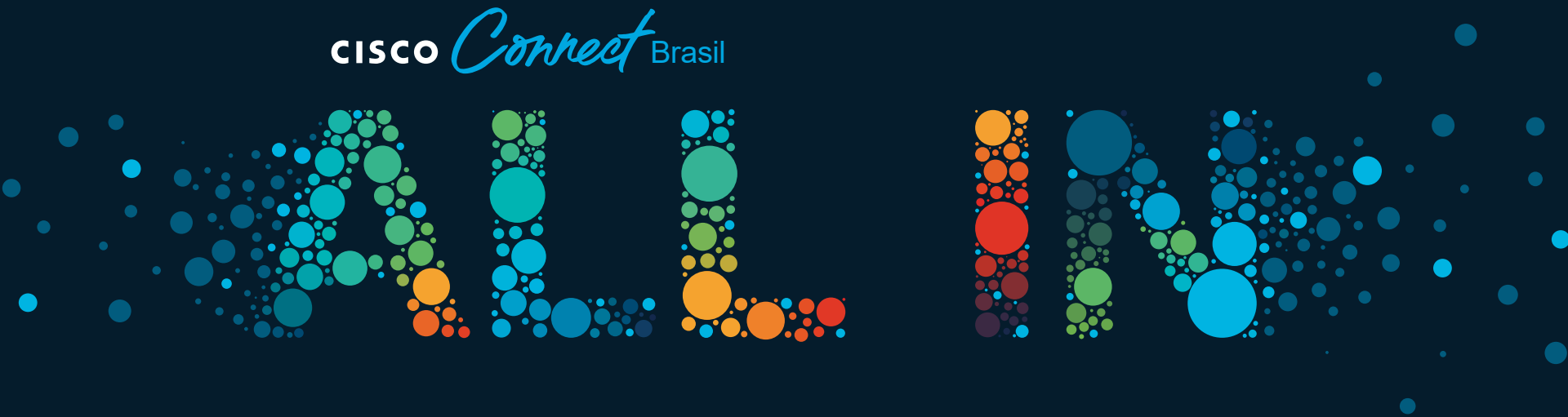

CISCO Connect Brasil
ALL IN

The bridge to possible

The Path to Deterministic Wireless

Matt MacPherson
Wireless CTO

cisco Connect Brasil

The ‘Wireless-First’ World

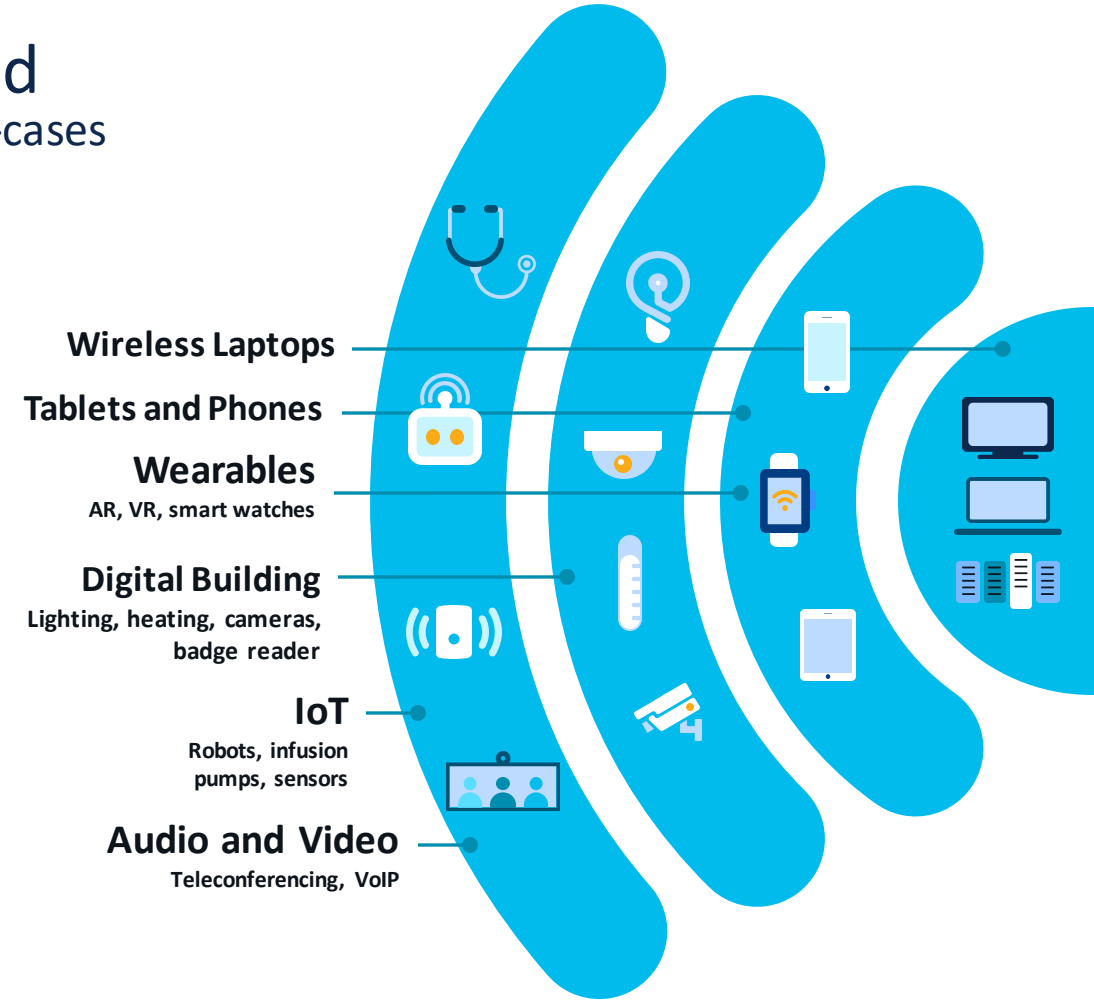
Expanding Expectations for new use-cases

Reliable
Always-on, Predictable

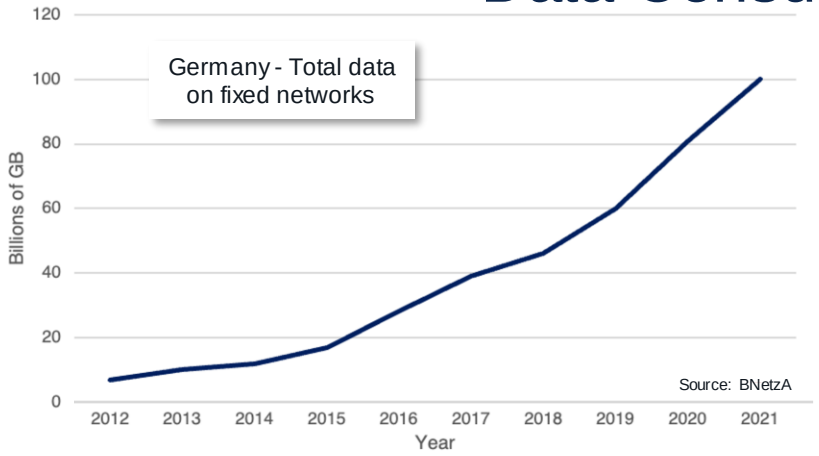
Scalable Performance
Bandwidth / Bounded Latency

