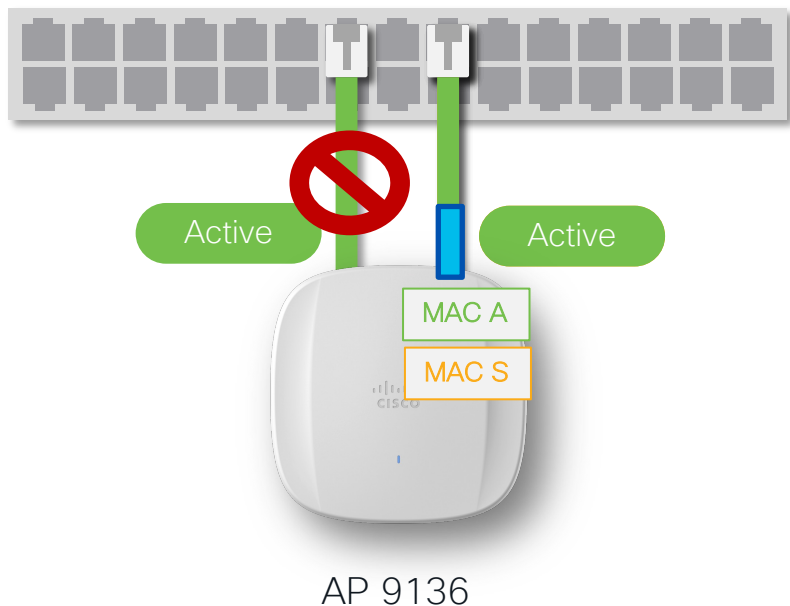
mGig = multi gigabit ethernet
PoE = Power over Ethernet
LAG = Link Aggregation Group

Catalyst AP 9136 to Switch connection



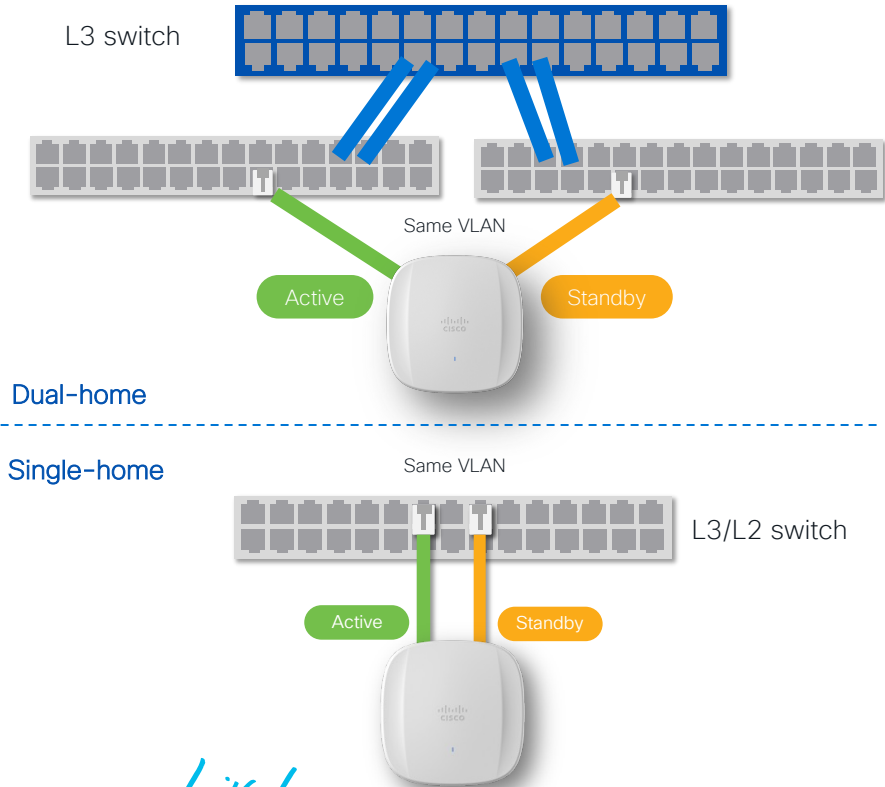
- When configured as standalone ports, one becomes **active** and the other one **standby**
 - If power is equal on both ports, Port 0 becomes **active**. Otherwise, the one with more power
- Traffic is exchanged on **active** port using active **MAC A** (CAPWAP, ARP, etc.)
- **Standby** port only exchanges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

Catalyst AP 9136 to Switch connection



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

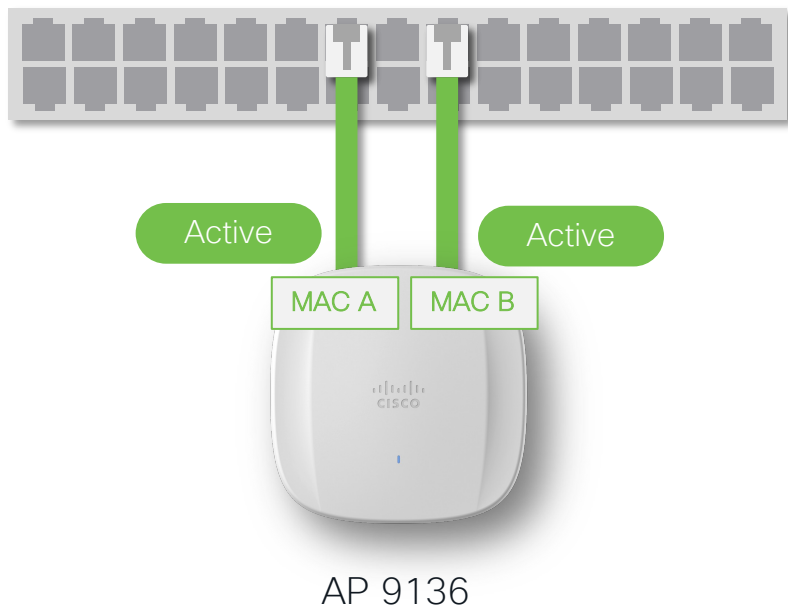
Catalyst AP 9136 to Switch connection



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

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

Catalyst AP 9136 to Switch connection



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

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

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

Catalyst CW9162 Power over Ethernet

Default Configuration (Fixed Power profile)

Power Source	Number of Spatial Stream	2.4 GHz Radio	5 GHz Radio	6 GHz Radio	mGig Link Speed	USB	AI/ML Driven Scanning Radio
802.3af	2	Disabled	1x1	1x1	1G	Disabled	Y
802.3at	6	2x2	2x2	2x2	2.5G	Y/4.5 W	Y
802.3bt	6	2x2	2x2	2x2	2.5G	Y/4.5 W	Y
DC Power	6	2x2	2x2	2x2	2.5G	Y/4.5 W	Y

Note:

1. AIR-PWRINJ7 is C9164I's official 802.3bt Power Injector

USB = universal serial bus
AI = Artificial Intelligence
ML = Machine Learning

Catalyst CW9164 Power over Ethernet

Default Configuration (Fixed Power profile)

Power Source	Number of Spatial Stream	2.4 GHz Radio	5 GHz Radio	6 GHz Radio	mGig Link Speed	USB	AI/ML Driven Scanning Radio
802.3af	n.a.	Disabled	Disabled	Disabled	1G	Disabled	Y
802.3at	10	2x2	4x4	4x4	2.5G	Disabled	Y
802.3bt	10	2x2	4x4	4x4	2.5G	Y/4.5 W	Y
DC Power	10	2x2	4x4	4x4	2.5G	Y/4.5 W	Y

