

From Blueprints to Breakthroughs: 25 Years of Wi-Fi Design Evolution and the Road Ahead

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Who am I?



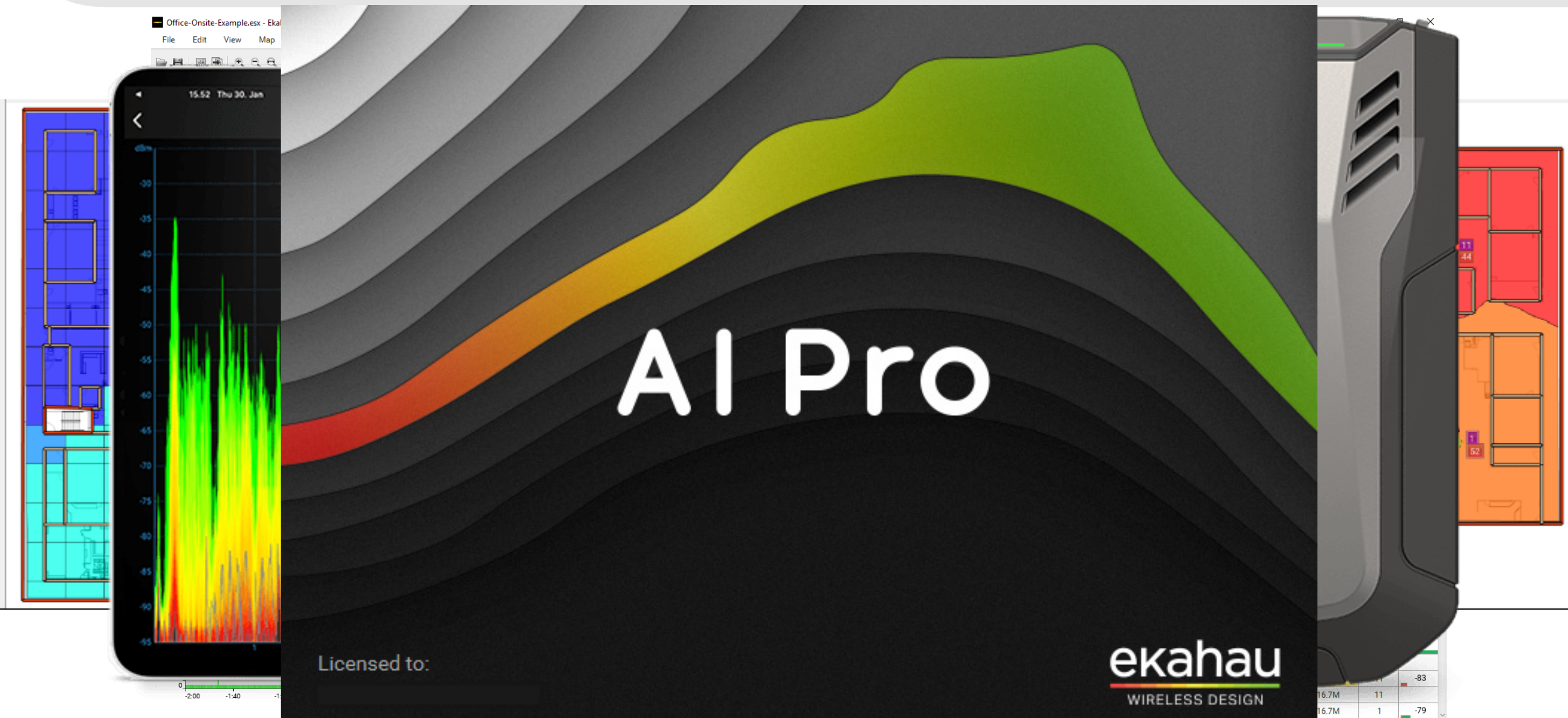
Extreme Networks
Office of the CTO
Director of Wireless



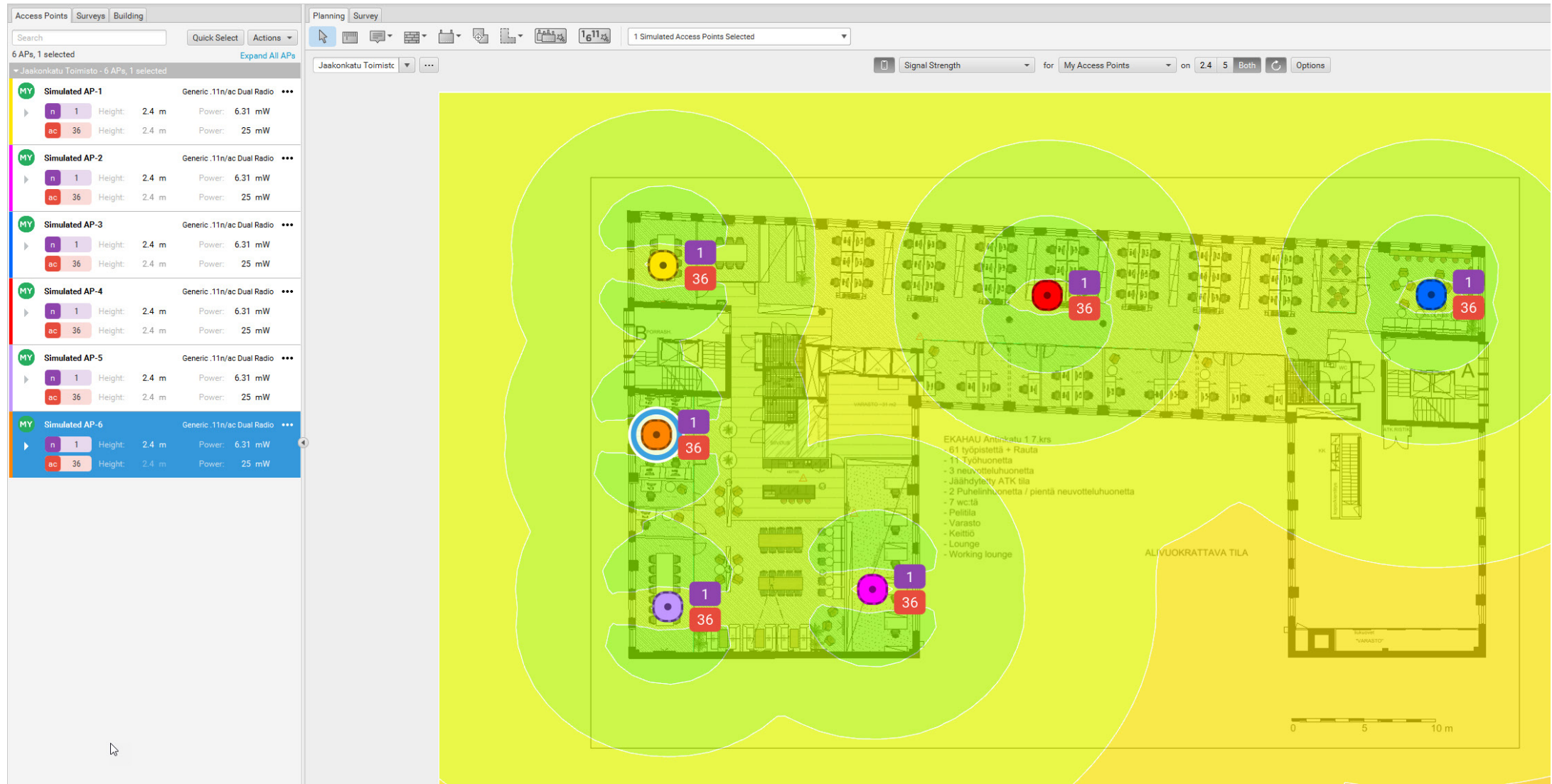
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Evolution of Ekahau



