



Practical AI

...for Spectrum Convergence

Dynamic Spectrum Alliance
Matt MacPherson
Wireless CTO, Cisco

September 2024



Converged Multi-Access Wireless

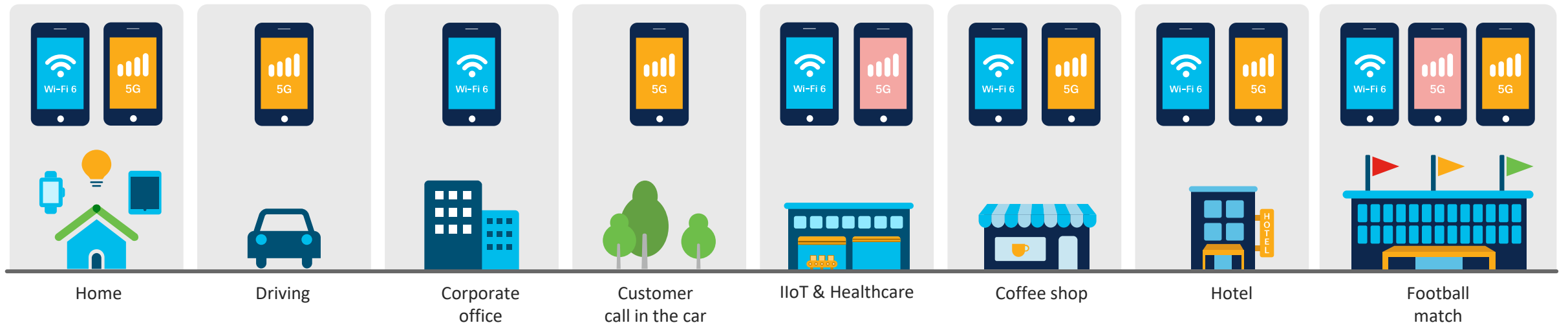
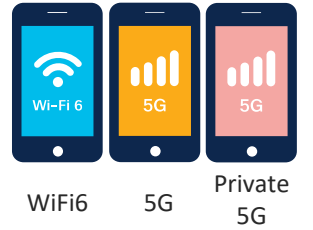
Policy-based seamless roaming across enterprise and service provider

Use ALL Spectrum Seamlessly

Users Win! Countries Win!



Converged Access for People and Things



To use all stacks better, we need...

Frictionless Onboarding

OpenRoaming for all stacks
(assure access to all available paths)

Seamless Interworking

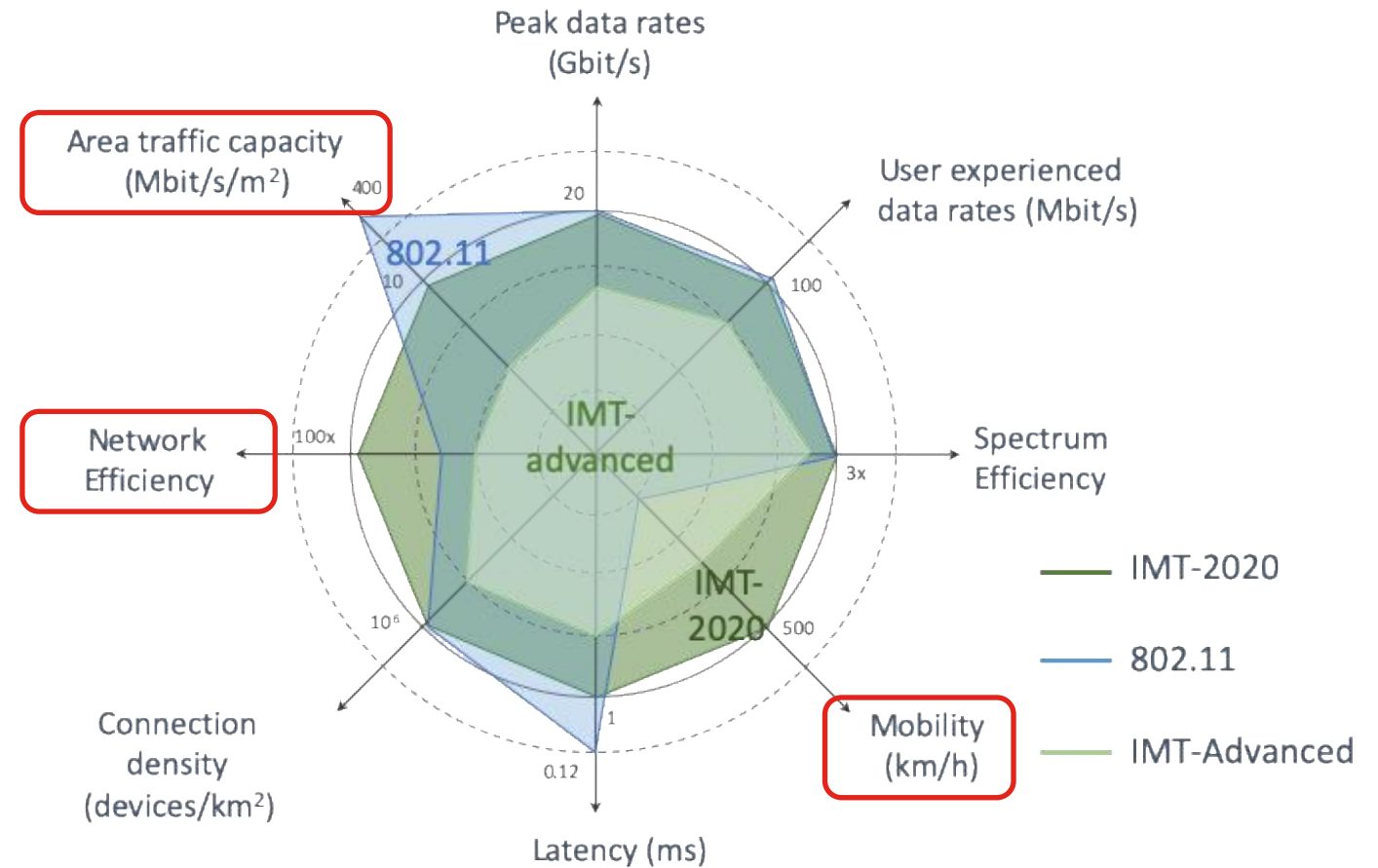
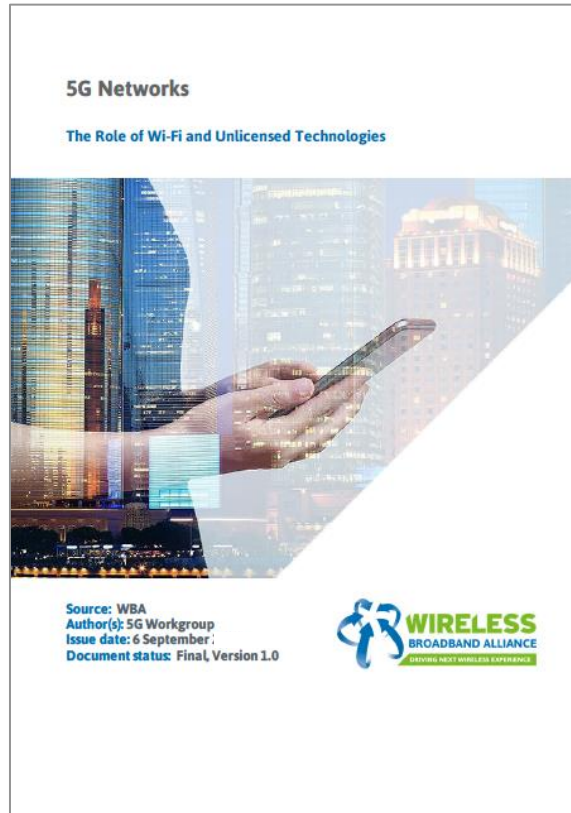
Policy-based path selection for
Loosely coupled Access Networks