Note:

1. AIR-PWRINJ7 is C9164I's official 802.3bt Power Injector
2. Actual Power Draw data will be available later (as final testing is in progress)

USB = **universal serial bus**
AI = Artificial Intelligence
ML = Machine Learning

Catalyst CW9166 Power over Ethernet

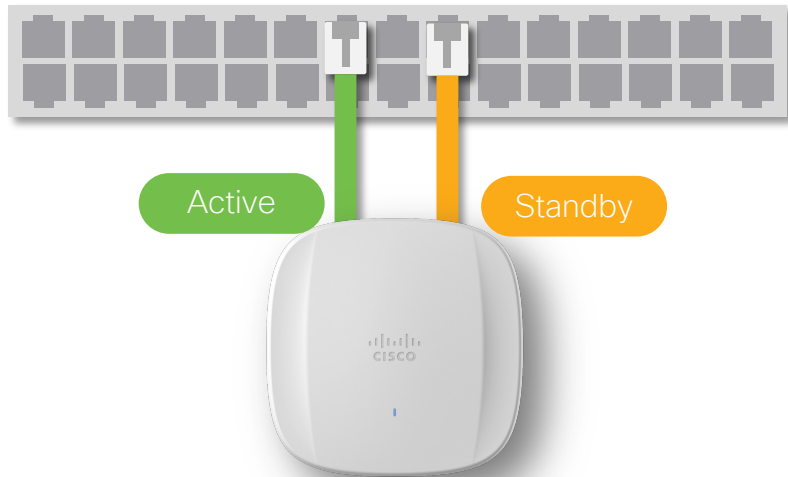
Default Configuration (Fixed Power profile)

Power Source	Number of Spatial Stream	2.4 GHz Radio	5 GHz Radio	5 GHz /6 GHz Radio (LPI)	mGig Link Speed	USB	Env Sensors	AI/ML Driven Scanning Radio
802.3af	n.a.	Disabled	Disabled	Disabled	1G	Disabled	Y	Y
802.3at	12	4x4	4x4	4x4	5G	Disabled	Y	Y
802.3bt	12	4x4	4x4	4x4	5G	Y/4.5 W	Y	Y
DC Power	12	4x4	4x4	4x4	5G	Y/4.5 W	Y	Y

Note:

1. AIR-PWRINJ7 is C9166I's official 802.3bt Power Injector
2. Actual Power Draw data will be available later (as final testing is in progress)

Catalyst 9136 Power Consumption (dual port)



Both ports negotiate power and need to be considered for budget

If no-LAG, Standby port consumes very little power

If LAG, both ports are active, and they both draw power

Power Allocated

Power Consumed

Port 0

48.3 W

16.5 W

Port 1

48.3 W

0.5 W

Catalyst 9136I Power over Ethernet

Default Configuration (Fixed Power profile)

Power source	Number of spatial streams	2.4-GHz radio (slot 0)	Primary 5-GHz radio (slot 1)	Secondary 5-GHz radio (slot 2)	6-GHz radio (slot 3)	mGig PHY 0 link speed	mGig PHY 1 link speed	USB	AI/ML-driven scanning radio	Env. sensors	Max power draw
802.3af (PoE)	0	Disabled	Disabled	Disabled	Disabled	1G	Disabled	Disabled	Y	Y	14W
802.3at (PoE+)	8	2x2	4x4	Disabled	2x2	2.5G	2.5G (Standby)	Disabled	Y	Y	24.4W
802.3bt (UPOE)	16	4x4	8x8 or dual 4x4	4x4	4x4	5G	5G	Yes/9W	Y	Y	47.3W

Note:

- Slot 2 can operate only together with slot 1 in 8x8 mode. Independent slot 2 operation is not supported until a future software release.
- AIR-PWRINJ7 is the 9136I's official 802.3bt power injector.

PHY = Physical layer
 PoE = Power over Ethernet
 UPOE = Universal Power over Ethernet

AP Power Optimizations Feature Suite

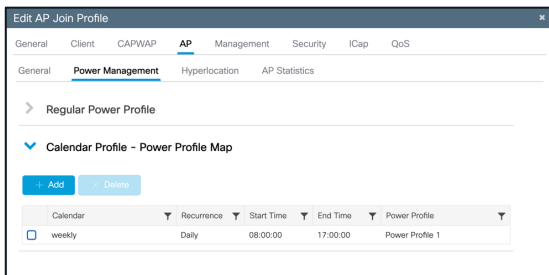
Save Power, Reallocate Power, and Visibility into Savings

AP Power Save Mode

Lower AP Power Usage



- Create a calendar profile for off-peak hours.
- Create a power profile to lower the power consumption budget during off-peak hours.
- Power Profile: Shut AP Radio or lower spatial Stream, lower port speed, disable USB port.



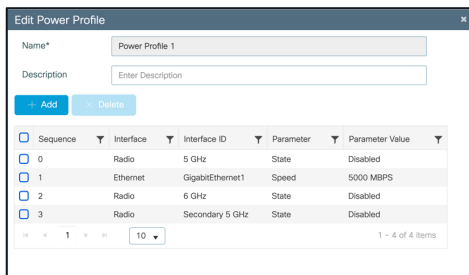
IOS-XE 17.8

AP Power Distribution

Control over how power is used



- Reallocate extra AP Power to different radios while operating on PoE+ (30W).
- Customization of your PoE power budget.
- Example: Disable 2.4 GHz radio -> use extra power for 6 GHz radio.

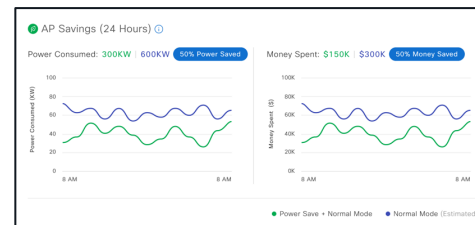


IOS-XE 17.10

AP Power Savings Insight



- Cisco DNA Center PoE dashboard integration.
- Power Savings, Money Savings, Emissions Reductions.
- Visibility into trends and insights.
- Both site level and AP level view.



Note: Cisco DNA Center integration is on the roadmap

Supported on 9115, 9120, 9130, 9136, 9166, 9164, 9162

RF Design



Setting the stage

- Regulatory Considerations
- Wi-Fi 6E Security
- Client Ecosystem

AP Deployment

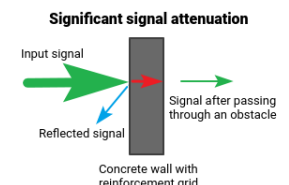
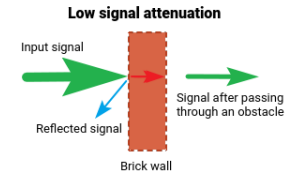
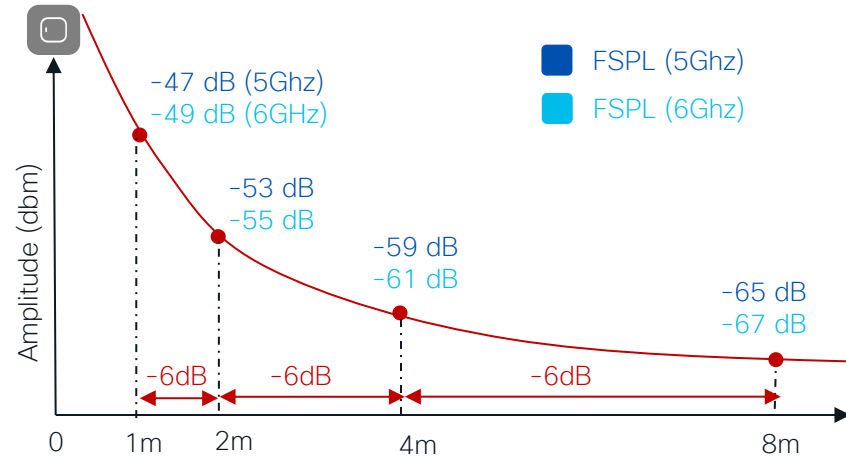
- AP Specs
- Power Requirements
- Switching Infrastructure

RF Design

- AP Coverage
- AP Density
- RRM for 6 GHz

What you need to consider?

