



Wi-Fi 6E

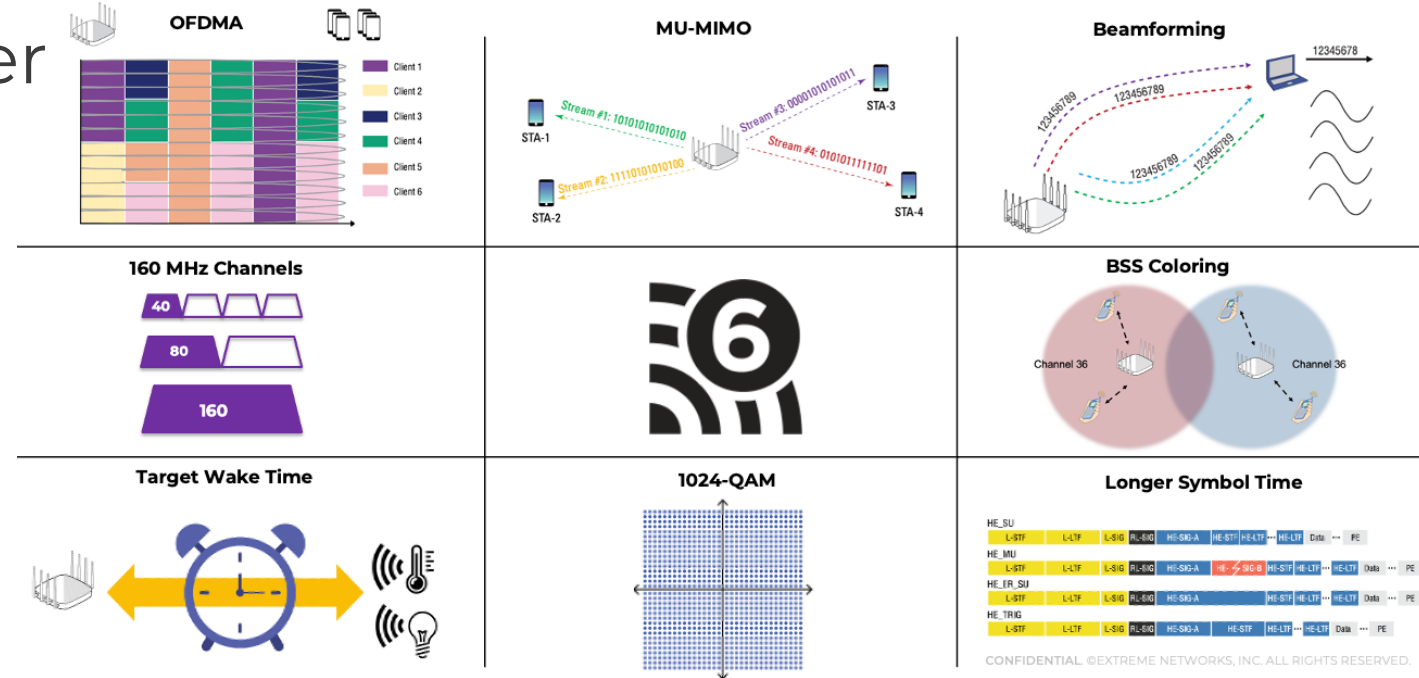
A new beginning for Wi-Fi in 6 GHz



- **Wi-Fi Alliance** has introduced a new generational Wi-Fi naming system that helps users better understand the experience they can expect
- **Wi-Fi 6** is the next generation of Wi-Fi based on 802.11ax technology: www.wi-fi.org/wi-fi-6

802.11ax – High Efficiency(HE)

802.11ax uses PHY and MAC layer enhancements for better traffic management



- Operates in both the 2.4 GHz and 5 GHz frequency bands
- And now..... 6 GHz band

Wi-Fi 6: The Story is EFFICIENCY



802.11ac



802.11ac transmits on a 20 MHz, 40 MHz, or 80 MHz channel for the communication between the AP and a single client. The communications are single-user.

802.11ax



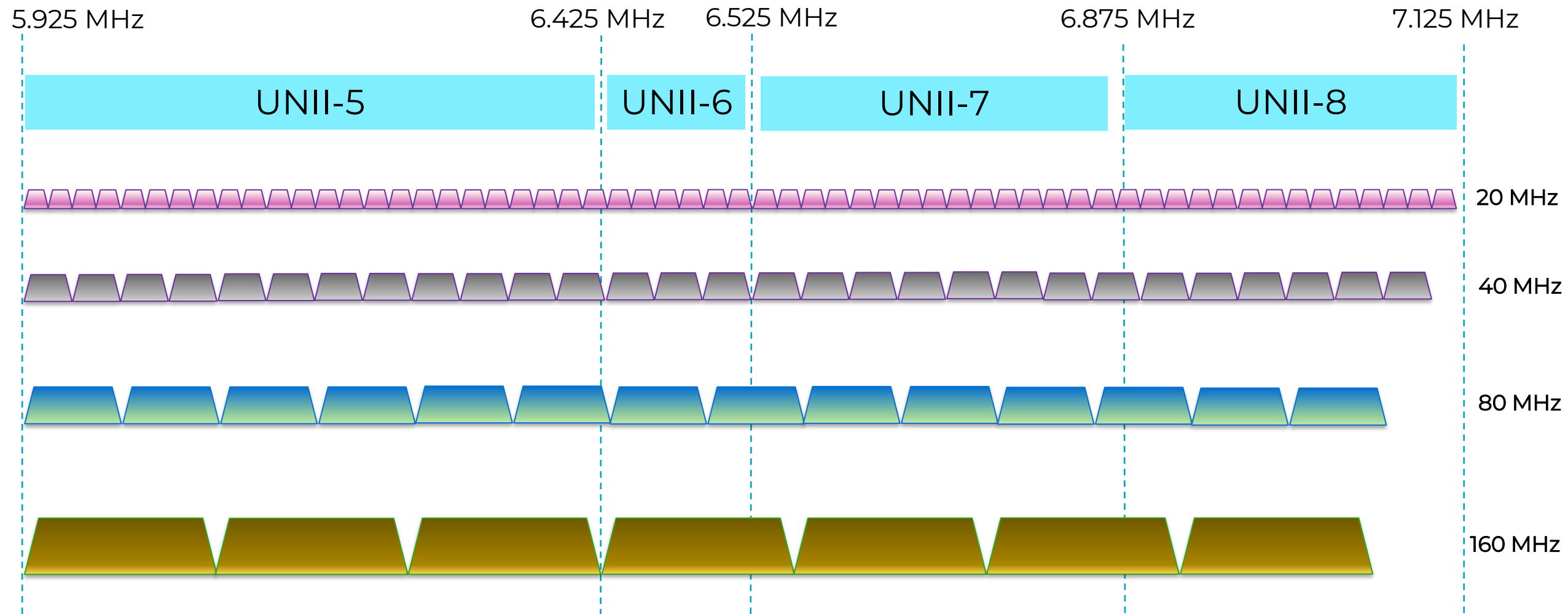
802.11ax partitions a Wi-Fi channel into smaller subchannels so that simultaneous multiple-user transmissions can occur. A more efficient use of the existing frequency space.