History of Wi-Fi Design - Coverage




The Shift to Capacity Planning



Area Options

Name

Area-24

 ▼

Coverage profile

High Speed Connectivity ▼

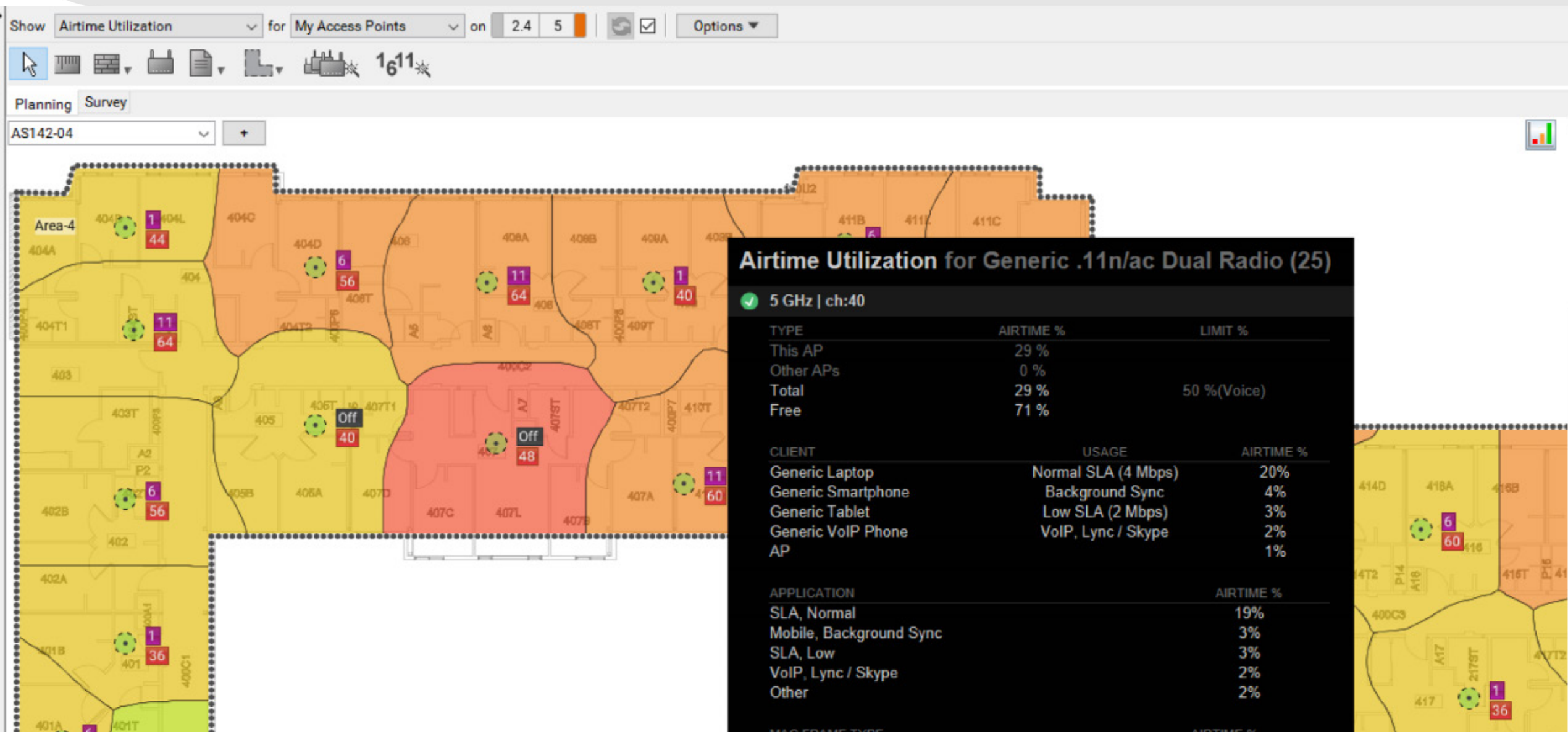
Devices

Total 428 devices, total bitrate 617.12 Mbps

Add devices

–	50	+	Generic Laptop 802.11ac 3x3:3 80MHz ▼	Normal SLA (2 Mbps) ▼	Delete
–	32	+	Generic Tablet 802.11ac 2x2:2 80MHz ▼	Very High SLA (10 Mbps) ▼	Delete
–	14	+	Generic Laptop 802.11ac 3x3:3 80MHz ▼	Streaming, Video ▼	Delete
–	32	+	Generic VoIP Phone 802.11ac 2x2:2 20MHz ▼	VoIP, Generic ▼	Delete
–	50	+	Generic Laptop 802.11ac 3x3:3 80MHz ▼	Background Sync ▼	Delete

