WF-101

Wi-Fi IoT Evolution, AI/ML, Matter & More

Kalevi Ratschunas
Senior Marketing Manager, Wi-Fi
SILICON LABS

Agenda

Wi-Fi Growth

Wi-Fi Evolution and Benefits to IoT

IoT-Optimized Wi-Fi

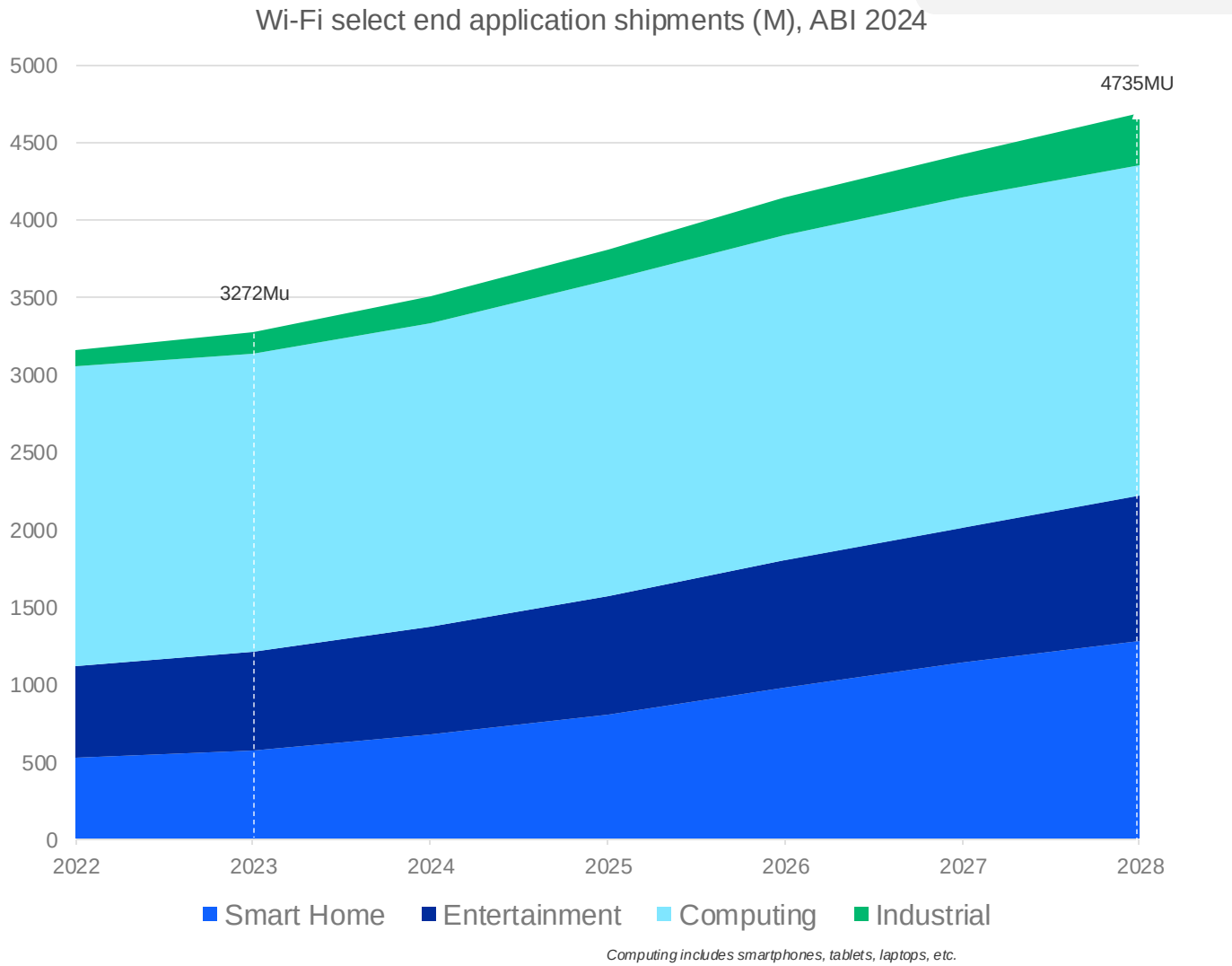
Matter

AI/ML Integration at Edge IoT

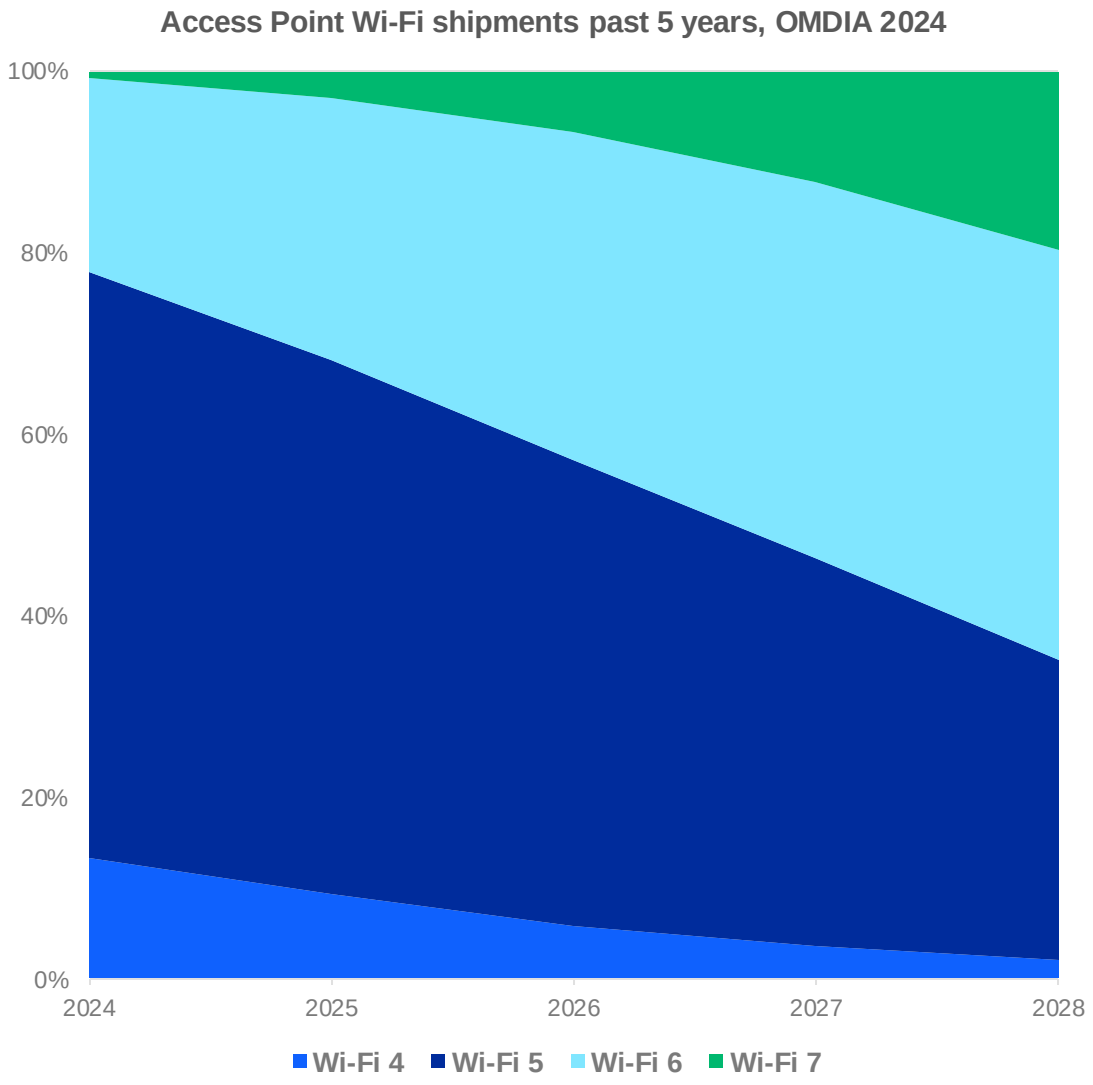
What’s Shipping & What’s Next

Wi-Fi Market Drivers

- 8% YoY CAGR from 2023 (3.3Bu) to 2028 (4.7Bu)
- Smart Home and Industrial lead the way
- Fast Expansion of IoT use cases
- Matter over Wi-Fi: vendor interoperability
- Advancements in Wi-Fi Technology
  - Wi-Fi 6
  - 6 GHz
  - Wi-Fi 7



Wi-Fi Access Points Drive Technology Adoption for IoT Devices



- Wi-Fi 4/5
  - Phasing out…
- Wi-Fi 6
  - Largest Installed Base
  - Increasing Share
- Wi-Fi 7
  - Access Points shipping now
  - Real ramp will be 2026+
- Wi-Fi 8
  - First products expected in 2027

Wi-Fi Standard Evolution

Speed
Efficiency
Density