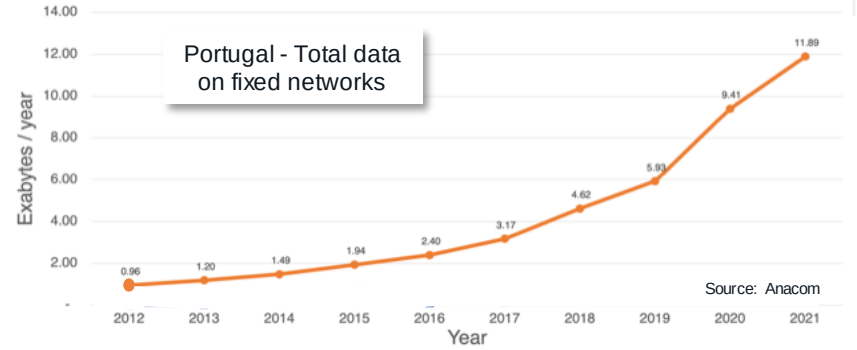
Secure
Software-defined Segmentation

Mobile
Policy-based path selection



Data Consumption Megatrend

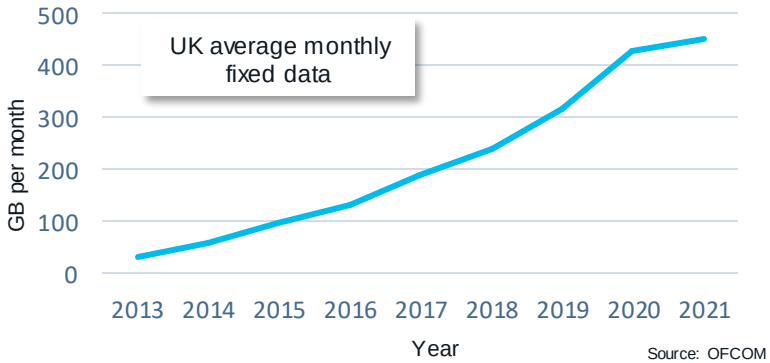




Country Consumption

Wi-Fi relays 92.3% of the overall fixed broadband traffic in Europe

Subscriber Consumption

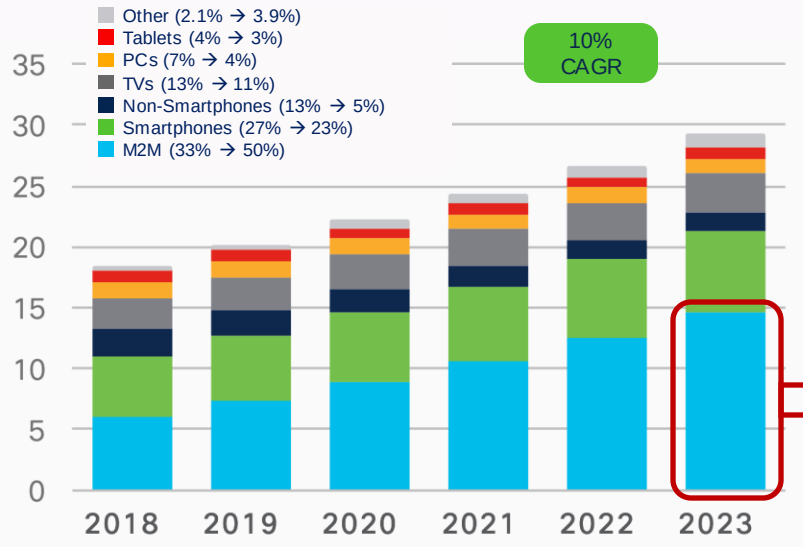


cisco Connect Brasil

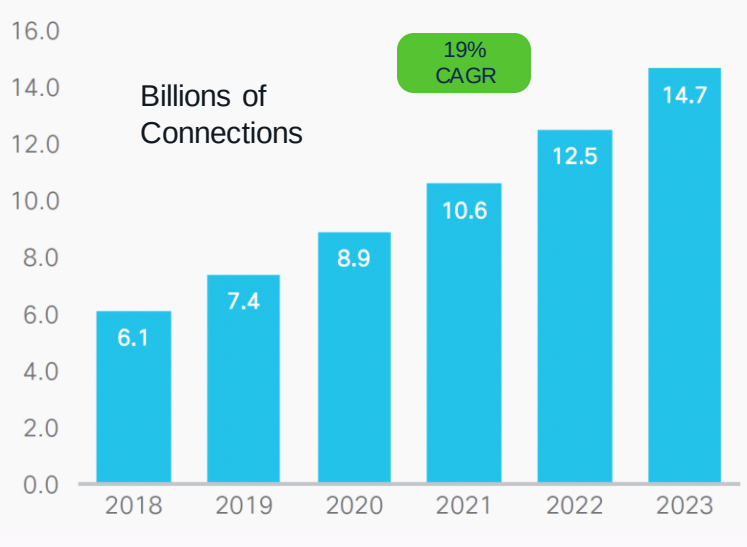
Density Megatrend

An Explosion of Access and Devices

Billions of Devices



Global M2M (IOT) Connection Growth



Globally, Wi-Fi 6 hotspots will grow 13-fold from 2020-2023, 11% of all public hotspots by 2023

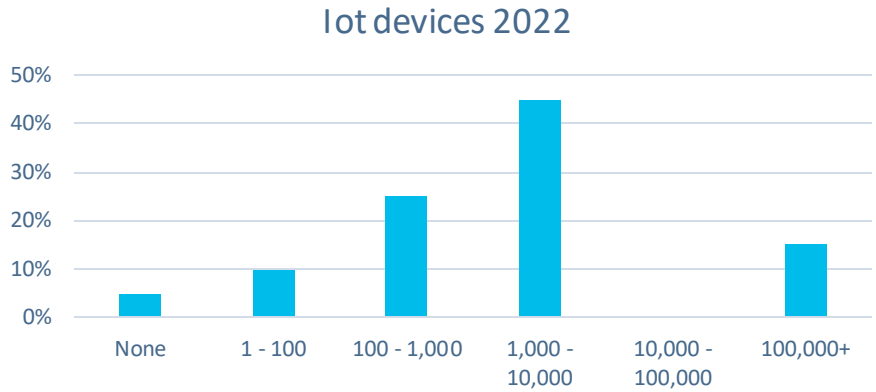
Source: Cisco Annual Internet Report (2018-2023)

5G devices and connections will be over 10% of global mobile devices and connections by 2023.

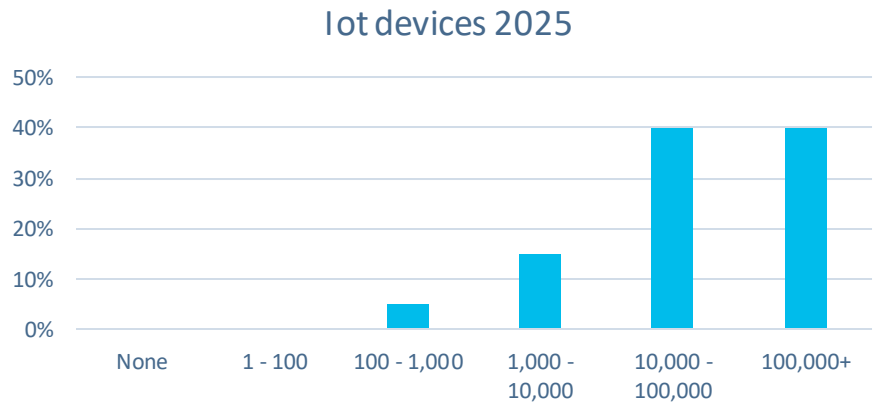
IoT in the enterprise

What our customers told us at Cisco Live US

2022



2025



Drivers:

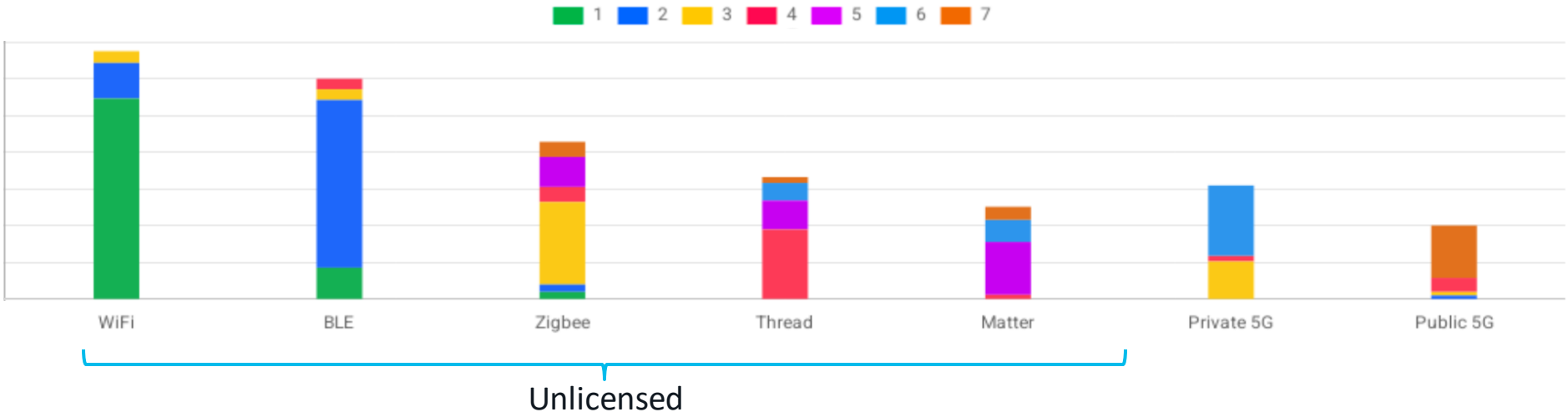
1) **Hybrid work & sustainability**
   - Lower seat occupancy
   - Environmental monitoring & Control

2) **Smart value chains**
   - Healthcare
   - Retail
   - Hospitality

3) **Automation**
   - Manufacturing
   - Supply chain
   - Operations

IoT wireless technology ranking

Survey of Cisco customers – what IoT access is most important to you?



Wireless Evolution

The path to Determinism

Currently W-Fi Addressable Use Cases

Convenience Best Effort

- Smartphones, tablets, cameras
- TV & Entertainment
- Appliances, Home automation
- Wearables & Fitness
- Home medical
- Work from home

Wireless First Enterprise - Scale Mission Critical

- Smartphones, tablets, laptops
- Hospitality & Smart Retail
- Business-critical communications
- Hybrid Workplace
- Smart Building & Campus
- Healthcare

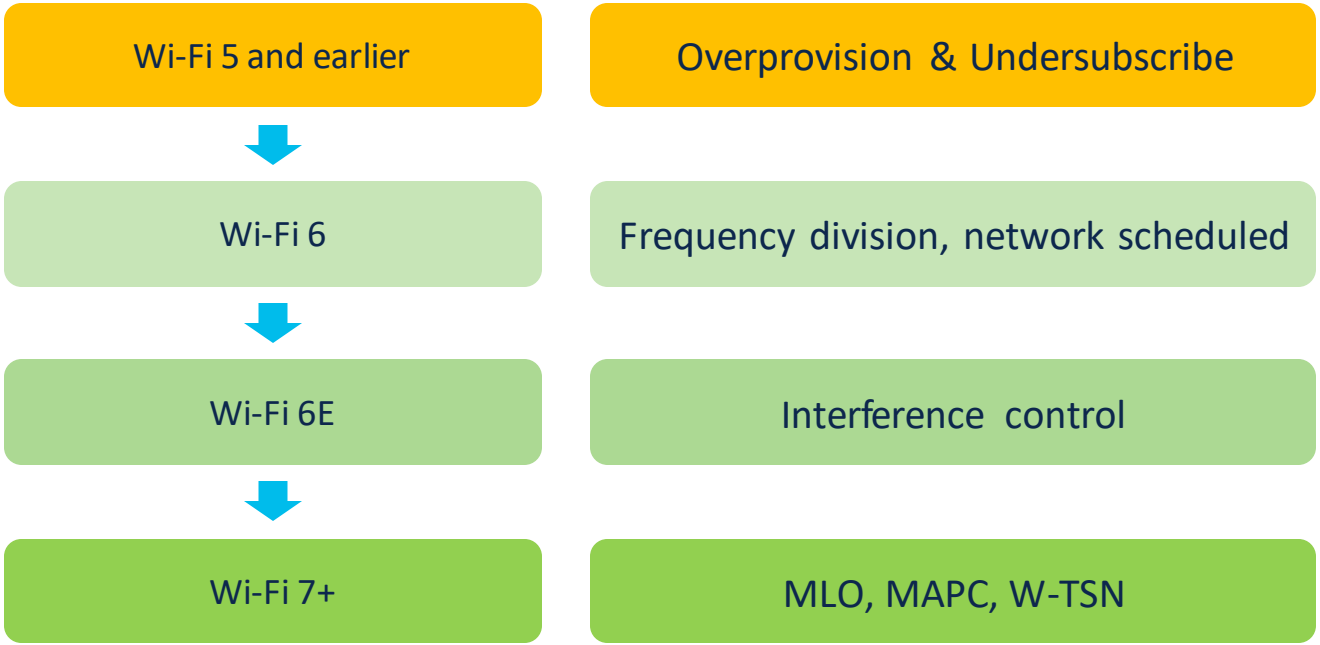
Determinism High Reliability Bounded Latency/Jitter

