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The bridge to possible

# Wi-Fi 6/6e and Private 5G for the Enterprise

BRKEWN-2030

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@MatthiasFalkner

A 'Better Together' Journey

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# Abstract

Wi-Fi6/6E and 5G are here to stay! Many Enterprises are identifying compelling new use cases on their digitalization journey that they are looking to fulfil with 5G or Wi-Fi6. Yet, the introduction of either is also often new territory for many operators. This session compares both technologies from a use-case and technical perspective. This session offers insights into the integration of Cisco's Private 5G solution into Enterprise Architectures. Synergies are created between the two technologies to consolidate transport, align access, application, and segmentation policies, or to streamline operations. Attendees will learn how together 5G and Wi-Fi6 will provide flexibility to apply the right technology to the appropriate use-case.

# Cisco Webex App

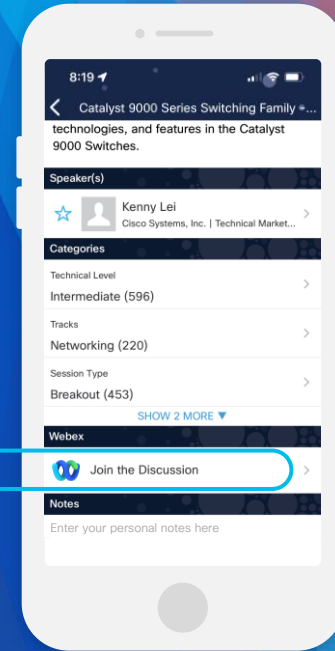
## Questions?

Use Cisco Webex App to chat with the speaker after the session

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# Agenda

- Recent Evolutions in Wi-Fi 6/6e and 5G
- What are some Use-Case Examples?
- Is there a Compelling TECHNICAL Difference?
- Wi-Fi6/6e and Private 5G – Better Together!

# Recent Evolutions in Wi-Fi 6/6e and 5G

# We are in a 'Wireless-First' World

## Reliable

Always-on, low latency

## Scalable

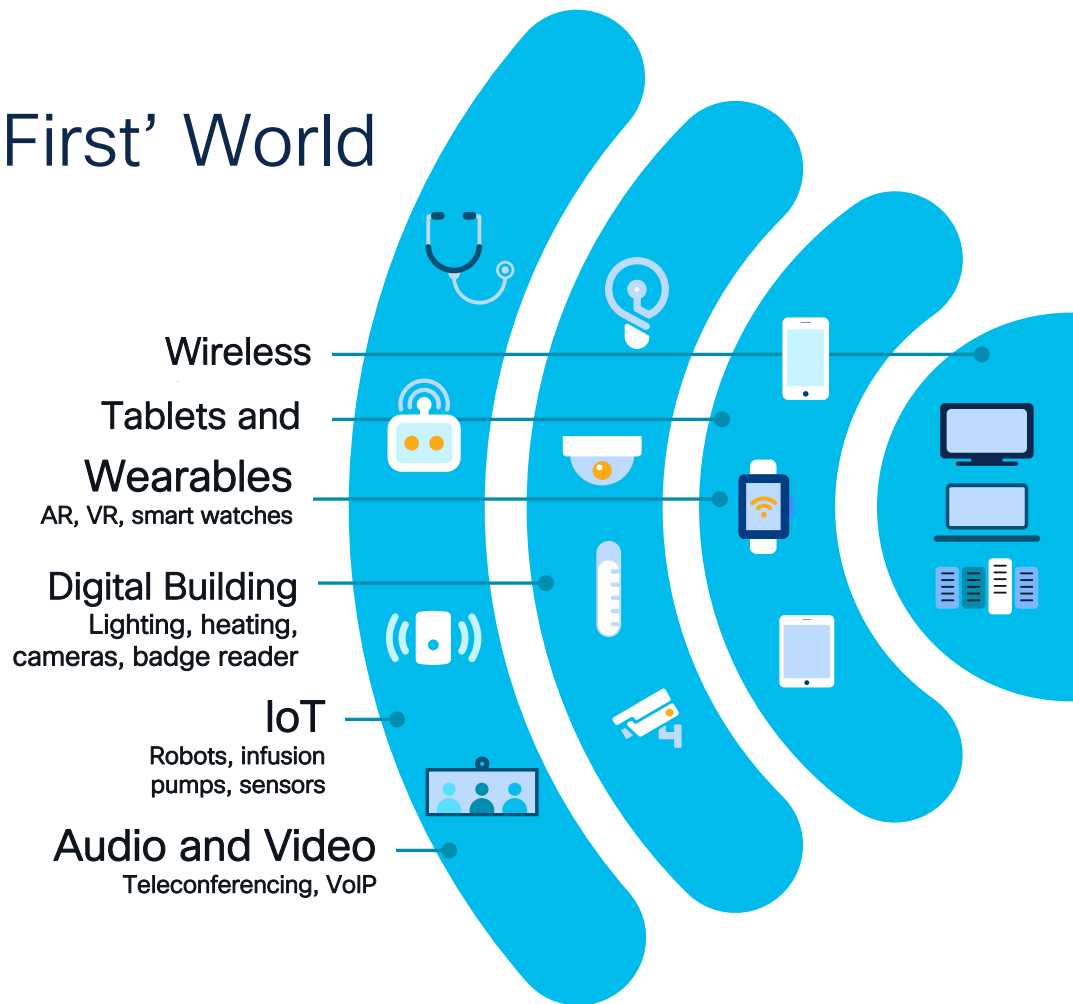
Wired for wireless

## Secure

Software-defined fabric

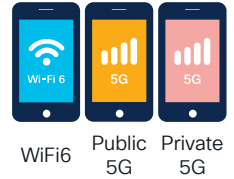
## Everywhere & Mobile

Heterogeneous Access

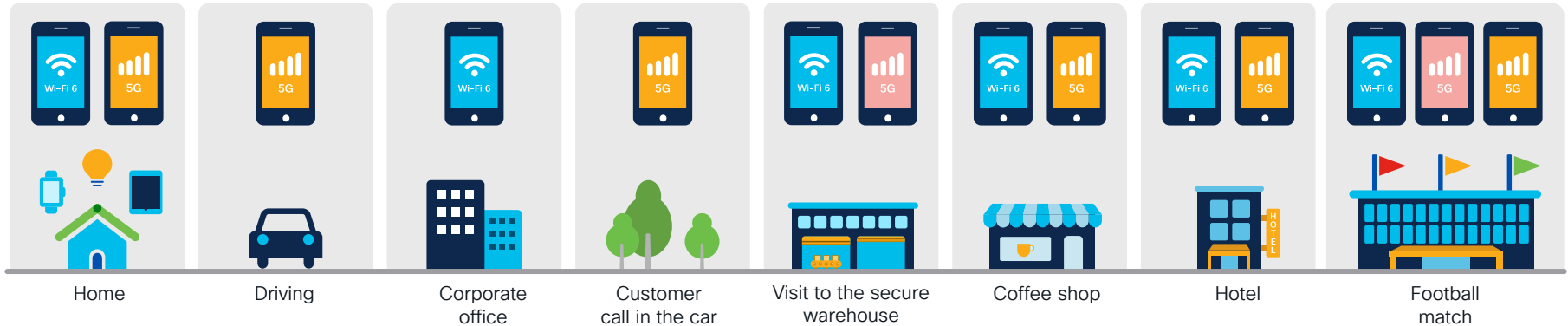


# The world is mobile everywhere

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



## 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 Mobility

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

# P5G - why now?

Enabling customers' digitization journey

Regulatory changes open cellular spectrum for private use

Unique 5G capabilities compliment Wi-Fi 6/6e  
(Ultra low latency, high reliability, broad reach )



## Industrial/Manufacturing

- Precision robotic control
- High speed SW downloads



## Distribution/Warehouse

- AGVs and driverless vehicles
- Distribution line automation



## Port/Hubs/Energy

- Video surveillance
- Unmanned autonomous vehicles



## Venues

- Efficient and reliable backhaul for Wi-Fi-connected endpoints
- Clean spectrum for venue operators

# What is private 5G?

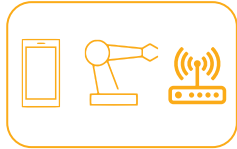
## Definition



A private network that is built using **3GPP 5G technology**, dedicated to carrying **traffic from a specific entity** (e.g., an enterprise or a public sector agency) in **licensed radio spectrum**



Devices



Endpoints  
Connected via 5G



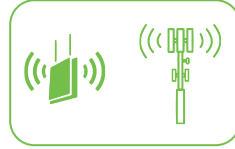
Spectrum



Licensed Spectrum  
Available for private use



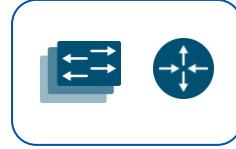
Radio



Radio Network  
Radios & antennas



Access



Access Network  
Enterprise LAN & WAN



Mobile core



Mobile Packet Core  
Session policy & control

# What changed in Wi-Fi 6/6e?



For your reference

**6GHz Spectrum:** 1.2 GHz of additional unlicensed spectrum to support high-bandwidth applications with Wi-Fi 6e



Bandwidth improvements

**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



Parallel transmissions

**Parallel processing:** enables greater capacity by allowing MU-MIMO and OFDMA to function in parallel and then adding channel reuse with BSS coloring



Channel Reuse With BSS Color

**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

**Mandatory WPA3:** protection of the management frames and simultaneous authentication on both sides



Improved Security

# What does 5G offer (as of Release 16)?



For your reference

**New Spectrum Bands:** 3.5 GHz and mmWave *licensed* spectrum to support high-bandwidth enhanced mobile broadband applications



Bandwidth improvements

**Uplink and Downlink Orthogonal Frequency Division Multiple Access (OFDMA):** Efficient use of spectrum to support ultra-low latency (URLLC) applications



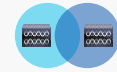
Packet latency improvements

**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



Parallel transmissions

**Spectrum Efficiency:** Ability to aggregate different carriers (frequency bands) into higher-capacity channels and simultaneous use of 4G and 5G Radios (dynamic spectrum sharing)



Higher throughput

**256 Quadrature Amplitude Modulation Mode (256-QAM):** efficient encoding of data in the same amount of spectrum



Faster Speed more Radios and 256 QAM

**Architecture Flexibility:** cost-efficient RAN architectures with flexible placement of network functions enabled by ORAN, slicing, and multi-access edge compute (MEC)



Operational efficiency

**Slicing:** Ability to create different virtual topologies for specific services (e.g. Gaming)



Dedicated resources for services

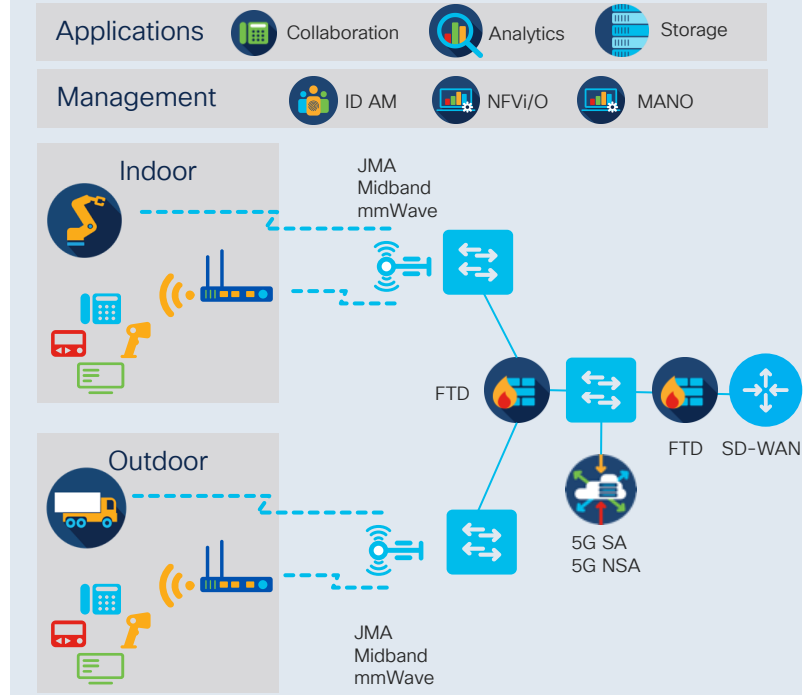
What are some  
use-case  
Examples?

# Private 5G use case: Logistics

## Use case description

- 5G Smart Warehouse Prototype
- Supply chain modernization for consumables and high value deployable assets e.g., vehicles, assemblies, parts
- Automated receipt, store, issue, and shipping using robots and asset
- Indoor and outdoor use cases e.g., 250k vehicles, multiple 200k sq ft warehouse buildings
- Real time asset tracking, facility modeling, predictive analytics
- Automated management/control of logistics, assets & inventory, environment management, & facility access control
- Optimization of modular warehouse space

## Architecture

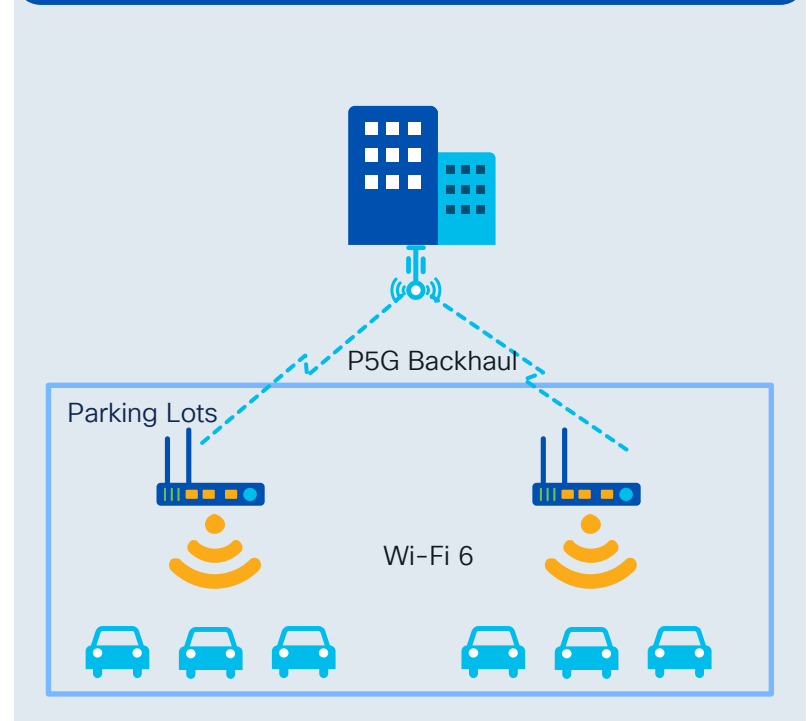


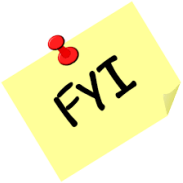
# Private 5G use case: Automotive Manufacturing

## Use case description

- Automotive: increase coverage indoor & outdoor
- Software download to cars in parking lots
  - 30 GB to 20 cars simultaneously in < 2min
  - Wi-Fi6 + private 5G backhaul
- Benefit:
  - Time savings (currently up to 90 mins)
  - Cars can have Wi-Fi Interface!
- Looking for synergies with additional use-cases
  - Handheld scanners
  - Ruggedized tables / IoT
  - AVGs