OFDMA: 4X improvement over 11ac



- (59) 20 MHz channels
- (29) 40 MHz channels
- (14) 80 MHz channels
- (7) 160 MHz channels

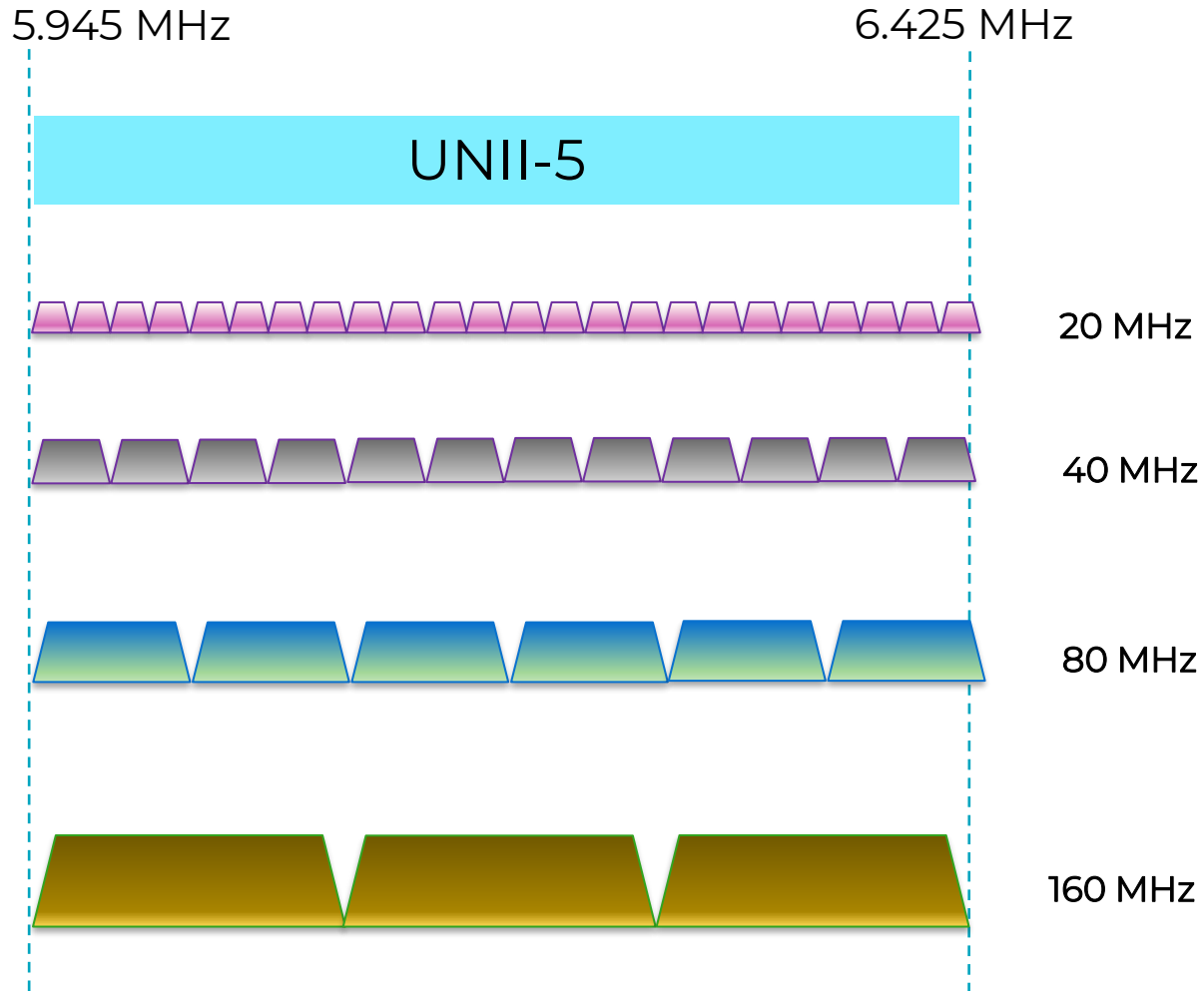
1200 MHz of new frequency spectrum





- (24) 20 MHz channels
- (12) 40 MHz channels
- (6) 80 MHz channels
- (3) 160 MHz channels

480 MHz of new frequency spectrum



European Commission:

480 MHz of additional spectrum available in the 6 GHz band for Wi-Fi networks.

Documentation available here:

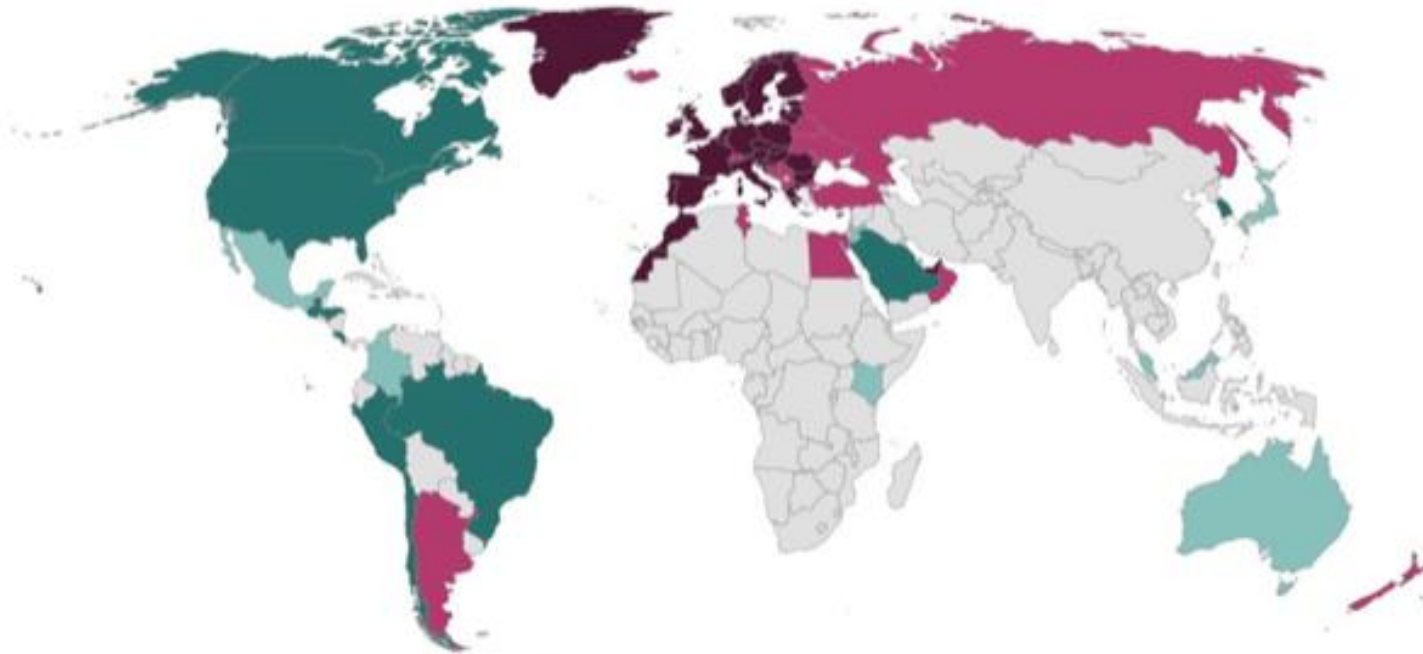
[6 GHz harmonisation - Europe](#)