- Digital Immersion (AR/VR/MR)
- Critical Operations use cases
- Supply Chain & Warehouses
- Manufacturing & Heavy Industry
- Natural resources & Energy
- Power & Utilities
- Automation & Robotics

Bandwidth | Overprovisioned by Design | Next Generation

Wi-Fi Stack Progression

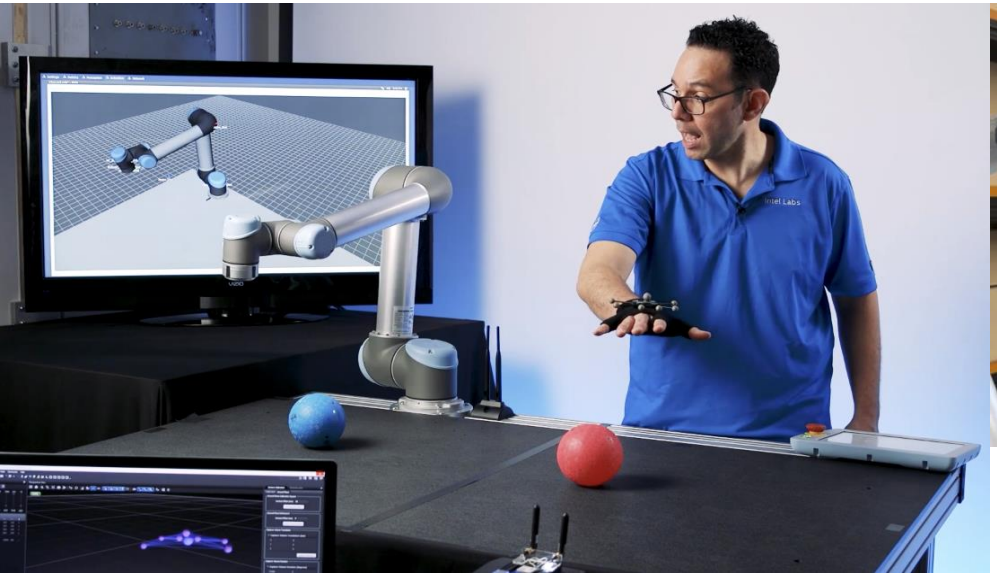
A gross over-simplification



Deterministic Wireless

Reliable communication while meeting application latency requirements at scale

Industrial IOT (IIOT) and deterministic Wi-Fi



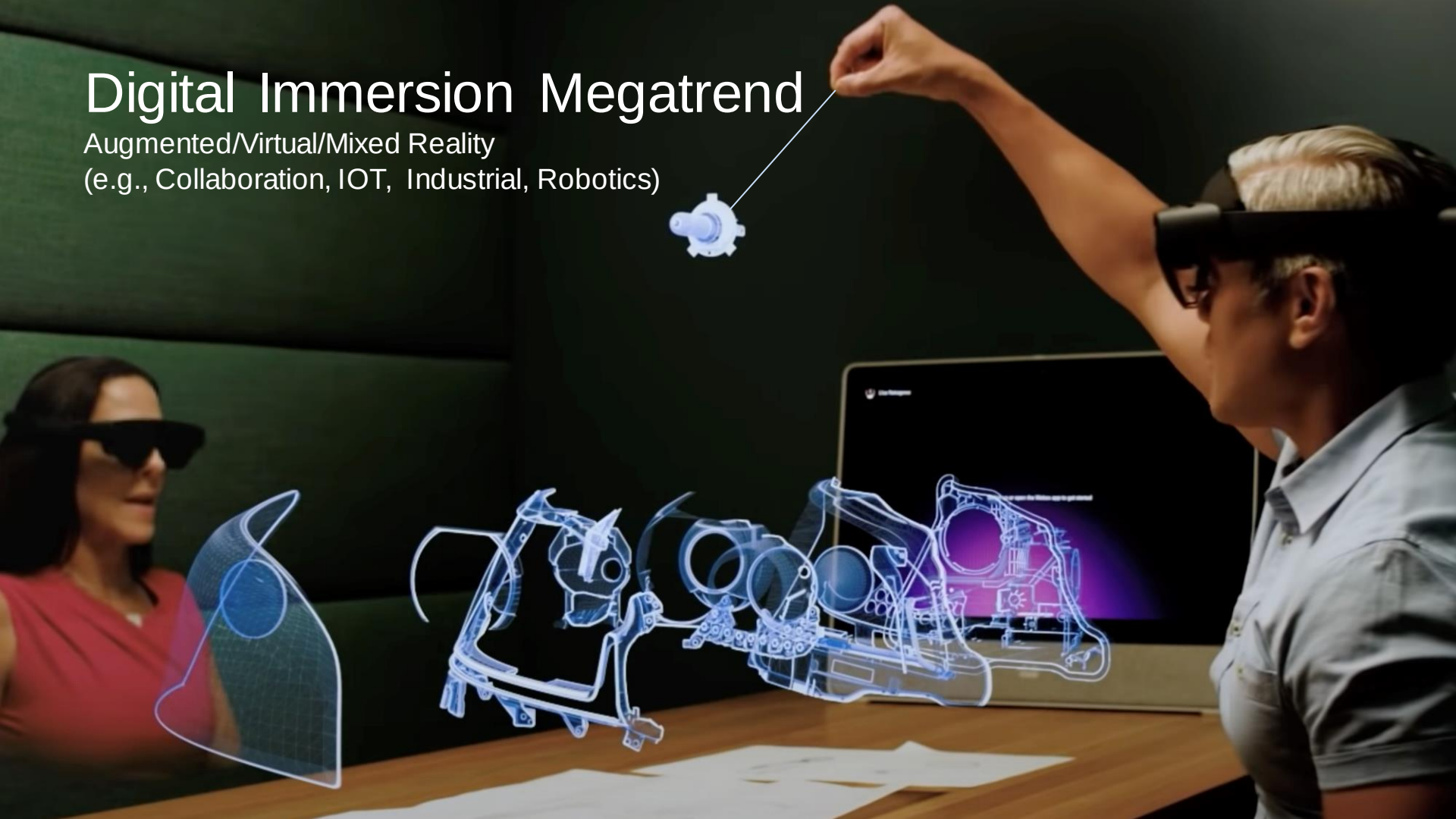
AMR (Autonomous Mobile Robot)
AMR (w/ positioning)
AMR (w/ Wi-Fi6E + 5G)

- Intel and Cisco are collaborating to enable Time-Sensitive-Network (TSN) applications like remote control of robotics for manufacturing in Wi-Fi6 networks
- These applications rely on the new **deterministic/bounded** (<2ms) of WiFi6-TSN

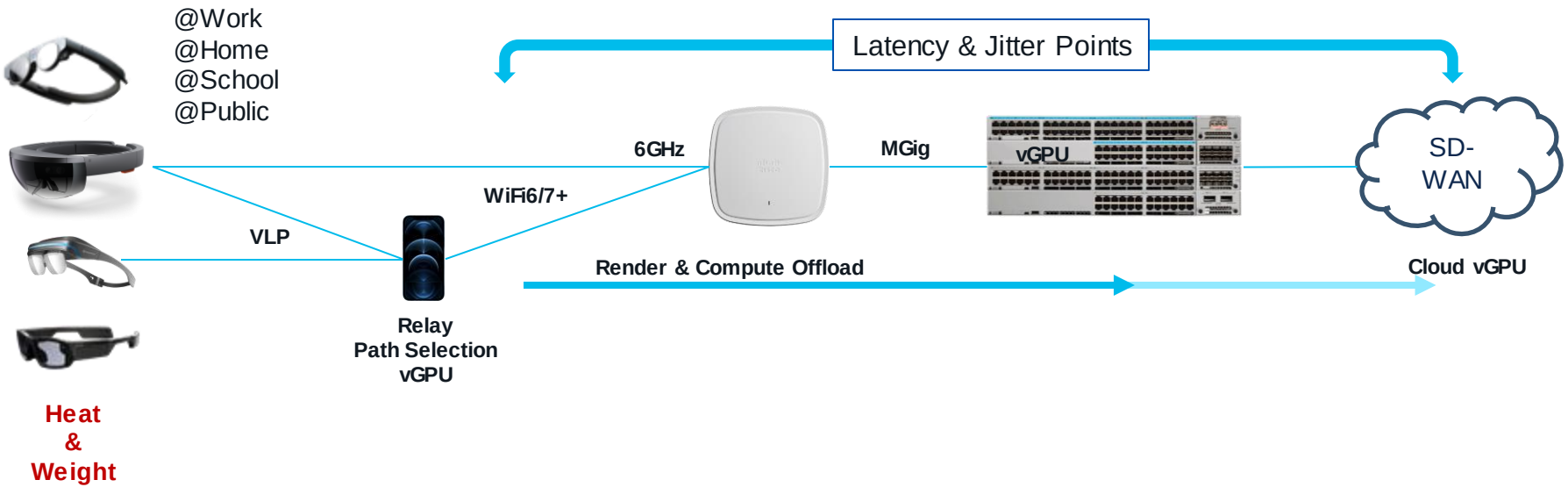
Safety (remote control)

Digital Immersion Megatrend

Augmented/Virtual/Mixed Reality
(e.g., Collaboration, IOT, Industrial, Robotics)