## Architecture





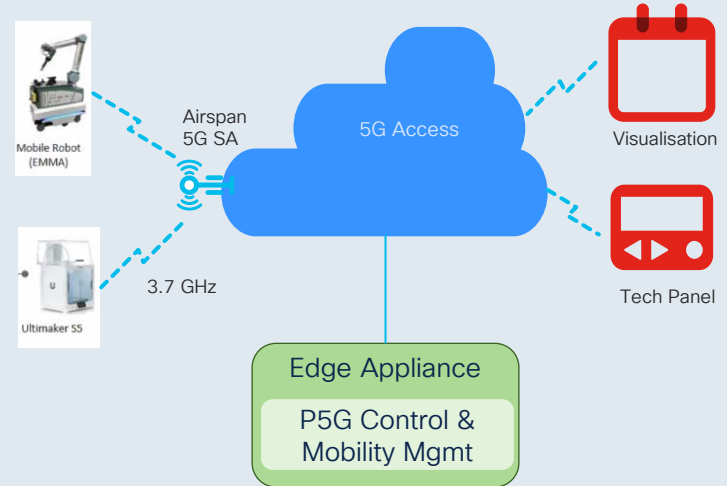
# Private 5G use case: Manufacturing

## Use case description

- Industry 4.0 manufacturing
  - Experimentation / training for robots
  - Closed loop manufacturing (sensors, controlling mobile robots, automated pickup of 3D printed components)
  - Safety: remote services, shop floor monitoring
- Key requirements
  - Private / protected spectrum
  - Reliable communication incl. slicing
  - Location accuracy
- Applications: AGV, CAD drawings, 3D printing

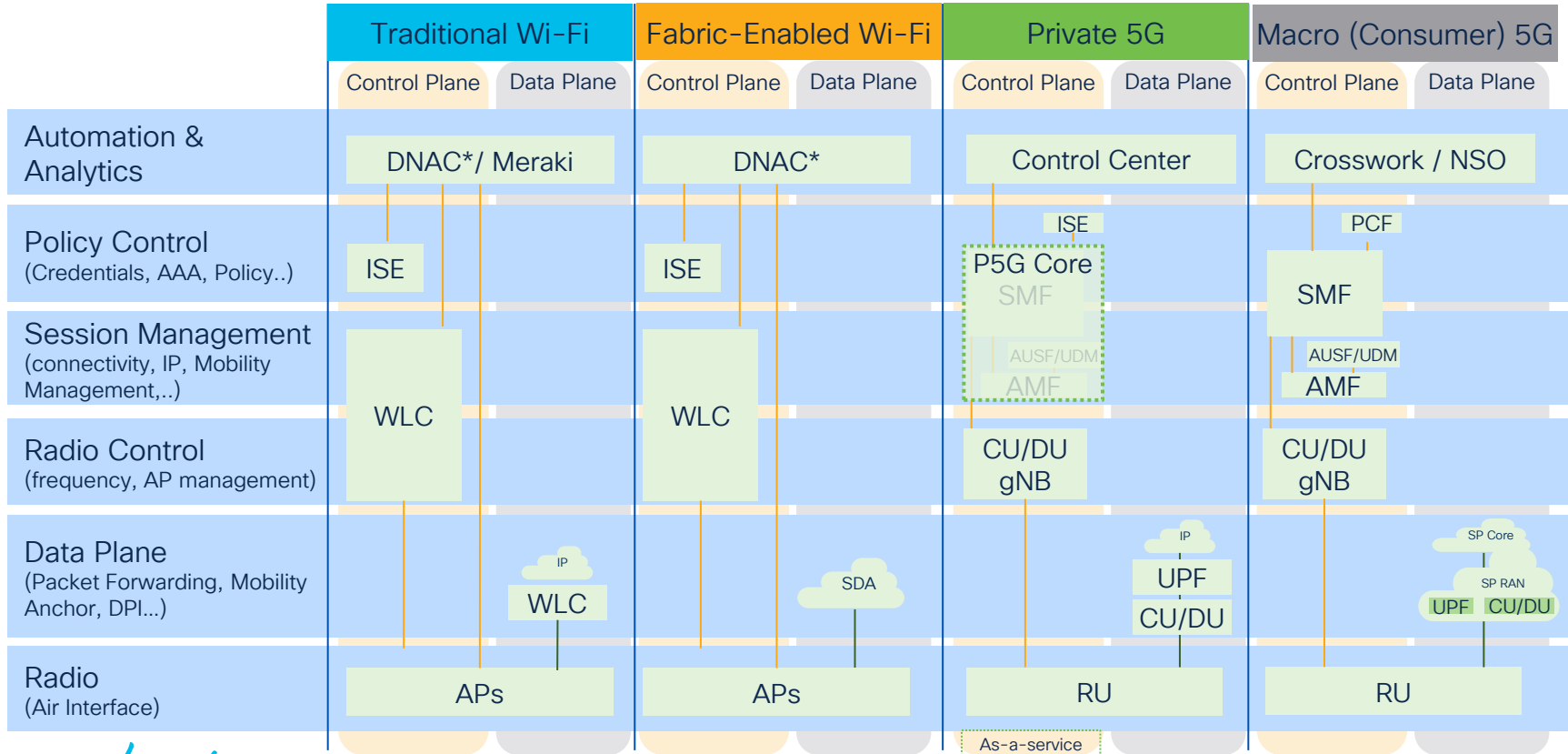
## Architecture

Automated robot delivery of 3D printed components

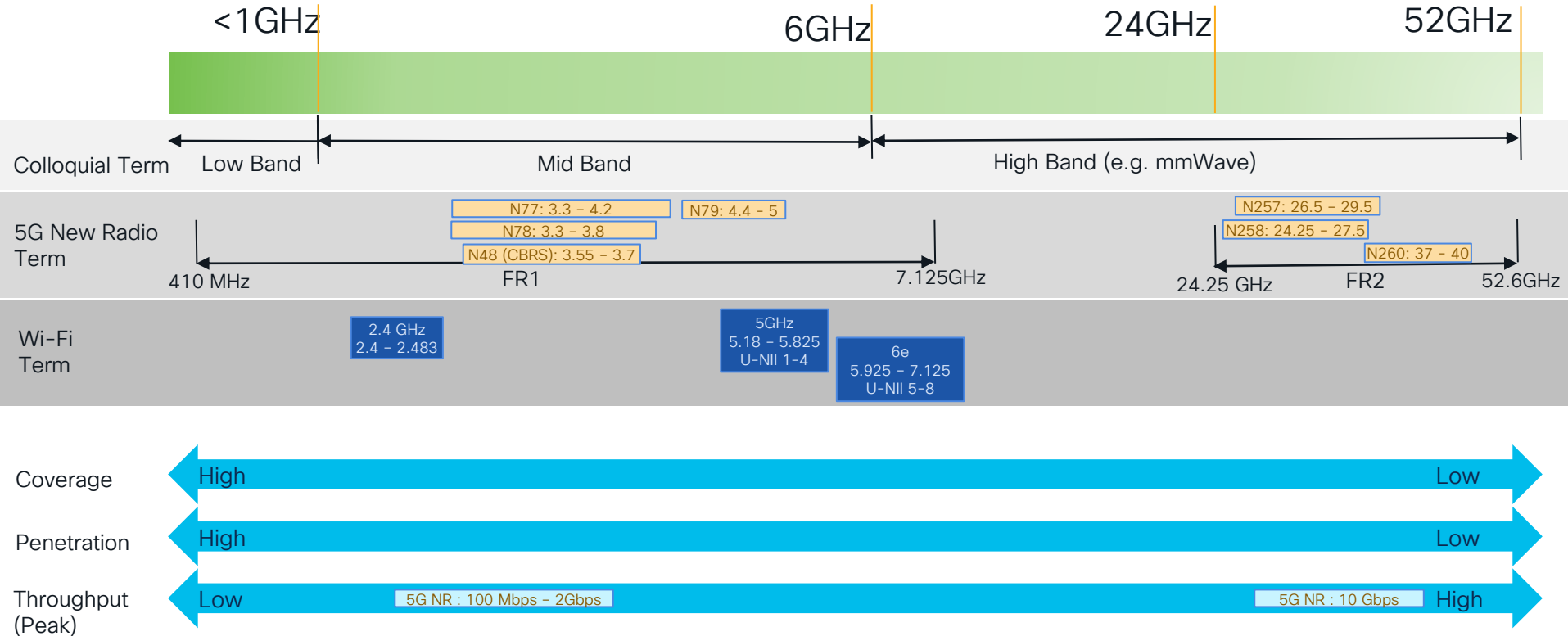


Is there a  
compelling  
technical  
difference?

# Wireless Architecture Functions at 30000 ft

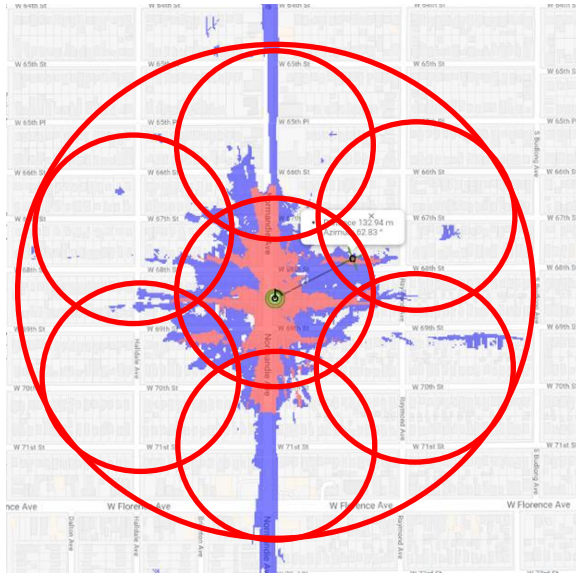


# Spectrum Nomenclature & Properties



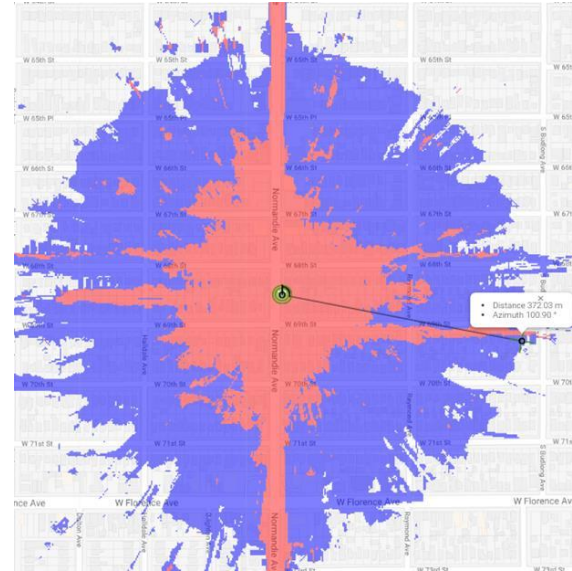
# What about mmWave vs. Sub-6GHz?

Modeled at same pole height in a relatively flat part of Los Angeles



mmWave Propagation

100 Mbps 1 Gbps



Sub-6 Propagation

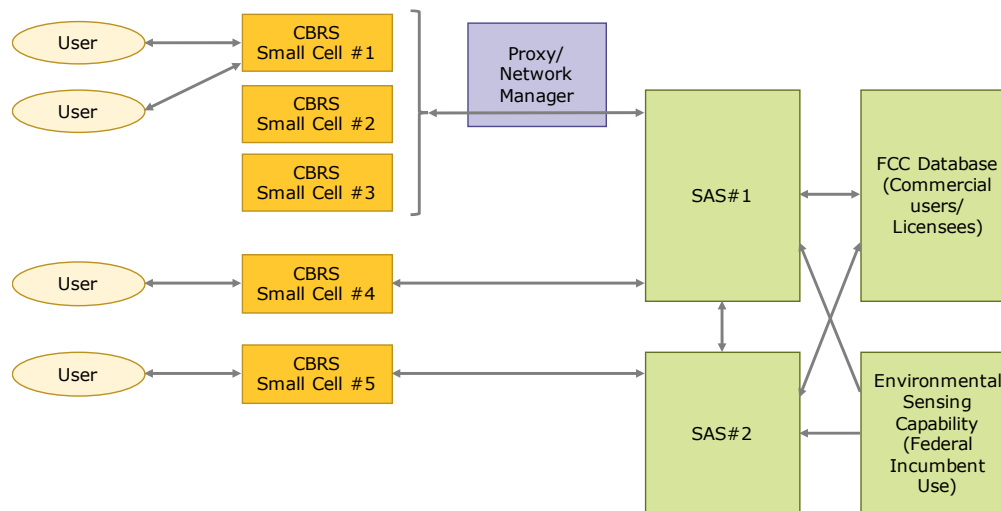
Source: Defense Information Board 5G Study

Big Circle has 400m Radius  
Small circle has 150m Radius

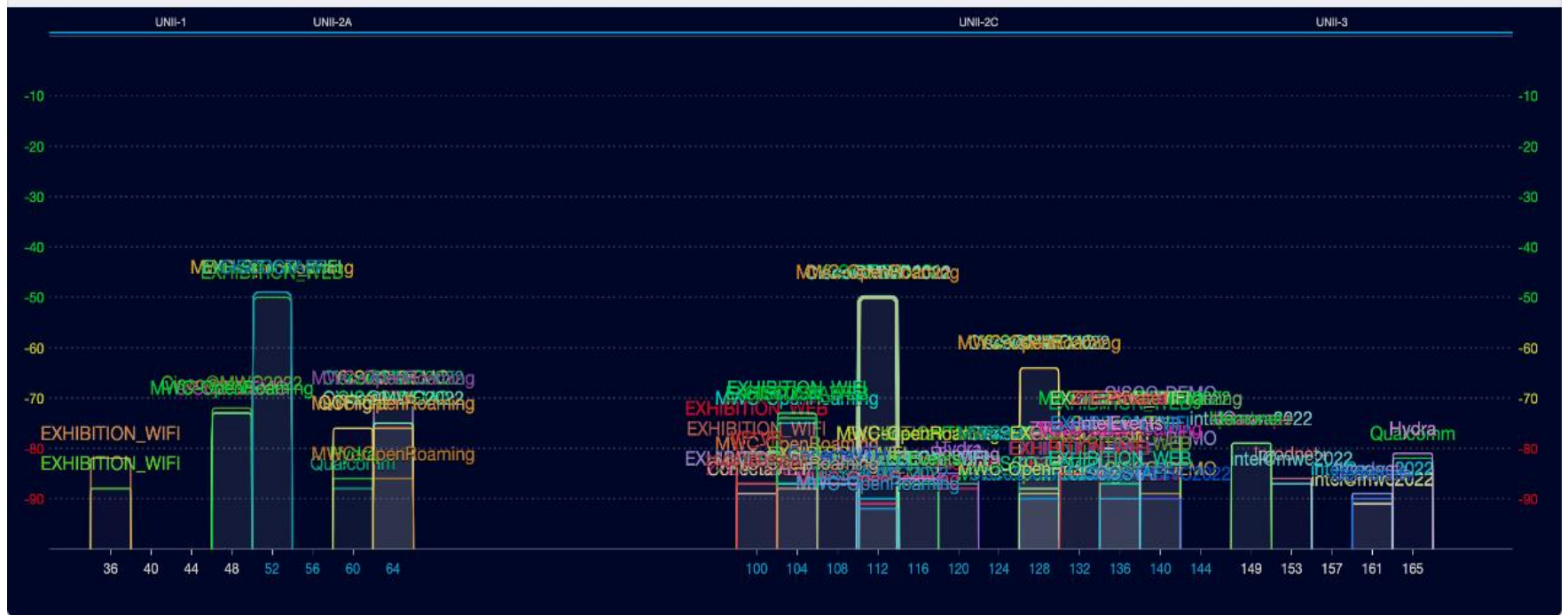
# A note on CBRS Spectrum in the US



- 150MHz for outdoor/indoor small cells, has its own 3GPP band class (Band 48), for LTE or 5G-NR
- PAL/GAA are regulated by Spectrum Access System Administrators (SAS), who also coordinate assignments for GAA
- PAL licenses are auctioned/purchased, GAA access is not; SAS-fees apply to both
- Many use-cases (Esp. indoor) can be realized using GAA!