Seamless Handover

Roaming between Wi-Fi (private)
and cellular (public)

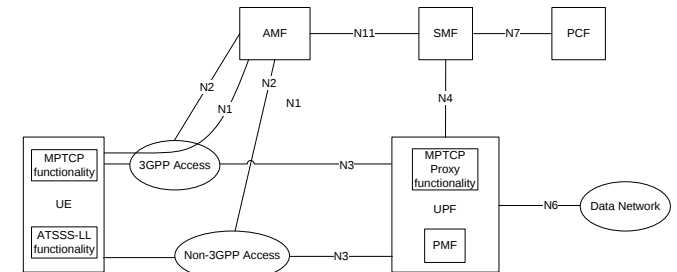
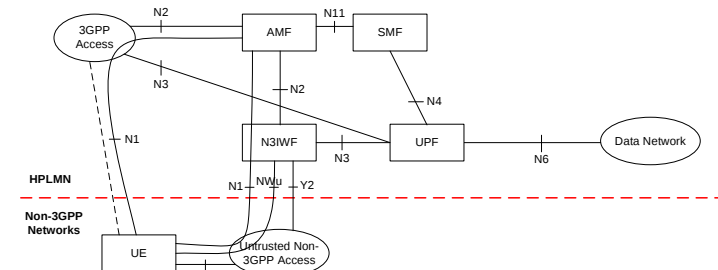
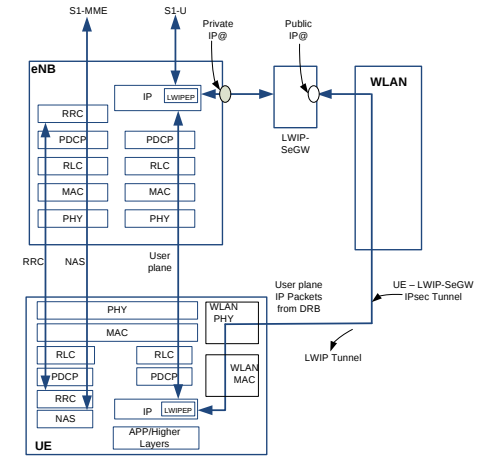
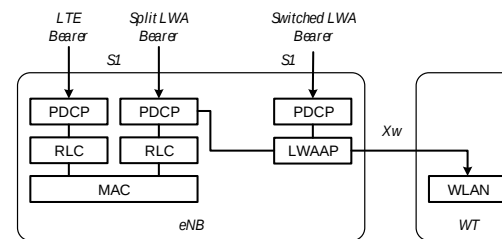
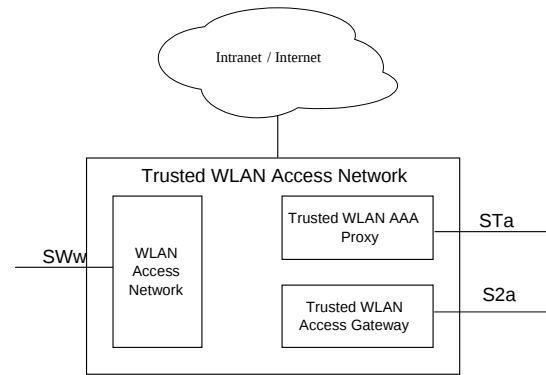
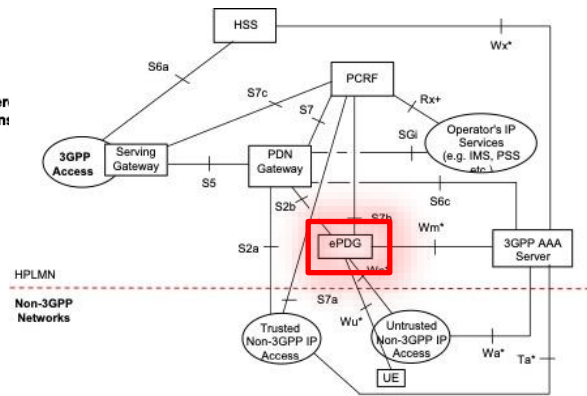
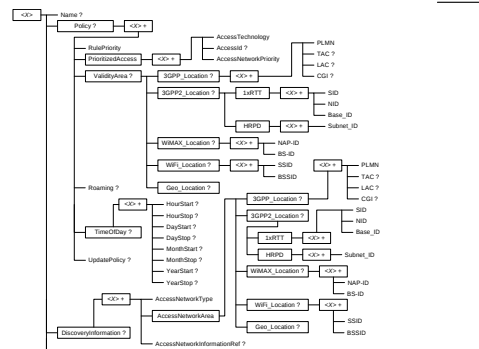
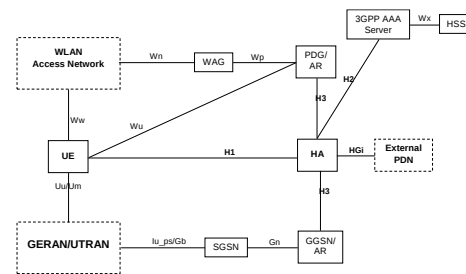
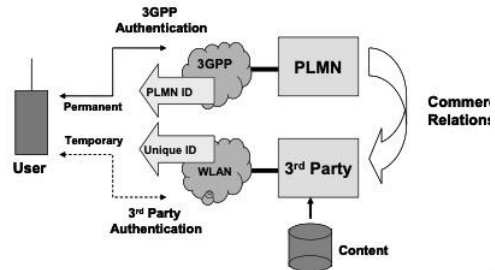
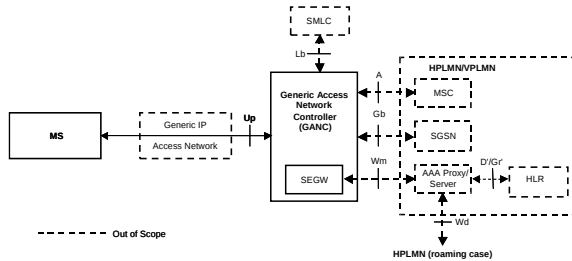
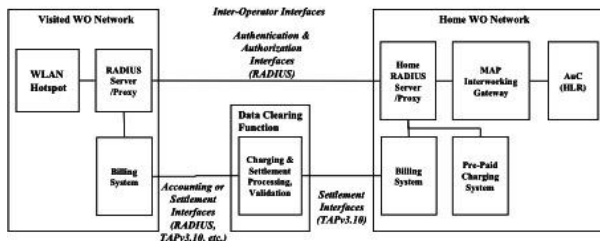
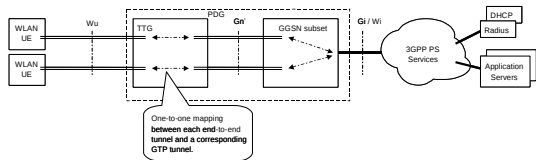
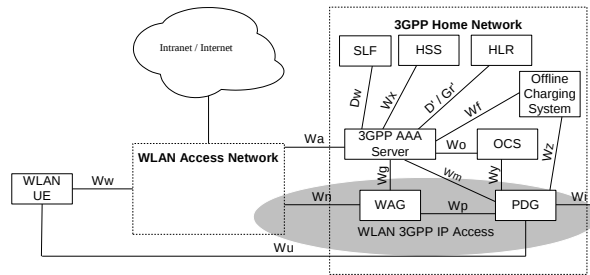
Multi-Access – Yes!