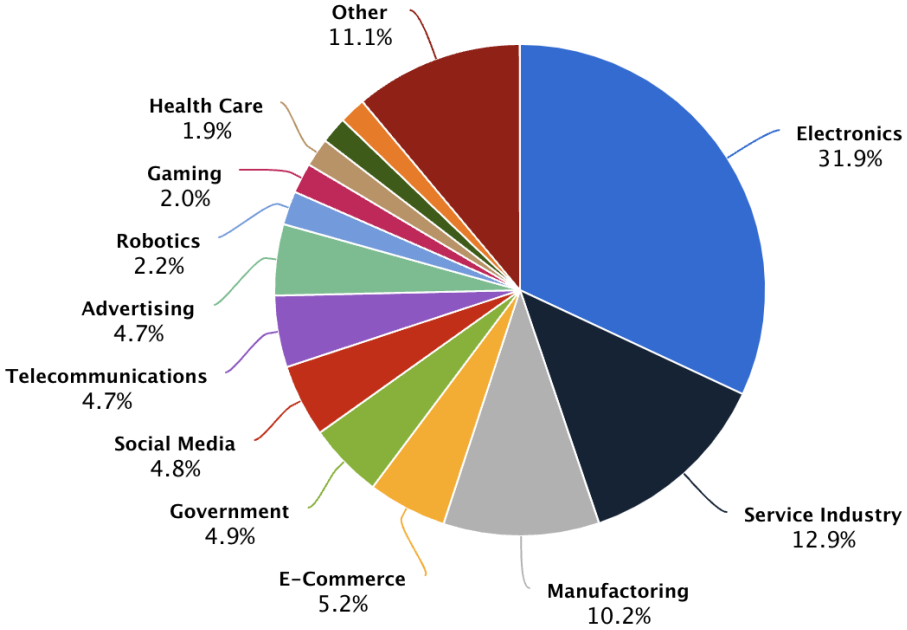


Remote Rendering Megatrend

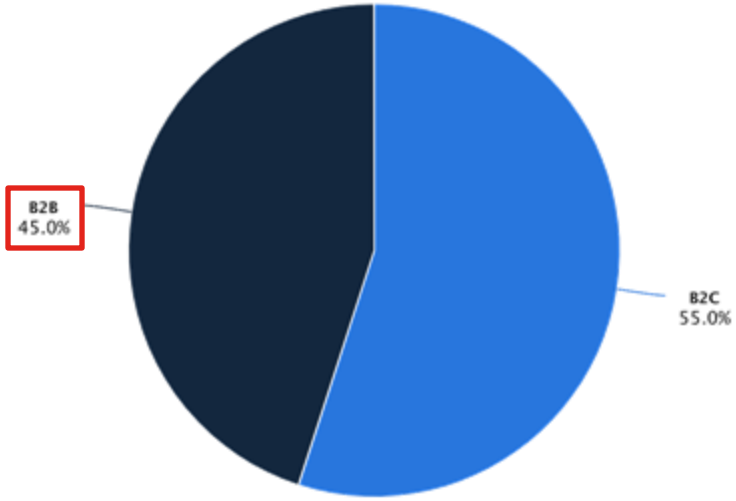


Industry Revenue Share

Revenue-share per Industry (B2B and B2C)



B2B vs B2C



$52B Market by 2027

Source: Statista, Oct 2022

Cisco-Apple FastLane+ for superior client experience

1. iOS device sends ASR request to the network
2. ASR session is established between network and client
3. Network uses ASR trigger data to estimate all future BSRs

- Up to 40% improved voice MOS in loaded networks!
- Superior high-density scheduling in Wi-Fi 6/6E/7
- Already deployed in both Catalyst and Meraki APs

FastLane Auto-802.11r/k/v

Low-latency mobility (Available today, on by default)

Ultra-Reliable Bounded-Latency Megatrend

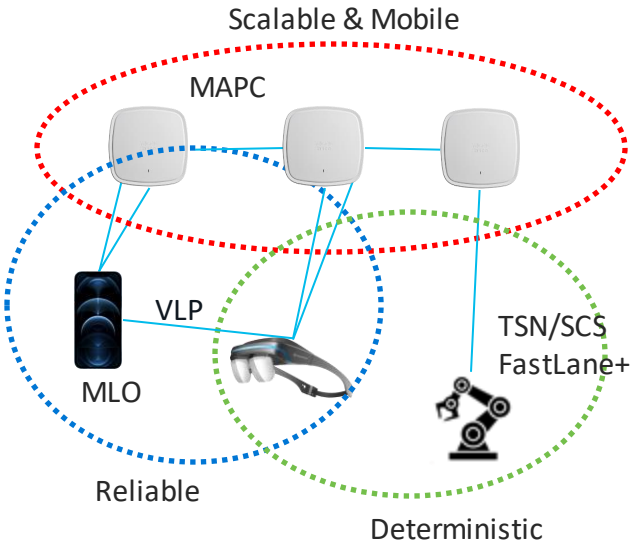
in

Wi-Fi

Wi-Fi 7+

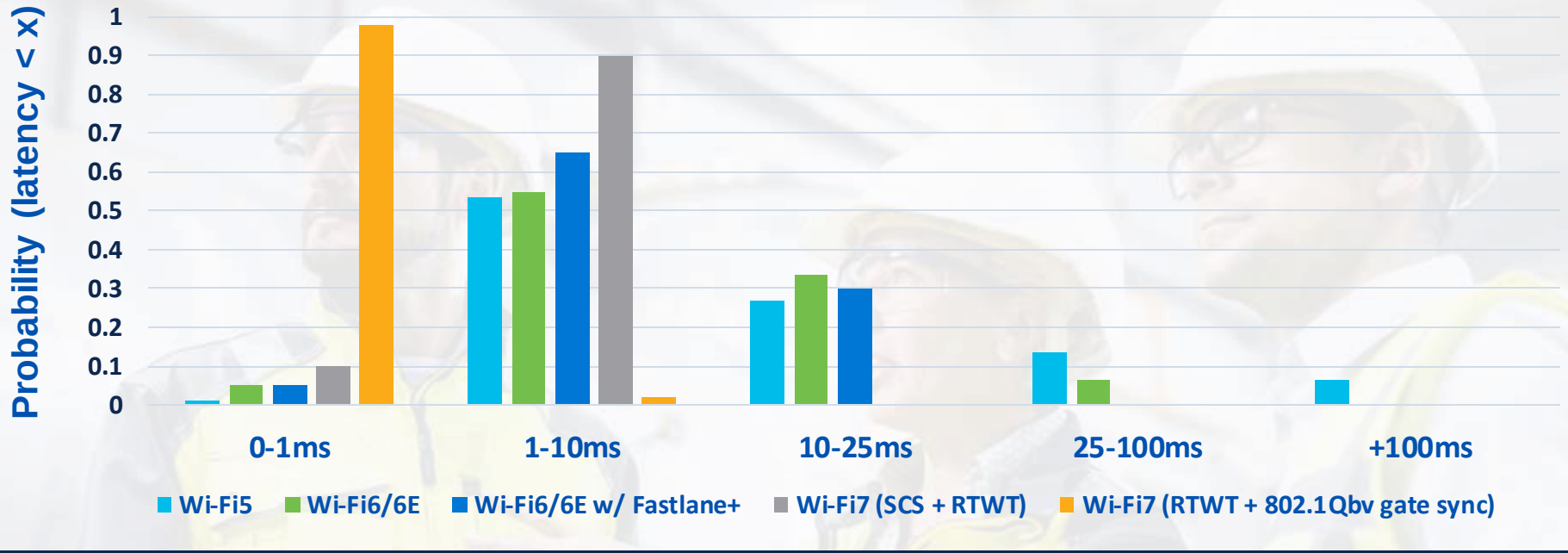
- Wi-Fi 7 (802.11be EHT)
  - Extremely High Throughput
    - ~4X Wi-Fi 6
    - >30Gbps
  - Multi-Link Operation (MLO)
    - Spectral separation
  - SLA-based Wi-Fi (SLAW, WTSN)
    - Bounded Latency for next generation applications
    - QoS Management (SCS)
    - Policy-based SLA
- Wi-Fi 8
  - MAPC – Multi-AP Coordination

Architecture



SCS = Stream Classification Service

The path to deterministic latency & high reliability



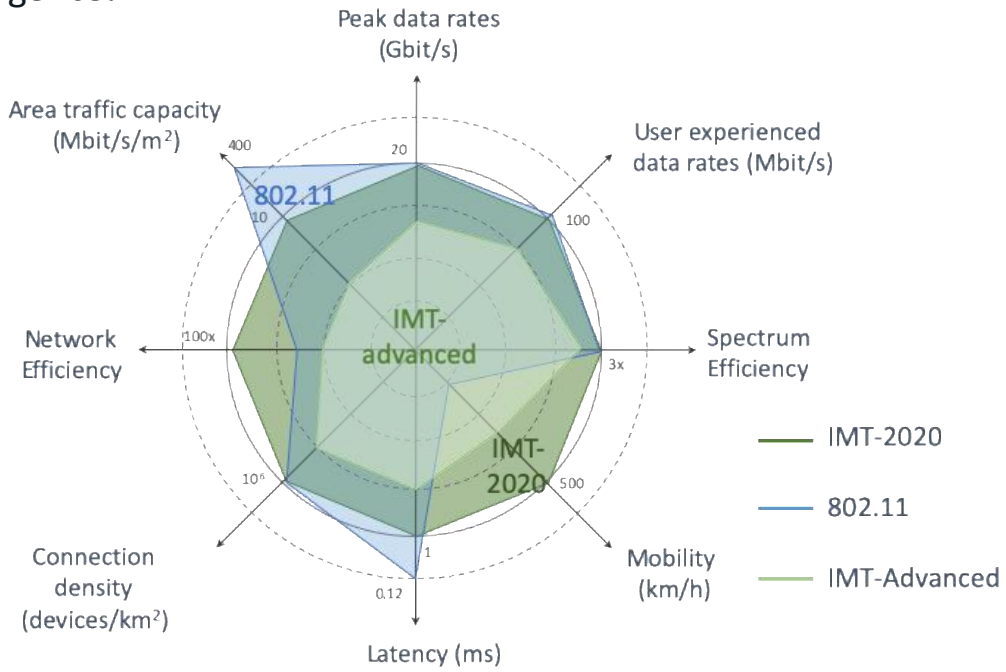
Latency performance bounded, even in high-traffic scenarios.

Source: https://mentor.ieee.org/802.11/dcn/22/11-22-0634-00-00be-802-11be-enhancements-for-tsn-time-aware-scheduling-and-network-management-considerations.pptx

Convergence

Multi-Access – Yes!