- **Path Loss (FSPL)*** - Path loss in the first meter is on average **2dB higher at 6GHz** vs. 5GHz. After that, the 6 dB rule applies: doubling the distance results in a 6 dB loss, regardless of the frequency
- **Cell Size** - At 6 GHz @ same power level cell is smaller vs. cell size at 5 GHz
- **Absorption/Reflectance** - 6 GHz will be attenuated more through wall or other surface
- **Noise floor** at 6 GHz is much lower than 5 GHz, at least for some time 😊
- **Coverage type**: Today 6GHz is indoor only

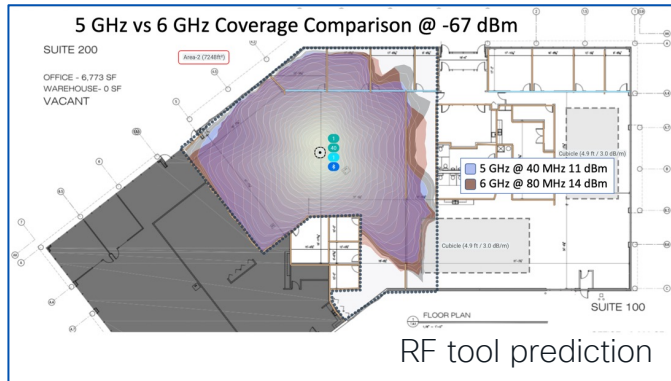


(*) FSPL = Free Space Path Loss: https://en.wikipedia.org/wiki/Free-space_path_loss

<https://help.keenetic.com/hc/en-us/articles/213968869-Wi-Fi-signal-attenuation-coefficients-when-passing-through-different-materials>

RF Design considerations

- AP antenna patterns at 6GHz are similar to 5GHz
- **AP coverage** between 5GHz and 6GHz will be similar, especially in open spaces BUT it does require to compensate with **power > 3dB higher in 6GHz**



- 5GHz @40 MHz 11dbm
- 6GHz @80 MHz 14 dbm

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

RF Design considerations

- 1:1 AP replacement for brownfield, assuming:
 - Cell size 1500/2000 ft² (140 – 190 m²) with 10 ft. (3 m) ceiling height
 - Power levels of 11–15 dBm in 5 GHz > power can easily be adjusted upward for 6 GHz to match 5GHz

Rule of Thumb :

- *5 GHz network with RRM operating at power levels 3-4? >then equal 5 and 6 GHz coverage is possible with a one for one AP replacement in both ETSI and FCC. Assuming 80 MHz channel in FCC and 40 MHz channel in ETSI/UK*
- *If the power level is in 1-2, then you may need around 10 to 20% additional access points.*
- For greenfield, a site survey is recommended: leverage the new site survey mode on Cisco Wi-Fi 6E APs
- Mixing Wi-Fi6E APs with existing APs in the same area is **not recommended** > avoid “salt & pepper” design if you can



New Gear!!! Wi-Fi 6E Measurement !

Ekahau Sidekick 2

- 2.4, 5, 6 GHz
- Ekahau AI Pro
- Ekahau Analyzer



NetAlly Aircheck G3

- 2.4, 5, 6 GHz
- NetAlly Link-Live



- Ekahau Sidekick 1
- 2.4, 5 GHz
- Ekahau AI Pro



Catalyst Wi-Fi 6E Site Survey Mode



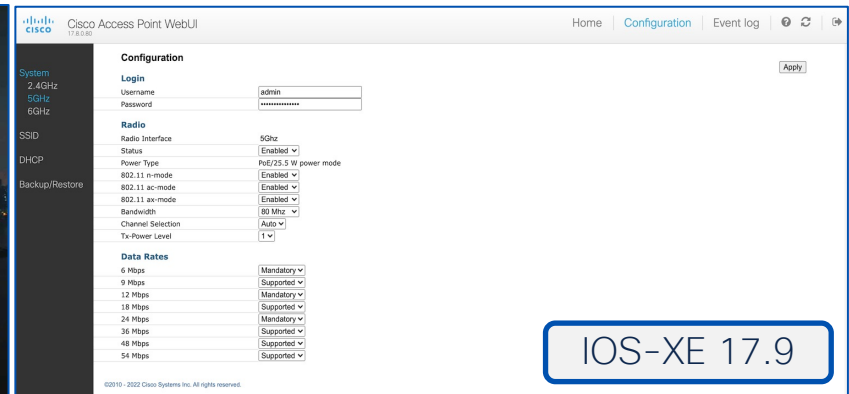
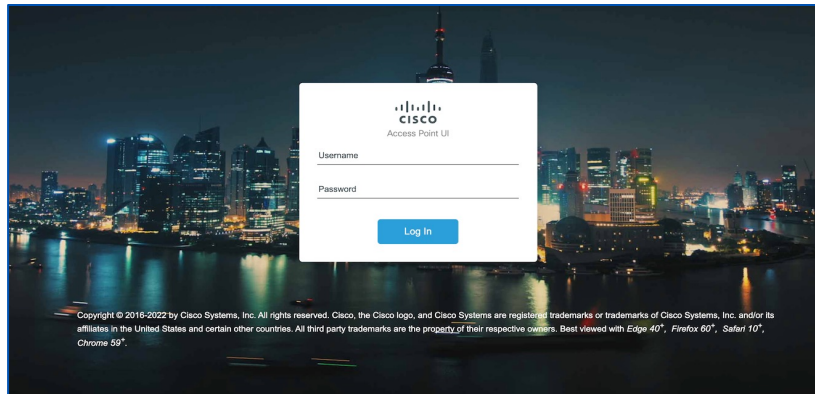
AP in standalone mode, broadcasting SSIDs across all 3 bands
Embedded DHCP server provides Client IP

WebUI access for easy configuration and viewing of various RF metrics for RF coverage and planning

Supports configuration of channel number, channel width, Tx power, SSID, and data rates

Site survey mode configuration steps

1. Change AP to site survey mode > Enter command “ap site-survey”
C9136#ap ?
capwap Switch to CAPWAP AP type
site-survey Switch to Site Survey AP type
2. After bootup, the AP is automatically assigned a static IP of 10.0.23.1.
3. AP will start broadcasting the **C9136_site_survey** with Open/OWE authentication security
4. Connect your wireless client with the site survey SSID and it'll receive an IP from 10.0.23.0/24
5. Access the Catalyst 9136 Site Survey WebUI via 10.0.23.1



6 GHz Predictive view with WCAE Tool

Get a taste of how the network would look, without adding any Aps!