Designing for Airtime Utilization

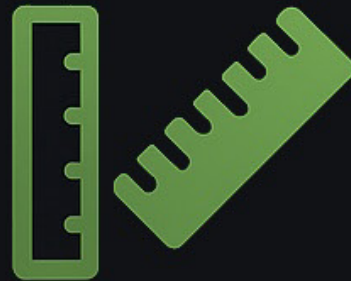




Building



Material



Size



RF Attenuation



**Enhanced Propagation
Models via Machine
Learning**



**Adaptive
Channel and
Bandwidth
Recommendations**



**Automatic Wall
Attenuation and
Calibration**



**Real-Time
Design
Validation**



**Smart Auto-Planner
for AP Placement**



**AI-Based
Capacity
Planning**

Generative AI and Wi-Fi Design

- accessPointMeasurements.json
- accessPoints.json
- applicationProfiles.json
- areas.json
- attenuationAreaTypes.json
- deviceProfiles.json
- floorPlans.json
- floorTypes.json
- image-2f240060-b65d-4740-8a79-4da322ee2fb8
- images.json
- interferers.json
- measuredRadios.json
- networkCapacitySettings.json
- project.json
- projectConfiguration.json
- projectHistorys.json
- requirements.json
- scanDeviceInformations.json
- spectrum-6f5002b3-7649-4599-b8cf-7a5f6436c444.bin
- spectrum-490f359b-1139-...0b-b484-b180a703696b.bin
- spectrum-1524e7f3-533e-4cae-b6c4-543db9be49f6.bin
- spectrumAnalyzerInformations.json
- survey-1f01bc39-8252-4016-b315-b90900d7bfaa.json
- survey-79141400-e1b3-4891-a554-5abbbae50331f.json
- surveyLookups.json
- track-0d6b176a-f18c-44f7-91c2-8423f5a11af5.bin
- track-1d9c818f-b373-4d84-867a-a63df64f1fbf.bin
- track-41746244-cbad-43e6-b37a-f0fc999379b0.bin
- track-a88302b9-91ea-4e17-bce3-24c66f9ee680.bin
- track-a8394433-2281-4c64-8166-94b9de872e11.bin
- track-c54ba293-5a4e-4454-a56e-a170ae85e4e4.bin
- track-de9998a5-ef3c-4f6a-9adc-16c9c85122c2.bin
- track-e70fc883-3ba6-4d68-a8bc-ed8463718924.bin
- usageProfiles.json
- version
- wallTypes.json
- wifiAdapterInformations.json

JSON Files (Project Data & Metadata)

These files describe the structure, configuration, and data collected in the Wi-Fi survey project:

• Access Points & Measurements

- accessPoints.json: Details about all detected or planned APs.
- accessPointMeasurements.json: Measurement data per AP (e.g., signal strength).

• Surveys

- survey-*.json: Individual survey walks or passes.
- surveyLookups.json: Maps survey IDs to metadata like names or timestamps.

• Floor Plans and Layout

- floorPlans.json: Metadata about floor images used.
- image-*: Binary image files for floor plans.
- images.json: Links image UUIDs to filenames or floor layouts.

BIN Files (Raw Measurement Data)

- **Track Data** (track-*.bin): Device movement and positioning during the survey.
- **Spectrum Data** (spectrum-*.bin): Raw RF energy measurements captured during survey.

Can you analyze the data from ESX file captured with an Ekahau SideKick?

Yes, I can help analyze data from an **ESX file** captured with an **Ekahau Sidekick**.

However, to proceed, I'll need you to **upload the .esx file** here. Once uploaded, I can extract and analyze key information such as:

- Heatmaps (signal strength, SNR, interference, etc.)
- AP locations and configurations
- Channel utilization
- Spectrum analysis (if Sidekick 2 was used)
- Network health (coverage, roaming, co-channel interference)
- Client behavior (if tracked)
- Wi-Fi standard usage (e.g., 802.11ax adoption)

If you have specific questions—like verifying coverage for a certain SSID, checking channel planning, or validating design against requirements—let me know, and I'll tailor the analysis.

Recommendations: 6 GHz Deployment

Immediate Design Actions

1. **Increase AP density** in areas with weak 6 GHz RSSI (< -80 dBm).
2. Consider **enabling 6 GHz band steering** for capable clients (Wi-Fi 6E/7).
3. Prioritize channels in **UNII-6/7 (mid-upper 6 GHz)** for lowest interference risk.

RF Planning Tips

- Use **80 MHz channels** where possible — band is clear.
- Use Ekahau's 6 GHz predictive planning tools to confirm coverage per wall model.
- Validate **DFS-free operation** if needed for rapid reconnections.

Validation

- Run **client-side tests** on 6 GHz in critical areas (video calls, roaming).
- Verify **secondary signal coverage** in Ekahau if seamless roaming is a goal.



Be Conversational



Import the JSONs and BIN files independently into of the .ESX file



Max file size is 512 MB (The smaller the better)



Use supporting files such as screenshots



Provide supporting information such as Client specs and requirements

Use ChatGPT to help define requirements



I need to design a Wi-Fi network for a 50-bed hospital that has emergency care and is 100,000 square feet. Can you help me create a list of requirements that I might need to define before performing a predictive design in Ekahau?



Absolutely, I can help you with that! Before doing a predictive Wi-Fi design for a **50-bed, 100,000 sq ft hospital with emergency care** in **Ekahau**, it's crucial to define clear **design requirements** to ensure coverage, capacity, and reliability — especially given the mission-critical nature of healthcare environments.