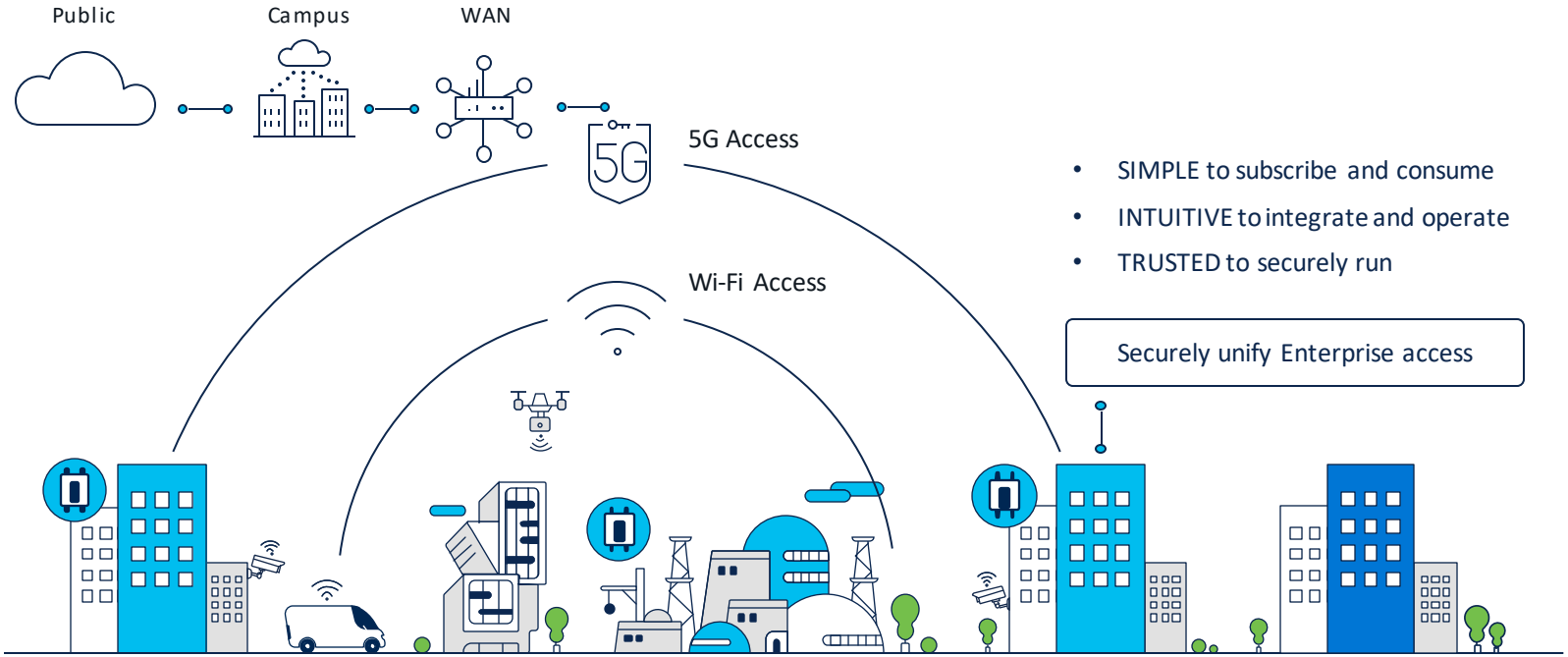
5G & Wi-Fi – more overlap means better convergence!



optimized to stack strengths

Cisco vision for Private 5G in the enterprise

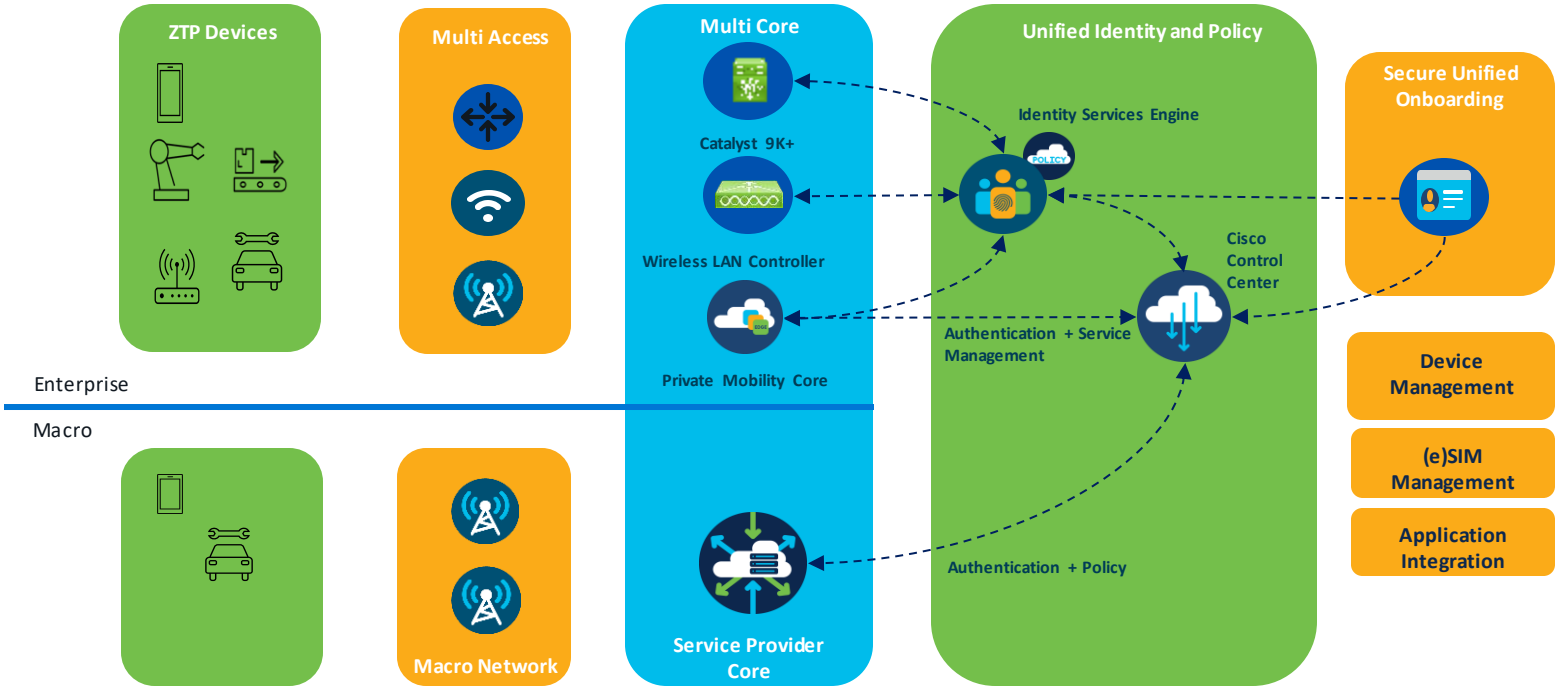
Enhancing the enterprise network

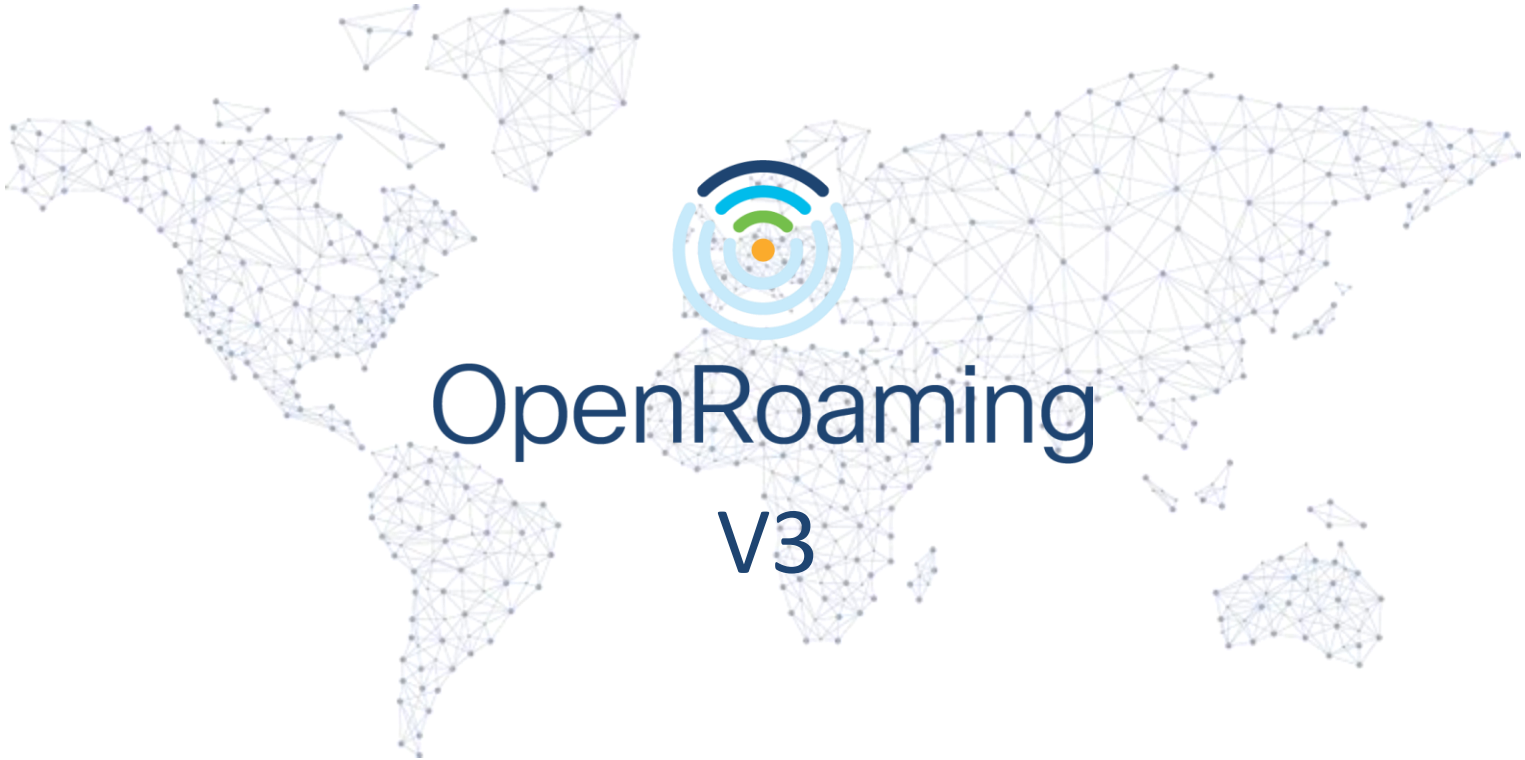


- SIMPLE to subscribe and consume
- INTUITIVE to integrate and operate
- TRUSTED to securely run

