Diving Deeper Into Wi-Fi 6

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What is Wi-Fi 6 (or 11ax)?

IEEE
Advancing Technology for Humanity
802.11ax

Wi Fi ALLIANCE
Wi-Fi 6

11B
11A
11G
11N
11AC
11AX

High Efficiency
4x Capacity
IoT Scale

- Cellular like Determinism for high quality services
- Higher power efficiency to accelerate IoT adoption
- Greater IoT Coverage
- Better app. performance in high density deployments

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Experience: Wi-Fi 6 (802.11ax)

What is the big deal?

Higher data rates

- 1024-QAM for up to 9.6 Gbps per radio and single-antenna speeds of 1.2 Gbps
- 8x8:8SS
- Enables next-generation 4K/8K and AR/VR video

Increase in overall network capacity

- 3x to 4x more throughput than 802.11ac via OFDMA
- Up to 4x capacity gain in dense scenarios with BSS coloring
- Multiuser MIMO gains on all client types

Reduced latency and greater reliability

- Scheduled uplink and downlink OFDMA for deterministic "cellular-like" latency, reliability, and QoS
- Optimized for IoT scale with hundreds of devices per AP

Improved power efficiency

- Up to 3x better battery life with Target Wake Time (TWT)
- New coding structure and signaling procedures for better transmit and receive efficiency

For more information, see: https://www.cisco.com/c/en/us/products/collateral/wireless/white-paper-c11-740788.html

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11ax benefits with OFDMA

- 3x to 4x more throughput than 802.11ac via OFDMA

Small Packet Aggregation for reduced latency

IOT and VoIP – OFDMA allows parallel processing of multiple clients

Lowering Latency at High Density – Deterministic performance at scale – real time multimedia in a crowd

Consistent Data Throughput

Higher client and AP density, improved spatial reuse via BSS coloring

Built for IOT

Deterministic, scalable scheduling (TWT) allowing group and individual scheduling out to 5 years

OFDMA

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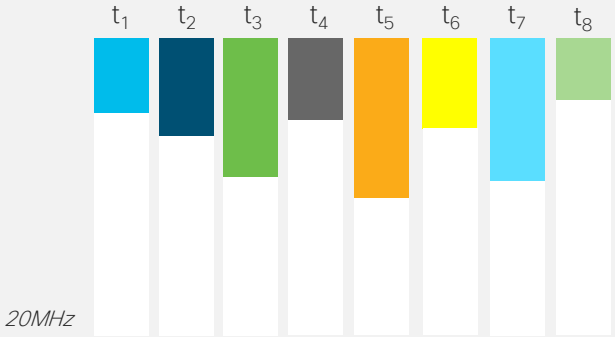
OFDMA – Using subcarriers more efficiently

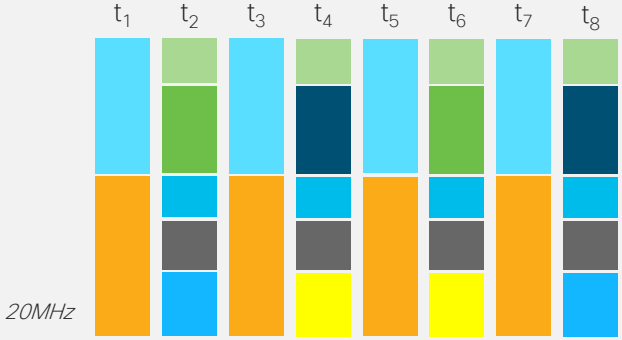
Maximizing client count – lowering latency

OFDM



- Each User gets 1 time slot – whole channel bandwidth
- Each User must wait t_8 before Next TX_op
- As more clients Join the cell, Latency – Jitter Increases
- QOS only manages TX_op – someone has to wait

OFDMA



- Multi user Packet makes flight more efficient
- Also provides much more regular and consistent TX_op
- Deterministic nature – miss this truck – no worries here comes another "meaning the truck" is always leaving "full"… net result is lower latency

User 1 - Telemetry | User 2 - Voip | User 3 - Video | User 4 - Voip | User 5 - Data | User 6 - IoT | User 7 - Data | User 8 - Voip

Each subcarrier is a transport - Latency goes up when subcarriers go out "half empty"…
OFDMA solves this by allowing **multi-user packets to go out on one subcarrier**