Here's a **comprehensive list of requirements and considerations** to define upfront:

1. Project Scope & Goals

- **Total square footage:** 100,000 sq ft
- **Number of floors**
- **Departmental layout:** ER, patient rooms, ORs, labs, admin, etc.
- **Use case(s):** Clinical apps, VoWiFi, IoT, guest access, RTLS, staff communication, etc.

2. Primary Wi-Fi Use Cases (Design Drivers)

List and prioritize critical applications:

- **Electronic Health Records (EHRs)** – high priority
- **Voice over Wi-Fi (VoWiFi)** – real-time communication (requires high design standards)
- **Medical IoT devices** – infusion pumps, telemetry, etc.
- **RTLS (Real-Time Location Services)** – asset/staff/patient tracking

Future of Wi-Fi Design?

Client Profiling for eMLSR Behavior

Client Type

Enhanced Multi-Link Single Radio (eMLSR) ▾

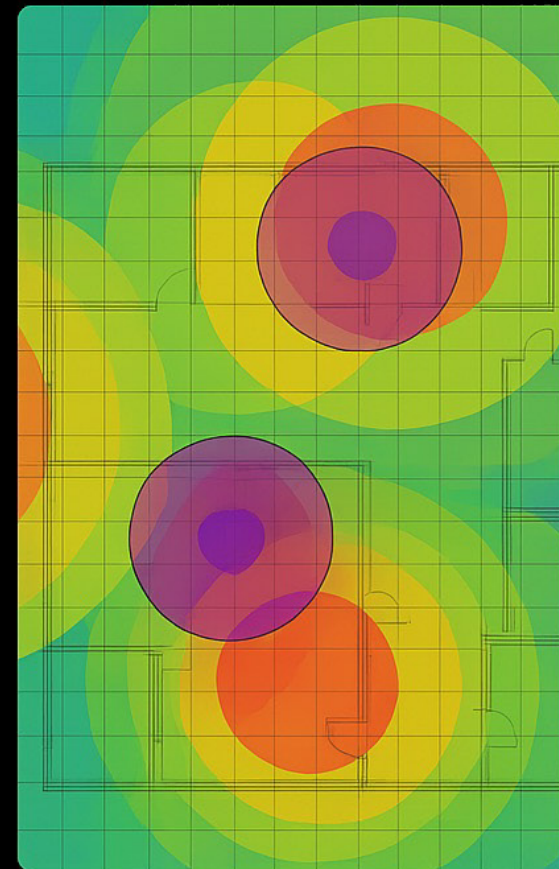
Options

- ☒ Single-radio client hopping between multiple bands

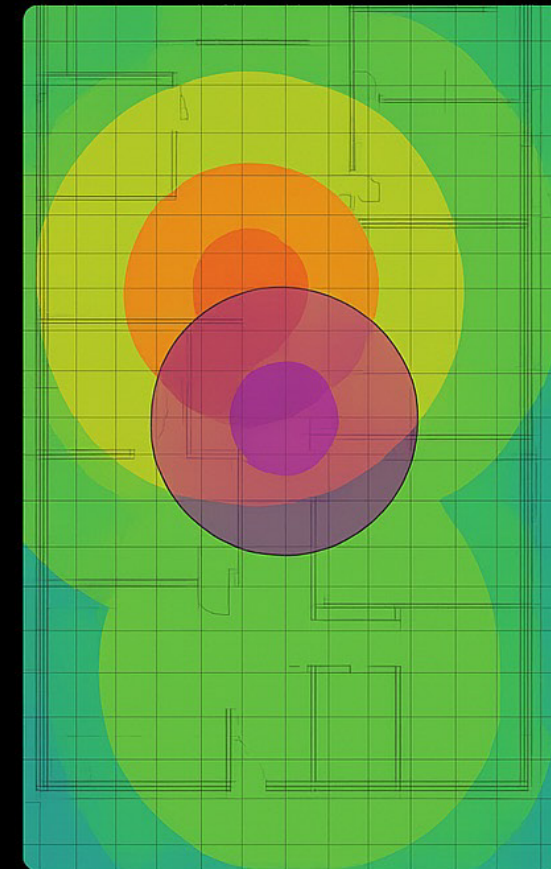
5 GHz — 6 GHz



5 GHz



6 GHz



eMLSR Density Zones

Sustainability as a Design Priority



Energy monitoring

Energy Efficient Ethernet (EEE)

Low-power sleep modes

Leverage PoE classification signatures

Dynamic MIMO radio capabilities

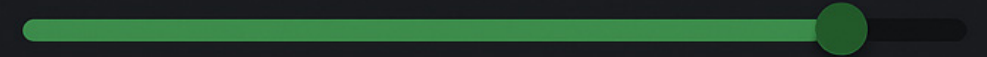
Eco-friendly insights

Green reporting

Occupancy Analytics

Sustainability as a Design Priority

Sustainability Level



Estimated Energy Usage Per Year
10.000 kWh



Estimated CO₂ Savings Per Year
2.500 kg



Estimated Cost Savings Per Year
€800

[Generate Green Design Report](#)

Sensing-Aware Simulation Models

Estimated Occupancy

15 people

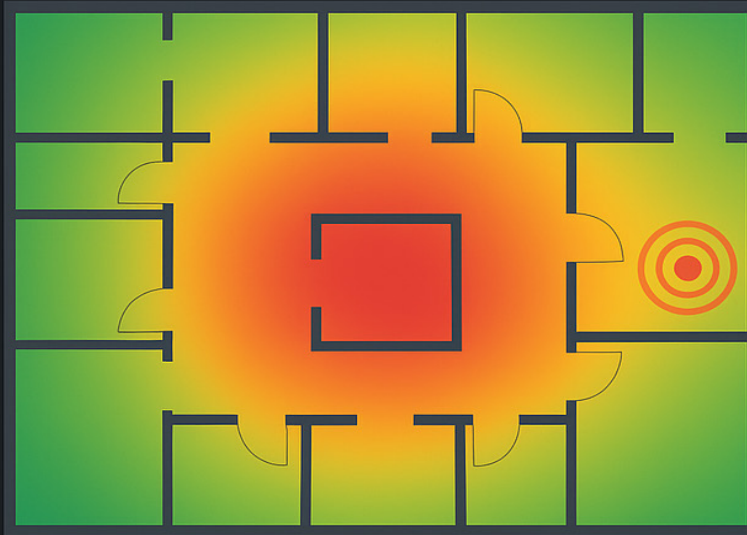
Low

Medium

Simulate

Sensing-Aware Levels

- Low
- Medium
- High



Sensing Sensitivity



Motion Detection



Fall Detection



Security Monitoring

Wi-Fi sensing uses **channel state information (CSI)** to interpret changes in RF signals to sense motion