Securely unify Enterprise access

Access Convergence with Policy




OpenRoaming
V3

Intelligent Multi-Access

Smart Convergence – Seamless roaming across enterprise and service provider based on context and policy

Access providers

Public
Ent. Guest

WiFi6 5G Private 5G

Identity providers

Service-based

Converged Access for People and Things

Home | Driving | Corporate office | Customer call in the car | Visit to the secure warehouse | Coffee shop | Hotel | Football match

To use all stacks better, we need…

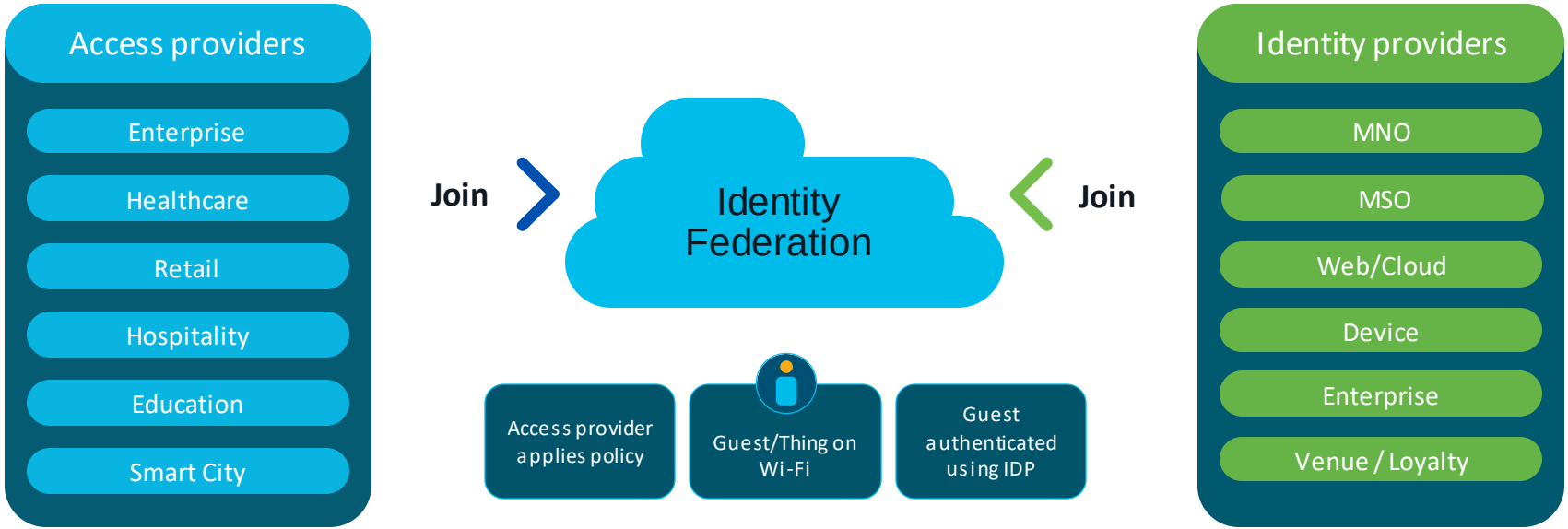
Frictionless Onboarding
OpenRoaming for all stacks
(assure access to all available paths)

Seamless Interworking
Policy-based path selection for
Loosely coupled Access Networks

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

OpenRoaming: Opening the Wi-Fi Ecosystem to new experiences & business models

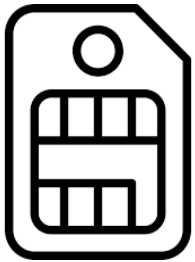
Leverage Identity Federation to scale and facilitate relationships



OpenRoaming is a consortium of identity & access providers to enable seamless roaming & onboarding

Which ID’s are available?

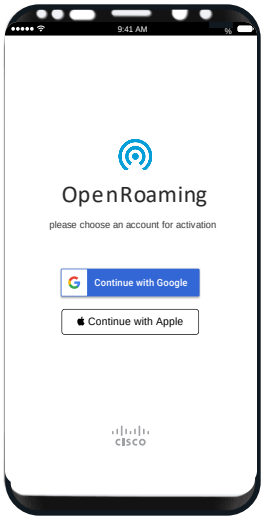
Service Provider



Enterprise

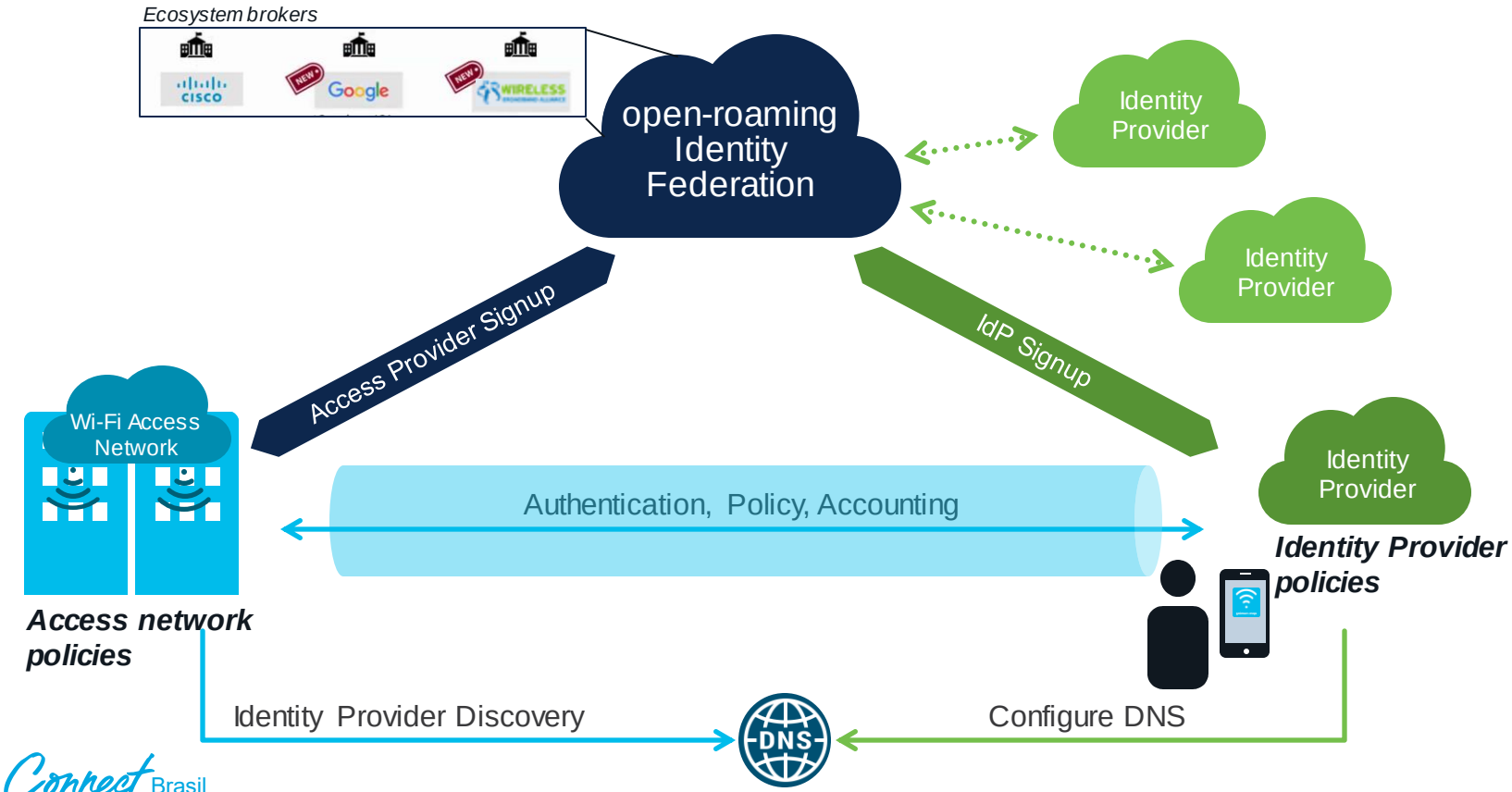
Device Embedded

Cloud ID



Loyalty

OpenRoaming double-click: How it works

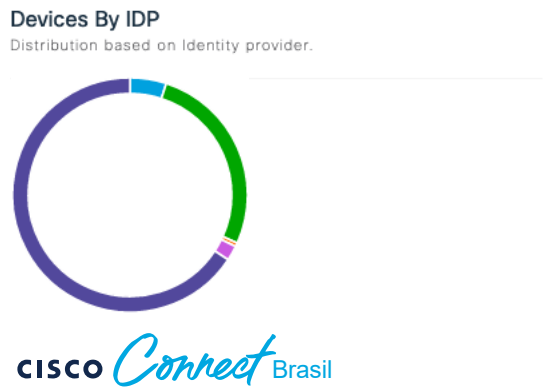


OpenRoaming: Increased Attach with SLA

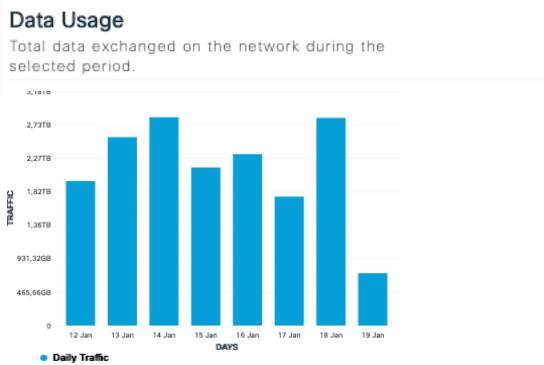
Enables new convergence models between Enterprise and SP (e.g. indoor coverage)

Immediate Impact: Coverage issues solved

Good IDP distribution



High Usage



User Feedback

- Delight!
- Some users do not notice they are on Wi-Fi, but they notice good data / voice
- Other users want to get on Wi-Fi and notice they are already on, compliment the great experience
- Reduced visitor coverage complaints
- Lower burden on staff