WCAE Version: 0.9.11 or later

Configuration Checks:

[Controller Checks Results](#)

[APs Checks Results](#)

Controller: C9800-CL

[Data Summary](#)

[Log Summary](#)

[Upgrade Advisor](#)

[WLAN Summary](#)

[Interface Summary](#)

[RF Profiles 2.4 GHz](#)

[RF Profiles 5 GHz](#)

[RF Profiles 6 GHz](#)

[Site Tags](#)

[Resources](#)

[AAA Server Details](#)

[WNCD Load Distribution](#)

[Tag/Policy Usage](#)

[RF Stats 2.4GHz](#)

[RF Stats 5GHz](#)

[RF Stats 6GHz](#)

Client Audit

[Apple IOS](#)

[Cisco 8821](#)

[Drager](#)

[Spectralink](#)

[Vocera](#)

AP Information

[APs Configuration](#)

[APs Slot Configuration](#)

[APs Interface Status](#)

[APs RF Summary 2.4GHz](#)

[APs RF Summary 5GHz](#)

[APs RF Summary 6GHz](#)

[APs RF Health Details](#)

[APs NDP Summarization 2.4GHz](#)

[APs NDP Summarization 5GHz](#)

[APs NDP Summarization 6GHz](#)

[APs RF Neighbors 2.4GHz](#)

[APs RF Neighbors 5GHz](#)

[APs RF Neighbors 6GHz](#)

[6GHz Predictive Planning](#)

Get to Know Average Power Level with WCAE Tool

Summarization Level	Name	Channel	APs	Clients	Average Power	Average Power dBm
Controller	9800-a	48	42	17	1.81	14.57
Controller	9800-a	64	257	20	1.58	16.25
Controller	9800-a	132	173	12	2.1	19.6
Controller	9800-a	36	311	16	1.36	15.92
Controller	9800-a	100	213	30	2.2	19.34
Controller	9800-a	112	90	9	2.8	17.57
Controller	9800-a	56	11	2	1.36	16.91
Controller	9800-a	108	16	0	2.12	19.62
Controller	9800-a	52	115	11	1.89	15.34
Controller	9800-a	40	9	0	1.44	15.67
Controller	9800-a	44	49	4	2.12	13.63
Controller	9800-a	104	8	0	1.88	20
Controller	9800-a	60	16	4	1.19	17.44
Controller	9800-a	136	34	3	2.04	17.18
Controller	9800-a	116	1	0		

Example of site with Low 5 GHz coverage

1. Check Channel Stats 5 GHz
2. Presents summary per channel at Controller or Site-tag level of average power levels

Controller	9800-b	36	82	20	5.63	2.79
Controller	9800-b	52	26	3	5.62	2.62
Controller	9800-b	64	53	11	5.42	3.13
Controller	9800-b	132	68	12	7.15	3.53
Controller	9800-b	100	49	11	7.04	3.82
Controller	9800-b	112	45	17	7.16	3.53
Controller	9800-b	48	20	2	5.95	2.05
Controller	9800-b	44	21	6	6.24	0.24
Controller	9800-b	104	4	1	6	7.75
Controller	9800-b	108	1	0	4	14
Controller	9800-b	56	13	4	5.54	2.69
Controller	9800-b	40	2	0	3	12
Controller	9800-b	136	3	0	6.33	7

Example of site with Good 5 GHz coverage

6 GHz Predictive view with WCAE Tool

6GHz predictive” view of how the power distribution, Nearby relationships, and RSSI for clients would look.

Name	Radio Mac	Slot	Country	5GHz Power Level	5GHz Power dBm	6GHz Predicted Level	6GHz Predicted dBm	5GHz Effective Neighbors	Predicted 6GHz Neighbors
AP1	08-4F-A9-9C-E3-00	1	US	5	8	4	8	15	2
AP2	08-4F-A9-9C-E3-01	1	US	3	14	2	14	11	8
AP3	08-4F-A9-9C-E3-02	1	US	4	11	3	11	12	9
AP4	08-4F-A9-9C-E3-03	1	US	4	11	3	11	8	6
AP5	08-4F-A9-9C-E3-04	1	US	4	11	3	11	19	14
AP6	08-4F-A9-9C-E3-05	1	US	3	14	2	14	10	8
AP7	08-4F-A9-9C-E3-06	1	US	3	17	1	17	11	7
AP8	08-4F-A9-9C-E3-07	1	US	4	11	3	11	16	10
AP9	08-4F-A9-9C-E3-08	1	US	2	17	1	17	4	4
AP10	08-4F-A9-9C-E3-09	1	US	4	11	3	11	13	12
AP11	08-4F-A9-9C-E3-10	1	US	1	20	1	17	4	3
AP12	08-4F-A9-9C-E3-11	1	US	5	8	4	8	22	13
AP13	08-4F-A9-9C-E3-12	1	US	4	11	3	11	10	8
AP14	08-4F-A9-9C-E3-13	1	US	3	14	2	14	11	8
AP15	08-4F-A9-9C-E3-14	1	US	4	11	3	11	24	16
AP16	08-4F-A9-9C-E3-15	1	US	5	8	4	8	12	9
AP17	08-4F-A9-9C-E3-16	1	US	5	11	3	11	23	16
AP18	08-4F-A9-9C-E3-17	1	US	5	8	4	8	10	10
AP19	08-4F-A9-9C-E3-18	1	US	5	8	4	8	16	12
AP20	08-4F-A9-9C-E3-19	1	US	4	11	3	11	16	10
AP21	08-4F-A9-9C-E3-20	1	US	4	11	3	11	11	9
AP22	08-4F-A9-9C-E3-21	1	US	5	8	4	8	11	9
AP23	08-4F-A9-9C-E3-22	1	US	5	11	3	11	18	9
AP24	08-4F-A9-9C-E3-23	1	US	4	11	3	11	17	10
AP25	08-4F-A9-9C-E3-24	1	US	1	20	1	17	1	1
AP26	08-4F-A9-9C-E3-25	1	US	4	11	3	11	11	6
AP27	08-4F-A9-9C-E3-26	1	US	2	17	1	17	9	8
AP28	08-4F-A9-9C-E3-27	1	US	1	20	1	17	1	1
AP29	08-4F-A9-9C-E3-28	1	US	5	11	3	11	24	13
AP30	08-4F-A9-9C-E3-29	1	US	5	11	3	11	24	17
AP31	08-4F-A9-9C-E3-30	1	US	4	11	3	11	11	10
AP-HOS-SON-2001	08-4F-A9-9D-B1-C0		US	4	14	2	14	16	10

Matches FCC or ETSI regulatory requirements.