Capacity
Reliability
Applications

- Basic HD streaming
- Multi devices per home
- SOHO setups

- MIMO
- Advanced Power Save
- Aggregation
- 64-QAM

Wi-Fi 4
(802.11n)

- HD & 4K streaming
- Online gaming
- Large file transfer

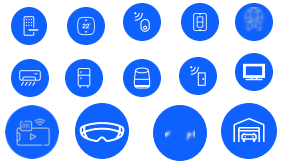
- MU-MIMO
- 80/160Mhz CBW
- 256-QAM

Wi-Fi 5
(802.11ac)

- High density environment
- IoT and smart homes
- Enhanced gaming
- Immersive VR/AR

- OFDMA
- TWT
- BSS-coloring
- 6GHz band
- 1024-QAM

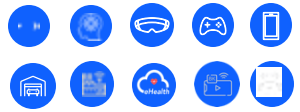
Wi-Fi 6/6E
(802.11ax)



- Seamless 4K/8K streaming
- RT Advanced VR/AR
- High-capacity Wi-Fi

- MLO
- 320MHz CBW
- rTWT
- 4096-QAM

Wi-Fi 7
(802.11be)



- Advanced AI/ML driven network optimization
- NG IoT (e-Health, Digital twin, etc)
- Highly-reliable Wi-Fi

- Multi-AP
- DMLO
- ELR
- dRU
- 2x LDPC

Wi-Fi 8
(802.11bn)

Latency
Power (J/bit)

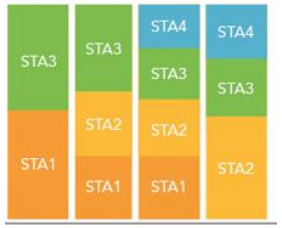
What is IoT-optimized Wi-Fi?