more overlap means better convergence!



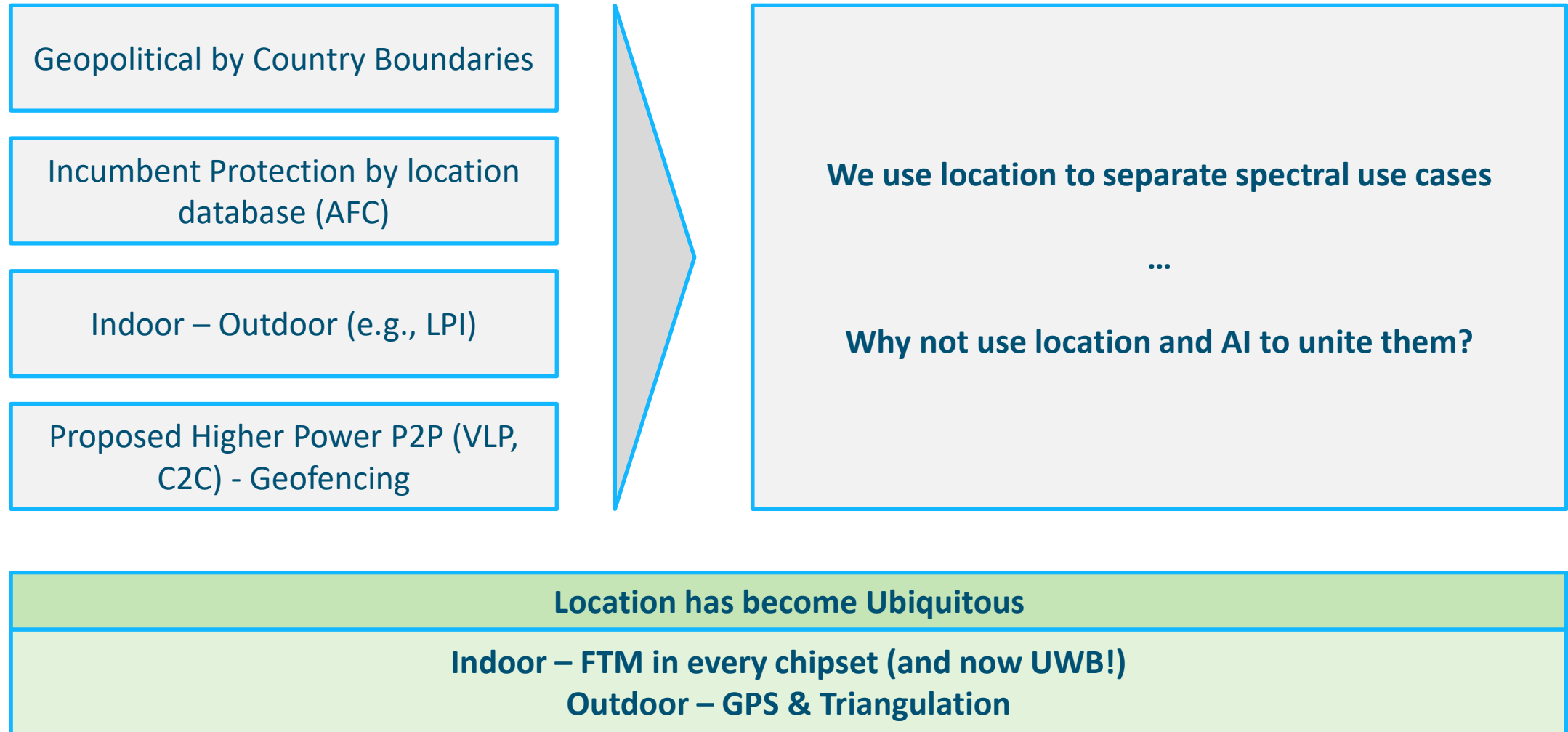
optimized to stack strengths: Wi-Fi is Dense, 5G is Ubiquitous

20 years of fragmentation and failures...