6 GHz worldwide adoption



Countries Enabling Wi-Fi 6E

- Adopted 5925-6425 MHz
- Adopted 5925-7125 MHz
- Considering 5925-6425 MHz
- Considering 5925-7125 MHz

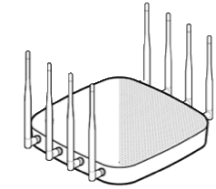
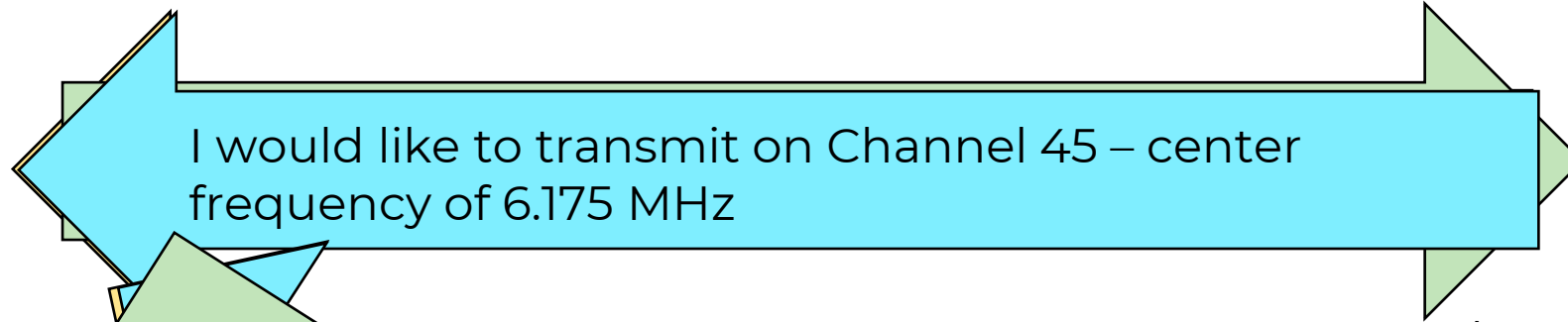


- Many other world regions are also working towards making all or portions of the 6 GHz frequency band available for Wi-Fi.
- As of today, over 60 countries have adopted or working on new regulations for the unlicensed use of 6 GHz.
- Ratification for use usually follows regulatory approval in a timely fashion.
- The Wi-Fi Alliance maintains a web page with a current list of countries with a path toward enabling Wi-Fi in the 6 GHz band: <https://www.wi-fi.org/countries-enabling-wi-fi-6e>.

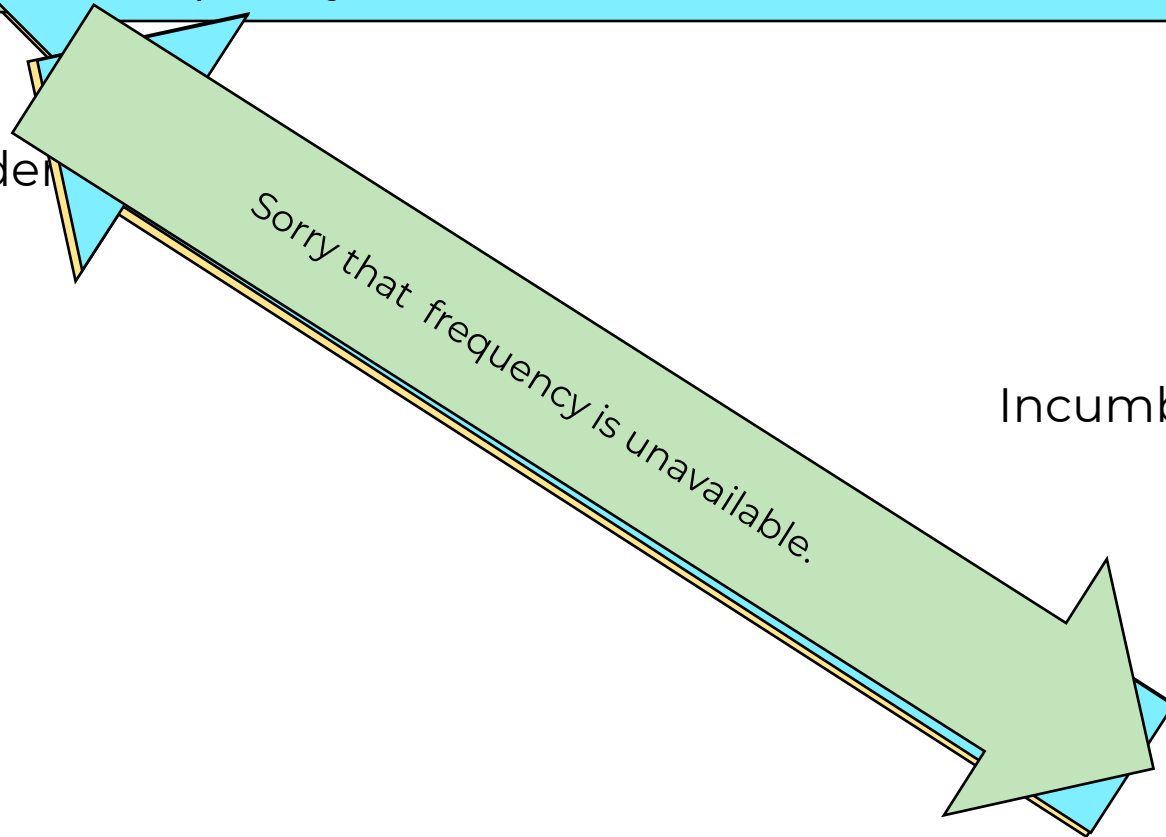
Automated Frequency Coordination (AFC)