- **Traditional Wi-Fi**
  - High bandwidth, high power
  - Access Points, PCs, Smartphones, AR/VR
  - Highly resourced hardware running Linux/Android/iOS/Windows
- **IoT-optimized Wi-Fi**
  - Energy-efficient
  - Limited device resources
  - Cost and size-constrained devices
  - Challenges from crowded RF spectrum
  - Connectivity to multiple Cloud providers
  - Coexistence and interoperability
  - Limited user interface
  - Security against online and physical attacks

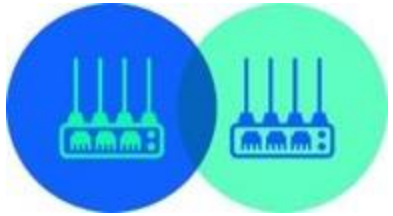
Wi-Fi 6 IoT Features

Support Denser Environments

OFDMA



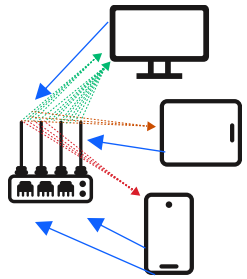
Spatial Reuse,
BSS Coloring



Higher Efficiency, High Density, Lower Latency

Better Performance

Multi-User (MU) MIMO*

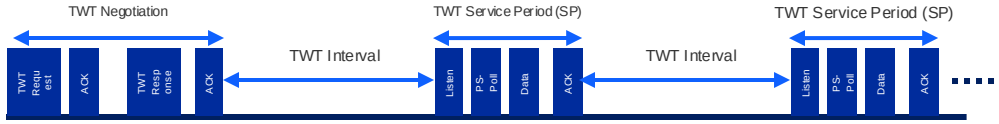


Beamforming

Higher Throughput, Higher Capacity, Longer Range

Longer Battery Life

Target Wake Time*



Extended Range

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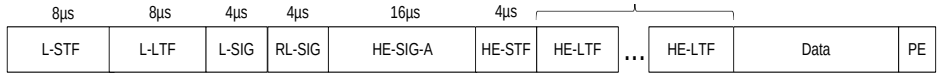
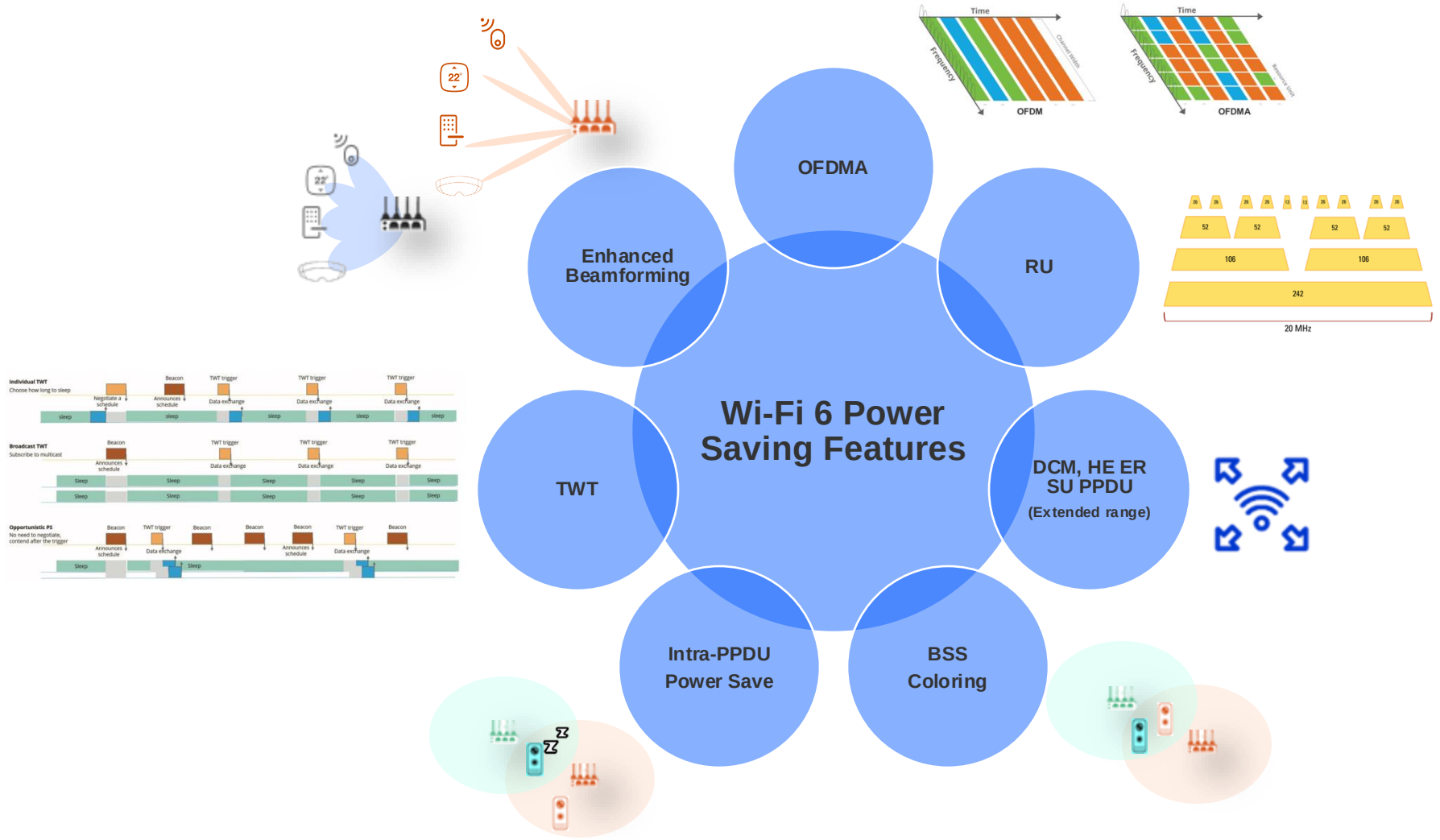