Wi-Fi Network Design



Setting the stage

- Regulatory Considerations
- Wi-Fi 6E Security
- Client Ecosystem

AP Deployment

- AP Specs
- Power Requirements
- Switching Infrastructure

RF Design

- AP Coverage
- AP Density
- RRM for 6 GHz

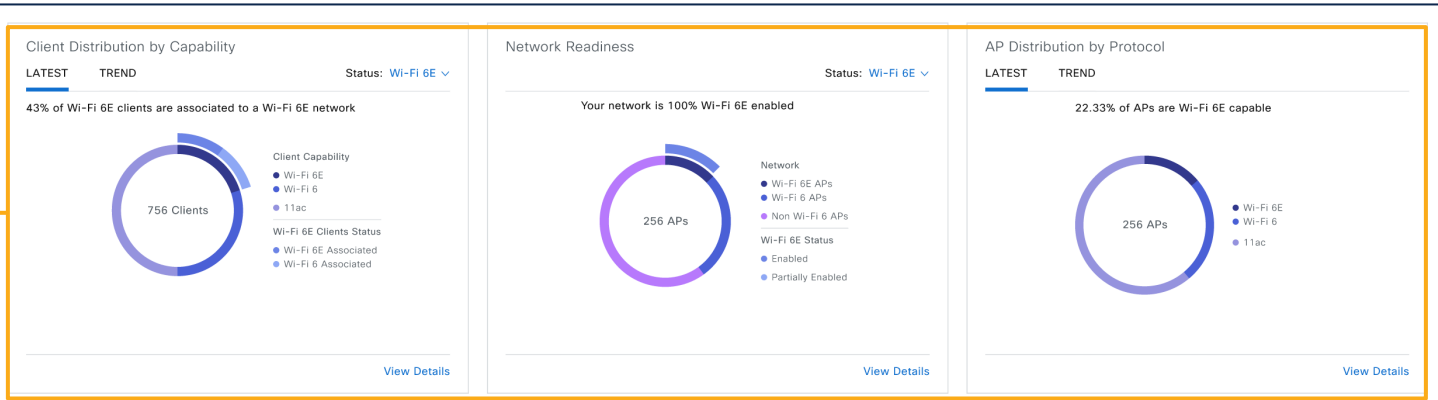
Wi-Fi Network Design

- Adoption/Migration
- WLAN/SSID Design

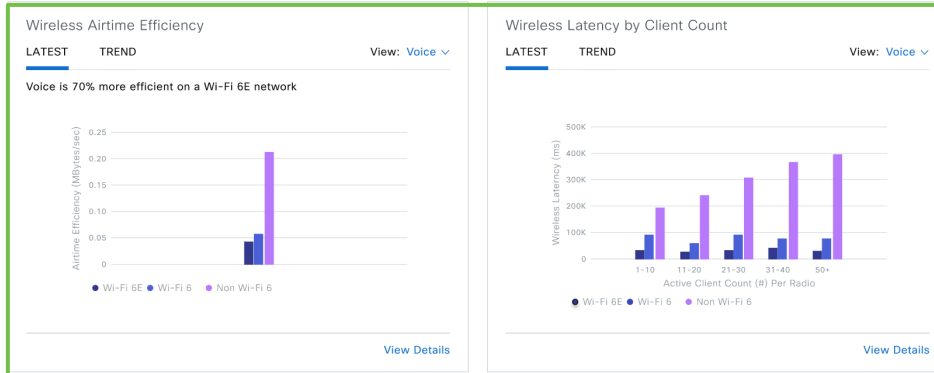
Wi-Fi 6E integrated into Wi-Fi 6 dashboard

Observe the readiness and benefits of 6 GHz from 2.3.2

Readiness



Benefits



Observe Channel Utilization in your Network

Show: **Access Points** KPI: **Channel Utilization**

Time range: **One Month: December 2022** Location: **Global** Band: **2.4 GHz** **5 GHz** **6 GHz** View by: **Avg** **Max**

SUMMARY

December 2, 2022 was the day with the highest average Channel Utilization in your network in the selected period.

Is this heatmap helpful?

76% Top AP by Channel Utilization: SCJ01_9136_6

8 No. of APs with avg Channel Utilization > 70%

Nov 04, 2022 **80%** Daily Max

Channel Utilization %
0 100

Select AP: **All APs**

Monthly View (November 2022) [Export](#)

Name	Band	AP daily max
SJC01_9136_15	5GHz	57.03%
SJC01_9136_12		
SJC01_9136_9		
LAB-...7.B788		
SCJ01_9136_5		
SCJ01_9136_7		
SCJ01_9136_6		
LAB-...7.B788		
SJC01_9136_9		
SJC01_9136_10		

Showing radios 1-22 of 22

1-22

Nov 4, 2022

SJC01_9136_15

Location: San Jose/SJC01

MAC: a0:f8:49:7e:c0:77

Radio: 5GHz

Slot: 1

Daily max: **77%**



Wi-Fi 6/6E runs on Cisco Catalyst Wireless

Supported Access Points



Catalyst 9800
Wireless LAN Controller (WLC)

Wi-Fi 6/6E

C9136



CW9166/64



CW9162



Wi-Fi 6

9130



9124



9120



9115



9105



Legacy Controllers (AireOS)



1

“Generation 1” controllers: 5508, 8510.

- Supported on 8.5 AireOS
- Allows IRCM with IOS-XE 9800 Controllers
- Supports both Wave 1 and Wave 2 AC Access Points (1700 to 3800)

2

“Generation 2” controllers: 5520, 8540, 3504

- Supported on 8.10 AireOS
- Allows IRCM with IOS-XE 9800 Controllers
- Supports Wi-Fi 6 Aps (Catalyst 9105, 9115, 9120 and 9130)

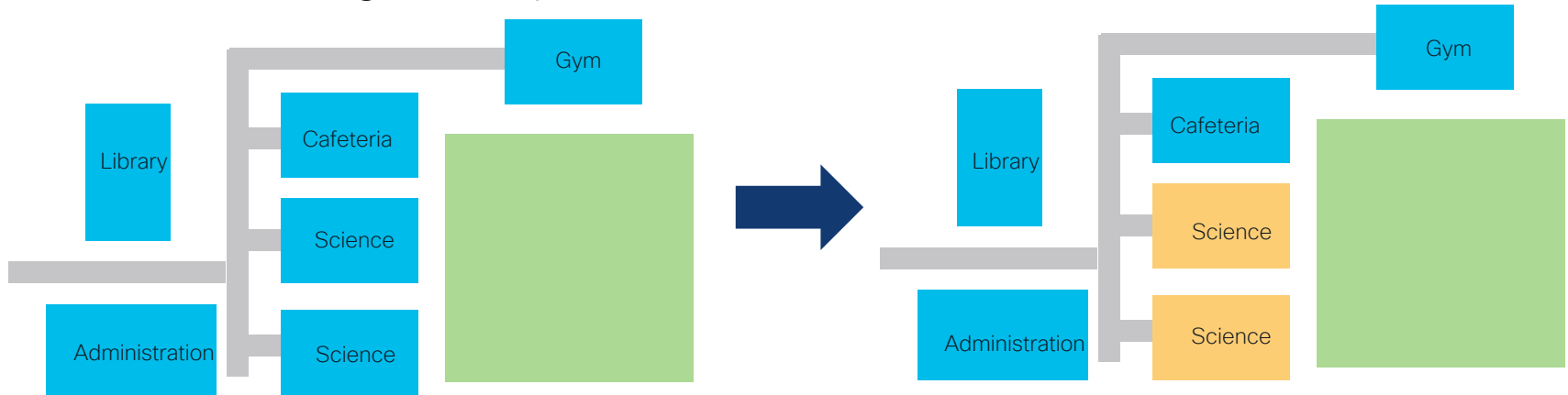
3

“Generation 1” controllers without IRCM: 2504, WiSM2, vWLC, 7510

- No mobility is possible between them and IOS-XE, so additional steps with different migration scenarios are needed

Migration Scenarios

- Move “per RF blocks”
- Move a building or complete floor into the new hardware and software