AFC System Provider

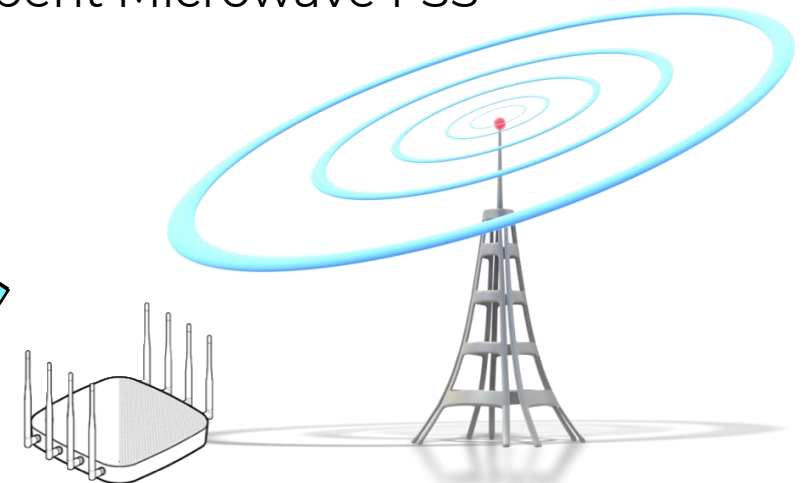


Outdoor AP – Brookhaven, GA



Incumbent Microwave FSS

Outdoor AP – San Diego, CA



Wi-Fi 6E Design Considerations



40 MHz channel reuse for 6 GHz

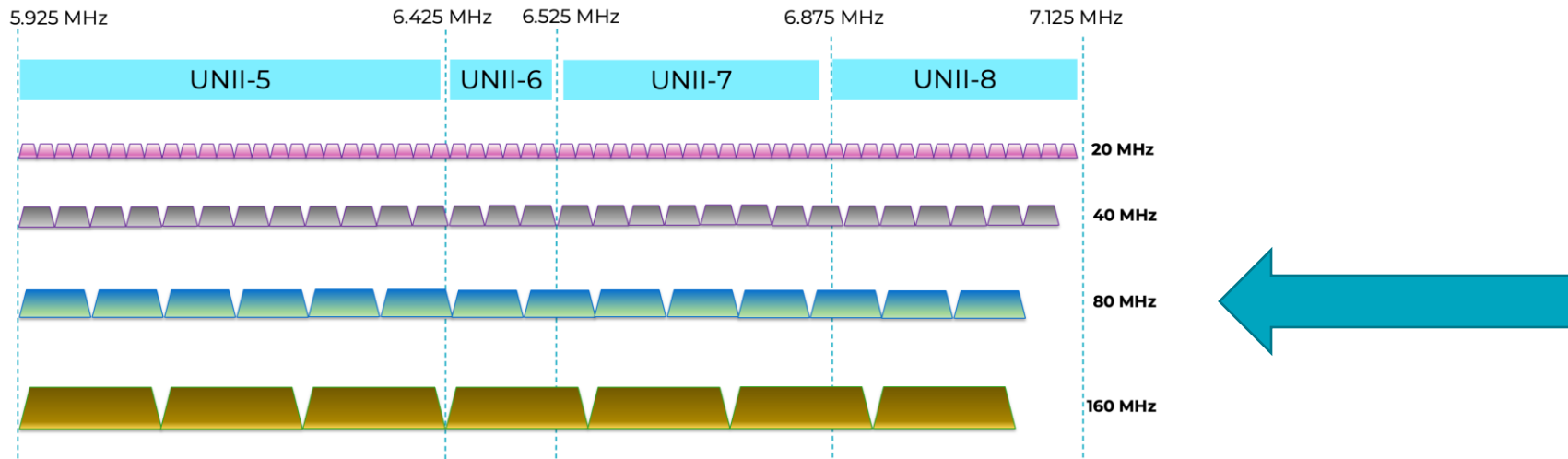


		UNII-5																							
		5.955	5.975	5.995	6.015	6.035	6.055	6.075	6.095	6.115	6.135	6.155	6.175	6.195	6.215	6.235	6.255	6.275	6.295	6.315	6.335	6.355	6.375	6.395	6.415
20 MHz		1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61	65	69	73	77	81	85	89	93
40 MHz		3		11		19		27		35		43		51		59		67		75		83		91	
80 MHz		7				23				39				55				71				87			
160 MHz		15								47								79							

WLANs deployed in high-density scenarios such as gymnasiums, conference halls, stadiums and other venues normally only use 20 MHz channel reuse plans in the 5 GHz band

- Because of all the available frequency space in 6 GHz, it is expected that the use of **40 MHz** channel reuse plans will become much more prevalent
- Twenty-nine 40 MHz channels are available for the USA and twelve for Europe

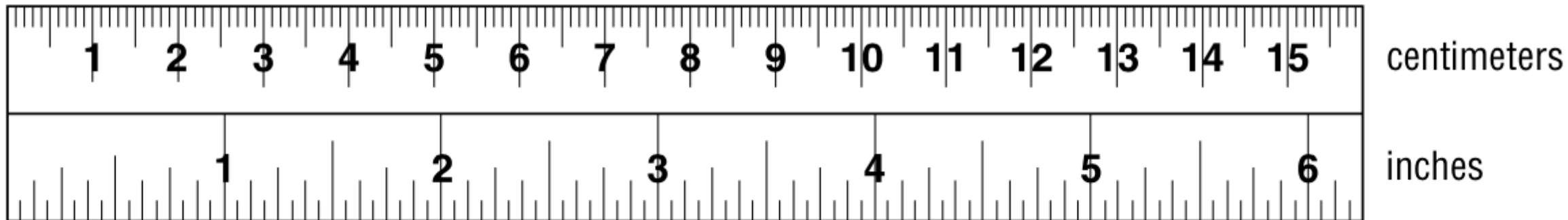
80 MHz channel reuse for 6 GHz



What about 80 MHz channels?

- In the United States, 14 channels are available for an 80 MHz channel reuse plan
- 80 MHz channel reuse is also expected to become more relevant because of the new 5 dBm/MHz PSD rules may offset rises to the noise floor caused by channel bonding
- **Power spectral density (PSD)** is the measure of signal strength (energy) variations as a function of frequency.

What about range for 6 GHz?