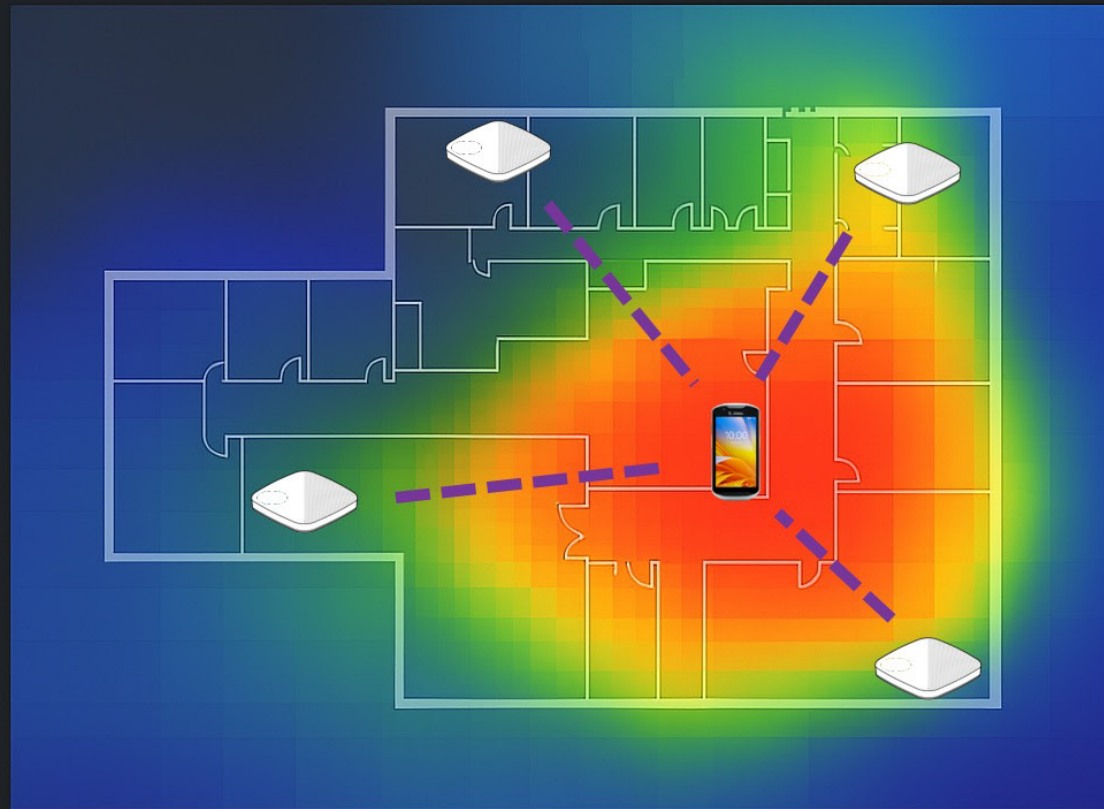
Tracking Technologies

- ☐ BLE Tracking
- ☐ UWB Tags
- ☒ Wi-Fi
 - ☐ 802.11mc
 - ☒ 802.11az

Channel Width

- ☐ 40 MHz
- ☐ 80 MHz
- ☐ 160 MHz

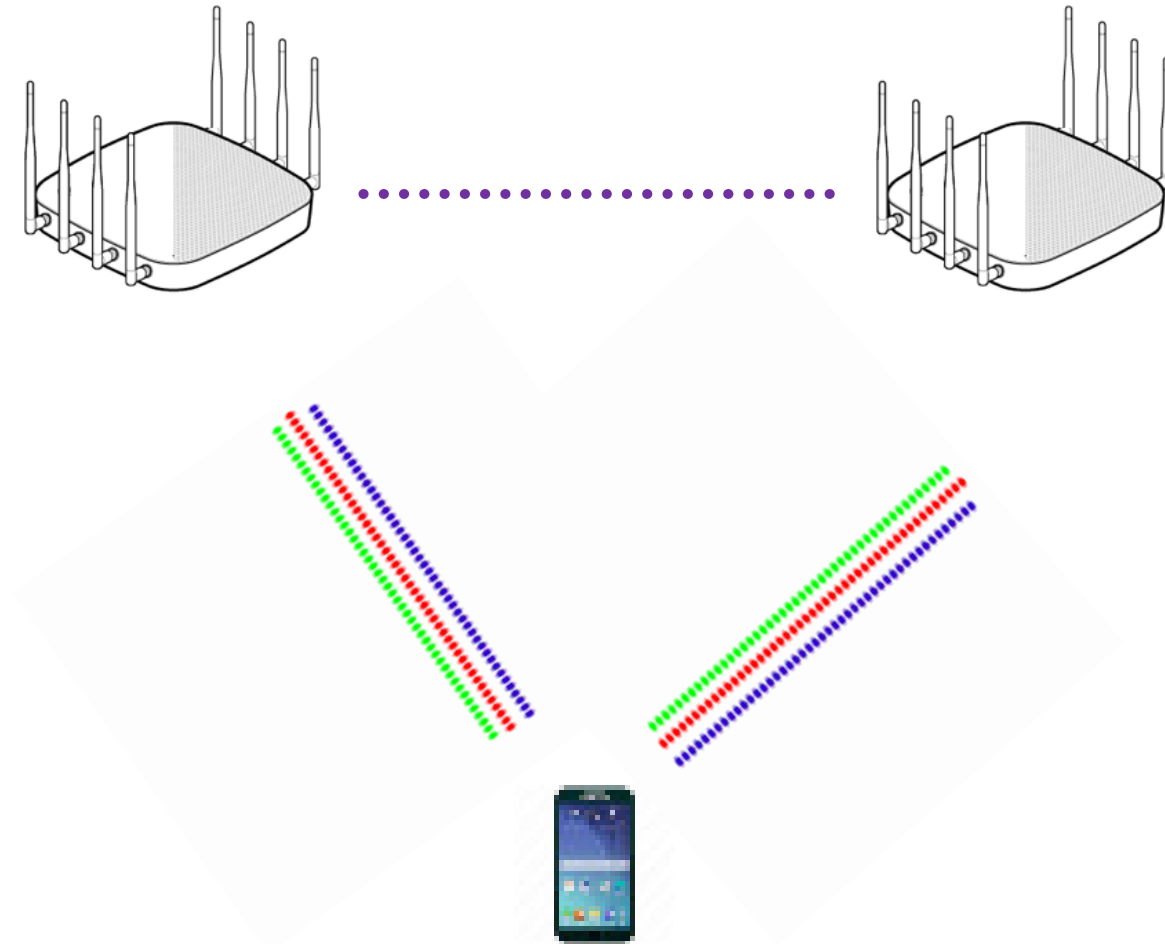
6 GHz



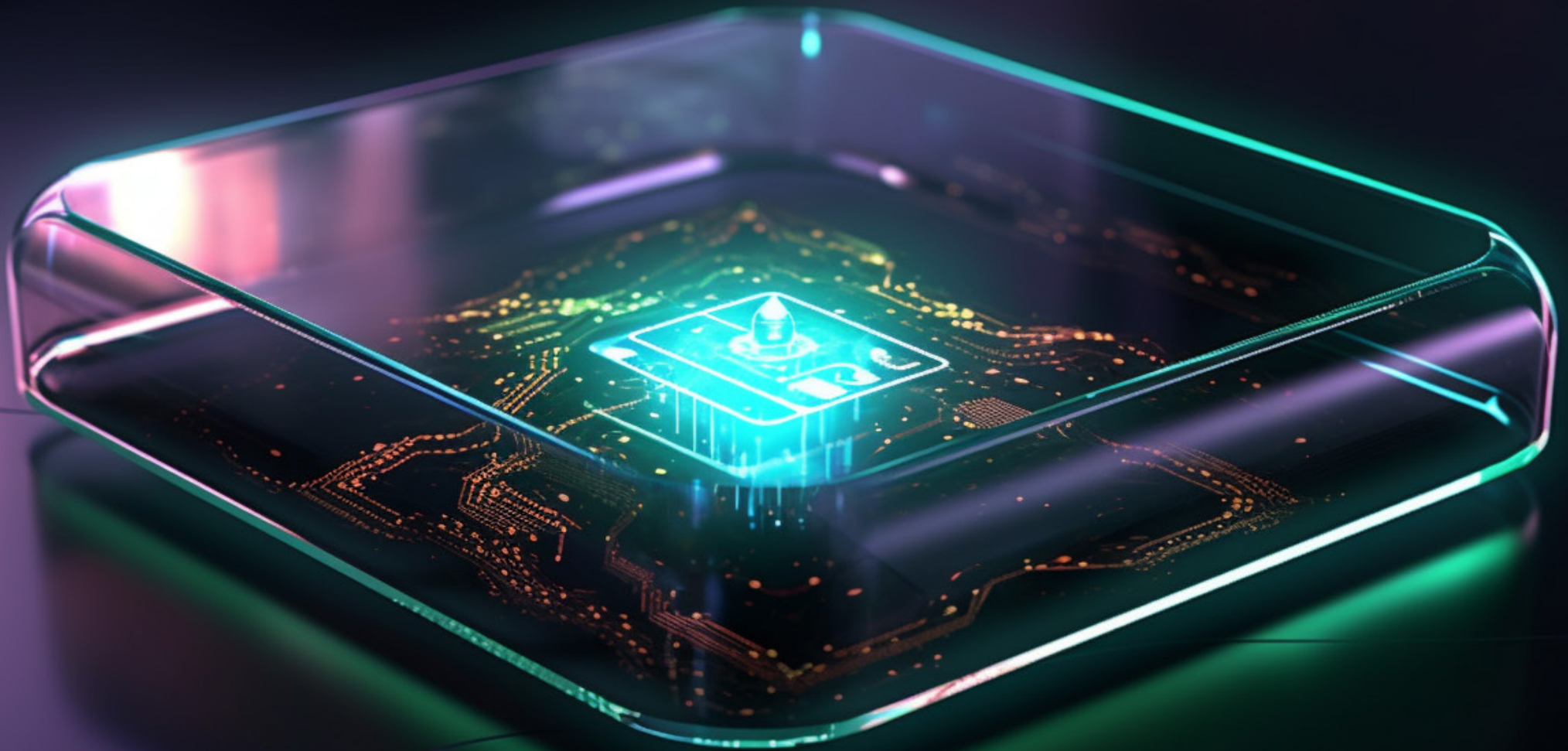
Wi-Fi 8 - Multiple AP Operation Coordination (MAPC)

Wi-Fi 8 is coming to market as early as late 2028

- Based IEEE 802.11bn – Ultra High Reliability (UHR)
- Main technology is **Multiple AP Operation Coordination** where a Wi-Fi 8 client is connected to two Wi-Fi 8 APs at the same time
- Benefits:
 - Potential for near zero latency times
 - Greatly enhanced roaming
 - Distributed use of channel spectrum across APs for greater bandwidth