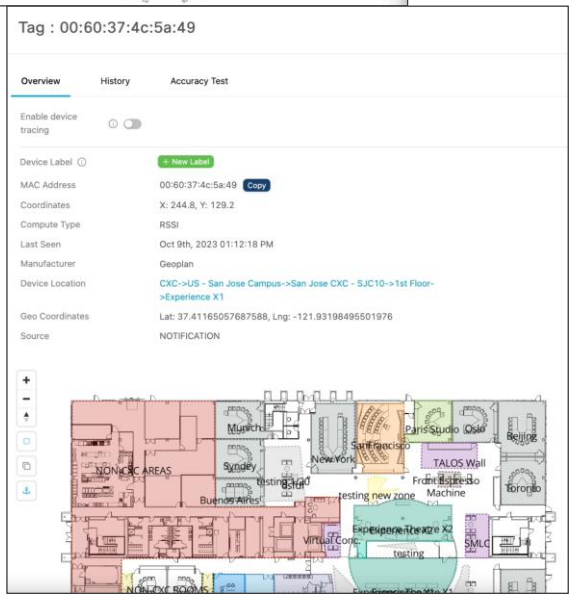
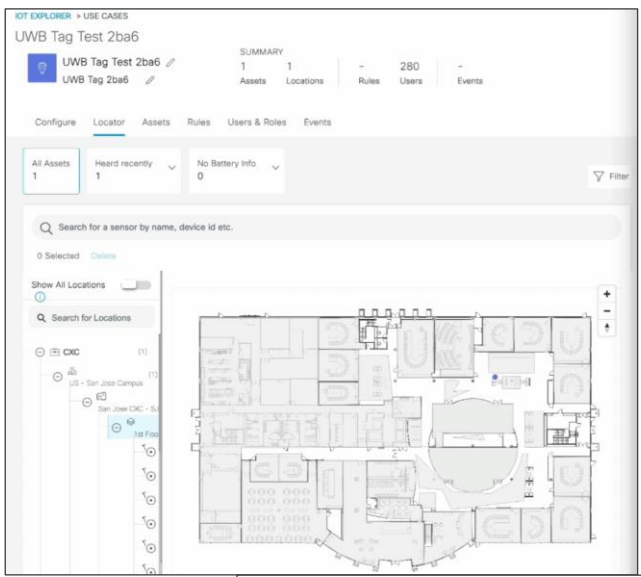
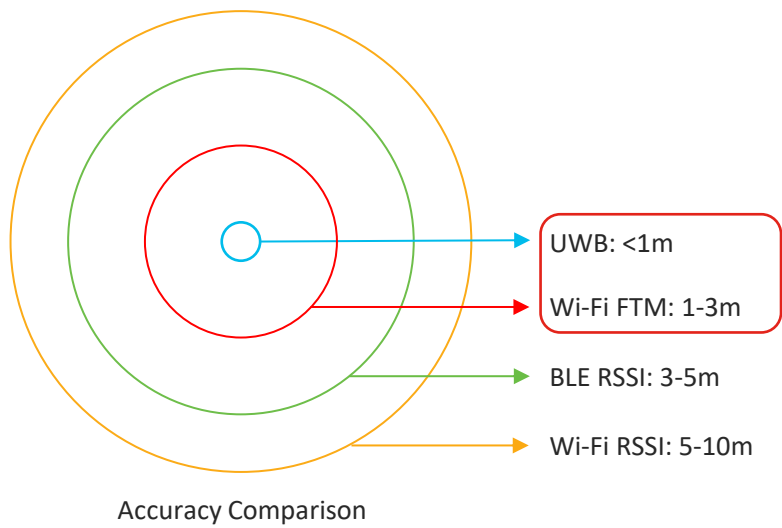
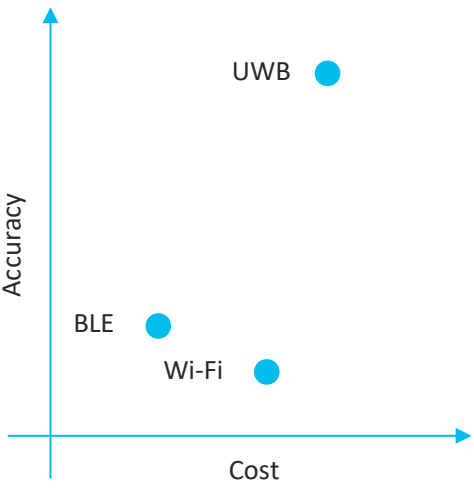
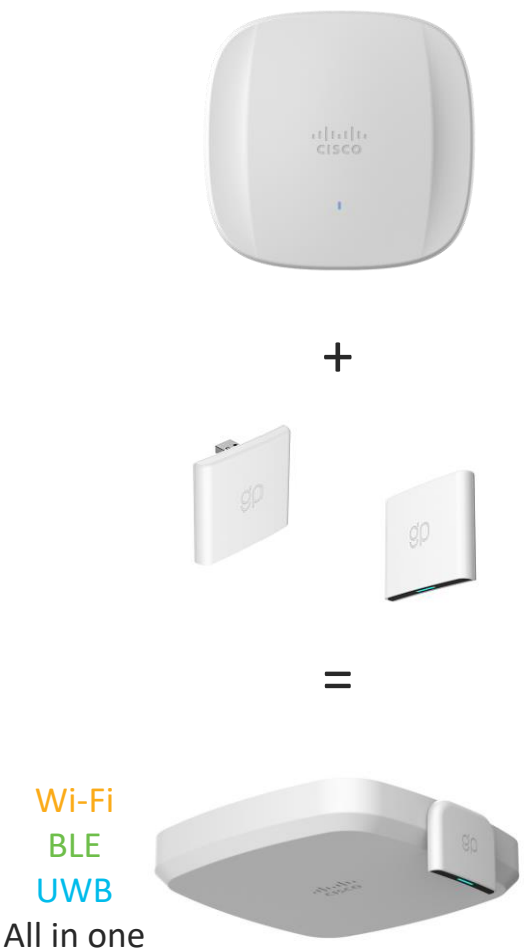


Can AI to solve convergence? ... solve the edge conditions?