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11ax benefits with MU-MIMO

MU-MIMO is now supported with the benefits of OFDMA

8 MU-MIMO transmissions (users in a group) up from 4

Multiuser MIMO gains on all client types

Spectrum Efficiency

Parallel Processing support for additional MU-MIMO users (compared to .11ac)

Handling Multiple Users

Allows more data to be transferred and to transmit to a larger number of concurrent clients at once

Creating Groups and Managing

AP calculates channel matrix for each user and simultaneously steers beams to different users

Multi-User MIMO

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11ax benefits with BSS Coloring

Up to 4x capacity gain in dense scenarios

Explosion of IoT devices – Strong need for 2.4 GHz

Allows cell isolation with omnidirectional instead of Directional antennas

Benefit 2.4 GHz

where many IOT clients operate and/or High-density networks are desired

Increase Channel Efficiency

BSS and client can work to optimize channel power, creating less noise and improving SNR

Greater range outdoor links

Flexible Protocol to address multiple use cases. Variable Guard interval, longer preamble and narrower subcarriers make easier to decode

BSS Coloring

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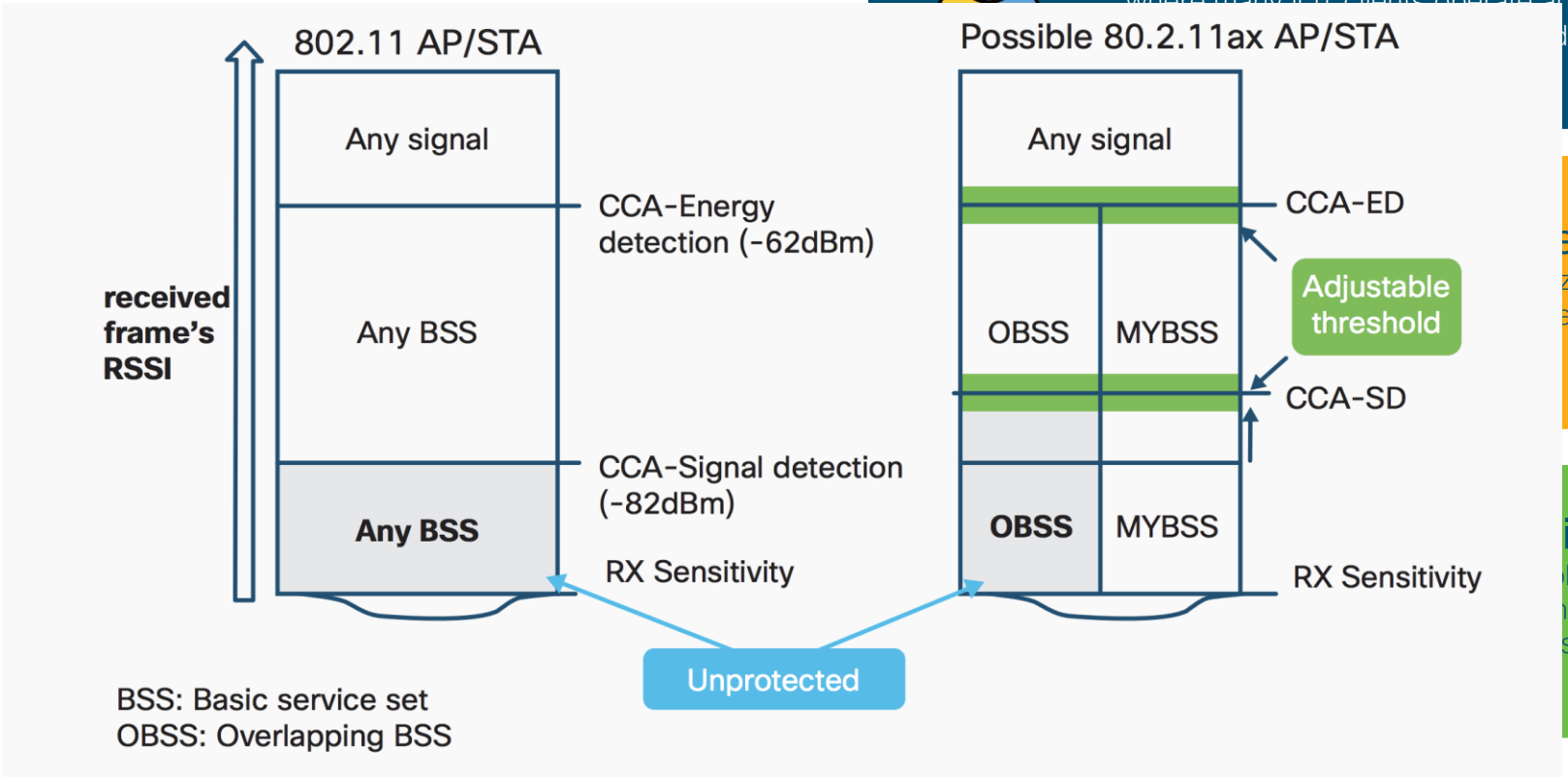
11ax benefits with BSS Coloring