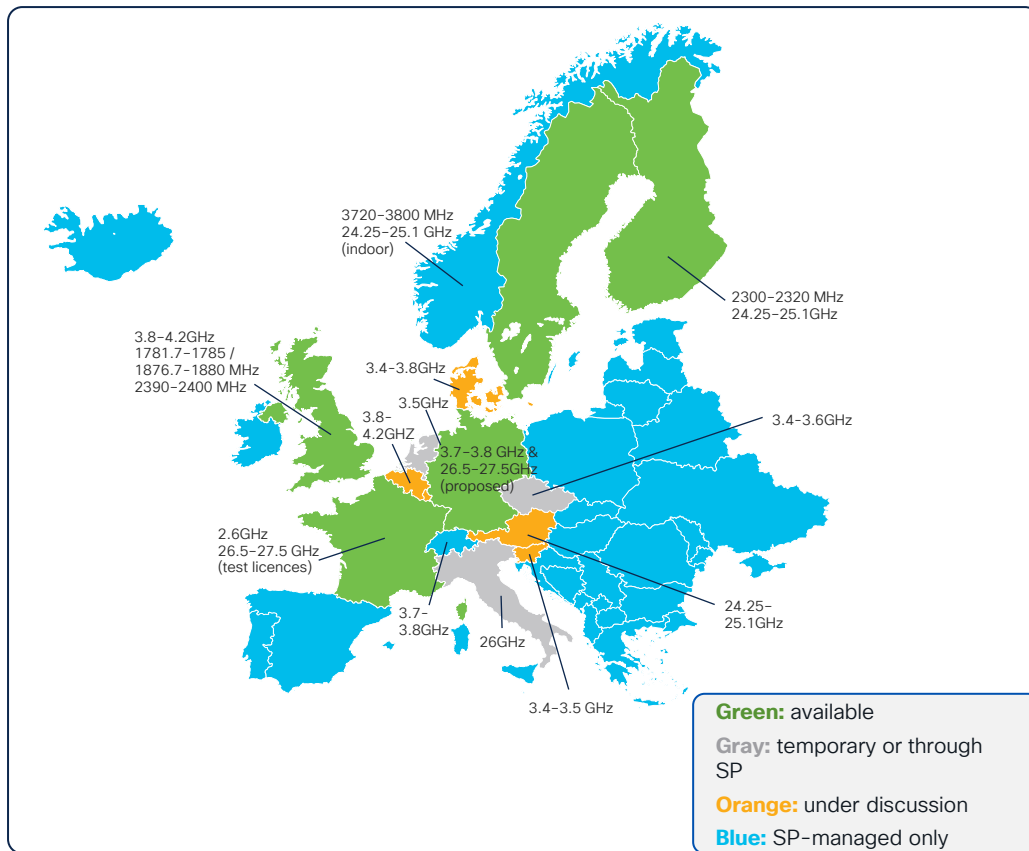
# ... And don't forget about Interference in WiFi on 2.4 / 5GHz!



# P5G Spectrum Availability in EMEA

Country	Frequency Band	Frequency	Auction Status
Finland	n78	3.41 – 3.8 GHz	Auctioned (Oct 2018)
	n258	25.1 – 27.5 GHz	Auctioned (Jun 2020)
France	n78	3.4 – 3.8 GHz	Auctioned (Sep 2020)
	n257	26.5 – 27.5 GHz	Upcoming
Germany	n1	1920 – 1980 MHz (Uplink) 2110 – 2170 (Downlink)	Auctioned (Aug 2019)
	n78	3.4 – 3.7 GHz	Auctioned (Aug 2019)
	n78	3.4 – 3.8 GHz	Upcoming (Planned)
Ireland	n258	24.25 – 27.5 GHz	Upcoming (Planned)
	n78	3.4 – 3.8 GHz	Auctioned (May 2017)
	n258	26 GHz	Upcoming
Italy	n78	3.6 – 3.8 GHz	Auctioned (Oct 2018)
	n258	26.5 – 27.5 GHz	Auctioned (Oct 2018)
	-	700 MHz	Auctioned (Oct 2018)
Russia	n40	2.3 – 2.4 GHz	Upcoming
	n41	2.57 – 2.62 GHz	Upcoming
	n79	4.4 – 4.99 GHz	Upcoming
	n248	24.25 – 27.5 GHz	Upcoming (Planned)
	-	694 – 790 MHz	Upcoming (Planned)
Spain	n78	3.4 – 3.6 GHz	Auctioned (Jul 2018)
	n78	3.6 – 3.8 GHz	Upcoming (Planned)
	-	700 MHz	Upcoming (Planned)
	n258	26 GHz	Upcoming (Planned)
United Kingdom	n78	3.4 – 3.6 GHz	Auctioned (Apr 2018)
	n78	3.6 – 3.8 GHz	Upcoming (In 2020)
	n258	24.25 – 27.5 GHz	Upcoming (Planned)

Source: GSMA, Date November 2021



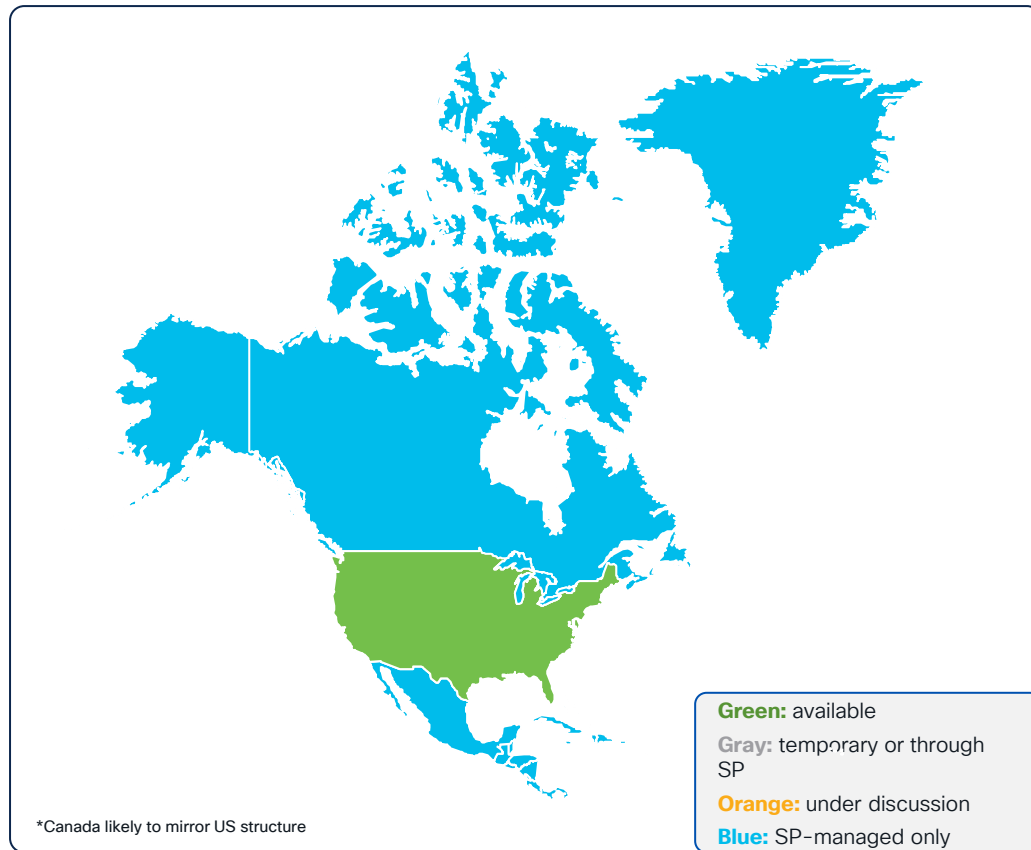
# P5G Spectrum

## Availability in North America (US)\*

Market	EN Managed (private spectrum)	
	LTE	5G
<b>United States</b>		3.55 to 3.7 GHz
<b>Canada</b>		3.5 GHz

- CBRS Spectrum now in commercial use - predominantly 4G LTE & proprietary technologies
- Shared Spectrum structure - Incumbents, Priority Access Licenses (PAL), and General Authorized Access (GAA)
- Spectrum managed dynamically by Spectrum Access System (SAS)
- SAS providers - Google, CommScope, Federated Wireless and Sony

Source: GSMA, Date November 2021

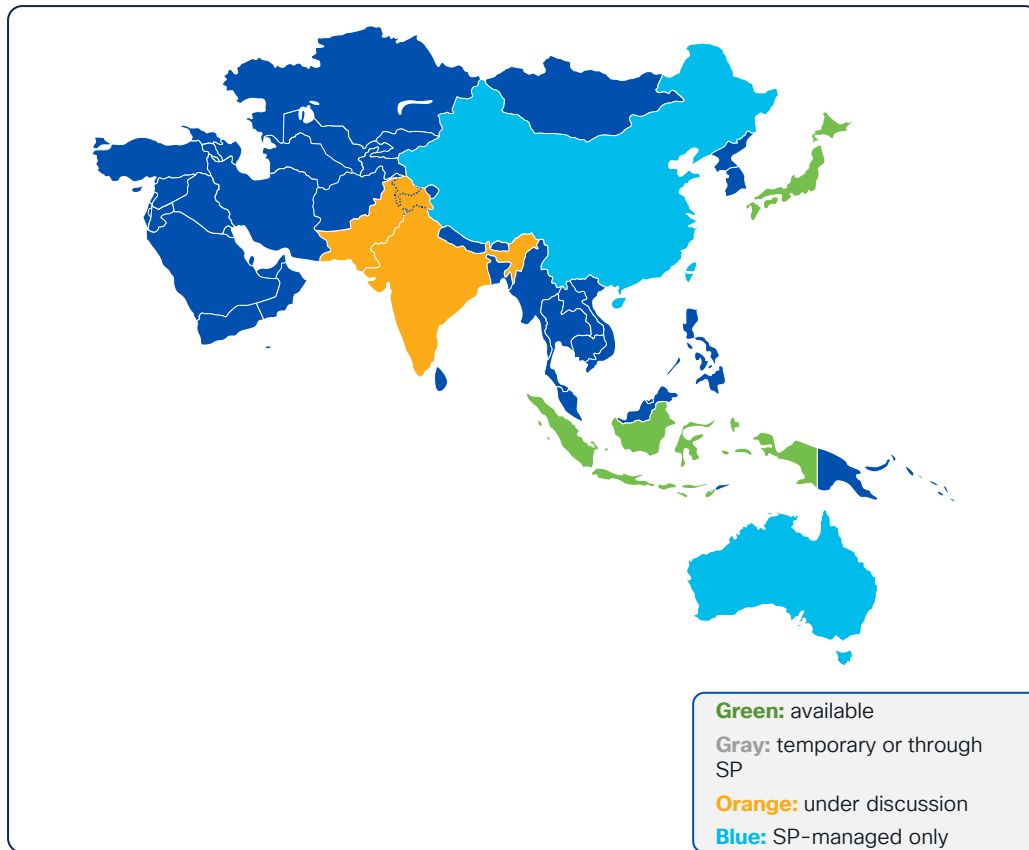


# P5G Spectrum

## Availability in APJC

Market	EN Managed (private spectrum)	
	LTE	5G
<b>Australia</b>	Now (2GHz)	Now (26, 28GHz) 2022 (3GHz)
<b>China</b>		2022 (<6GHz)
<b>India</b>	Now (Mil)	2023 (3, 4, 28 GHz)
<b>Hong Kong</b>		Now (26 GHz)
<b>Japan</b>		Now (4, 28 GHz)
<b>Korea</b>	Now (PS)	Now (4, 28 GHz)
<b>New Zealand</b>		2023+ (3GHz, mmW)
<b>Singapore</b>	Now (Mil)	
<b>Taiwan</b>		Now (4GHz, mmW)
<b>Thailand</b>		2022 (mmW)

Source: GSMA, Date November 2021



# Cellular Spectrum Considerations

What type of spectrum is needed for the use case?

- Cellular frequency bands and the radio implementations in those bands have different propagation, capacity, and delay characteristics.
- Low (<1GHz) / Mid (1GHz – 6GHz) / High-band (> 6GHz).
- Licensed bands provide access guarantees at a cost, whereas unlicensed bands are open access but free.

	Low-band	Mid-band	High-band
<b>Reach</b>	10+ Km/Miles	Km/Miles	Meters/feet
<b>Coverage</b>	Nation-wide	Site/regional	Building
<b>UE Bandwidth</b>	~100 Mbps	< 1Gbps	1Gbps+

Where do I get spectrum?

- Licensed Spectrum is a regulated resource allocated via an auction processes.
- In MOST countries, the large SPs/MNOs hold all spectrum types in their area of operations (typically nation-wide).
- Regional/private spectrum is currently available in USA, Germany, UK, with test licenses in Sweden, Japan, Australia. Other countries are in the process of making such spectrum available to regional providers or even enterprises directly.
- In the USA, CBRS offers both licensed (PAL) and unlicensed (GAA) mid-band spectrum controlled by a few SAS providers (for a fee!).

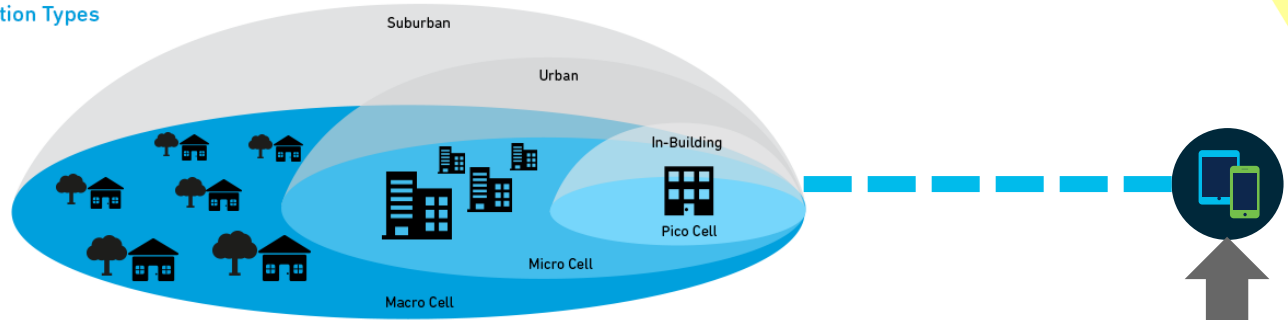
Do partner radio vendors support the spectrum band?

- Cisco's primary radio partners Airspan and JMA offer both indoor and outdoor radios to support P5G use-cases.
- Radio Products from these vendors have varying support characteristics for spectrum bands. Not all products support the full range of spectrum bands for both indoor and outdoor deployments!
- Radio vendors also have varying support within countries. For example, JMA is strong in the North America, whereas Airspan has many engagements in Europe. This changes over time!