Spectrum has Location/Power dependencies



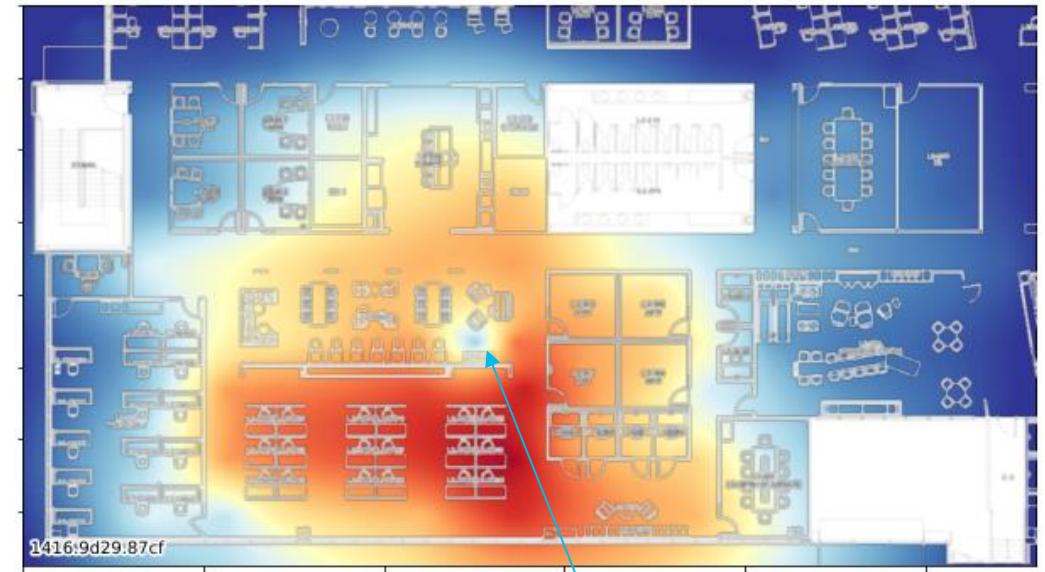
Advanced Location with FTM/UWB



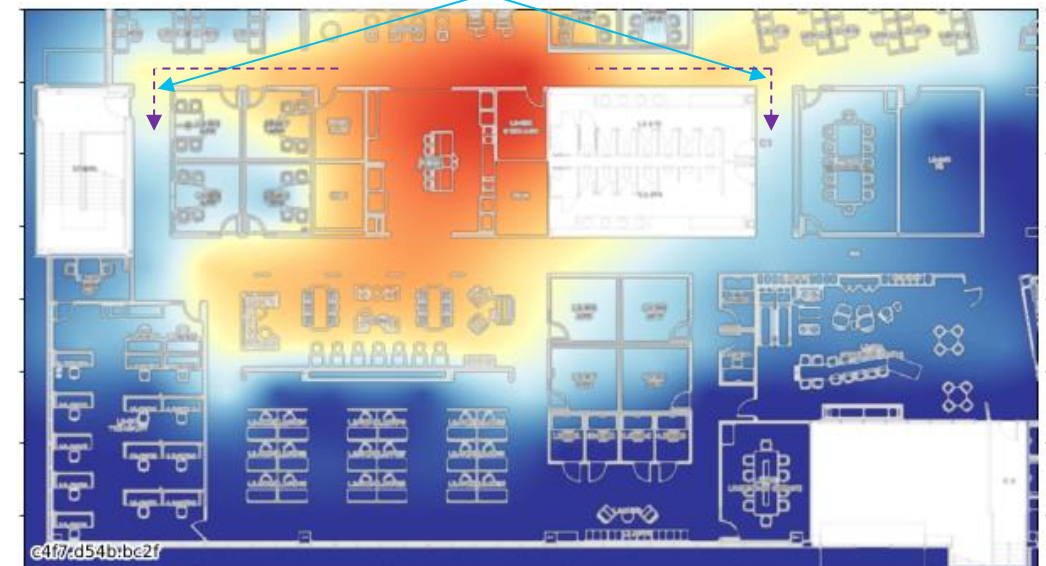
AI is data hungry

Data is required to train the AI

- AP's measure RF propagation
- Cisco AP's also collect the client RF view
 - Using location of client provides details on current RF propagation
- This allows for sophisticated **ML & AI** algorithms to...
 - adjust RF power to maximize coverage and minimize dead spots
 - minimize transmission power requirement at AP and client – sustainability (green!)
 - optimize/maximize network capacity through channel re-use RRM