Benefit 2.4 GHz

BSS Coloring

11ax benefits with TWT & 1024-QAM

Devices can sleep conserving battery life and then wake to take advantage of MUMIMO

- 1024-QAM for up to 9.6 Gbps per radio and single-antenna speeds of 1.2 Gbps

New 1024 QAM introduces a 25% performance in throughput with single Radio

Better Battery Life

Up to **3x better battery life** with Target Wake Time (TWT)

Spatial Reuse

BSS coloring allows higher channel reuse rates = higher SNR to support 1024-QAM

1024-QAM

Single-antenna devices (smart-phone) should see MCS10-11 (Gigabit speeds) → **35% faster than 11ac**

Target Wake Time

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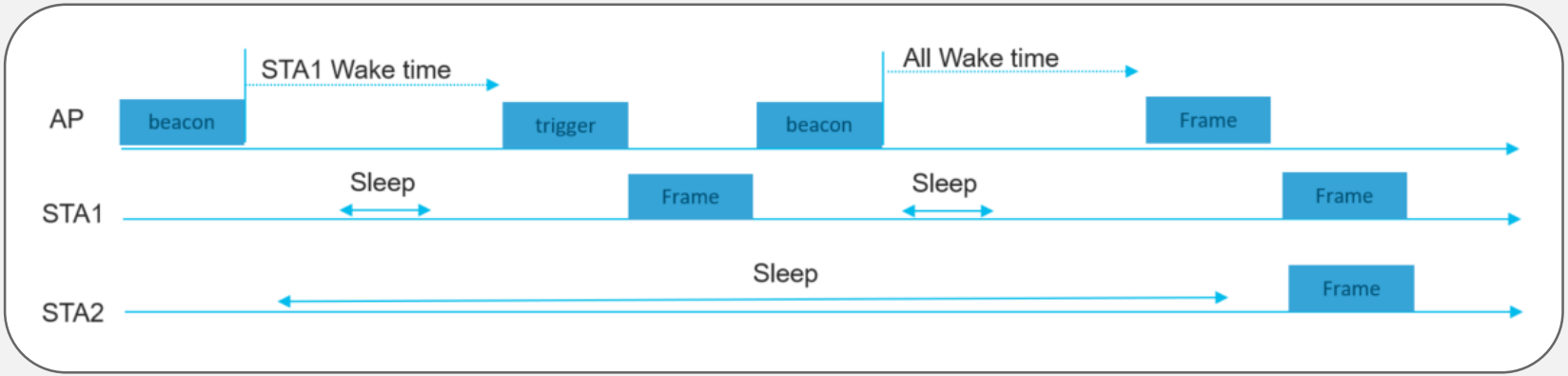
Target wake time – Putting devices to sleep

For your reference

- With Target Wake Time (TWT), the AP can schedule phones and IoT devices sleep for long durations (**up to 5 years**) and then wake the individual device up.
- Devices can be configured to wake up as a group to communicate at the same time sharing the channel for increased network capacity and reduced battery drain.
- Use of BSS Color field and UL/DL flag in preamble to enable intra PPDU power Saving



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New Cisco Catalyst 9100 Series Access Points

Ideal for small to medium-sized deployments

Mission critical

9115AX
(Wi-Fi 6 certifiable)

- 4x4 + 4x4
- MU-MIMO, OFDMA
- Spectrum Intelligence
- 1 x 2.5 mGig
- TWT

9117AX
(Pre-standards based)

- 8x8 + 4x4
- MU-MIMO, OFDMA (only DL)
- Spectrum intelligence
- 1 x 5 mGig
- Non Triggered TWT
- Integrated Antenna only

Powered by Cisco RF ASIC

9120AX
(Wi-Fi 6 certifiable)