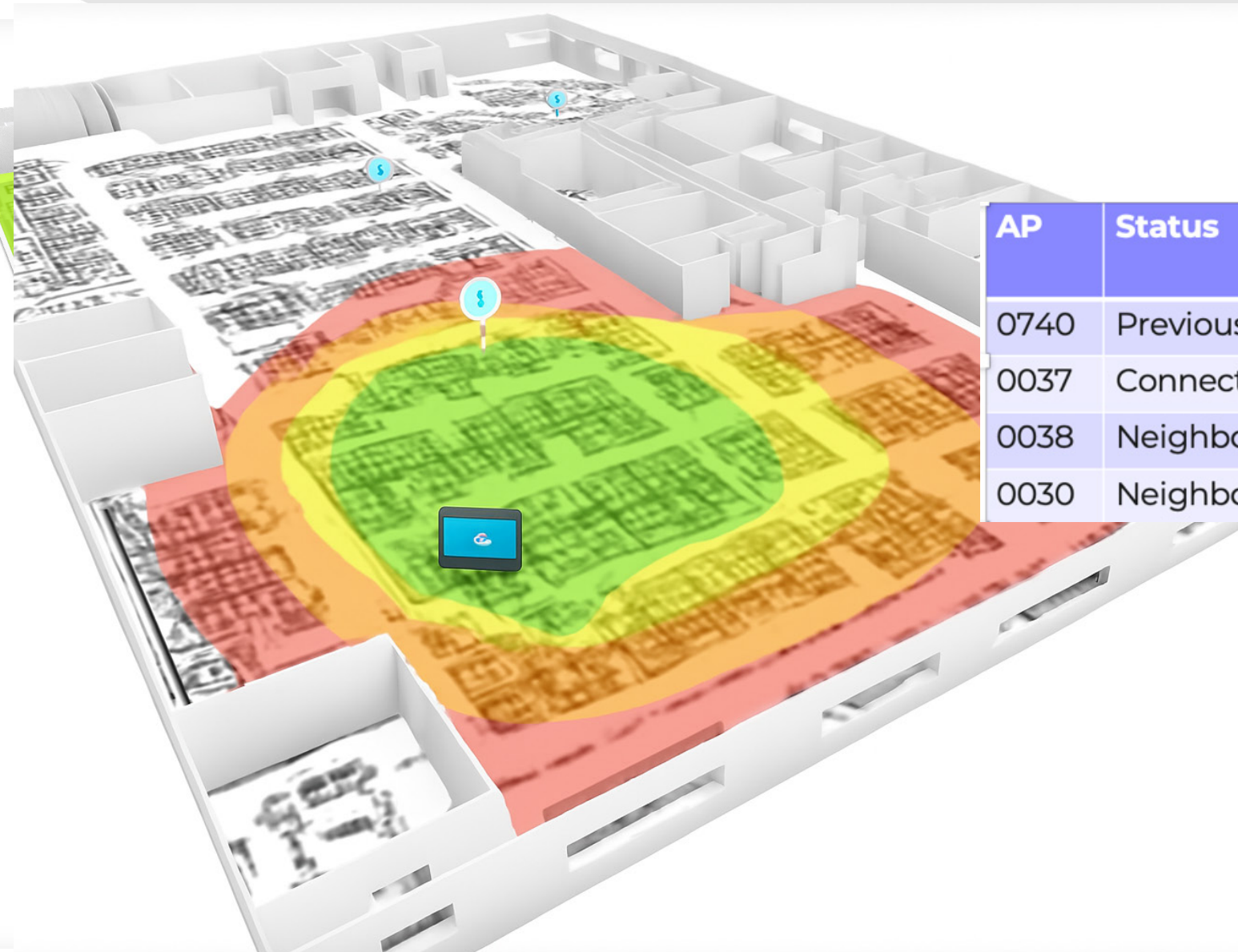


AI at the Edge – APs with Built in Intelligence





We have been looking at Wi-Fi from the wrong side of the signal

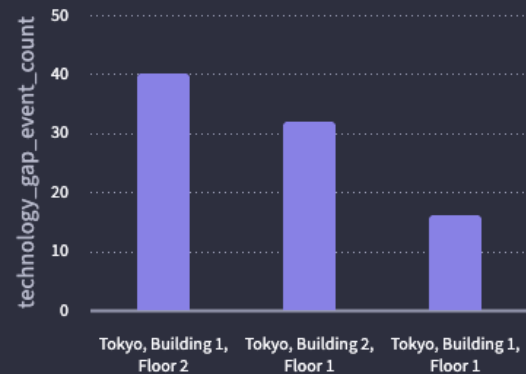


AP	Status	RSSI	SNR	Roaming Priority
0740	Previous	-80 dBm	15 dB	3
0037	Connected	-65 dBm	35 dB	
0038	Neighbor	-72 dBm	28 dB	1
0030	Neighbor	-75 dBm	25 dB	2

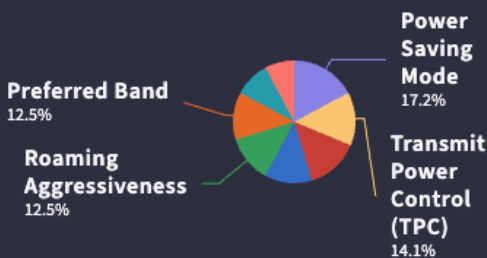
Demo – The power of client-side data



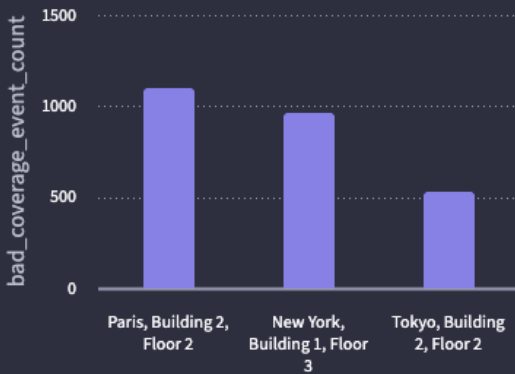
Technology Gap Events by Location



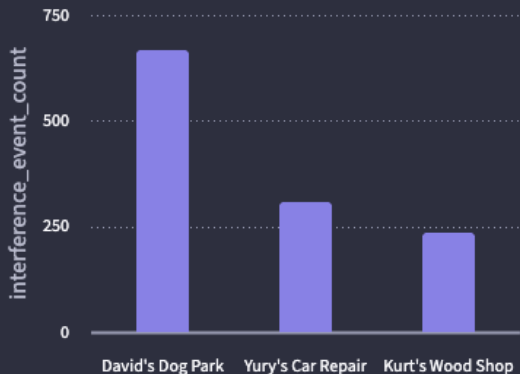
Most Reported Suboptimal Driver Properties