# Power impacts Reach and Endpoint Handoffs



## Base Station Types



### Notes:

- Typical data for licensed spectrum service.
- Tx power limited by regional regulator for “shared spectrum”
- **For Enterprise use throughput per cell is important and this may reduce overall practical cell radius further**
- Actual values will depend on exact environments – we cannot change the laws of physics

Cell Type	Output Power (w)	Theoretical Cell Radius (m)	Practical Cell Radius (m)	Typical active / Max Users per AP / RU	Typical Locations
Wi-Fi 2.4 GHz	0.1	75	<70	30/256	Indoor
Wi-Fi 5 GHz	0.2 to 4*	Limited by max client Tx power)	<35	30/512	Indoor
Wi-Fi 6 GHz	0.2 to 4*		<30	30/400-1024	Indoor
Femtocell	0.001 to 0.25	10-100	8 - 15	1 to 30	Indoor
Picocell	0.45 to 1	100-200	<200	30 to 100	Indoor/Outdoor
Microcell	1 to 10	200-20000	<2000	100 to 2000	Indoor/Outdoor
Macrocell	10 to >50	30000 to 80000	1000 to 20000	>2000	Outdoor

\* Higher transmit powers not typically used as devices have limited Tx range

## Endpoint / UE Tx

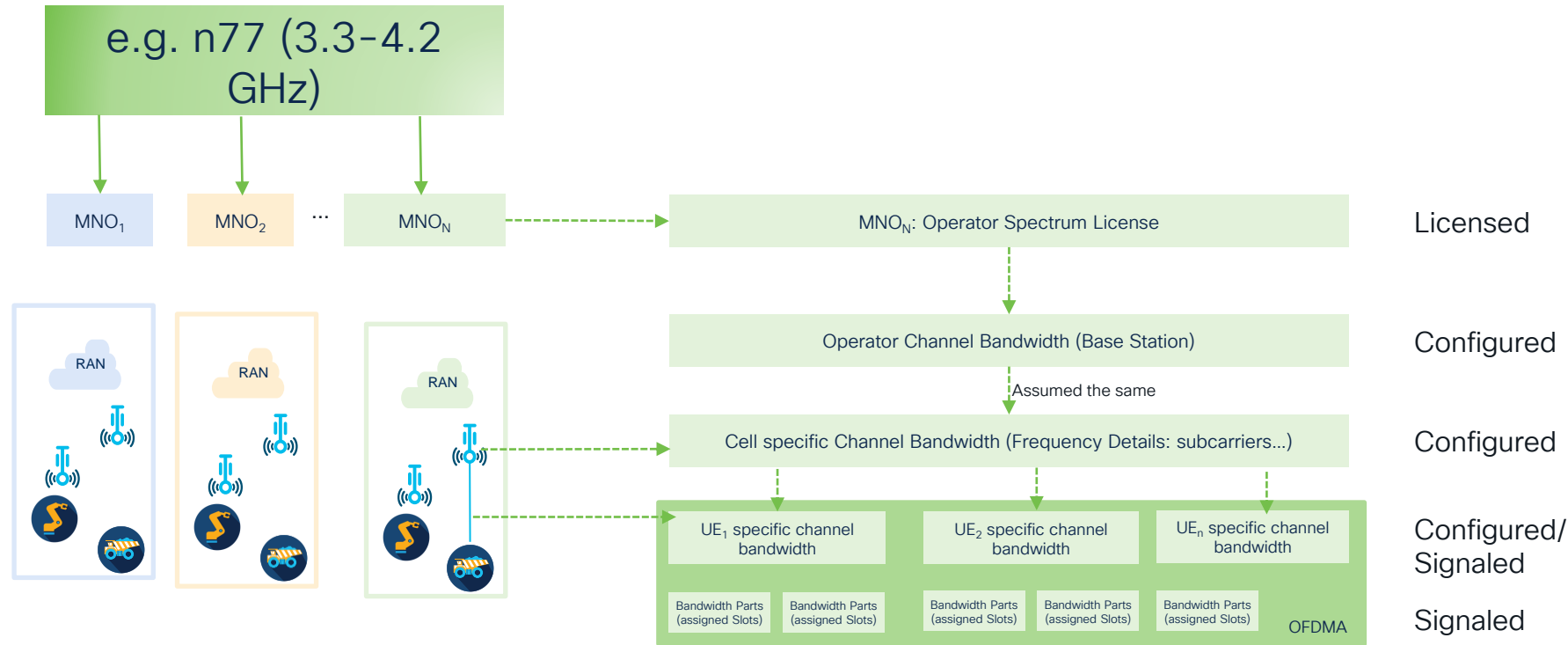
Variable Tx power.  
e.g. 4G:

- Typical 0.1W or less but can go higher typically to 0.2W
- Cat 0 (M2M) max 0.2W

E.g. Wi-Fi6:

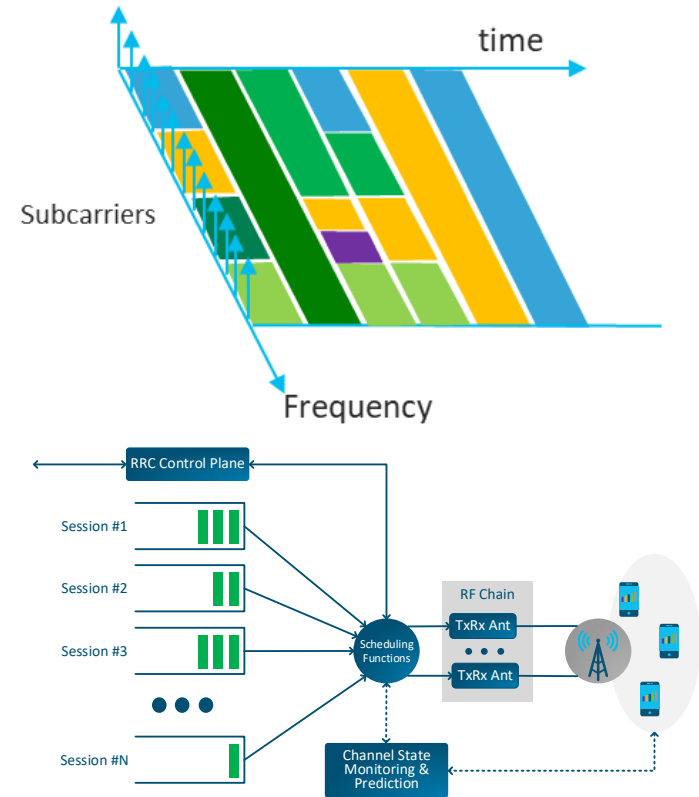
- Support for Dynamic Transmit Power Control (DTPC)
- Average 0.01W or less

# How does the Spectrum get used by Endpoints in 5G?



# The foundation for higher bandwidth (and latency) is OFDMA Scheduling

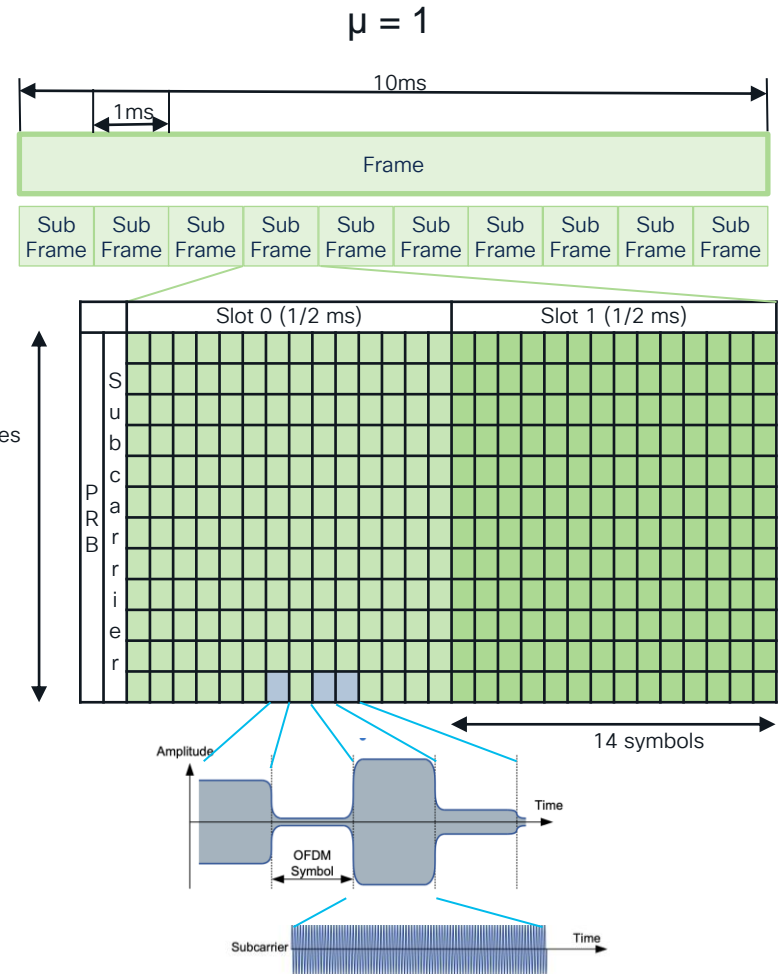
- Both Wi-Fi 6 and 5G are based on OFDMA
  - Slice up spectrum in two dimensions: frequency and time
- Radio scheduler schedules transmission request to
  - A particular frequency (subcarrier)
  - At a particular timeslot
- Endpoints don't have permanent frequency entitlements



# 5G OFDMA Scheduling

- Time domain is always clocked at 10 ms and arranged into frames = 10 subframes =  $2^\mu$  slots
- Frequency domain: group 12 different frequencies (subcarriers) into a physical resource blocks (PRBs)
- Numerology  $\mu$  determines how coarse the grid is
  - But always have 14 symbol slots!
  - The larger  $\mu$ , the more slots and the shorter the symbol slot length (i.e. symbol duration gets smaller)

Numerology $\mu$	N symbols / Slot	N Slots / subframe ( $2^\mu$ )	N slots / frame	Band
0	14	1	10	LOW, Mid
1	14	2	20	LOW, Mid
2	12/14	4	40	Mid, High
3	14	8	80	High
4	14	16	160	



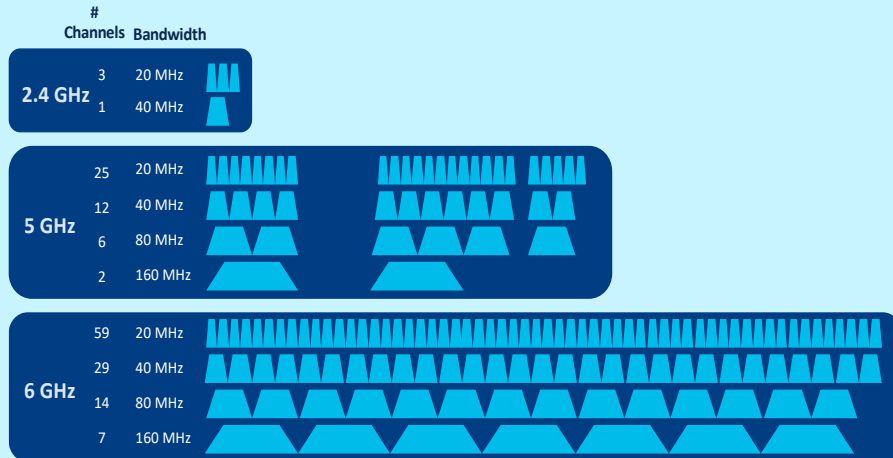
# How does this spectrum help me get more bandwidth?



- Both 5G and Wi-Fi can have flexible spectrum channel widths (i.e. more bandwidth on the air!)

## Wi-Fi 6/6e

- Configure channel widths for APs



## 5G:

- Allow for flexible bandwidth allocations over time
- Varies by frequency band (e.g. n78) and Numerology (= sub-carrier spacing aka. ' $\mu$ ')
- Ranges from 10 MHz - 100 MHz
- A Base station can support *multiple* channel widths per endpoint (c.f. UE bandwidth parts)
- Also support for Carrier Aggregation (CA) and Dual Connectivity (DC)

Band	SCS	FR	UL band [MHz]		DL band [MHz]		BW [MHz]	Duplex	Possible channel bandwidth
			$F_{UL, low}$	$F_{UL, high}$	$F_{DL, low}$	$F_{DL, high}$			
n78	15	1	3300	3800	3300	3800	500	TDD	15: [10, 15, 20, 25, 30, 40, 50] 30: [10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100] 60: [10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100]

Source: <https://www.nreexplained.com/bandwidth>

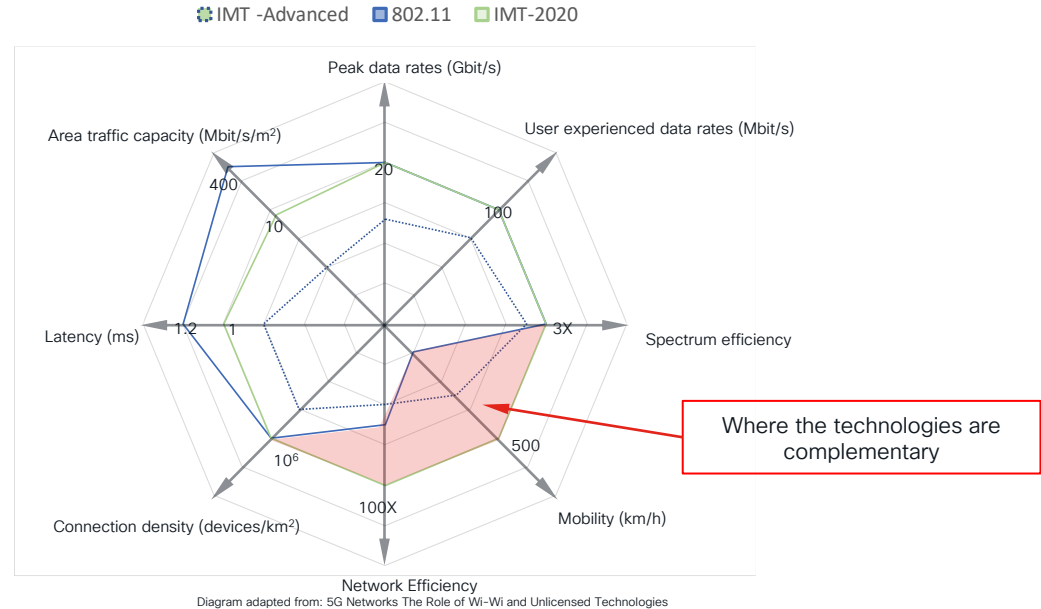
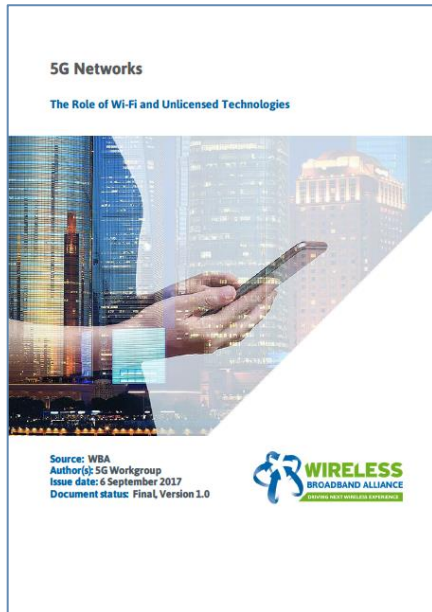
# The two next generation wireless Technologies

	Wi-Fi 6/6e	5G
<b>Spectrum</b> <span style="color: red;">economics</span>	Unlicensed: 2.4 GHz, 5 GHz, 6 GHz International with regional regulations	Licensed: 3.5 GHz Midband, mmWave Local License & rules but not always available
<b>Channel Width</b> <span style="color: red;">bandwidth</span>	2.4 GHz: 20, 40 MHz 5 GHz & 6 GHz: 20, 40, 80, 160 MHz	mixed numerology within carrier Midband: 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz mmWave: 50, 100, 200, 400 MHz
<b>Radio</b> <span style="color: red;"># Radios</span>	OFDMA, MU-MIMO, Beamforming	
	1024 QAM Antennas: 8T8R, 12T12R	256 QAM Indoor Antennas: 4T4R <b>Outdoor Antennas: 64T64R</b>
<b>Infrastructure</b> <span style="color: red;">operations</span>	WLC Self contained Access Points no complex transport	5G Packet Core both control and user plane (offered as-a-service) RUs with complex sync requirements on transport (PTP)
<b>Identity / AAA</b>	Typically enterprise ID and Authentication	ID: SUPI & SUCI mechanism (address 3/4G vulnerabilities) Auth: EAP-AKA or 5G-AKA
<b>Security</b>	Encryption: Galois/Counter Mode Protocol(GCMP-256) Key HMAC-SHA-384	Encryption: SNOW 3G, AES-CTR, and ZUC Key AHMAC-SHA-256
<b>Endpoint Availability</b>	Pervasive	Improving
<b>Endpoint Mobility</b>	Endpoint controlled/initiated	Network Initiated / Controlled
<b>Target use-case</b>	High Data Rates, Massive IoT, Low Latency	<b>Macro Mobility</b> , EMBB, mmTC, URLLC

Typical Drivers to 5G

# Dominate stack use-case expansion

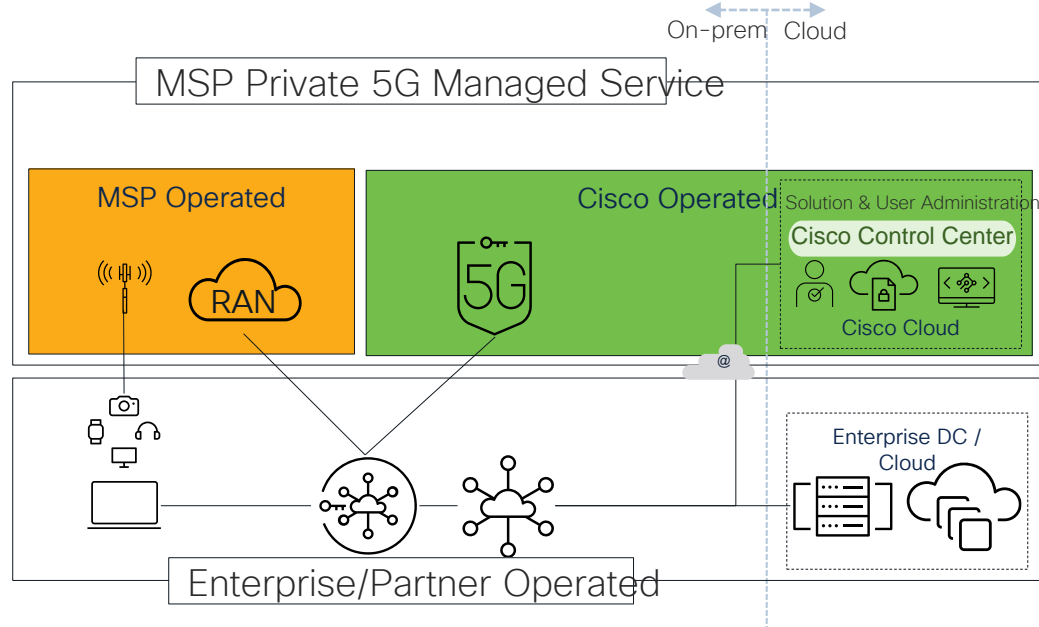
more overlap means better convergence!