2.437 GHz (Channel 6)

Wavelength = 12.3 cm/4.85 in

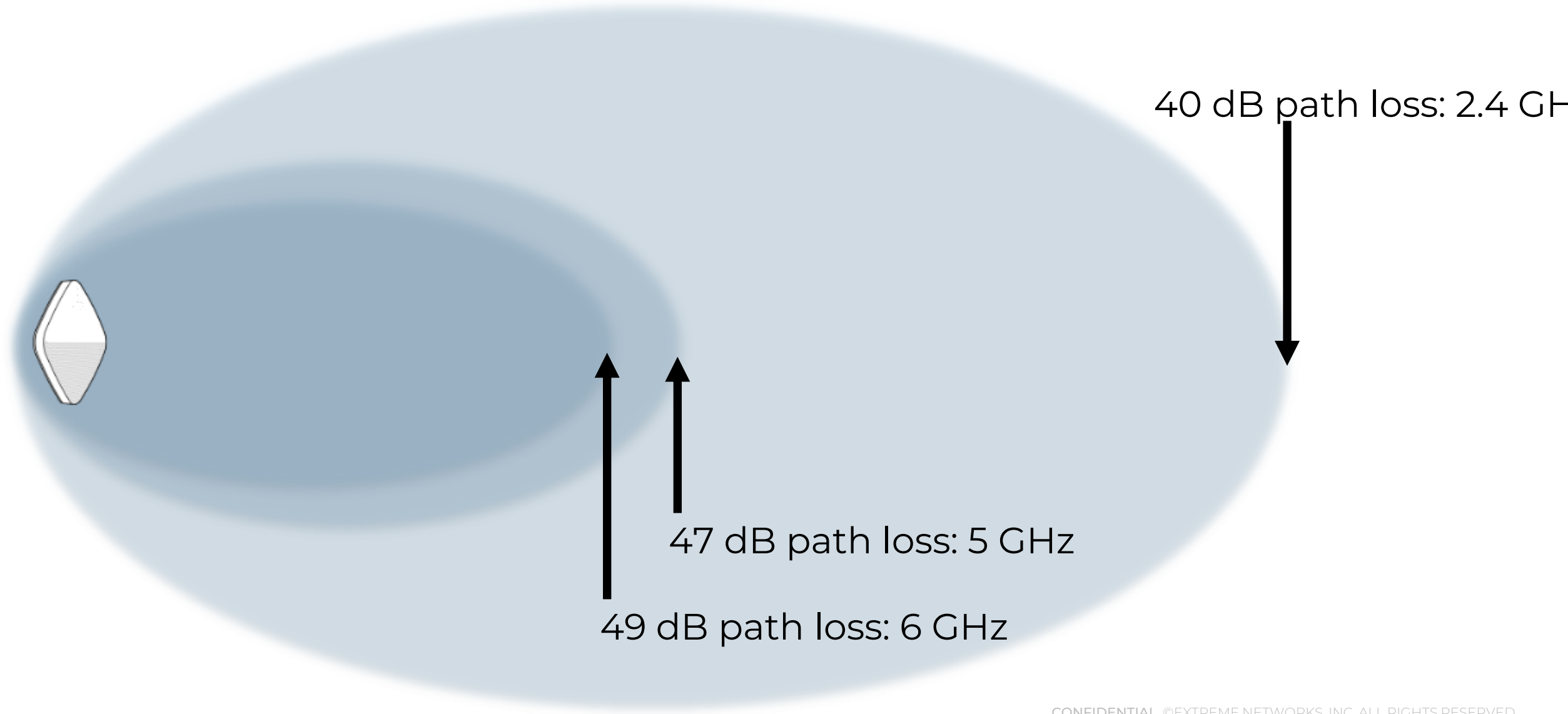
5.500 GHz (Channel 100)

Wavelength = 5.45 cm/2.15 in

6.675 GHz (Channel 145)

Wavelength = 4.49 cm/1.77 in

Only a 2 dB difference between 5 GHz and 6 GHz



Wi-Fi 6E and MultiGig



- Will we at least need 2.5 or 5 MultiGig (802.3bz) Ethernet ports?
- Tri-band APs may *finally* make the need for MultiGig a requirement
- As Wi-Fi 6 and 6E client populations grow, MultiGig will be needed



- The extra radio chains of tri-band radios will require more power
- 802.3at PoE Plus power of 25 watts *will* be required in most form factors
- PoE Plus requirements for **4x4:4** and/or **tri-band** MIMO APs should be considered a standard requirement





- The FCC low-power AP rules mandate that external antennas cannot be used (internal only) on low-power indoor (LPI) APs. And this class of the AP cannot be inside a weatherized enclosure.
- As a result, the current FCC rules for using Wi-Fi in the 6 GHz frequency band may create significant challenges for some enterprise verticals

When will we see Wi-Fi 6E clients?



Samsung Galaxy S21 Ultra smartphone using a Broadcom 6 GHz radio



Google Pixel 6 and 6 Pro smartphone using a Broadcom 6 GHz radio



Numerous laptops from Samsung, Lenovo, Dell and more using the Intel AX210NGW radio