Fast fading coverage gap behind a pillar

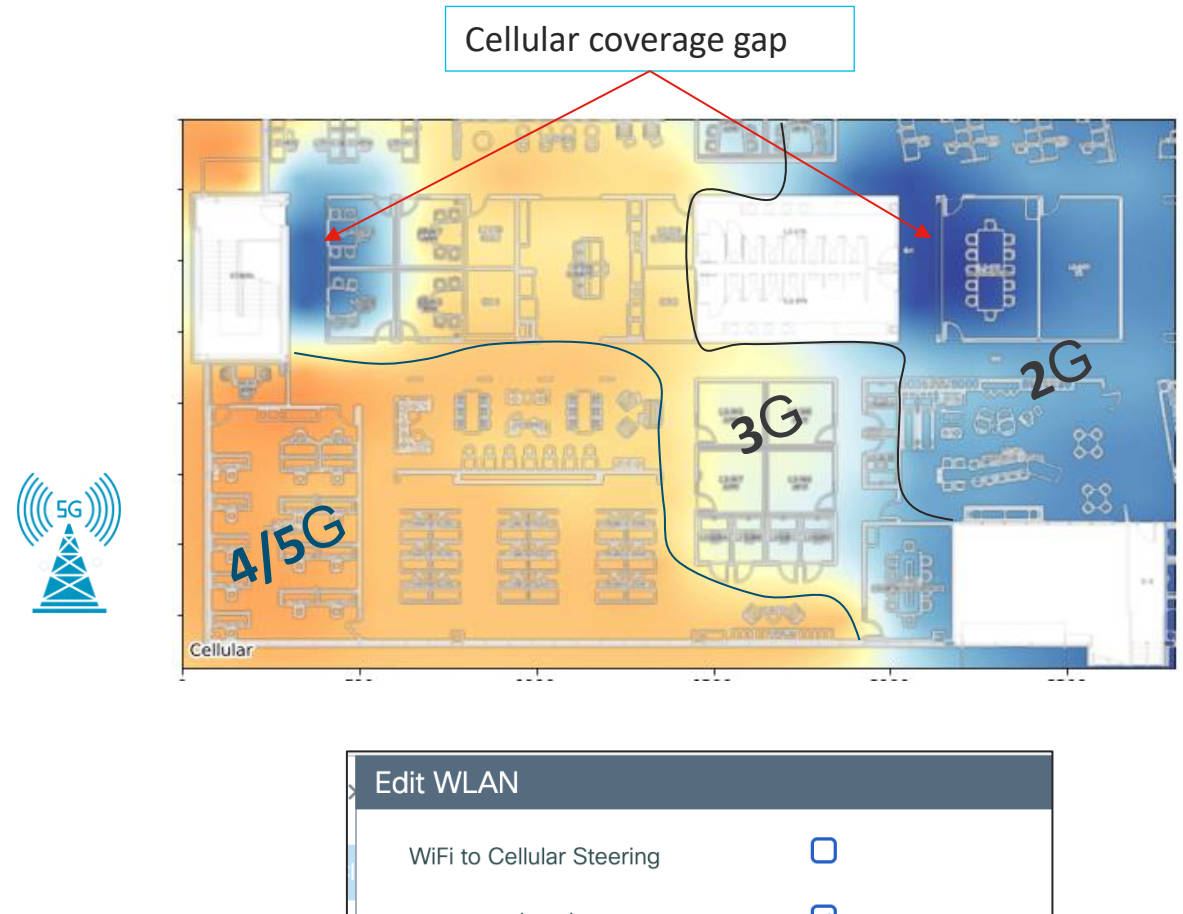


Signal drop as client turns the corner

AI for intelligent path selection – RF optimization

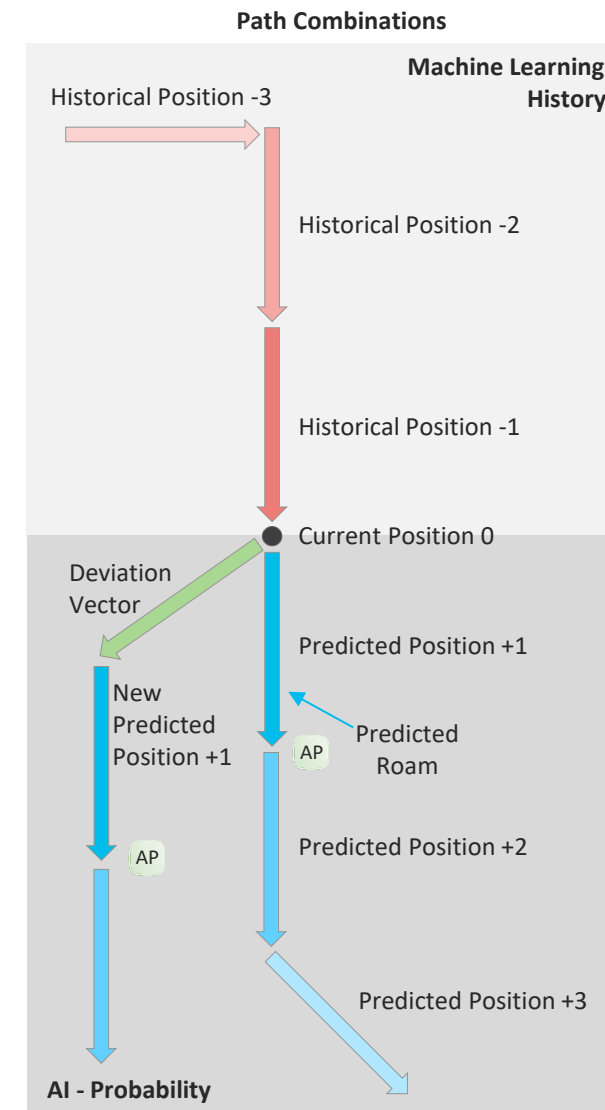
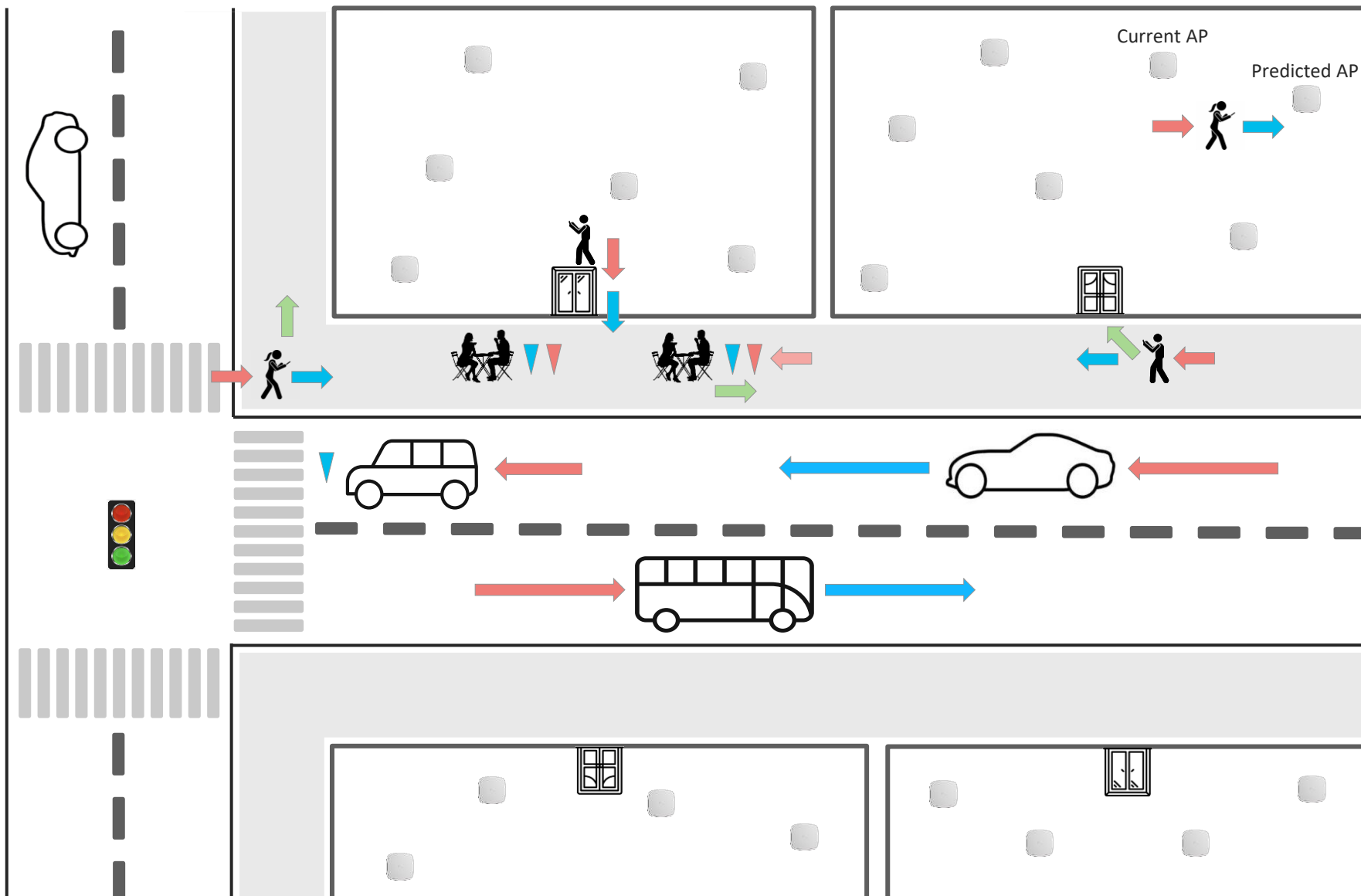
...Seamless user experience