Complementary technology – optimized access everywhere

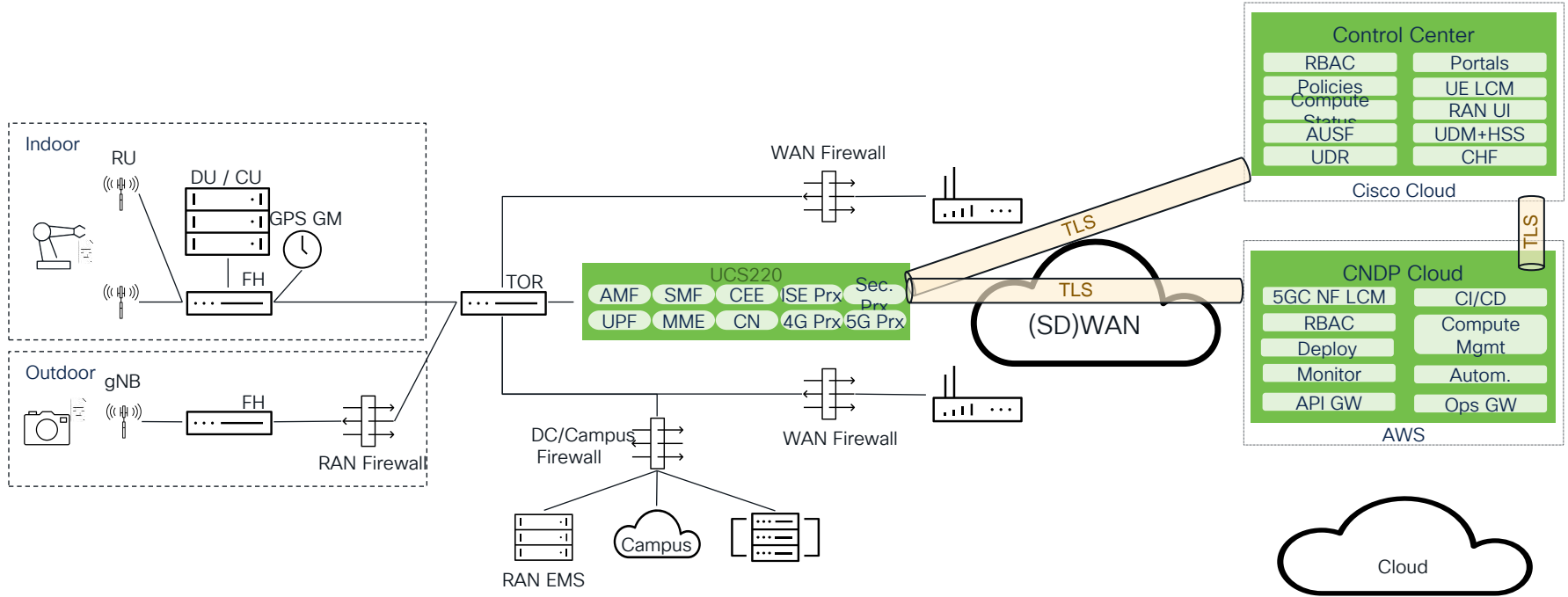
# Cisco's Private 5G Solution

# Private 5G Managed Service Offer

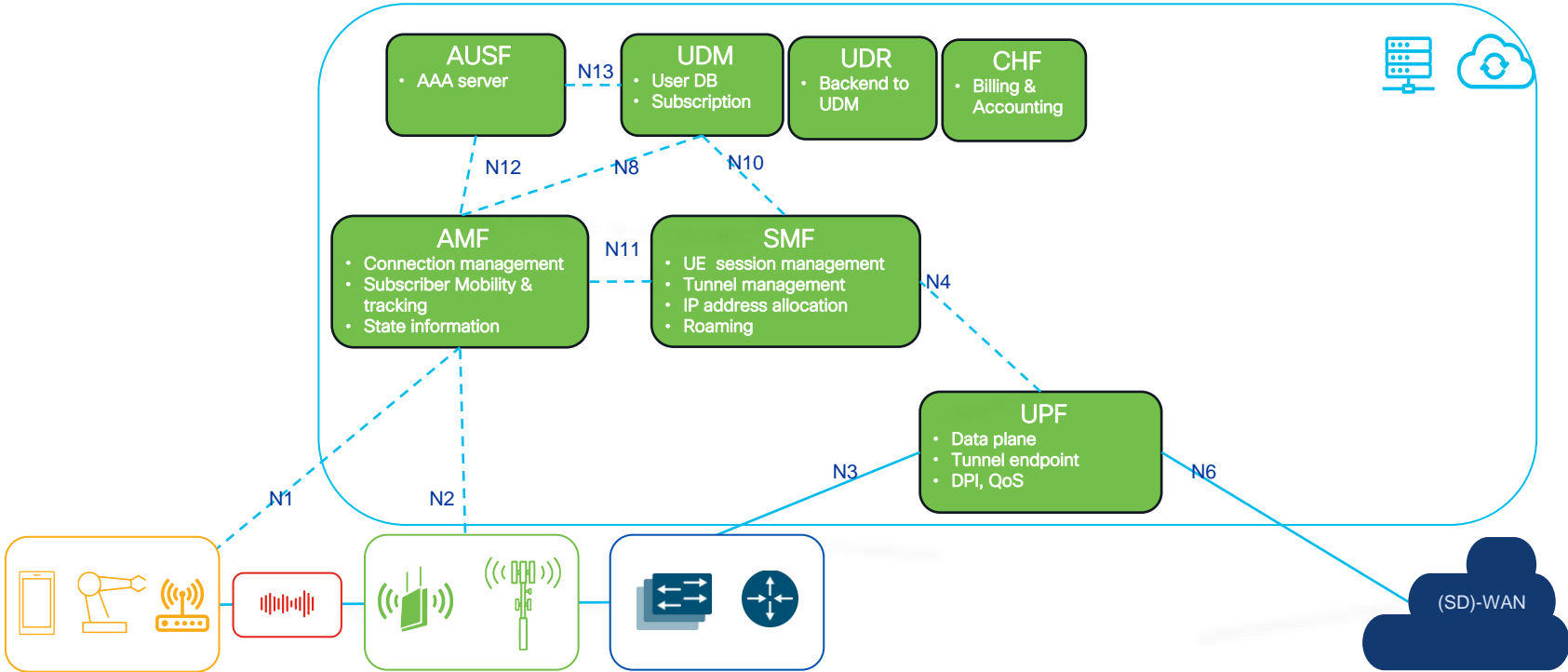


- Partner managed and operated Private 5G connectivity for 5G enterprise endpoints
- Easy, outcome-based consumption of Private 5G transport

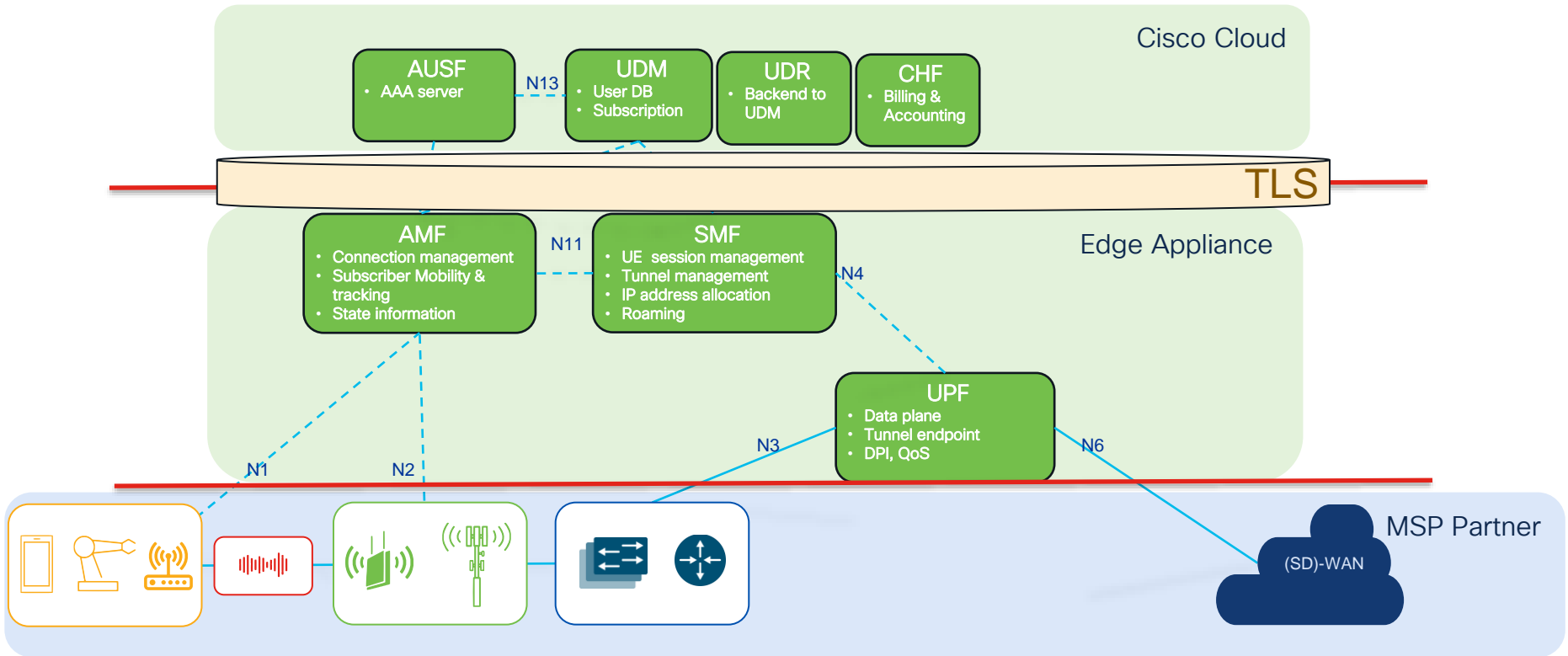
# The Cisco P5G Architecture in Detail



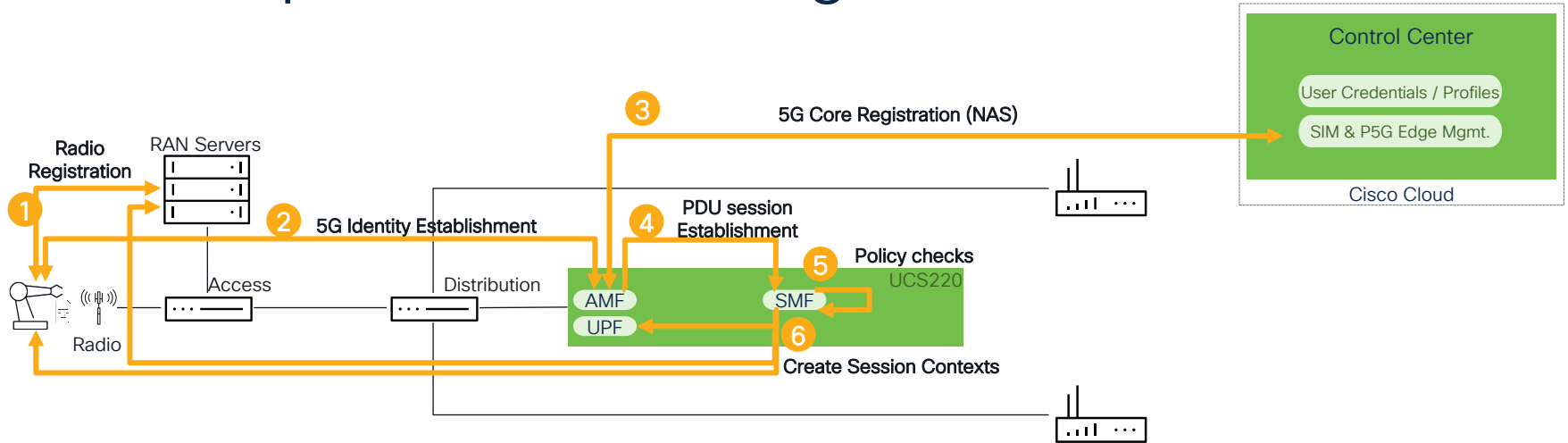
# The Cisco Converged Core Governs the P5G Access



# Cisco Converged Core: Hybrid Deployment Model



# 5G Endpoint Network Registration



## 1 Radio Registration

- Separate Encryption Keys!
- Separate Integrity Protection

## 2 5G NAS Identity

- Encrypted Identity response from Endpoint to Authentication Mobility Function (AMF)!