Here comes the 6 GHz client invasion



*Samsung
Galaxy S22
and S21 Ultra*



*Samsung
ZFold*



*Google
Pixel 6*



*Asus
ZenPhone8*



*Redmagic
6S Pro*



*Motorola
Edge*



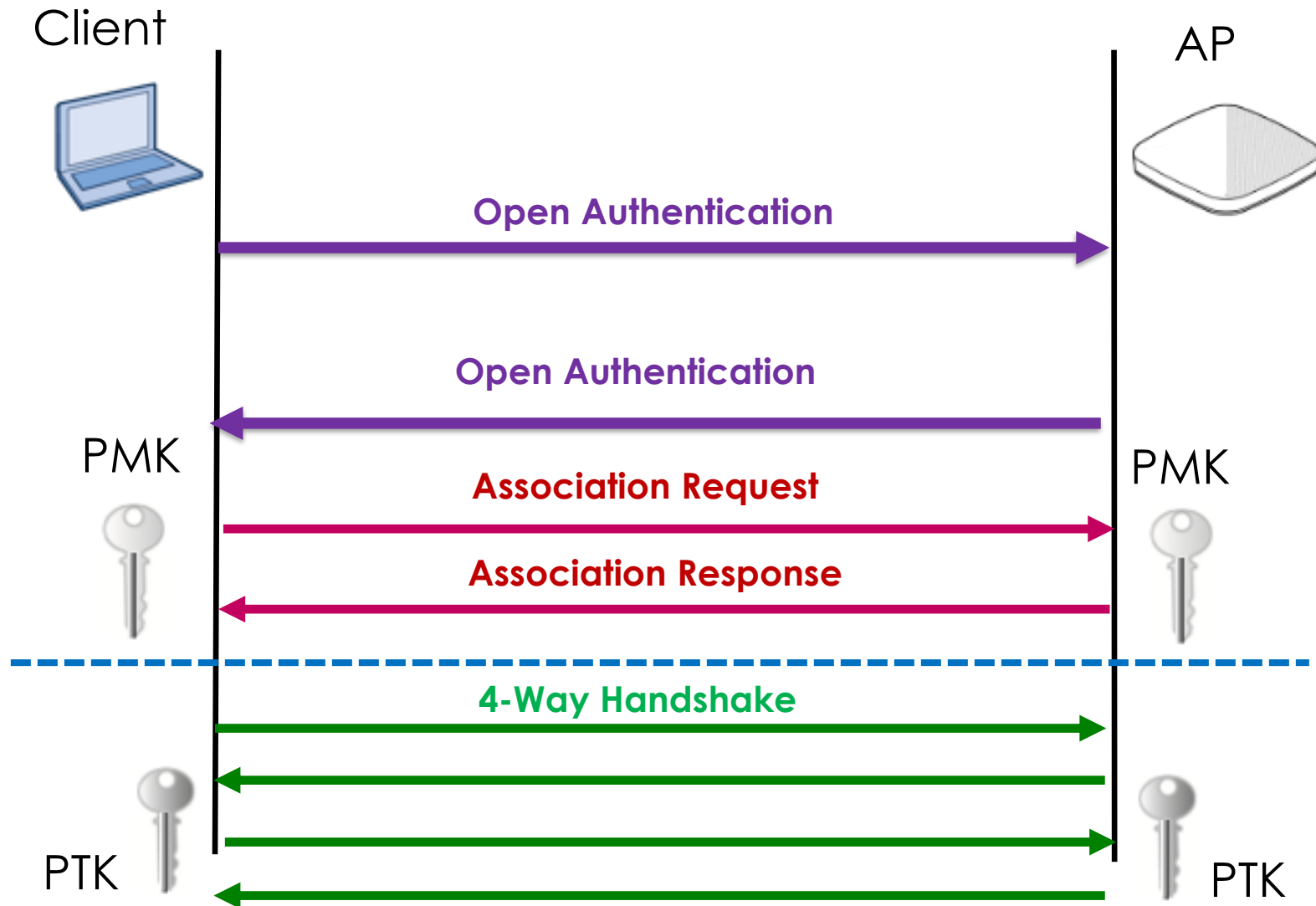
*Intel
AX210*

The Apple devices and Chromebooks are not going to be far behind...

Wi-Fi 6E Security



OWE – Enhanced Open



- Opportunistic Wireless Encryption (OWE)
- Encryption without authentication
- Enhanced Open certification is not part of WPA3 and is an entirely different and optional security certification

SAE – Simultaneous Authentication of Equals



Select passphrase

Select passphrase



SAE commit



SAE commit



SAE confirm



SAE confirm

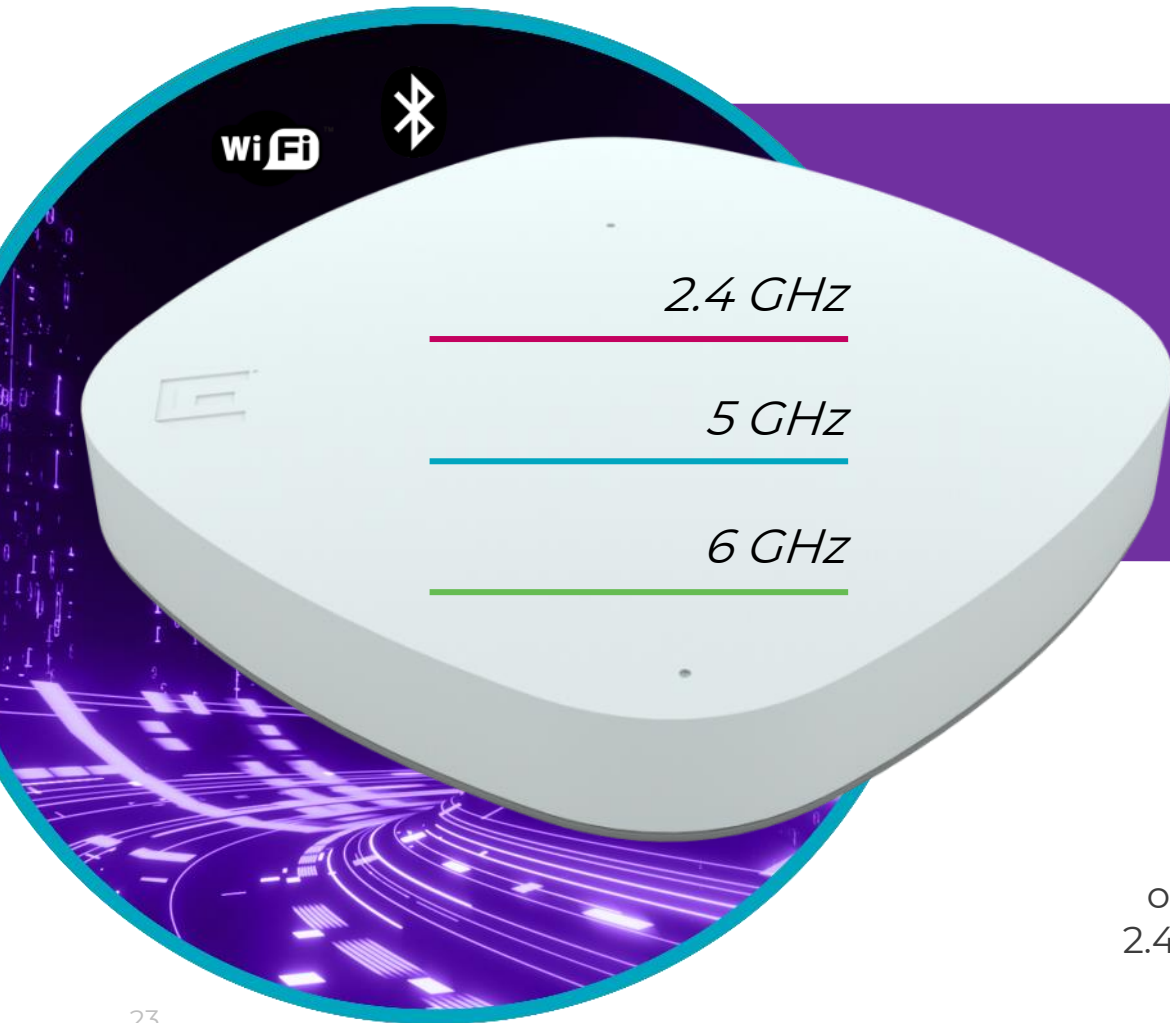


- WPA3 Personal
- WPA3 replacement for PSK
- Password key exchange based on a zero-knowledge proof
- Prove you know the credentials without compromising the credentials
- No forging, modification or replay attacks
- No offline dictionary attacks