- 5G clients are multi-radio
- Overlap and boundaries of both licensed and unlicensed RF understood
 - AI can determine where and when to move between access (Wi-Fi & 5G)
 - Mobility handoff power level can be **dynamic**
- The old way...
 - Break before make – bad experience
- The new AI way...
 - Predictive mobility through AI



Seamless handover with Vector Roaming

Vector-based roaming: use STA movement vector to recommend APs and handoff



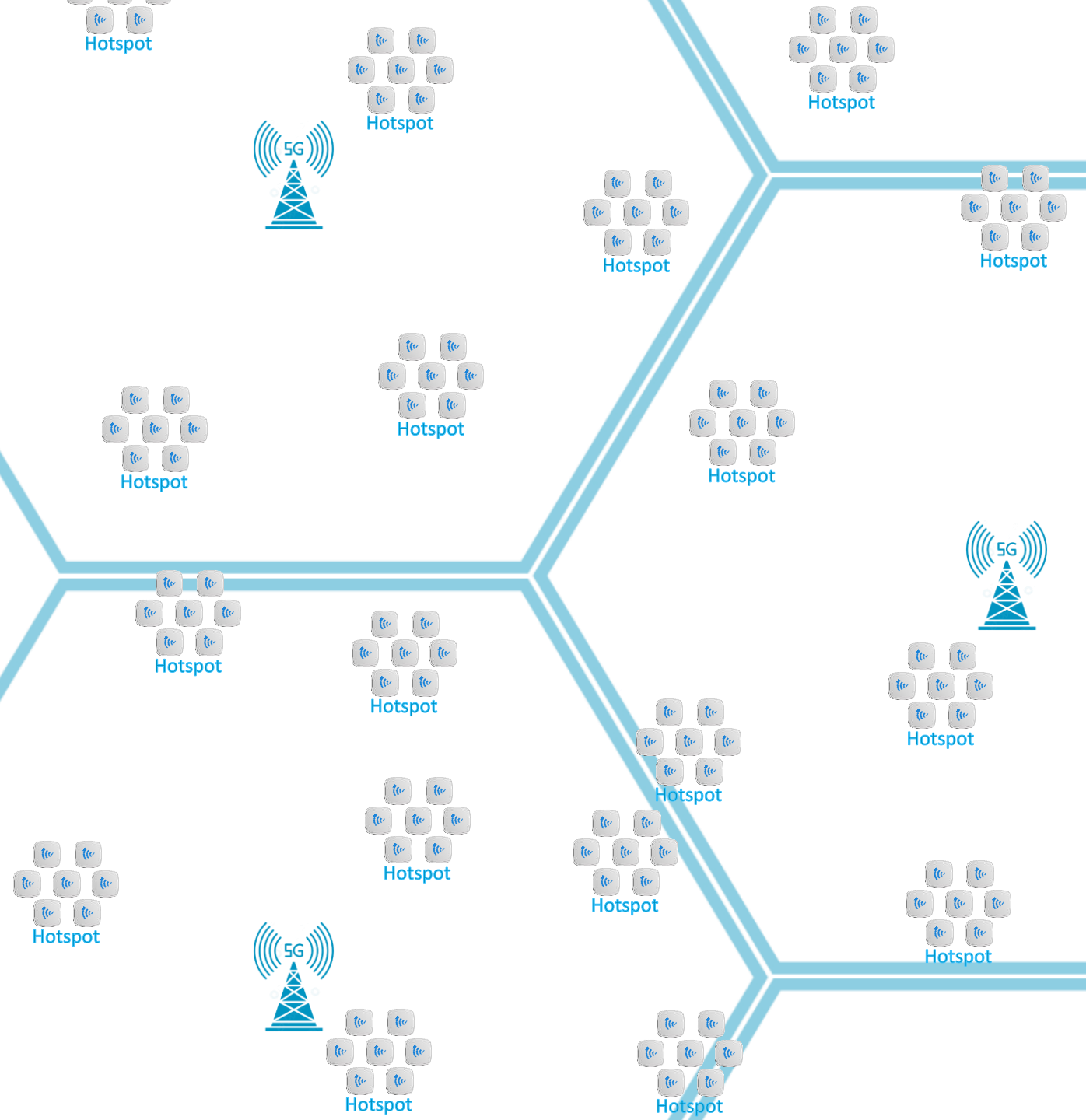
**5G is the answer to
Wi-Fi coverage**

-

**Wi-Fi is the answer to
cost-effective
5G densification (capacity)**

-

**AI is the answer to efficient convergence
of
licensed & unlicensed spectrum**





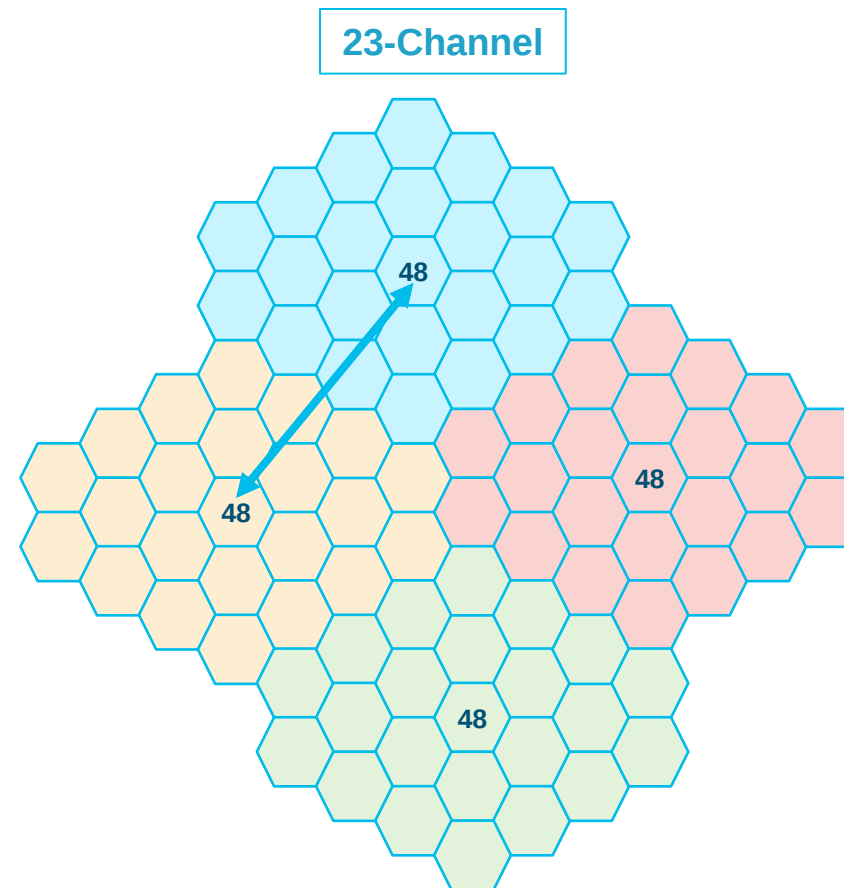
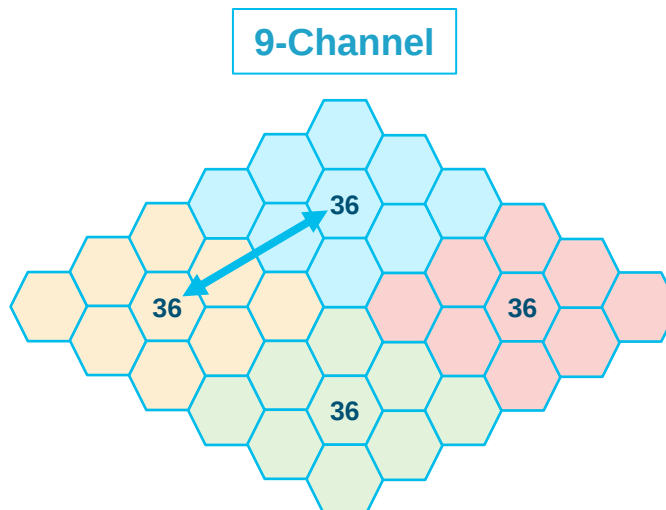
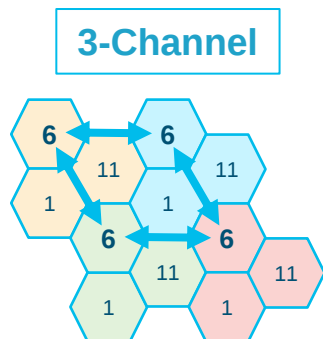
Questions?



Enterprise Wi-Fi Spectrum Design

More channels improve performance & reduces interference

Today's RRM is designed for worst case!
... enter **AI-RRM**



Benefits of Larger Number of Channels

- Lower AP-AP interference probability (especially in open environments)
 - Lower noise floor
- Higher data rates