OpenRoaming Achievements & Evolution

WIRELESS BROADBAND ALLIANCE

Approaching OpenRoaming Scale

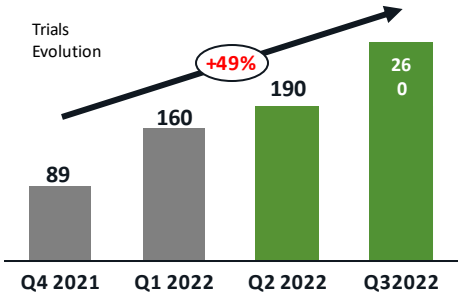
Achievements

+2000
Live Networks across the Globe

+2 Million
Live Hotspots

~600
Companies, Cities, Enterprise involved

Momentum around global trials and deployments



Truly holistic OpenRoaming standard, key industry players delivering

Wide Range Availability

airties · cisco · Cambium Networks · Extreme · EZELINK One World One WiFi · COMMSCOPE · HUAWEI · galgus · JUNIPER driven by Mist AI · LANCOM Systems

10+ Vendor OEM Implementing

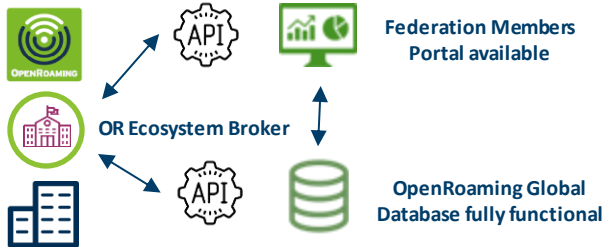
+20
Identity Providers

Google · intel · SAMSUNG

Identity Provider massification with key players virtually covering all the market (smartphones, tablets)

Accelerating adoption of Federation assets (e.g. API, DB)

Fostering standards compliance acting the Policy Authority to make sure the foundational components of the federation are used globally

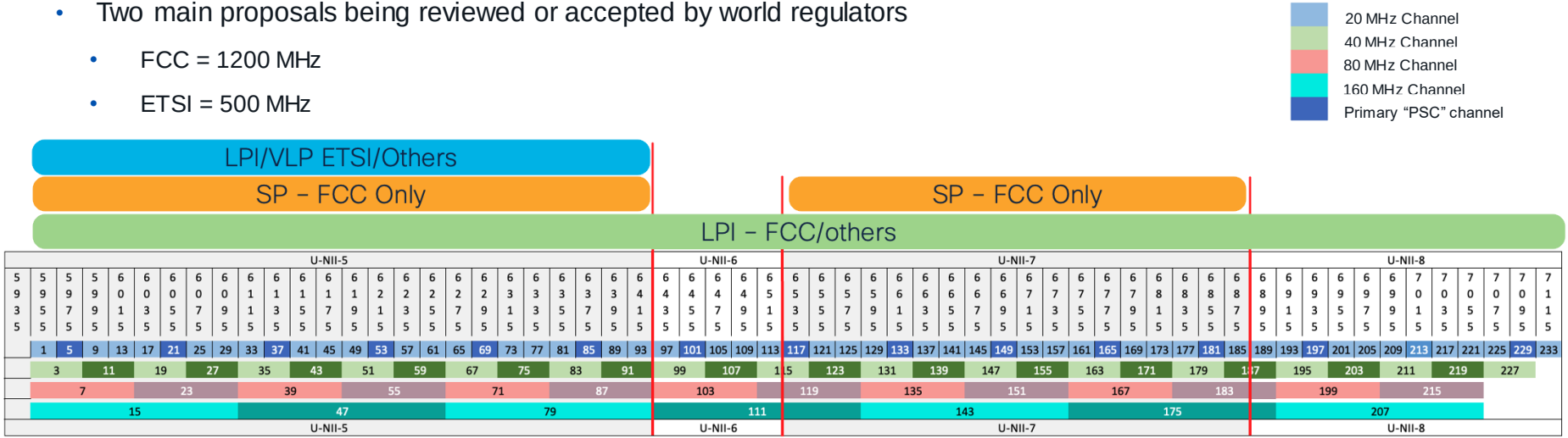


OpenRoaming leading the Public-Guest Wi-Fi > Focusing on evolving horizontally and vertically

Spectrum Regulatory
Interference Control

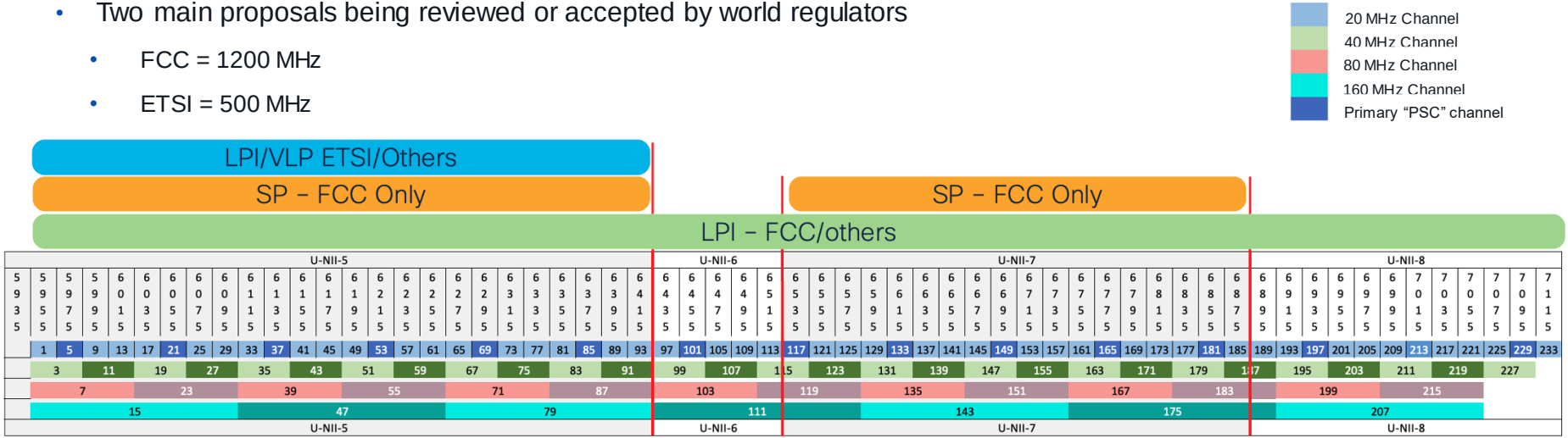
The new 6 GHz band

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



The new 6 GHz band

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



Why would you ever need 1200 more MHz in 6GHz for unlicensed?!?

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%	25%	60%	10%	0.02%

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

6GHz is wider channels

Less interference, higher throughput & density = Reliable Wireless

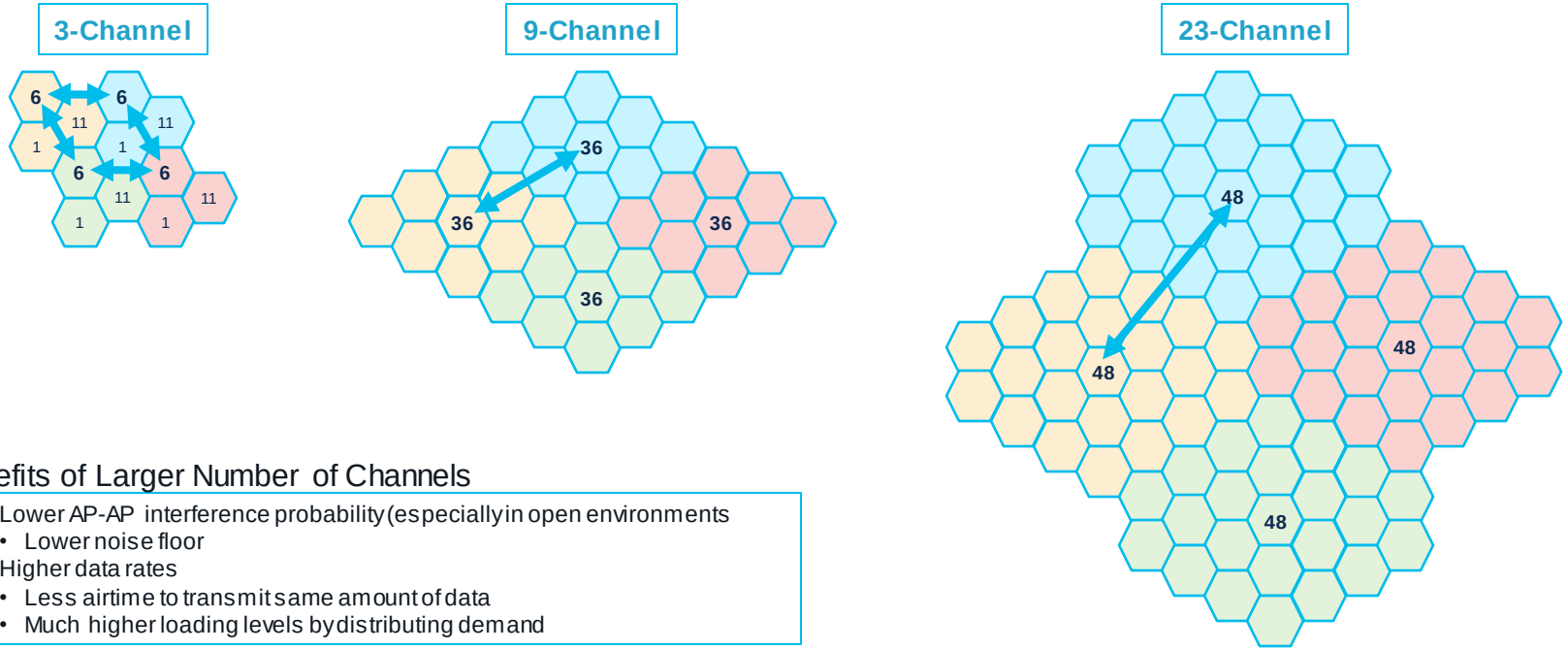
5GHz channel width feasibility				
Environment	20 MHz (25)	40 MHz (12)	80 MHz (6)	160 MHz (2)
High Density [1200 ft²]				
Typical Density [2500 ft²]				
Low Density [6000 ft²]				

6GHz channel width feasibility (1200 MHz)				
Environment	20 MHz (59)	40 MHz (29)	80 MHz (14)	160 MHz (7)
High Density [1200 ft²]				
Typical Density [2500 ft²]				
Low Density [6000 ft²]				

Note: Experience based on relative amount of AP co-channel interference at the AP based on Max EIRP power and channels available.