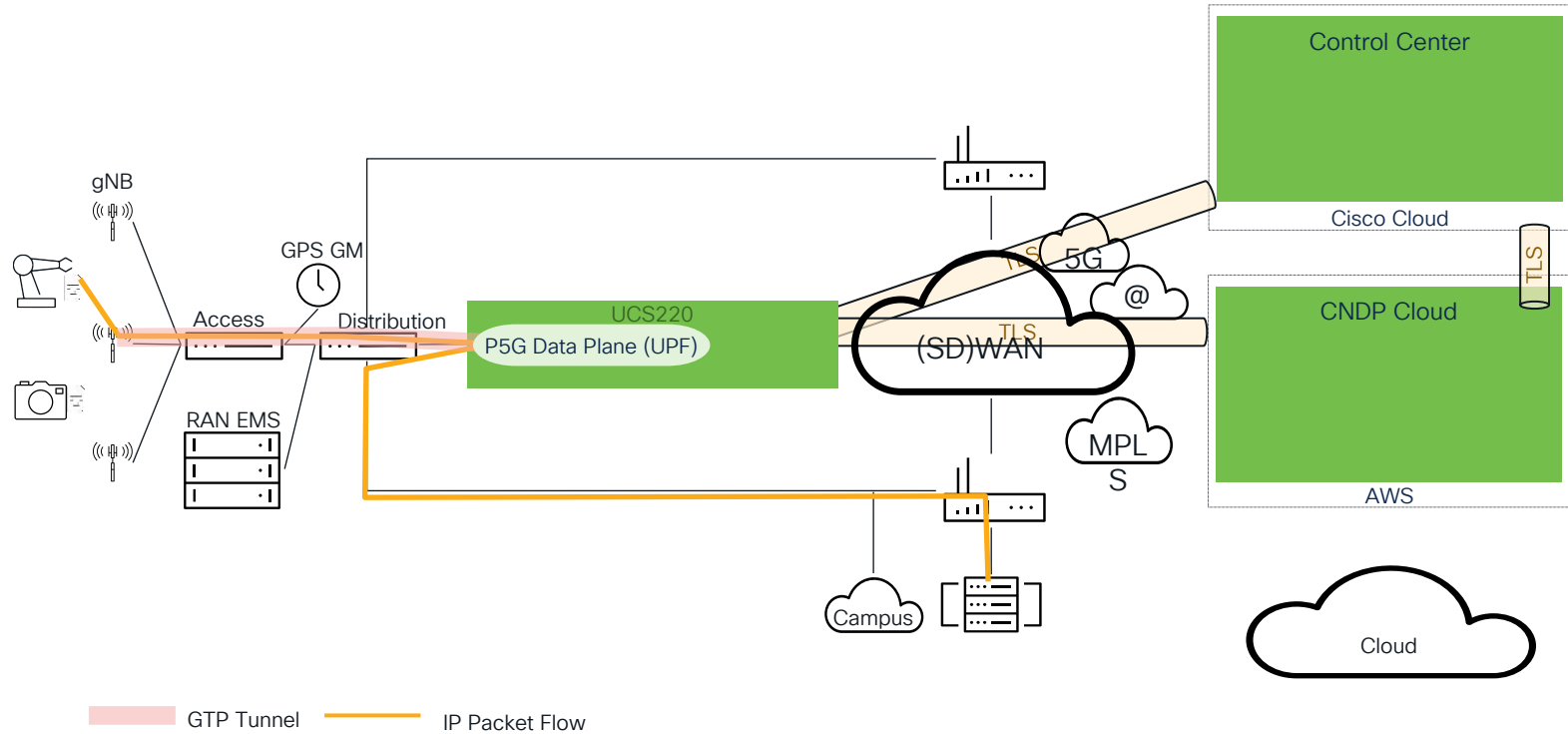
## 3 NAS Registration

- Authentication based on 128 or 256 bit Symmetric Key stored in SIM/eSIM.
- Identity is IMSI stored in SIM/eSIM.

## 6 Context Creation

- Data-plane traffic between Device and RAN (CU) is encrypted and integrity protected.
- Different keys for data-plane and signaling plane

# A Typical Data Plane Packet Flow



# Cisco P5G at FCS

## Technical Details



### Optimized Edge

- Minimal footprint at edge
- 1 server to run converged core
- Next-gen ORAN deployment running RU/CU/DU



### Scale & Performance

- 4G & 5G Device support
- 5K sessions (4G + 5G combined)
- 15 Gbps throughput (4G + 5G combined)



### Automation

- Automated installation and configuration from cloud after initial edge installation
- Automated monitoring and alerting



### UX & API Interface

- Dashboard for onboarding & day-2-day mgmt.
- E2E status in simplified traffic light view [R, Y, G]
- Feature rich APIs for external consumption



### Operations & Support

- 24x7x365 support
- Continuous monitoring and management of the service
- Seamless software and firmware upgrade for edge appliance



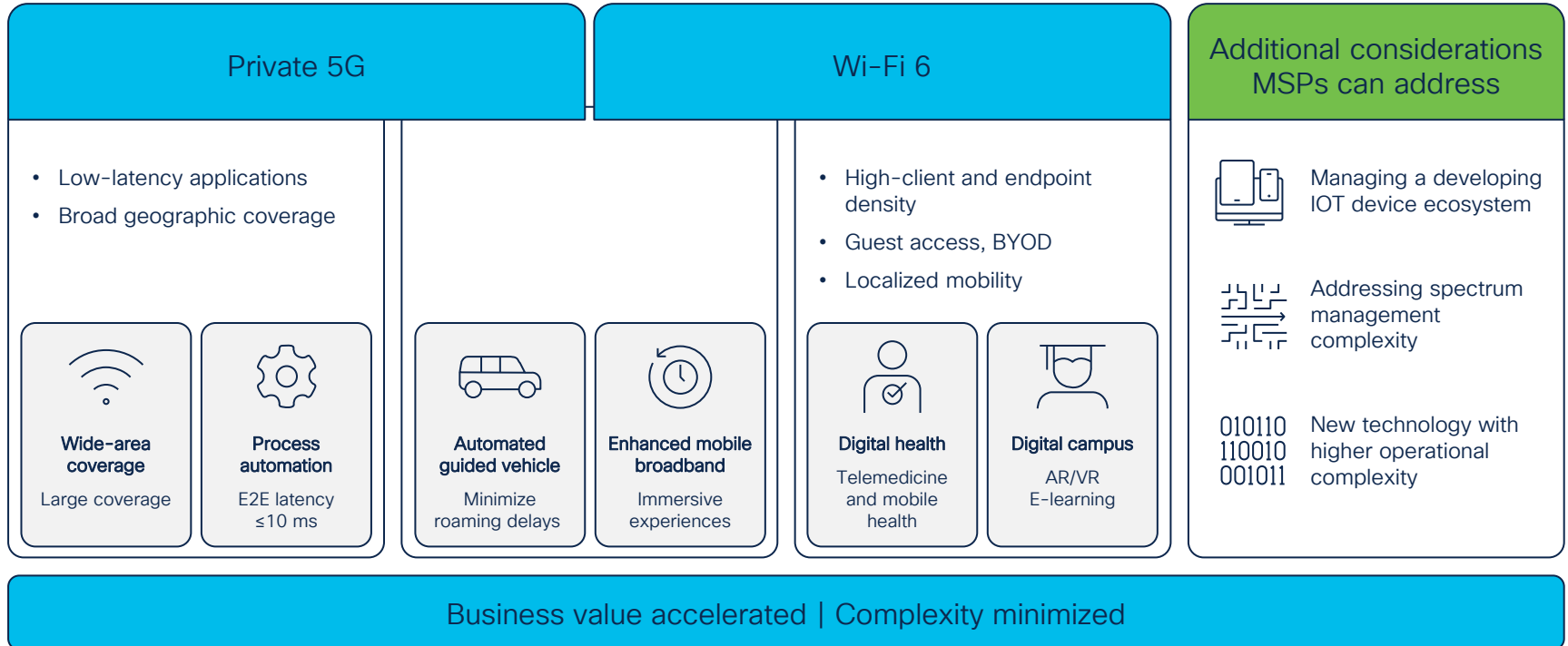
### Additional Features

- High level E2E monitoring for the service
- SIM Cards supply, provisioning and configuration
- Continuous enhancement and feature addition

# Wi-Fi6/6e and Private 5G - Better Together!

# Complementary technologies

## Wi-Fi and Private 5G



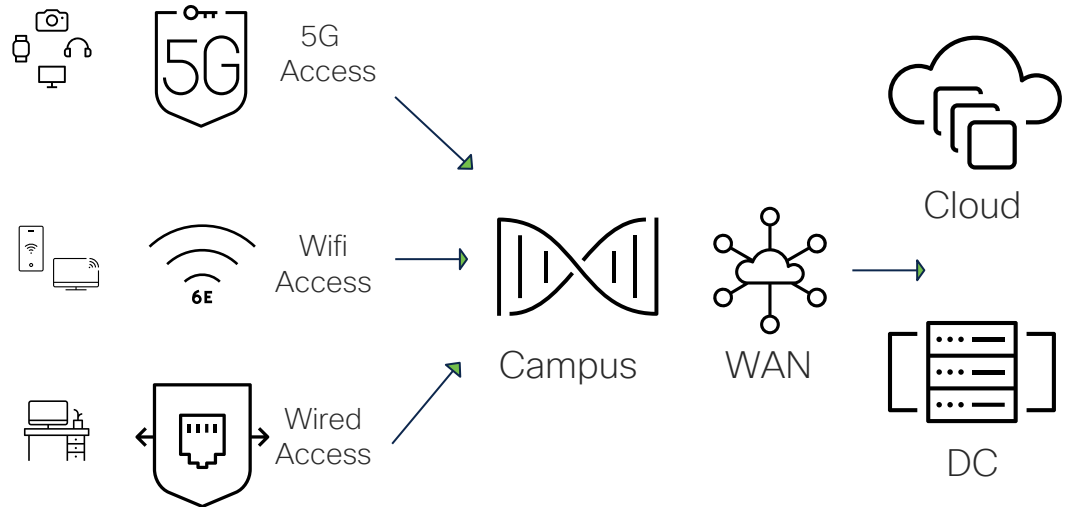
# Cisco P5G Integrated Enterprise Architecture Vision

End-end Automation and Policy

Comprehensive Telemetry and Assurance

Consistent Security and Segmentation

- ✓ Joint Transport
- ✓ Common Enterprise Policy
- ✓ Enterprise Security Integration
- ✓ Cisco Endpoint/IoT GW Integration
- ! Consolidated Insights & Analytics
- ! Unified Identity Framework
- ! Private & Public Mobility
- ! Unified EN Operations



# Leverage Existing Campus Transport

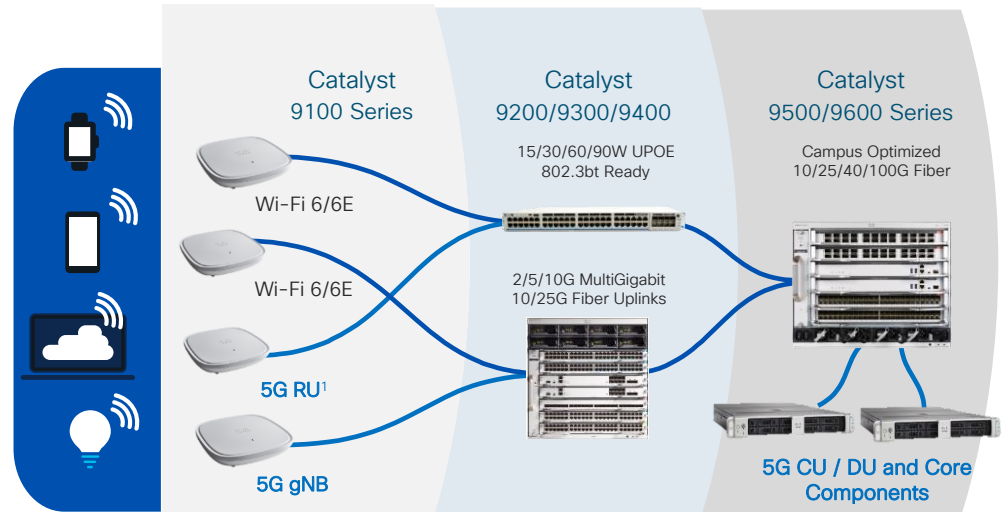
(Partially Available in Phase 1)

- P5G access networks have strict X-haul switching requirements to connect radios and 5G core / RAN functions (precision timing requirements, etc.)

- Cisco's Catalyst switching products will allow enterprise network operators to deploy Private 5G components on common enterprise infrastructure.

Benefits include:

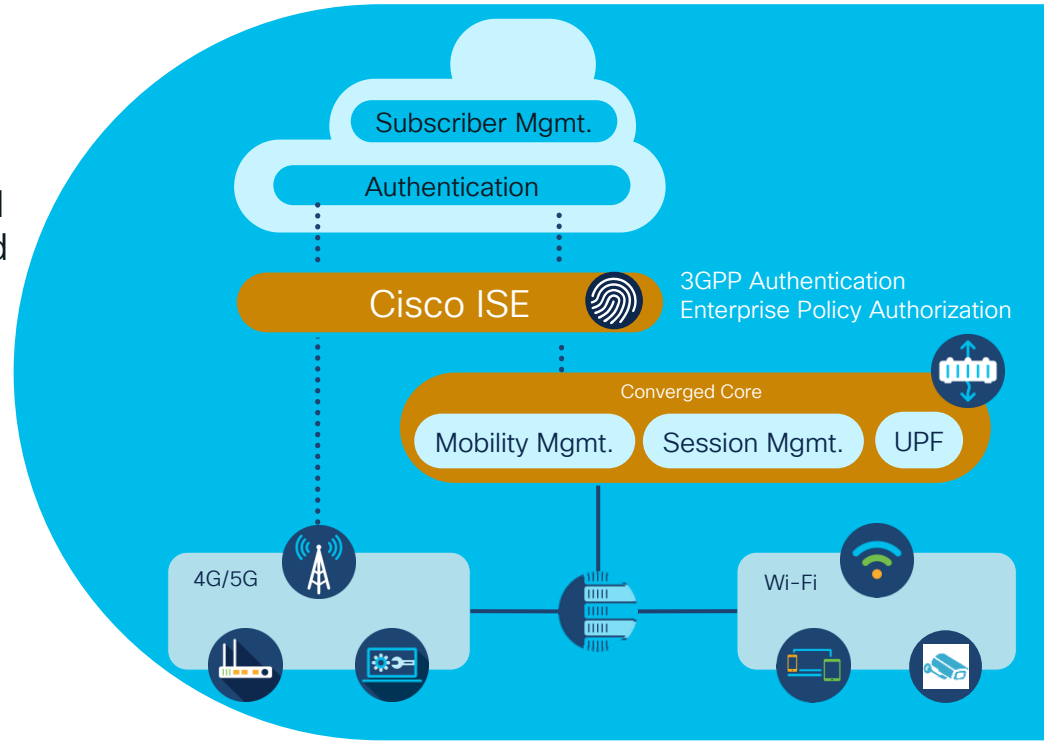
- Common operations
- Simplified inventory management
- Reduction of network elements
- Catalyst IOS-XE enhancements will support advanced 5G timing requirements, making the platform a candidate for Front-haul.



# Unified Enterprise Access Policies



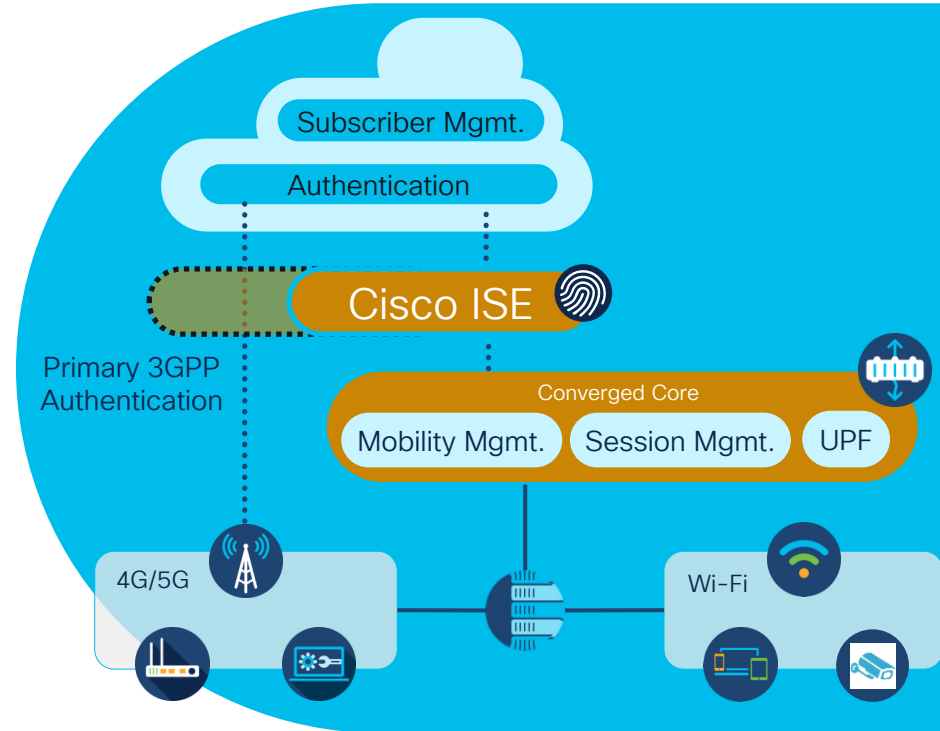
- Access Policies to the Enterprise Network MUST be consistent for 5G, WiFi and wired endpoints to enable consistent security and simplify operations
- Based on enterprise-wide unified Identity Framework
- Vision: Cisco ISE as a Single point for identity-based Enterprise Access Policies
  - Authentication & Authorization
  - Enterprise Operations define Access Policies holistically
- Initial Solution planned via ISE-Control Center Authentication (target 1H CY 2022)