Enhanced delay spread protection-long guard interval

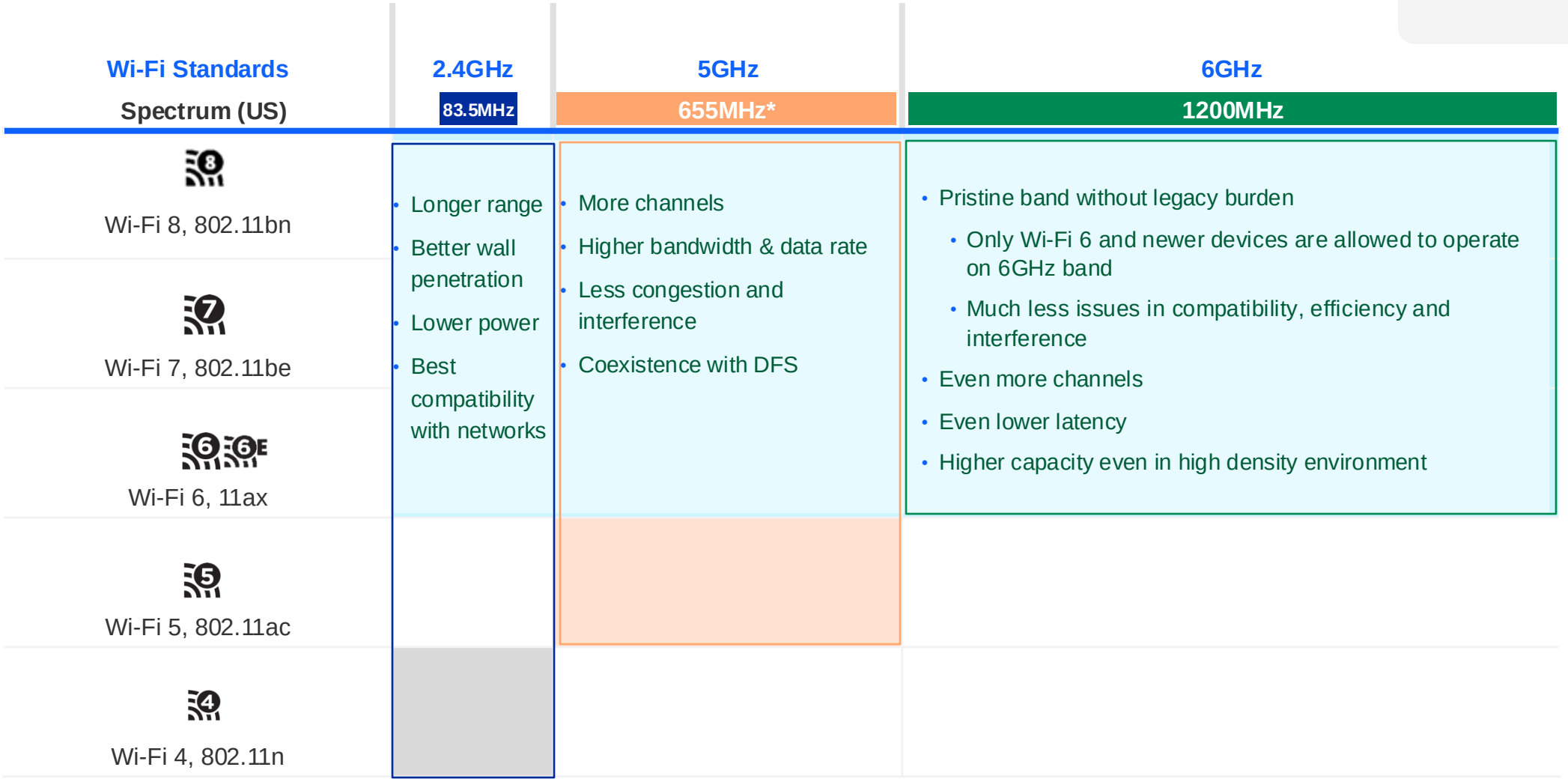
- 0.8us
- 1.6us 11ax
- 3.2us 11ax

** SiWx917 supports "Downlink" MU-MIMO and "Individual" Target Wake Time method.*

Wi-Fi 6 Finely-Orchestrated Features Improve Battery Life for IoT



Wi-Fi: Expanded Unlicensed Spectrum



* Including UNII-4

Matter's Vision

Developers

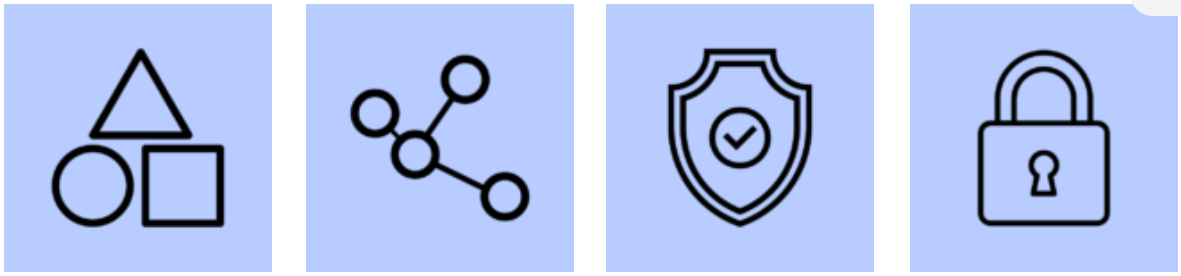
- Reduce "Ecosystem specific" products
  - Lower development & operational cost
  - Develop once / deploy everywhere
- Community Support
- Accelerates Innovation

Retailers

- Requires less shelf space
  - Lowers inventory cost
- Simplify purchasing experience
- Minimize returns

Consumers

- Simplify purchasing experience
- Simplify setup & control
  - Provide more consistent set up experience
- Works across ecosystems



Benefits of Silicon Labs Matter Solution

Reduce Costs

Simplify product design and reduce BoM and complexities
- Integrated wireless SoC, and Modules for Matter

Reduce development, maintenance, and warranty costs
- High-quality software, pre-certified solutions, interoperability-tested stacks

Protect Your Brand

Protect devices, users, and your brand reputation from cyber threats
- A fully Matter-compliant security solution protects your devices from local and remote attacks

Reduce your manufacturing risks by secure programming
- Injecting your Matter certificates, keys, and security settings as well as flashing your application and bootloader

Enhance User Experience

Extend battery life and recharging interval
- Industry's most power-efficient wireless SoCs and modules

Deliver reliable wireless in every room of the home and beyond
- High performance RF provides best in class TX power and RX sensitivity

Enable smooth Wi-Fi device setup
- through Wi-Fi stacks with maximum, independently-tested gateway compatibility

Accelerate Time-to-Market

Avoid time-consuming development mistakes
- Guided, end-to-end Matter & Ecosystem Developer Journey

Speed up your end-device certifications for wireless standards and Ecosystems
- Our Connectivity Lab and pre-certified stacks help ensure a robust, compliant solution

Cut up to 9 months from RF design and certifications
- RF-certified modules with an integrated antenna save time & money