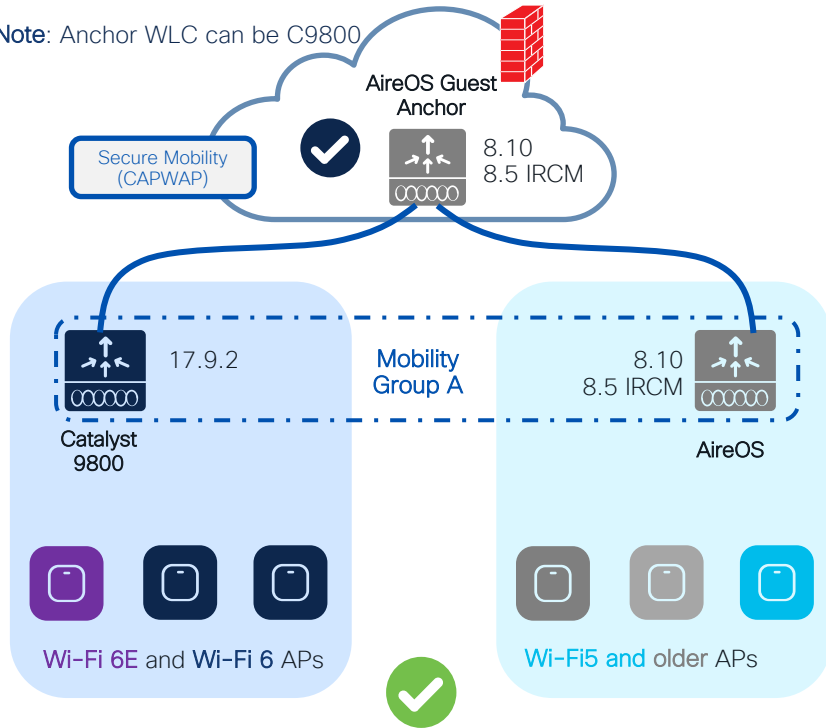


Avoid “Sale & Pepper” Deployments. Do not mix APs on different controllers at

How do I start adopting 6GHz?

Answer: Inter Release Controller Mobility (IRCM)

Note: Anchor WLC can be C9800



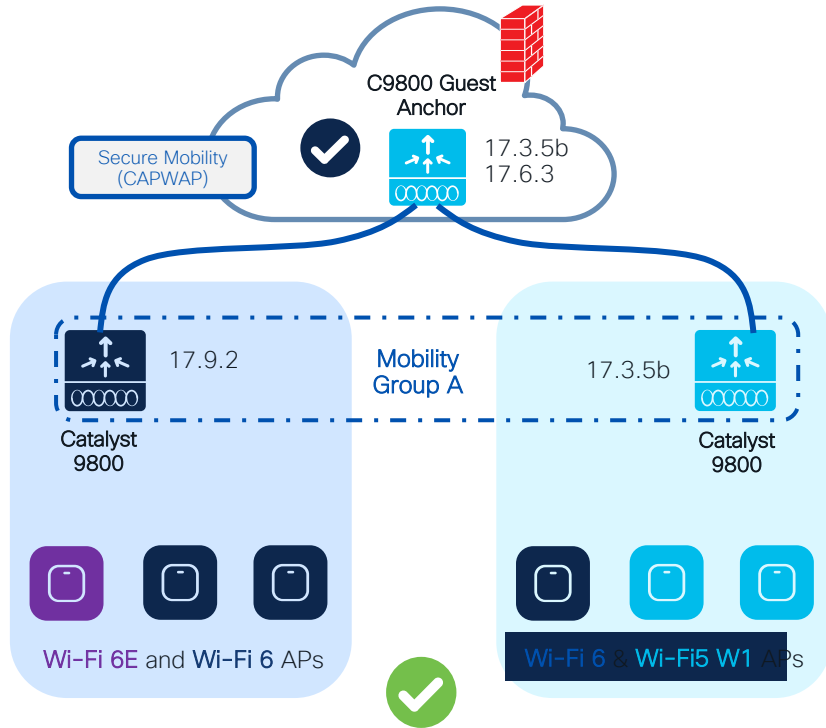
Scenario 1: Legacy Controller Supports IRCM

- Introduce new 6/6E 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-airesos_ircm_dg.html

How do I start adopting 6GHz?

Answer: Inter Release Controller Mobility (IRCM)



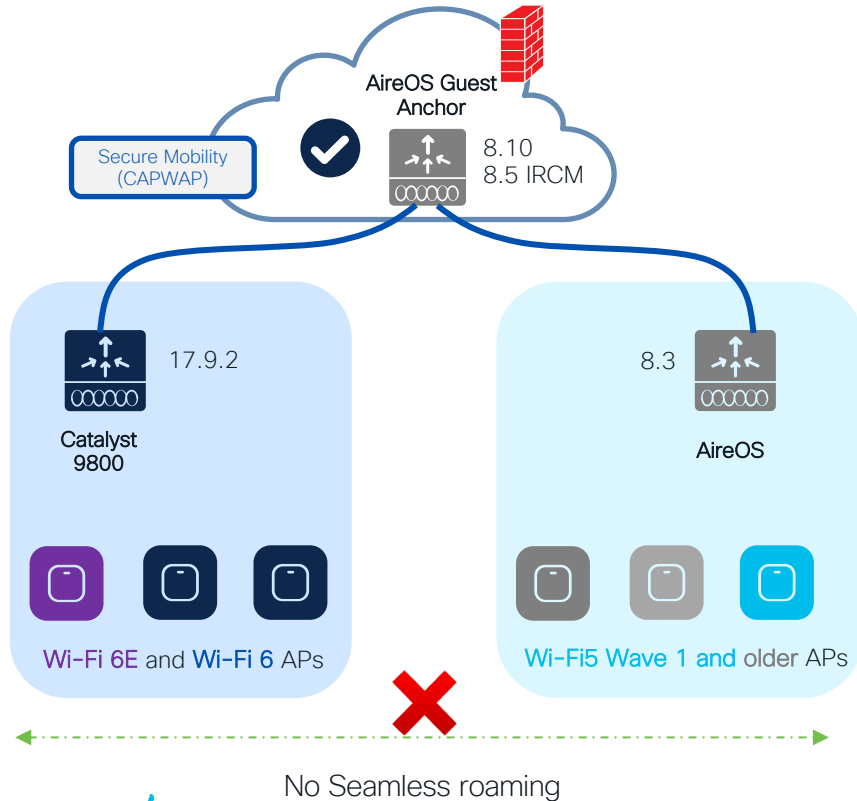
Scenario 2: AP is supported up to 17.3 but not in later version

- 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-aires_ircm_dg.html

How do I start adopting 6GHz?