Key 6 GHz security takeaways:

- 1) No more "open" unencrypted WLANs – They will be replaced with **Opportunistic Wireless Encryption (OWE)**
- 2) No more PSK security – Replaced entirely with **Simultaneous Authentication of Equals (SAE)**
- 3) **Management frame protection (MFP)** will also be required.
- 4) No Backward compatibility with WPA2





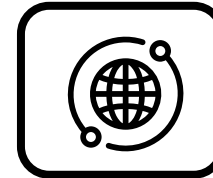
AP4000

Indoor access point

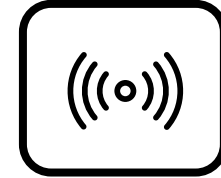
ORDERABLE NOW - FCC



Simultaneous operation across 2.4GHz/5GHz/6GHz



Universal platform with world SKU and universal SKU



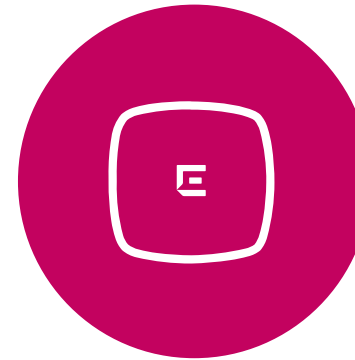
Full-time tri-band sensor for enhanced security

Benefits of Using AP4000



Security and Performance

Tri-band radio with full 2.4, 5 & 6 GHz operation



Flexible Placement

Smallest form factor enterprise 6E AP



Immediate Impact

Priced to help benefit now on par with Wi-Fi 6



Effortless Scaling

Centralized cloud management, and flexible cloud offerings

Introducing two new 6E APs

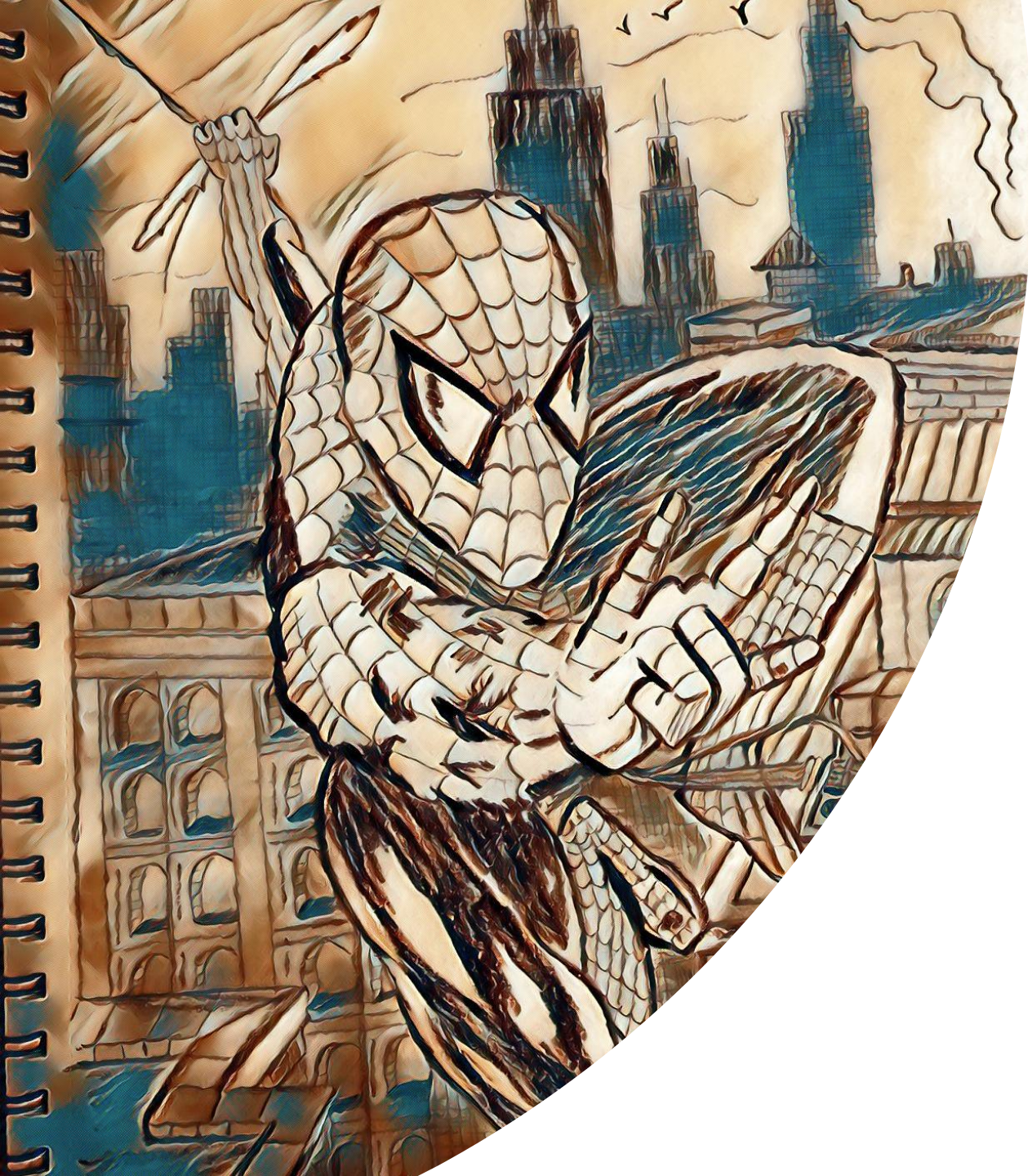
Access Point 5010 and 5010U



AP5010U and AP5010

- 4x4:4 Indoor Access Point (Operates within 802.3at)
- Supports PoE Out (with 802.3bt)
- Capable of Hosting Applications
- U SKU supports Indoor Positioning with Ultra-Wide Band*





A wise man once said

... with great POWER comes great responsibility

Vendor	AP Model	Power
Cisco	9136	47W
HP/Aruba	655	40W
Meraki	MR57	40W
Arista	C360	39W
Juniper	AP45	32W
Extreme	5010	26W

2022 Product of the Year Award



Award Winner: Extreme Networks AP 4000

The Extreme Networks AP4000 APs is one of the first shipping enterprise-grade Wi-Fi 6E access points. It can access over three times the spectrum of existing access points and is built on Broadcom chipsets. It features all the same functionality as the existing Extreme lineup from a software support perspective and is built for enterprises to deploy to users. The major challenge addressed is accessing the new 6 GHz spectrum allocated by the FCC for use in the US. This frequency band has the potential to relieve congestion and ensure that modern client devices have access to the largest amount of bandwidth possible.