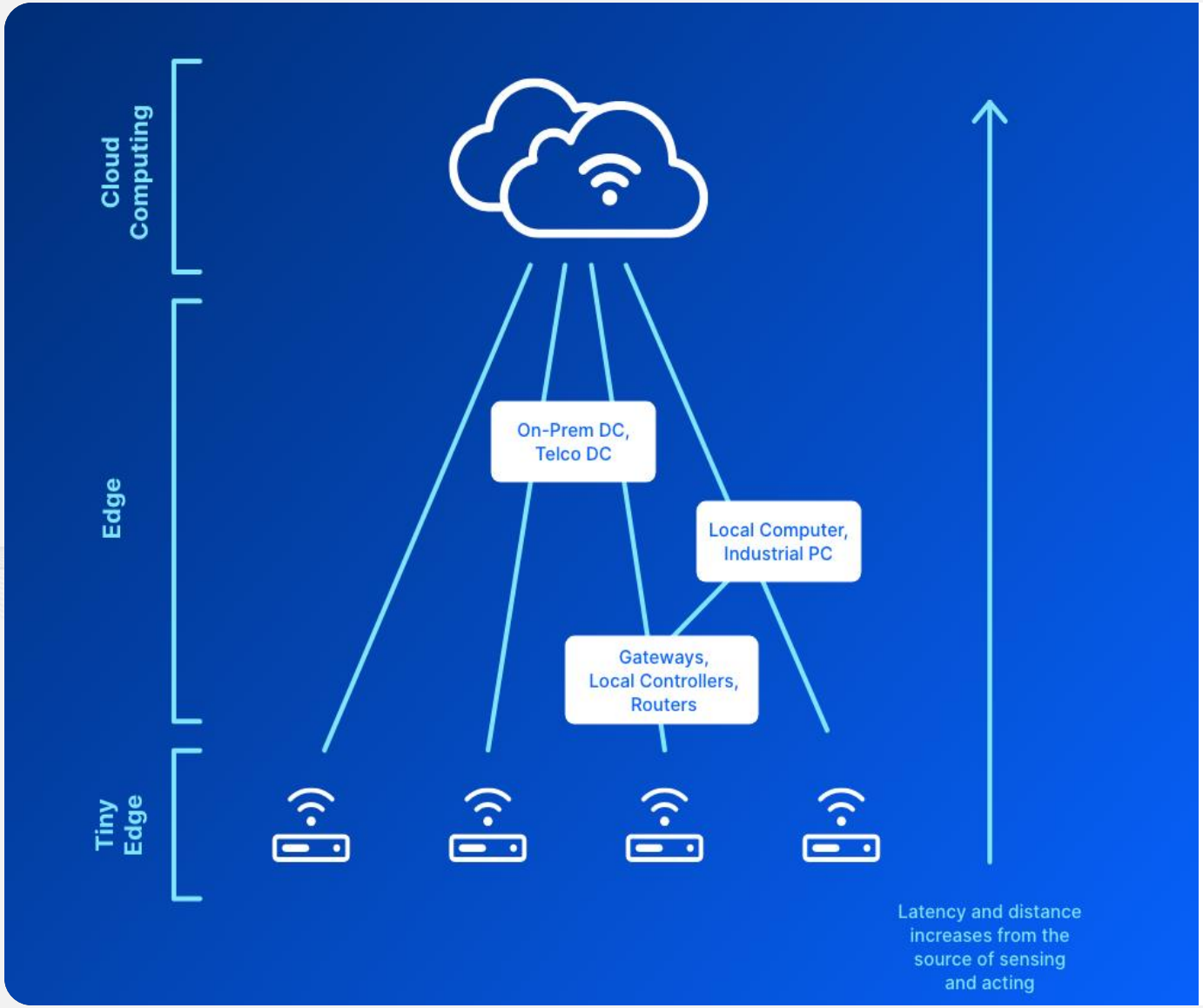
Grow Revenue

Enhanced User Experience
- Longer battery life, reduced waste and robust product for improved customer experience

Robust Matter-security
- Avoid negative publicity due to hacks and data breaches

Faster Time to Market
- Helps enable first-in-market advantages, allowing faster break-even and better cash flow

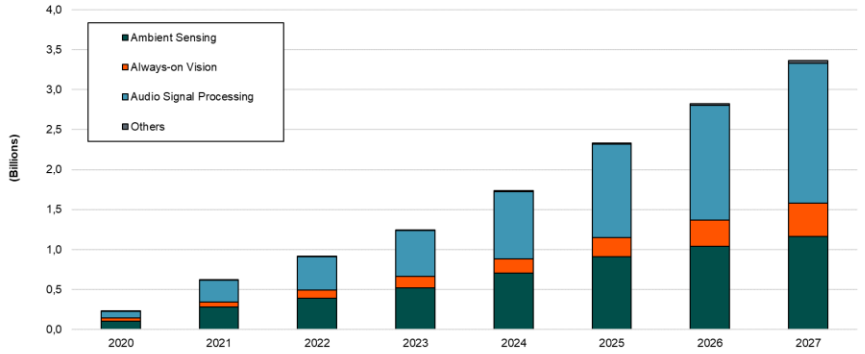
Artificial Intelligence(AI) and Machine Learning(ML) at the Tiny Edge



Key Benefits

- Low Latency
- Privacy, IP Protection, Security
- Bandwidth Constraints
- Offline Mode Operation
- Cost Reduction

>3B Devices projected with TinyML in 2027



Source: ABI Research, Artificial Intelligence and Machine Learning, 2 QTR 2022

Why Machine Learning on Edge IoT Device?

Low Latency Required

- Mission or safety-critical applications require real-time reactions
- Large data to process - typically at vision use cases - no time to upload to anywhere to process

Privacy and IP Protection, Security

- Data never leaves the sensing device, only inference result/metadata is transferred
- Less sensitive data to transmit, less chance to be hacked
- Protecting IP

Bandwidth Constraints

- Long range, low power, and slow networks can't transfer all Time Series data to process somewhere else
- Overloading of mesh network is an issue
- Large data to chunk e.g. hi-res images

Offline Mode Operation

- Local system keeps operating standalone in case of any network issue
- Connectivity is occasional or blocked by admin

Cost Reduction

- Network and infrastructure costs
- Data ingestion costs
- Data storage costs
- Cloud services
- Ops, maintenance
- Compact edge with ML solutions integrated to wireless SoC
- Cheaper devices