Answer: Inter Release Controller Mobility (IRCM)



Scenario 3: Legacy Controller not supporting IRCM

- Not possible to establish IRCM between old controller and new 9800 handling 6E Aps
- Limits options available. Forces more aggressive migration process.
- Migration alternatives:
 - Keep the two networks separated ; migrate physical RF areas as new Aps are added.
 - Roaming is not possible.
 - Avoid migrations “per floor” as in most building types, it is normal to see clients roaming between Aps on different floor.
 - Temporarily, replace the legacy controller with one that supports IRCM.
- The release combinations shown have been tested at scale, check IRCM deployment guide*

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

WLAN/SSID Design



6GHz WLAN Design Considerations

6GHz SSID Requirements

- WPA3 L2 Security: **OWE, SAE or 802.1x-SHA256**
- Protected Management Frame (PMF) enabled
- Any non-WPA3 L2 security method is not allowed – **no mixed mode possible**

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. “**One SSID**” option: Configure multiple WLANs with the same SSID name, different security settings – **Most conservative**
3. “**Multiple SSIDs**” option: Redesign your SSIDs, adding specific SSID/WLAN with specific security settings – **Most flexible**

Most likely your current SSID configuration would prevent it from being broadcasted on 6GHz
Note: as 17.9.1, there is a limit of 8 SSIDs broadcasted on 6GHz radio

AKM = Authentication and Key Management
OWE = Opportunistic Wireless Encryption
SAE = Simultaneous Authentication of Equals
SHA-256 = Secure Hash Algorithm (SHA) 256 bit

Option 1



Pros

- Cleanest and simplest option
- No new WLAN and SSID to be managed
- Most secure with WPA3 everywhere



Cons

- Breaks support for existing clients that don't support WPA3 and PMF in 2.4 and 5GHz
- Requires full control on client devices and drivers

Option 2



WLAN design considerations

- **Option 2:** Single SSID but different AKM per band. For Cisco today, this means creating an additional WLAN for 6GHz, with same SSID name but different WLAN profile name and security settings (AKM):

Existing WLAN serving 2.4 and 5GHz

The screenshot shows the configuration page for a WLAN. The 'General' tab is active. The 'Profile Name*' is 'employee', 'SSID*' is 'employee', and 'WLAN ID*' is '9'. The 'Status' is 'ENABLED'. The 'Broadcast SSID' is also 'ENABLED'. On the right, the 'Radio Policy' section shows three bands: '6 GHz' (Status: DISABLED), '5 GHz' (Status: ENABLED), and '2.4 GHz' (Status: ENABLED). The '802.11b/g Policy' is set to '802.11b/g'.

New WLAN, same SSID name serving 6GHz

The screenshot shows the configuration page for a new WLAN. The 'General' tab is active. The 'Profile Name*' is 'employee-6GHz', 'SSID*' is 'employee', and 'WLAN ID*' is '10'. The 'Status' is 'ENABLED'. The 'Broadcast SSID' is also 'ENABLED'. On the right, the 'Radio Policy' section shows three bands: '6 GHz' (Status: ENABLED), '5 GHz' (Status: DISABLED), and '2.4 GHz' (Status: DISABLED). The '802.11b/g Policy' is set to '802.11b/g'. Security settings are shown as 'WPA2 Disabled', 'WPA3 Enabled', and 'Dot11ax Enabled'.

AKM = Authentication and Key Management

Option 2 sub-options for 2.4/5 GHz

Two options for WLAN security settings in 2.4/5GHz band:

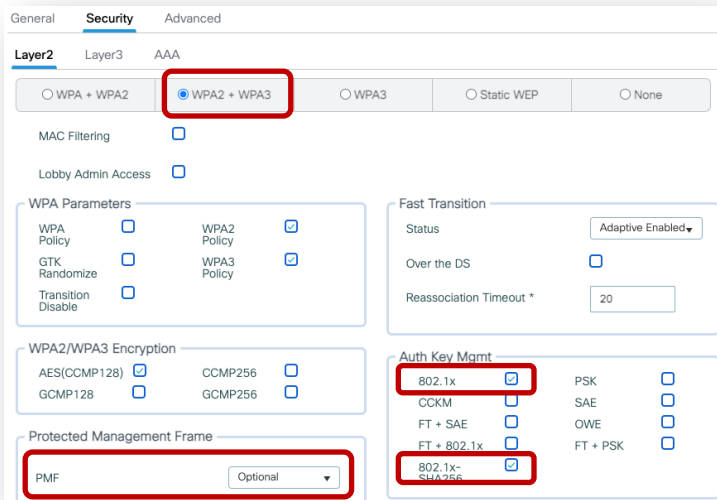
- a) WPA3 Transition mode
- b) WPA/WPA2

Things to keep in mind:

- From the initial testing done, some older drivers clients may have issues in connecting to a WPA3 transition mode
- Today Cisco doesn't support seamless roaming across WLANs, so for both options it will be a hard roam across bands.

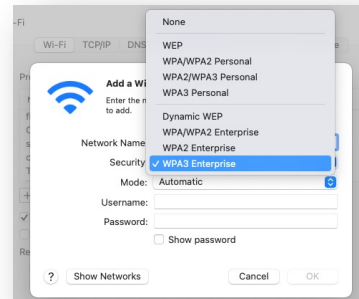
Option 2a (dot1x SSID)

WLAN security configuration for 2.4/5GHz > Enable WPA3-Enterprise Transition mode (a.k.a. mixed mode):



The screenshot shows the 'Security' tab of a Cisco WLAN configuration page. The 'WPA2 + WPA3' radio button is selected and highlighted with a red box. Other radio buttons include 'WPA + WPA2', 'WPA3', 'Static WEP', and 'None'. Below this, there are sections for 'WPA Parameters', 'Fast Transition', 'WPA2/WPA3 Encryption', 'Auth Key Mgmt', and 'Protected Management Frame'. In the 'Auth Key Mgmt' section, '802.1x' and '802.1x-SHA256' are checked and highlighted with red boxes. In the 'Protected Management Frame' section, 'PMF' is set to 'Optional' and highlighted with a red box.

- L2 Security would be WPA2+ WPA3. AKM should be set to 802.1x-SHA256 and 802.1x (SHA1). PMF as Optional
- How to configure the client side?
 - For clients that don't support 6 GHz, configure a **WPA2 profile**
 - For clients that support 6 GHz, configure **WPA3 Enterprise**. They will use these settings to connect to both 2.4/5 GHz and 6GHz



Option 2a



Pros

- Provide an adoption path to more secure Wi-Fi via WPA3 Transition mode
- No new SSID profile to be managed on the client side



Cons

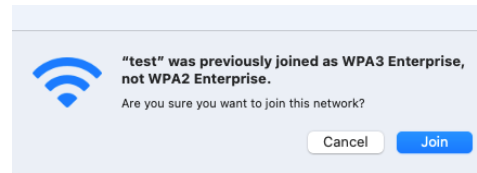
- Older clients may have issues connecting to an SSID with WPA3 Transition mode
- Roaming across different WLANs (same SSID) is not supported
- Not supported by Cisco DNA Center Automation

Option 2b (dot1x SSID)

WLAN security configuration on 2.4/5GHz:

The screenshot shows the 'Security' tab of a WLAN configuration interface. Under the 'Layer2' section, 'WPA + WPA2' is selected with a radio button. Below this, 'Protected Management Frame' (PMF) is set to 'Disabled'. Other visible settings include WPA Parameters (WPA2 Policy checked), WPA2 Encryption (AES/CCMP128 checked), and Auth Key Mgmt (802.1x checked).

- L2 Security would be **WPA+WPA2**. AKM should be set to **802.1x-SHA1**. PMF Disabled
- Make sure you don't have WFA "Transition Disable" feature turned on on the **6GHz WLAN**
- How to configure the client side?
 - For legacy clients just keep the existing **WPA2 profile**
 - For clients that are configured for 6GHz with a WPA3 profile, connecting to the 2.4/5GHz WLAN could be seen as a security downgrade attack. **Note:** MacOS gives you a warning:



Important: This option should only be recommended if planning for a full coverage at 6GHz. In this case, 6GHz capable clients would not need to connect to 2.4/5GHz.