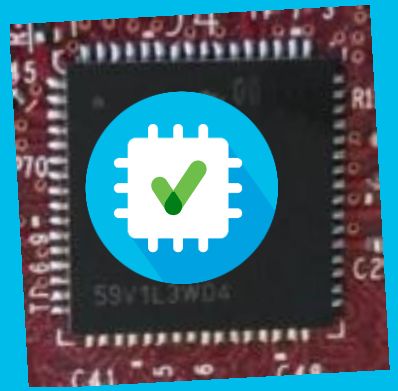
- 4x4 + 4x4
- Cisco RF ASIC for Next-gen CleanAir
- Dual 5 GHz, HDX
- RF signature capture
- IoT ready (Zigbee, Thread)
- IOx infra support
- 1 x 2.5 mGig
- TWT

Cisco DNA Assurance with Intelligent Capture | Bluetooth 5 | Supports PoE | Integrated or external antenna SKUs

Catalyst 9120 access point powered by Cisco RF ASIC

Embedded with superior analytics and security for mission critical deployments

Cisco RF ASIC



- RF Signature capture* (NEW)
- Clean Air, Offchannel RRM*
- Zero-wait DFS* (NEW)
- FastLocate w/o performance impact
- WIPS/WIDS/Rogue detection*
- Optimized Roaming for mobile devices

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* Roadmap Item

New Cisco Meraki MR Access Points

MR55

- Support for up to 8x8:8
- 2.4Ghz & 5Ghz band
- Downstream OFDMA & MU-MIMO
- 5Gbps mGig 802.3at Ethernet port

MR45

- Support for up to 4x4:4
- 2.4Ghz & 5Ghz band
- Downstream OFDMA & MU-MIMO
- 2.5Gbps mGig 802.3at Ethernet port

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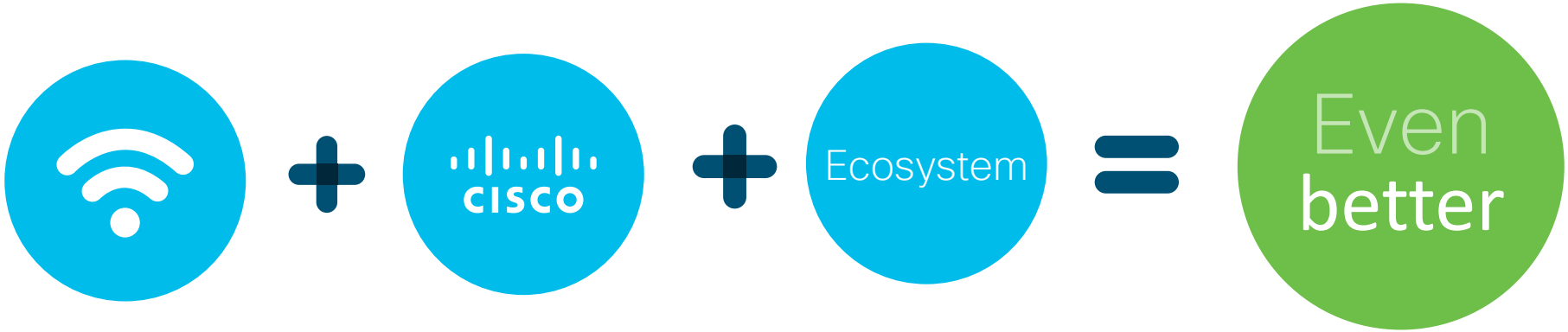

Beyond the WiFi6 Standard

RF ASIC*
Real-time Analytics
Dedicated third radio**

IoT Security

Multi-lingual AP
Layer 1 Visibility*
IoT Segmentation

Ecosystem Leadership

ios
intel
SAMSUNG
globalreach
Fira Barcelona
boingo
PRESIDIO
Future. Built.
DEVNET
CLAIR

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*Cisco Catalyst 9120
**Cisco Catalyst 9120 and Cisco Meraki MR 45/55

Wi-Fi 6 - Enhancements

For your reference

Uplink and Downlink Orthogonal Frequency Division Multiple Access (OFDMA): Increases network efficiency and lowers latency for high demand environments

Packet latency improvements

Multi-User Multiple Input Multiple Output (MU-MIMO): allows more data to be transferred at once and enables an access point to transmit to a larger number of concurrent clients at once