# Unified Identity Framework

(First Phase and Longer-Term Vision)

- In the first phase, primary SIM authentication will occur via the 5G packet core (3GPP authentication), with secondary authorization happening in ISE
- Cisco's longer-term vision will enable ISE to provide the primary SIM authentication function
- With unified identity, the authentication framework can be expanded to external identity providers (IdPs) via Open Roaming



Foundation for common enterprise policies:  
Access / Macro & Micro Segmentation / App Experience

# Cisco ISE Review

Cisco Identity Services Engine (ISE) is an industry leading, Network Access Control and Policy Enforcement platform, that lets you,



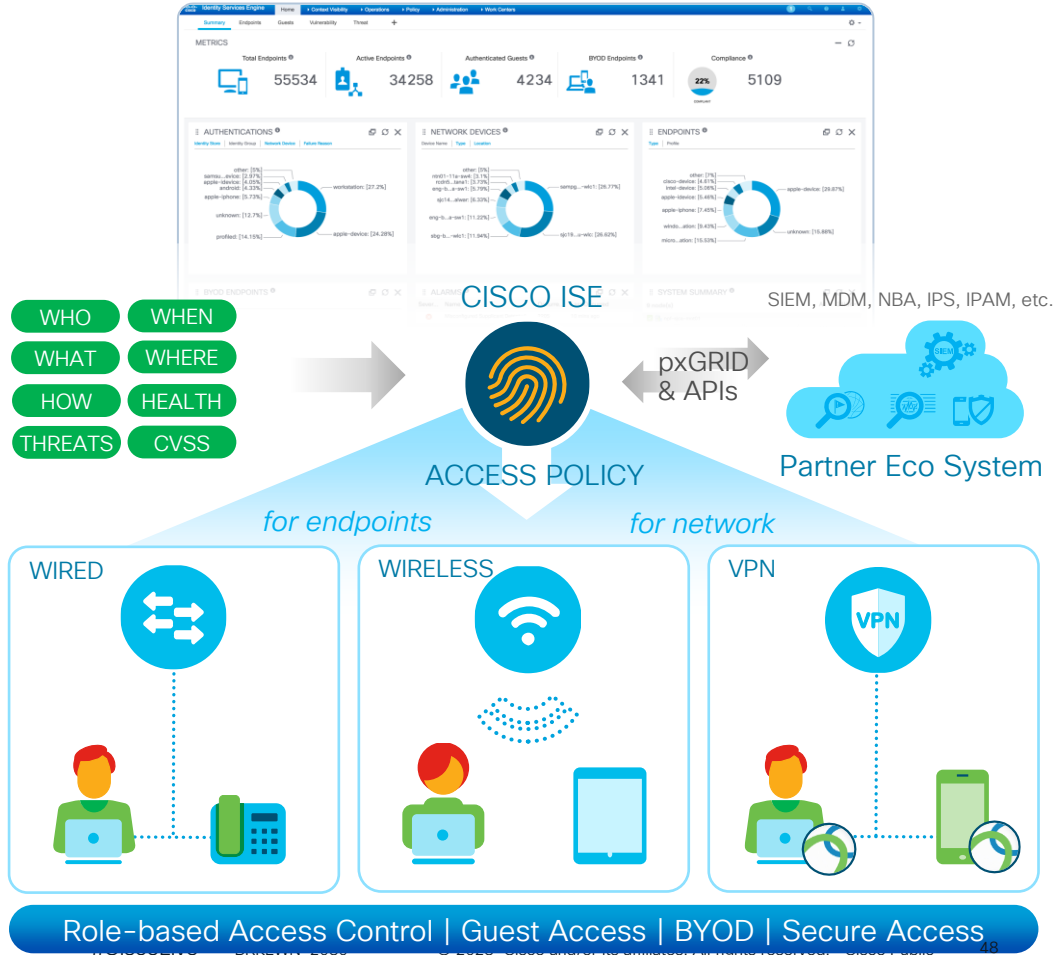
**See**  
Users, endpoints and applications



**Secure**  
By controlling network access and segmentation



**Share**  
Context with partners for enhanced operations



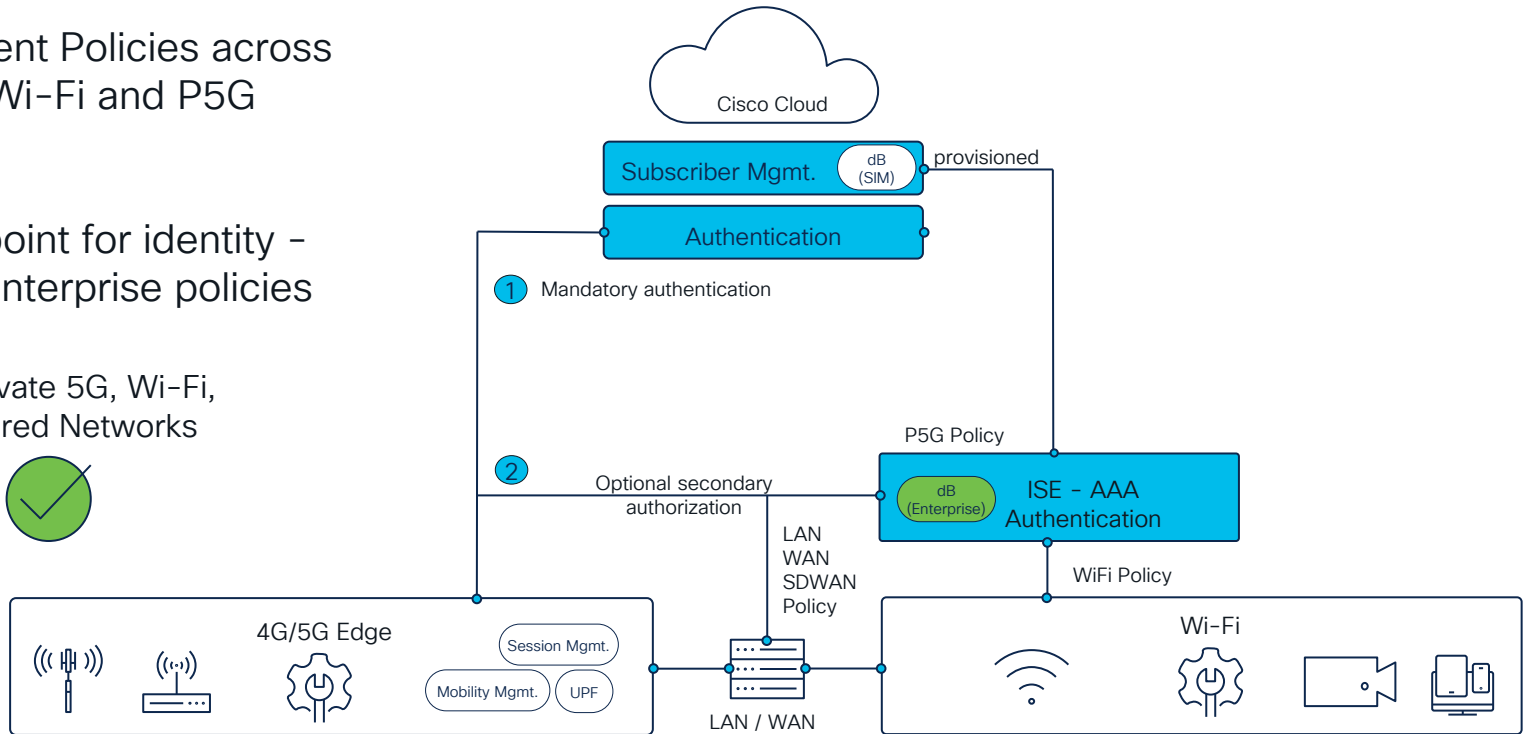
# Governing P5G Access Policies with Cisco ISE

Consistent Policies across Wired, Wi-Fi and P5G Access!

Consistent Policies across  
Wired, Wi-Fi and P5G  
Access!

Single point for identity -  
based enterprise policies

- For Private 5G, Wi-Fi,  
and Wired Networks

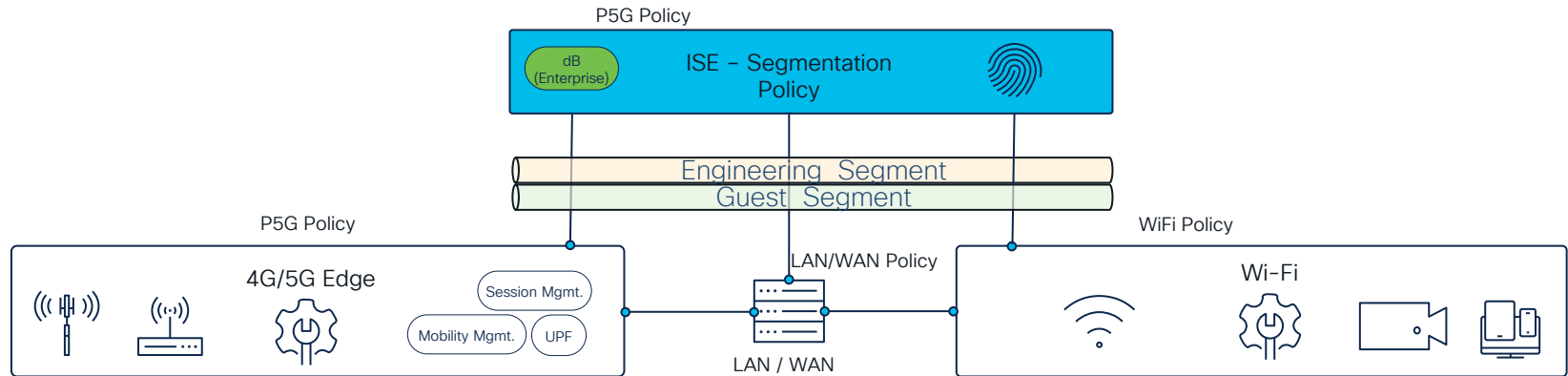


# Enforcing coherent Enterprise Segmentation with Cisco ISE

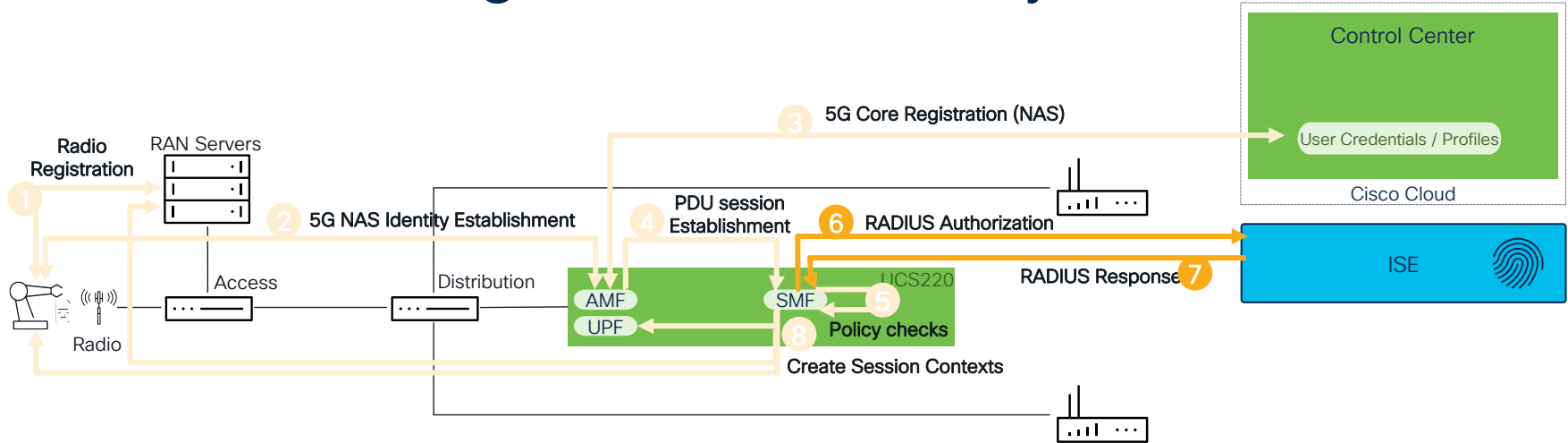
Unified Segmentation Policies across Wi-Fi, Wired and P5G access networks based on Cisco ISE Rules

Domain-specific segmentation

- VLAN, VXLAN, SGT, VRF



# Cisco ISE Integration: Secondary Authorization



- Cisco ISE Integration adds a secondary RADIUS-based authorization into the Registration process
- RADIUS Access Request: SMF sends IMSI/IMEI
- RADIUS Access Accept: ISE returns VLAN

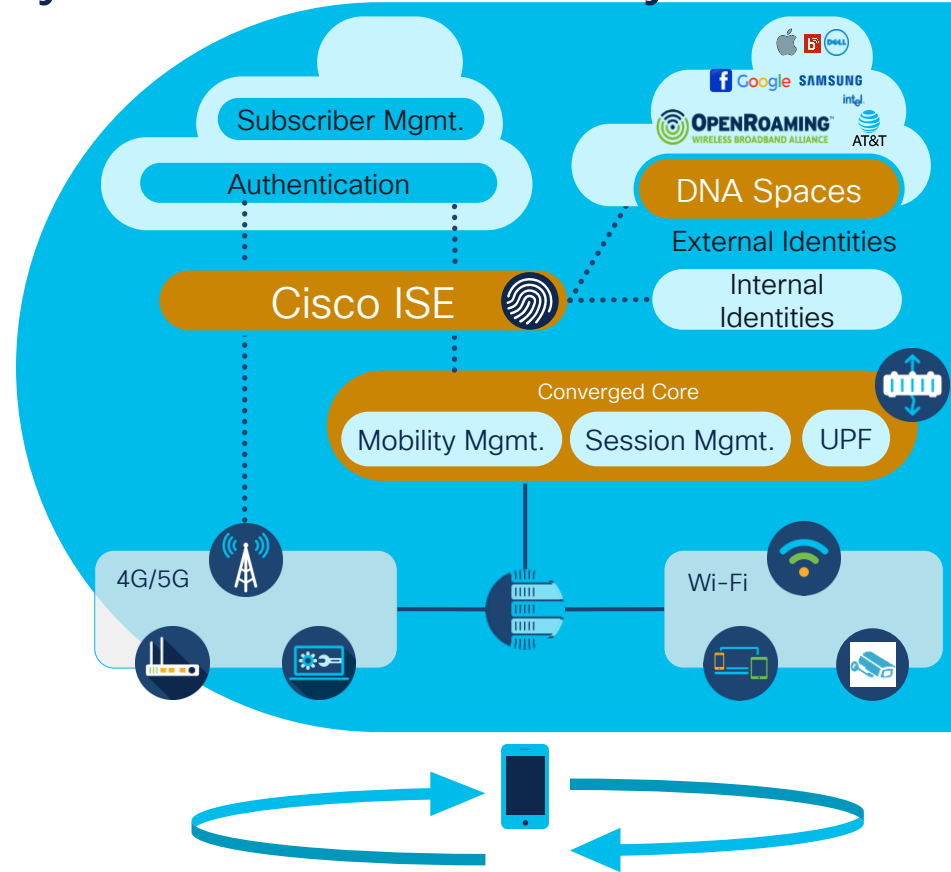
# Common Enterprise Policy – Private Mobility



(Partially Available in Phase 1)

- Wi-Fi & 5G Mobility happens today, controlled to a great extent by the device and the application
- Cisco's vision enables devices to select any bearer based on Policy
  - Consistent and centralized user / device policy based on ISE
  - Apps seamless reconnect @ bearer change if necessary
  - Devices can leverage external identities via Open Roaming federation.