Option 2b



Pros

- Maintain support for older clients using WPA/WPA2.
- No new SSID profile to be managed on the client side



Cons

- WPA2 only for 2.4/5GHz > not as secure as using WPA3
- Clients may complain going from a WPA3 SSID to a lower security
- Roaming across different WLANs (same SSID) is not supported
- Not supported by Cisco DNA Center Automation

Option 3



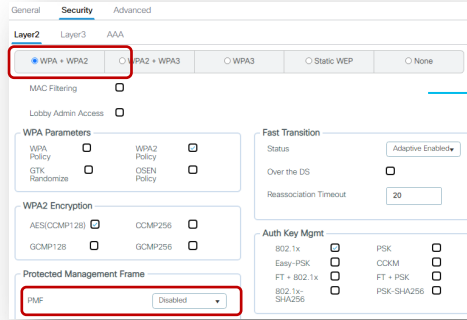
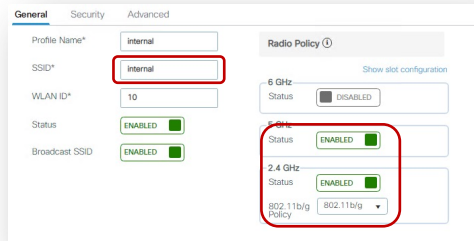
Option 3 – WLAN design considerations

- **Option 3:** Redesign the SSIDs. This entails adding a WPA3 separate SSID for 6GHz and then decide which bands to enable to address different customer use cases.
 - **Example 1:** customer wants to adopt 6GHz without touching the existing SSIDs > add a separate SSID with WPA3 and broadcast it in all bands.
 - **Example 2:** Customer wants to redesign the SSIDs dedicating each band for a specific device/use case

Option 3 > Example 1

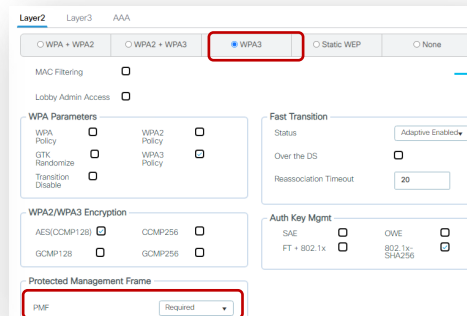
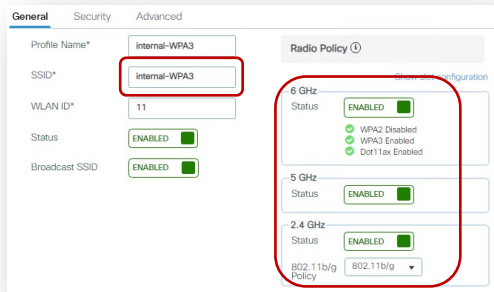
Add a separate WLAN with different SSID name for WPA3 and broadcast it in all bands. Leave the existing WLAN/SSID untouched.

Legacy SSID



Existing WPA/WPA2 SSID in 2.4 and 5GHz for legacy clients

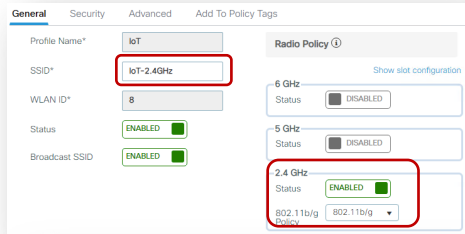
New SSID



Dedicated SSID for WPA3 (new name) capable clients in all bands. This is the SSID for 6GHz

Option 3 > Example 2

Redesign the WLANs, reserving each band for a specific device/use case



General Security Advanced Add To Policy Tags

Profile Name* IoT

SSID* IoT-2.4GHz

WLAN ID* 8

Status ENABLED

Broadcast SSID ENABLED

Radio Policy

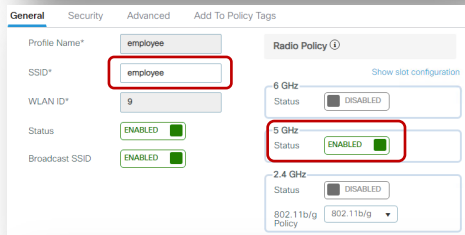
6 GHz Status DISABLED

5 GHz Status DISABLED

2.4 GHz Status ENABLED

802.11b/g Policy 802.11b/g

2.4GHz dedicated to specific devices. These could be legacy devices or IoT devices. If IoT will be mostly PSK



General Security Advanced Add To Policy Tags

Profile Name* employee

SSID* employee

WLAN ID* 9

Status ENABLED

Broadcast SSID ENABLED

Radio Policy

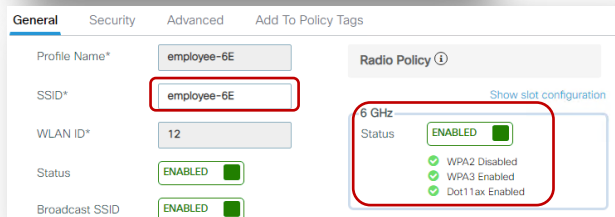
6 GHz Status DISABLED

5 GHz Status ENABLED

2.4 GHz Status DISABLED

802.11b/g Policy 802.11b/g

5GHz dedicated to majority of existing clients



General Security Advanced Add To Policy Tags

Profile Name* employee-6E

SSID* employee-6E

WLAN ID* 12

Status ENABLED

Broadcast SSID ENABLED

Radio Policy

6 GHz Status ENABLED

- WPA2 Disabled
- WPA3 Enabled
- Dot11ax Enabled

WPA3 on 6GHz band only, for the newest clients

Option 3



Pros

- Cleanest option from a client compatibility point of view
- Most secure options as clients can adopt WPA3 security
- WPA3 clients can roam across different bands
- Automated via DNA Center



Cons

- Additional SSIDs to configure & manage on WLC
- Need to manage additional SSID profiles on clients

Wi-Fi 6E, are you
ready?

Wi-Fi 6E, are you ready?



Is this the right time to move to 6 GHz?



Start with use cases not technology: go with 6GHz if your 2.4/5GHz RF is crowded, if applications are delay sensitive and bandwidth hungry



Check your infrastructure



Consider the switch infrastructure
Verify the power budget



Prepare your wireless



Evaluate the implications on RF and WLAN design

Continue your education



Visit the Cisco Showcase for related demos



Book your one-on-one Meet the Expert meeting



Attend the interactive education with DevNet, Capture the Flag, and Walk-in Labs



Visit the On-Demand Library for more sessions at www.CiscoLive.com/on-demand

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Cisco Digital Learning

Subscription-based product, technology, and certification training

Cisco Modeling Labs

Network simulation platform for design, testing, and troubleshooting

Cisco Learning Network

Resource community portal for certifications and learning

Train

Cisco Training Bootcamps

Intensive team & individual automation and technology training programs

Cisco Learning Partner Program

Authorized training partners supporting Cisco technology and career certifications

Cisco Instructor-led and Virtual Instructor-led training

Accelerated curriculum of product, technology, and certification courses

Certify

Cisco Certifications and Specialist Certifications

Award-winning certification program empowers students and IT Professionals to advance their technical careers

Cisco Guided Study Groups

180-day certification prep program with learning and support

Cisco Continuing Education Program

Recertification training options for Cisco certified individuals



The bridge to possible

Thank you

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