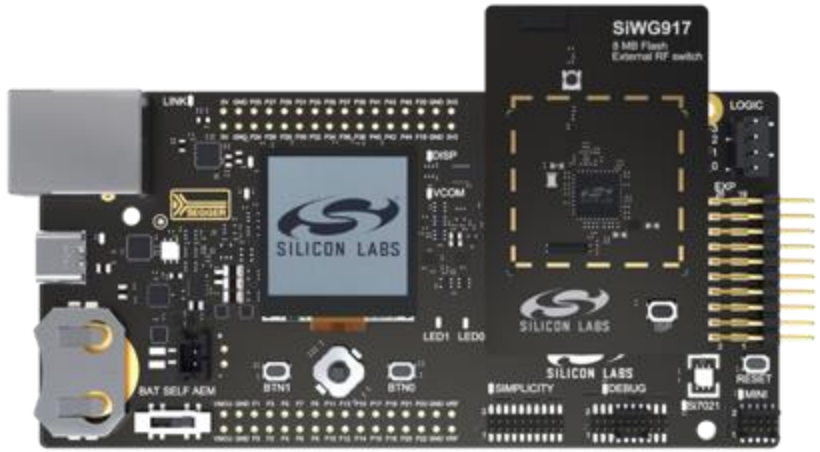
Power constraints

- Ultra-low power applications
- Always-on systems
- Healthy tradeoff in transmit to higher level compute vs. locally process

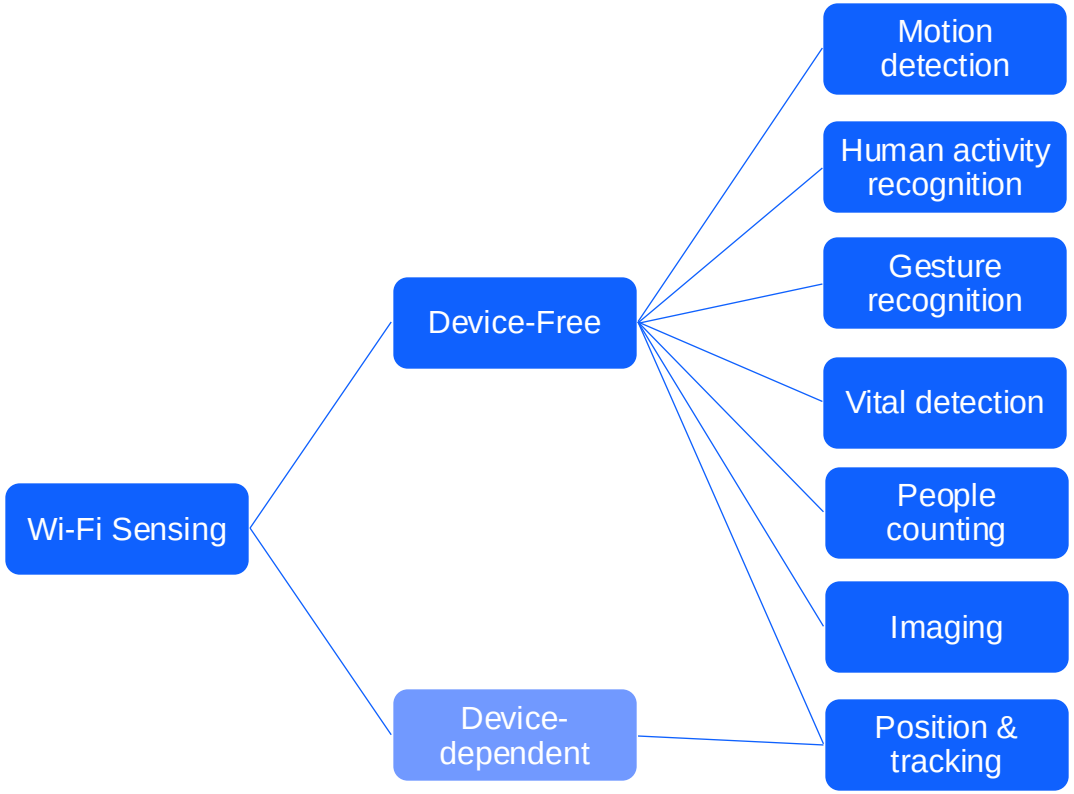
Data processing is more efficient with Machine Learning at the sensor level

Shipping Today: SiWx917

- Low power Wi-Fi 6 + BLE SoC
  - Minimizes battery replacement and recharging hassle for users with always-on cloud connectivity
- Superior wireless performance and easy device commissioning using Bluetooth LE co-ex
- Security focus: WPA3, TLS 1.3
- Integrated MCU with high memory PSRAM, and application dedicated ARM core
- MVP (Matrix Vector Co-Processor) for ML Applications
- Extensive Wi-Fi Gateway compatibility helps reduce user frustration
- Seamless integration with Simplicity Studio 5



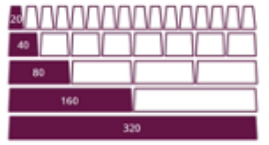
An Extensive Array of Emerging Wi-Fi Sensing Applications