For more information visit <https://www.extremenetworks.com/product/ap4000/>



WLAN IM OLYMPIASTADION BERLIN



- ✓ Flächendeckendes WLAN für bis zu 75.000 Zuschauer (User)
- ✓ Größte Wi-Fi 6 Stadion-Installation in Europa und größte flächendeckende Stadion-Installation in Deutschland
- ✓ Über 1.000 WLAN Access-Points verbaut
- ✓ Dynamische Anpassung an Zuschauerzahlen
- ✓ Modernste und sicherste Switching-Technologie als Basis



creating effortless networking experience with extreme



ExtremeCloud™ IQ

Streamline wired and wireless network operations and unlock new IT and business insights powered by machine learning

MGMT AND AUTOMATION



Extreme Campus controller

Unified Wired and Wireless for Centralized Campus Deployments

Extreme Cloud-Site Engine

Streamline your network operations from the edge to the data center



ANALYTICS AND VISIBILITY

Extreme Analytics for ExtremeCloud IQ – Site Engine

Keep your network secure with Application Visibility



Cloud-Based Location Analytics

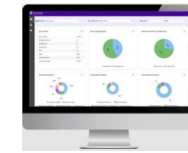
Resilient, Cloud-based Location and Analytics Solution



SECURITY AND ACCESS CONTROL



Extreme Control



Extreme Airdefense



Extreme Guest



ExtremeCloud A3



Advance your business and IT goals with Extreme Applications

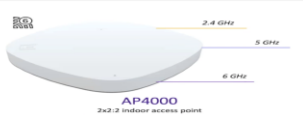


Extreme Wireless Access Points with Cloud-Driven Wi-Fi 6 /6E

Access Points - Wi-Fi 6 - 802.11ax

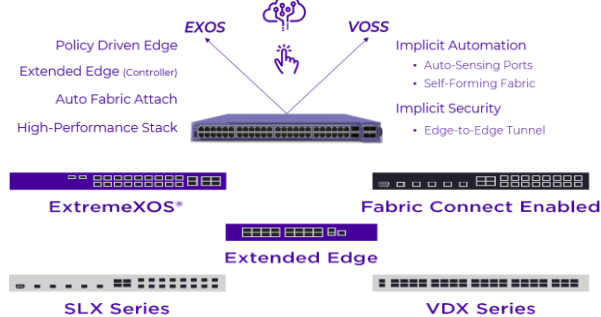


Extreme WiFi 6e



Make Every Connection Effortless with Extreme Switching

Universal **Switching**

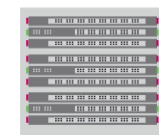


Next-Generation High-Performance Router



XR Series

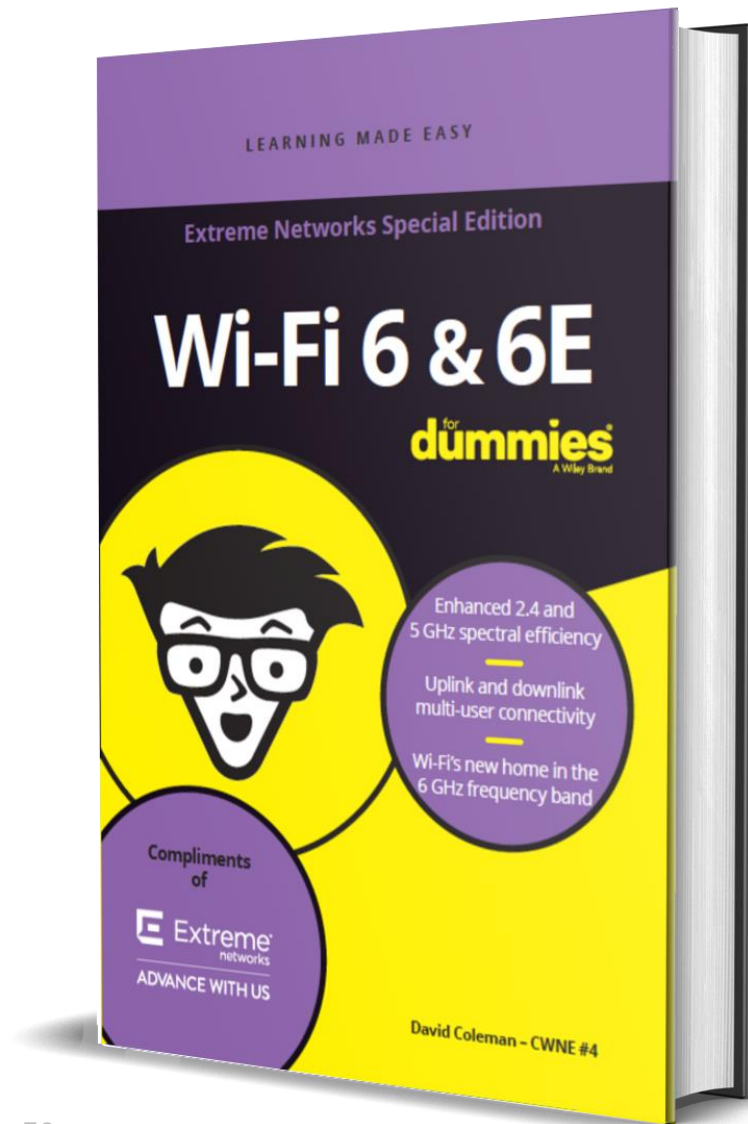
Cloud-Managed SD-WAN Routers with Gigabit Ethernet, PoE+



SLX Series

High-Density Routers for Demanding Data Centers

Available now:



Download your free copy:

<https://bit.ly/WiFi6E-Dummies>

Wi-Fi 6E – The Wireless Paradigm Shift Toward Infinitely Distributed Connectivity



David Coleman
Director, Wireless Networking at the
Office of the CTO

Published 4 Jun 2021

In late 2018, congressional representatives [Bob Latta \(R-OH\)](#) and [Jerry McNerney \(D-CA\)](#) joined together to create the [Congressional Wi-Fi Caucus](#) dedicated to addressing important issues shaping the future of Wi-Fi. The bipartisan caucus is the first congressional caucus solely dedicated to Wi-Fi-specific policy issues, providing a forward-thinking forum for legislators to learn about Wi-Fi related issues and to consider solutions.



Since then, in 2020, the FCC voted unanimously to make 1,200 megahertz (MHz) of spectrum in the 6 gigahertz (GHz) band available for unlicensed use in the United States. To put this in perspective, the new 6 GHz spectrum available for Wi-Fi is more than double the current usable frequency space of the 2.4 GHz and 5 GHz channels combined. In anticipation of the availability of this frequency space, the Wi-Fi Alliance announced [Wi-Fi 6E](#) as an "extension" for certifying

Wi-Fi 6E blog series:

<https://www.extremenetworks.com/extreme-networks-blog/author/dcoleman/>

Questions?