Channel Reuse With BSS Color

Parallel processing: enables greater capacity by allowing MU-MIMO and OFDMA to function in UPLINK and DOWNLINK mode

Parallel transmissions

1024 Quadrature Amplitude Modulation Mode (1024-QAM): increases throughput in Wi-Fi devices by encoding more data in the same amount of spectrum

Faster Speed more Radios and 1024 QAM

Target Wake Time (TWT): significantly improves battery life in Wi-Fi devices, such as Internet of Things (IoT) devices

Better Battery Life

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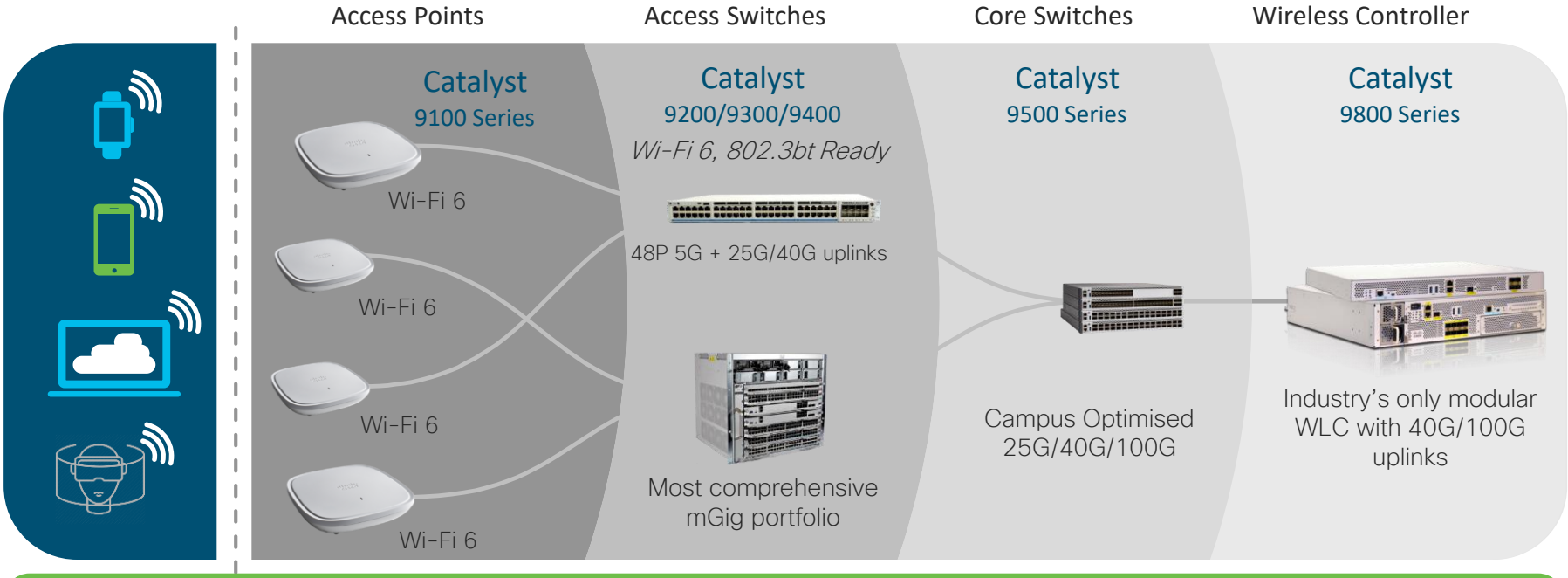
End-to-end Wi-Fi 6 leadership enabling next-generation mobility



The Full Experience End to End

Built for intent-based networking

Automation

Security

Analytics

Next Steps to Wi-Fi 6

Build a solid foundation

Catalyst 9800 Wireless Controllers
Catalyst 9000 Switches
Cisco DNA Center

Continue on the Wi-Fi 6 journey

Cisco Catalyst 9100 series APs

Wi-Fi 6 Info:

- cisco.com/go/wifi6
- cisco.com/go/accesspoints

TWTV Video

- Wi-Fi 6 & Access Points Tech

Cisco Live Melbourne – Wi-Fi 6

- BRKEWN-2017 - Understanding RF Design for 802.11ax (Wi-Fi 6) Wireless Networks

Cisco Whitepaper

- IEEE 802.11ax: The Sixth Generation of Wi-Fi

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