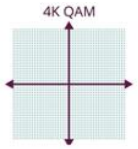


Wi-Fi 7: Adapted for IoT from the start…

Wi-Fi 7 Features for IoT

- 320MHz Channels
  - 2X Throughput without impact on size (no additional antenna or RF assets)
- Multi-link Operation (MLO)
  - Efficiency, reliability
- 4K QAM
  - +20% transmission rates
- MRU
  - Enhnaced spectral efficiency
- MCS14 and MCS15
  - Extended range



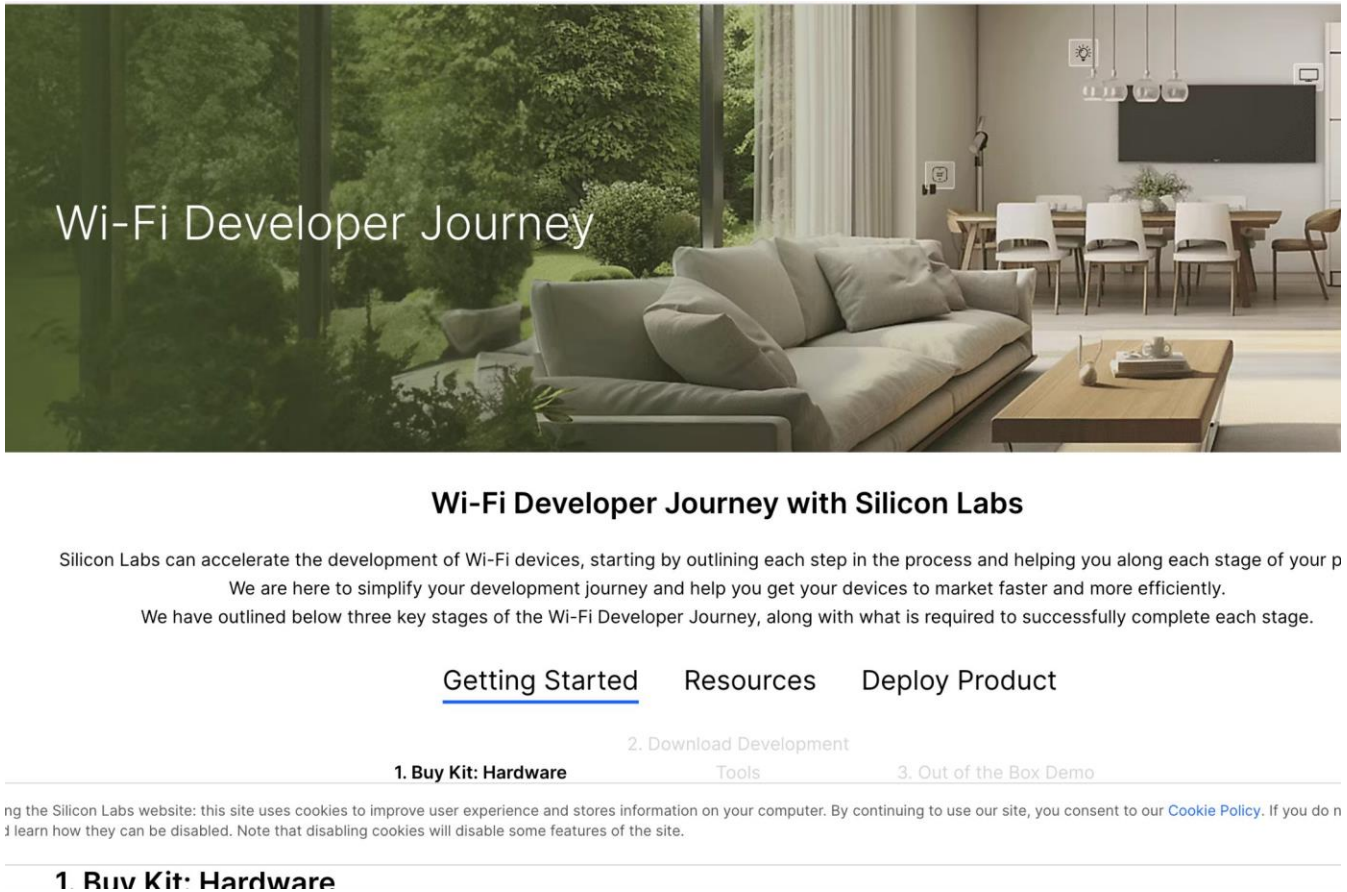


Enhanced Power Savings

- rTWT
  - Improved power savings with precision
  - Improved power savings for time
- MLO
  - Seamless switch to lower power link to save power
  - Seamless switch to best link to reduce retransmission or media access contention
- MRU
  - Improved efficiency and flexible interference avoidance
- MCS14 and MCS15
  - Less Tx power for same range

What's Next? Start your Wi-Fi journey with us…

- **Wi-Fi 6 is happening now**
- **IoT-optimized Wi-Fi is key**
- **20MHz channel provides a power/bandwidth balance for IoT**
- **Wi-Fi IoT applications keep expanding**
- **Matter is making a difference**
- **AI/ML at the edge optimizes resources**
- **Wi-Fi 7 was primarily designed for high datarate applications**
  - Multi-Link Operation (MLO) is Good for IoT
- **Growth continues!**



Thank You