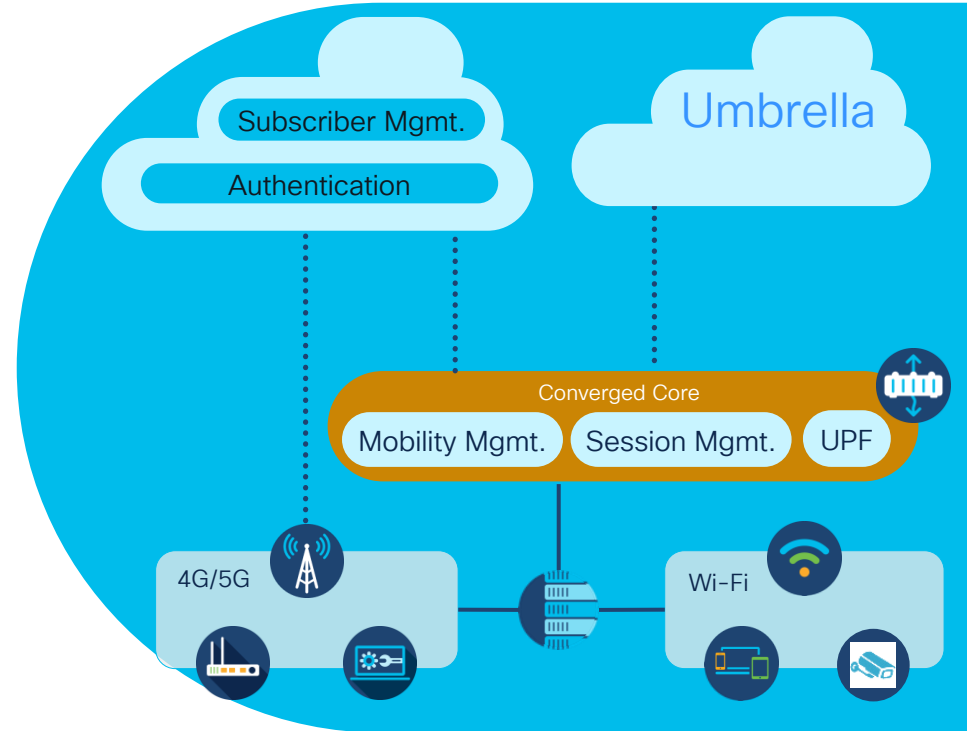
Movement across private wireless networks (P5G, Wi-Fi) is constrained only by business needs, business relationships and regulatory obligations. Not by technological constraints.



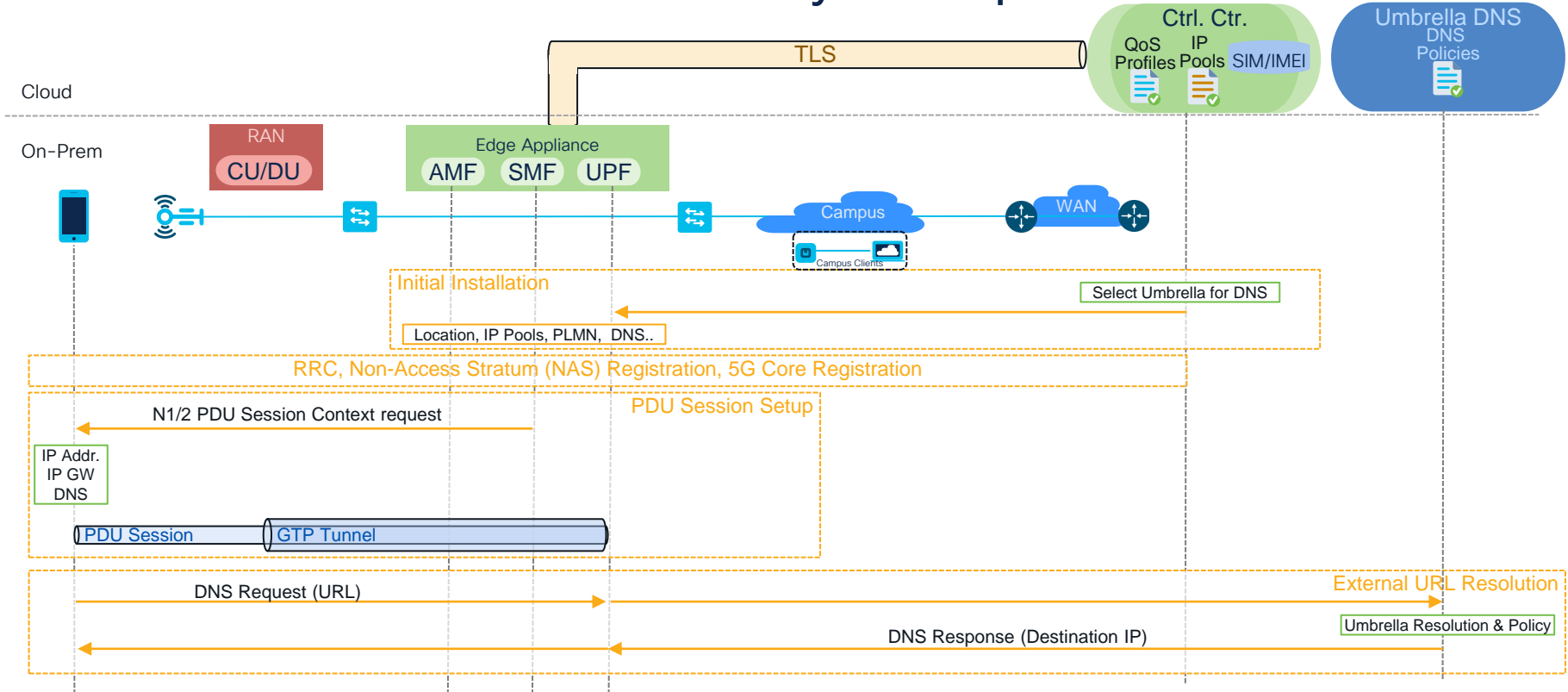
Demo Time!

# Common Enterprise Policy – Umbrella Security

- Umbrella-based DNS offers cloud-based security for the Enterprise
- Integration of Cisco P5G with Umbrella DNS extends security policies to 5G access networks
- Benefits:
  - Ability to define policy once and apply every where – including Network
  - Correlation of endpoints across managed P5G and Wired/Wi-Fi access networks
  - Operational cost savings
  - New use-cases



# Cisco Umbrella DNS Policy Setup and Resolution



# Get Engaged!

# Key Take Aways

- Use-cases drive best technology choice
- Cisco is executing on the vision of P5G + Wi-Fi = better together
  - ISE integration
  - Consistent Security
  - Operational synergies
- Don't dwell on doing a Wi-Fi vs. P5G technology comparison
- P5G and 5G are still emerging!
  - Device availability
  - Spectrum availability

# Summary – Wireless Truly is an Adventure

- No one wireless technology solves all the problems – Cisco will continue to develop solutions to meet the right needs
  - Wi-Fi6E
  - Private and Public 5G
- Private 5G is a new paradigm in enterprise access, but needs to be unified with existing enterprise networking capabilities
  - Consistent policy and security
  - Common management framework

# Cisco Private 5G Learning Map

Start

June 4 | 2:00 pm

## TECSPG-2432

New Adventures in Wireless: The Journey of WiFi6 and Private 5G Networks for the Enterprise

June 5, | 8:00 am

## BRKSEC-2085

Architecting Enterprise Security in a Wi-Fi plus Private 5G World

June 5 | 8:30 am

## BRKSPG-2042

Architecting Private 5G for resiliency, security, and enterprise network convergence

June 5 | 10:30 am

## BRKSPM-1006

The 5G System as a Spectrum Management Solution

June 5 | 11:00 am

## BRKENS-2950

Is your Enterprise Network Ready for P5G

June 5 | 11:30 am

## PSOSPG-1002

Leading Your Digital Transformation with Cisco Private 5G Network Offer

June 6 | 3:00 pm

## BRKEWN-2030

WiFi6 and Private 5G for the Enterprise - a 'Better Together' Journey

June 7 | 2:30 pm

## PSOGEN-1033

Unlock business outcomes from connectivity with a Private 5G solution

June 7 | 4:00 pm

## BRKSPG-3004

Monolithic or Polyolithic packet cores? The case for specialized use-case-based mobile packet cores

June 8 | 09:30 am

## BRKSPG-2044

5G Use Cases Flight Line of the Future and Smart Warehouse

June 8 | 01:00 pm

## IBOSPG-2007

Getting Started with Private 5G

June 8 | 1:00 pm

## BRKGEN-2001

Cisco P5G - A Robust and Secure Architecture

Finish

# Cisco 5G Learning Map

Start

- **June 4 | 9:00 am**  
**TECIOT-2584**  
Designing IoT Wireless Networks
- **June 5, | 8:30 am**  
**BRKNWT-2203**  
Automation-first Approach to Network Infrastructure Modernization for 5G & Beyond
- **June 5 | 1:00 pm**  
**BRKSPG-2063**  
Design, Deploy and Manage Transport Slicing using SDN Controller and Assurance
- **June 5 | 1:00 pm**  
**BRKARC-2094**  
Hiking the Band Canyon with 5G: New Use Cases, New Business Outcomes
- **June 5 | 2:30 pm**  
**BRKSPG-1002**  
Don't Just Connect, Grow your IoT Business with Cisco IoT Cellular Connectivity Management
- **June 5 | 3:00 pm**  
**BRKIOT-1126**  
Connecting Moving Assets with Cisco IoT Solutions
- **June 6 | 10:30 am**  
**BRKSPG-2315**  
Cloud-Ready Converged SDN Transport
- **June 6 | 1:00 pm**  
**BRKSPG-2401**  
Cisco Secure Edge Protection – Protecting the 5G Edge against DDoS Attacks
- **June 6 | 2:30 pm**  
**IBOSPM-2030**  
5G Transport Design Considerations Combining Onsite and Cloud-Based Deployments
- **June 6 | 4:00 pm**  
**BRKSPM-2027**  
Holistic Security in 5G Deployments
- **June 7 | 10:30 am**  
**BRKSPG-2133**  
Evolution of the Transport Network Architecture in the Context of 5G and Open RAN
- **June 8 | 8:30 am**  
**BRKSPG-3050**  
Synchronizing 5G Mobile Networks

# Cisco 5G Learning Map

● June 8 | 9:30 am

## **IBOSPG-2006**

DISH Wireless, World's first 5G Network with a Hybrid Cloud

● June 8 | 10:30 am

## **BRKNWT-2301**

DevNetOps Automation Approach to Network Infrastructure Modernization for 5G and Beyond

● June 8, | 11:00 am

## **BRKSPG-2040**

Troubleshooting 5G Architectures

● June 8 | 1:00 pm

## **BRKMER-2001**

Postcards from the 5G Edge: Meraki Cellular Gateways

Finish

# Fill out your session surveys!



Attendees who fill out a minimum of four session surveys and the overall event survey will get **Cisco Live-branded socks** (while supplies last)!



Attendees will also earn 100 points in the **Cisco Live Game** for every survey completed.



These points help you get on the leaderboard and increase your chances of winning daily and grand prizes

# Continue your education

CISCO *Live!*

- Visit the Cisco Showcase for related demos
- Book your one-on-one Meet the Engineer meeting
- Attend the interactive education with DevNet, Capture the Flag, and Walk-in Labs
- Visit the On-Demand Library for more sessions at [www.CiscoLive.com/on-demand](http://www.CiscoLive.com/on-demand)

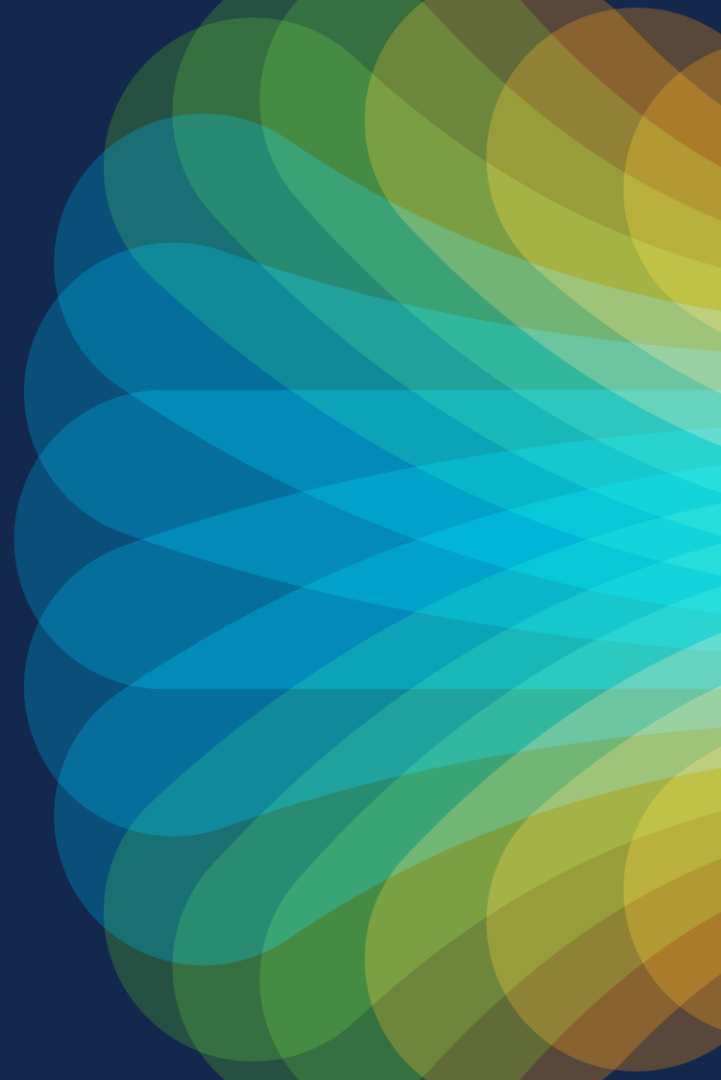


The bridge to possible

# Thank you

CISCO *Live!*

#CiscoLive

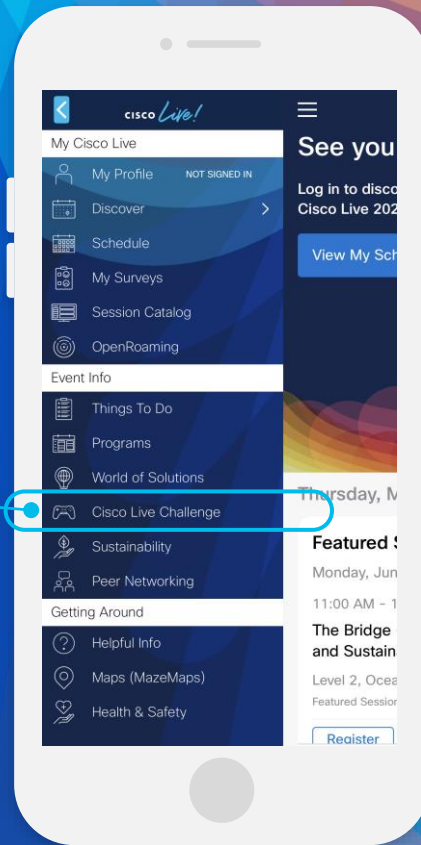
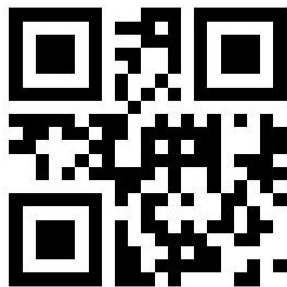


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Get points for attending this session!

## How:

- 1 Open the Cisco Events App.
- 2 Click on 'Cisco Live Challenge' in the side menu.
- 3 Click on View Your Badges at the top.
- 4 Click the + at the bottom of the screen and scan the QR code:



The Cisco Live! logo features the word "CISCO" in a bold, black, sans-serif font, followed by "Live!" in a black, cursive script font. The background of the entire image is a vibrant, multi-colored abstract pattern of overlapping, wavy bands in shades of red, orange, yellow, green, and blue, radiating from a bright white center on the right side.

CISCO *Live!*

Let's go

#CiscoLive