 - Less airtime to transmit same amount of data
 - Much higher loading levels by distributing demand

Density drives capacity, but also interference!

Channel Width – Solving Consumption Growth

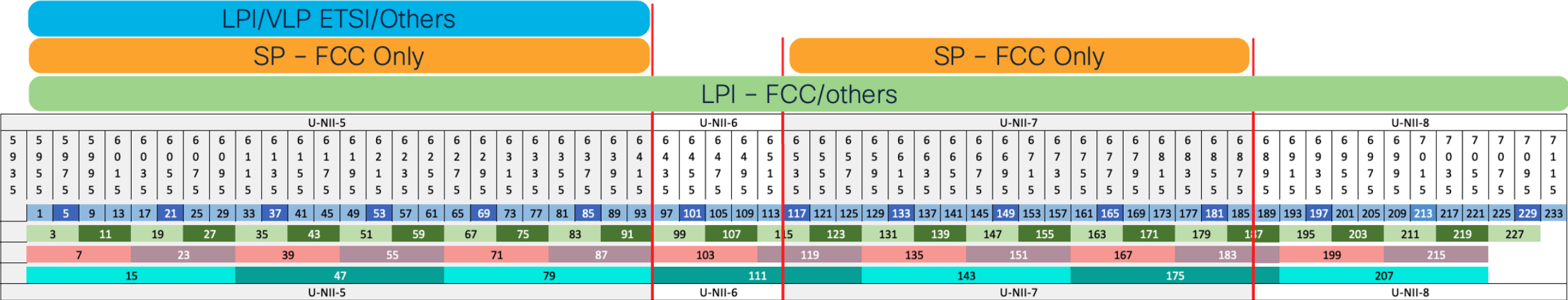
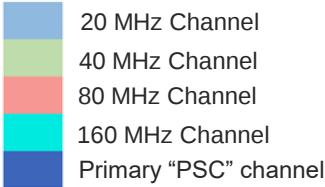
Wider channels at same re-use factor (6-12 APs based on device density)

% of customers at different channel widths				
20MHz (13-25ch@5GHz)	40MHz (6-12ch@5GHz)	80MHz (3-5ch@5GHz) (14@6GHz)	160MHz (1-2ch(160) + 1ch(80M) @5GHz) @6GHz)	320 MHz in 6GHz
5GHz Manual				
25%	64%	11%	0.02%	N/A
5GHz Auto				
23%	59%	17%	0.02%	N/A
6GHz Estimate				
5%	10%	60%	25%	0.02%

Anonymous data from >30k configs and >900k 160MHz capable APs across 6 countries

The new 6 GHz band

- Two main proposals being reviewed or accepted by world regulators
 - FCC = 1200 MHz
 - ETSI = 500 MHz



20 and 40 MHz channels will continue to be default for 500 MHz countries

2x2 Client 40 MHz 1024 QAM = **574 Mbps**

Width	FCC Channels	ETSI Channels
20 MHz	59	24
40 MHz	29	12
80 MHz	14	6
160 MHz	7	3

80 and 160 MHz channels will be the default for 1200 MHz countries

2x2 Client 160 MHz 1024 QAM = **2.4 Gbps**