Bad Coverage Events by Location



Co-channel Interference Events by Location



Client Technology Gap Events Ordered by Location

Ap Location	Event Device Id	Event Time	Event Device Name	Client Max Radio Type Capability	Ap Radio Type	Ap Device Id
Tokyo, Building 1, Floor 1	82b5e183	2024-12-10 12:32:13	Client-af:58:ec:ee:94:94	EHT	HT	62
Tokyo, Building 1, Floor 1	82b5e183	2024-12-11 09:02:13	Client-af:58:ec:ee:94:94	EHT	VHT	63
Tokyo, Building 1, Floor 1	82b5e183	2024-12-12 09:02:13	Client-af:58:ec:ee:94:94	EHT	VHT	63

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✓ Publish



No Artifacts Generated

New Chat



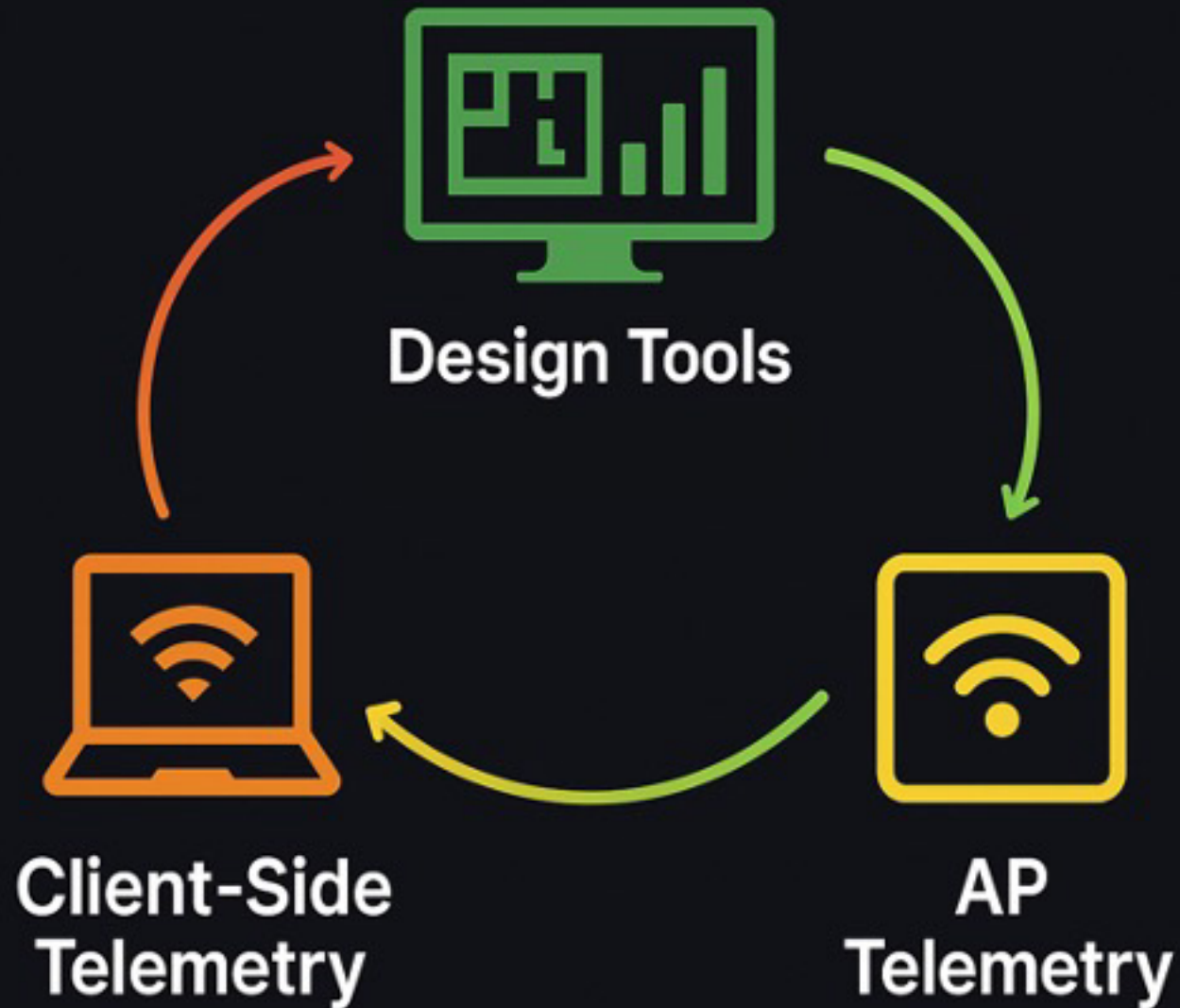
Hello, 1202!

Welcome to  Extreme AI Expert

Which locations in my network have the most roaming failures?



Extreme AI Expert can make mistakes. Check important info.



Extreme Platform ONE: Enterprise Secure Connectivity Made Easy



Wireless



Wired



SD-WAN



Security



Ecosystem

Agentic AI System for Wi-Fi Design



Agents work independently or collaborate to meet overall objectives.

Collaboration Agent

Main function is to coordinate sub-agents:

- *AP Selector Agent* → chooses models
- *Coverage Agent* → maximizes RSSI + SNR
- *Capacity Agent* → aligns with application profiles
- *Interference Agent* → optimizes channel plans



Wi-Fi is fuel that powers the enterprise engine



Always remember that over 75% of ingress data for the enterprise enters at the edge via Wi-Fi



Thank you, Karl Benedict



CWNE #395

Manager of the Americas Solution
Architect team at Extreme Networks