Enterprise Wi-Fi Design

More channels improve performance & reduces interference

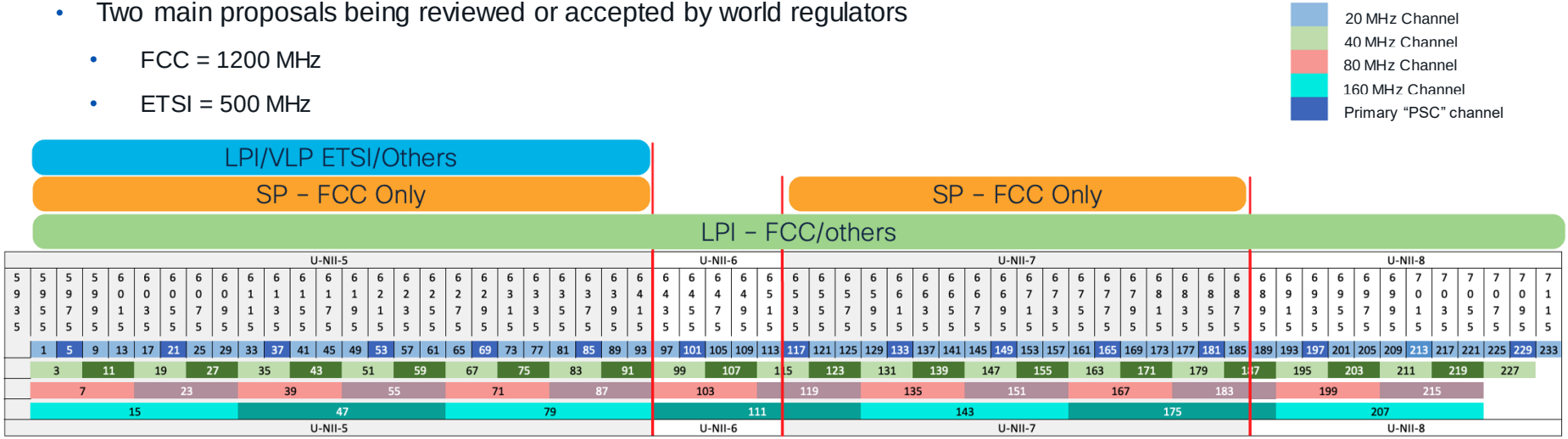


Benefits of Larger Number of Channels

- 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

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

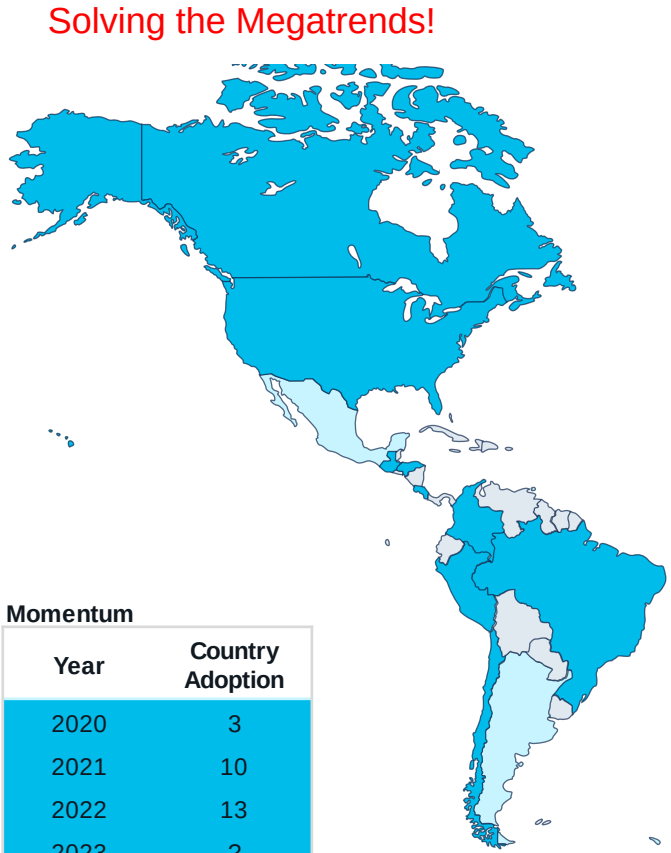
Width	FCC Channels	ETSI Channels
20 MHz	59	24
40 MHz	29	12
80 MHz	14	6
160 MHz	7	3

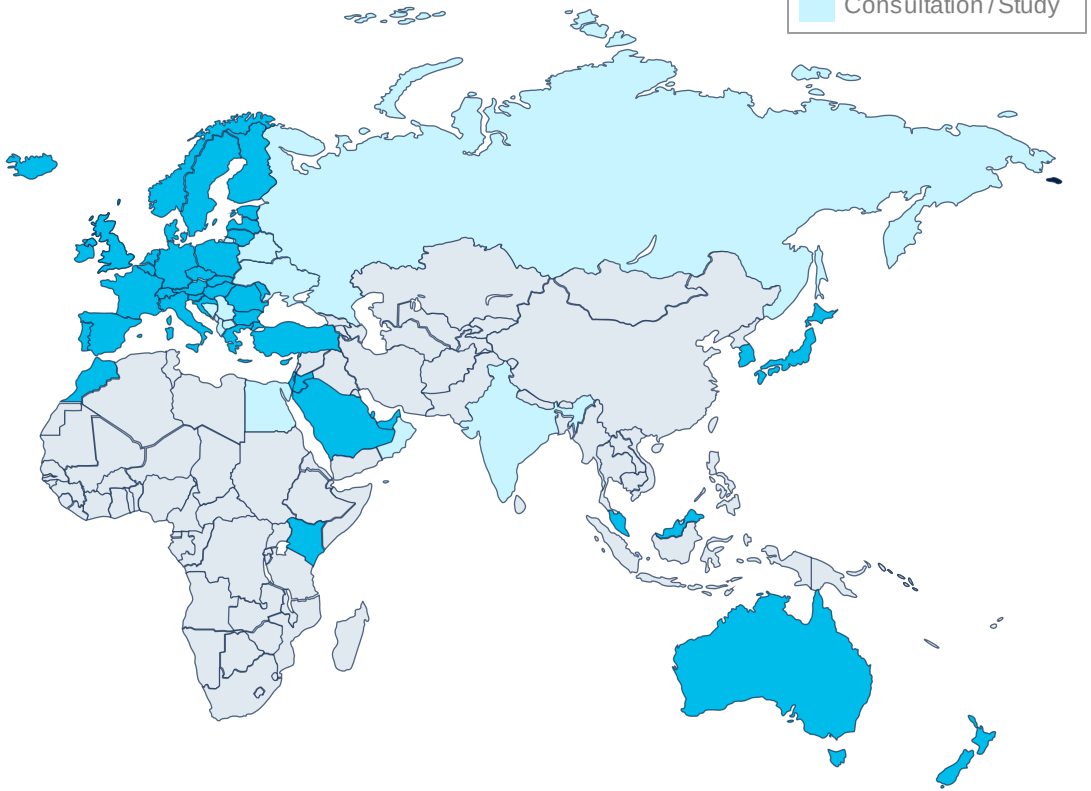
80 and 160 MHz channels will be the default for 1200 MHz countries

2x2 Client 160 MHz 1024 QAM = 2.4 Gbps

1200MHz at 6 GHz Unlicensed Band

Solving the Megatrends!



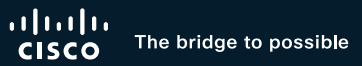


Momentum

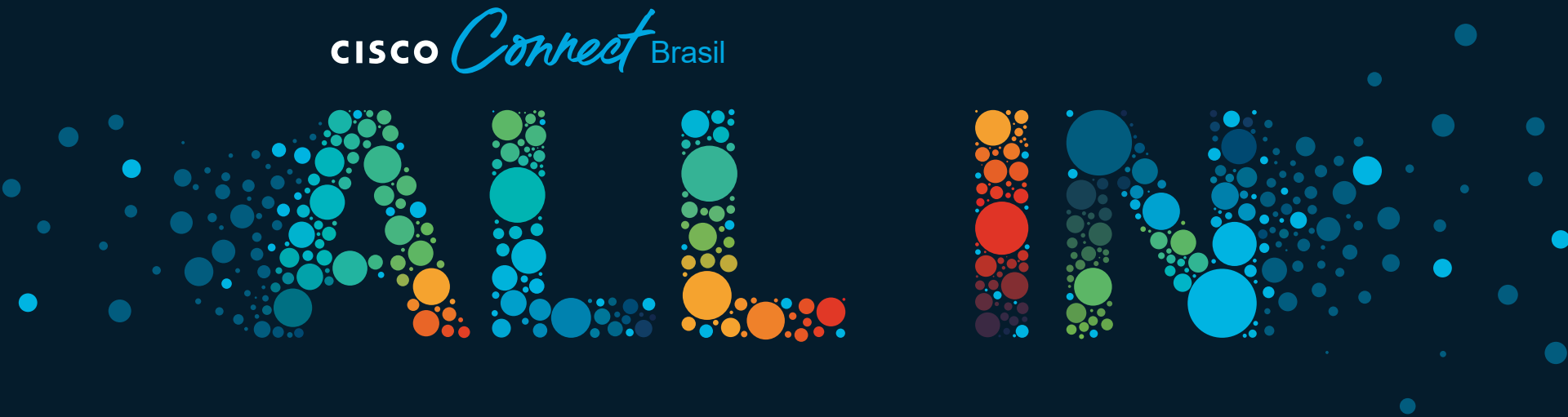
Year	Country Adoption
2020	3
2021	10
2022	13
2023	?

62 Countries
As of 22 March 2023

2B Citizens



Thank you


CISCO Connect Brasil
ALL IN