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ALL IN

The bridge to possible

Wi-Fi 6 and Private 5G for the Enterprise

Better Together Journey

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@MatthiasFalkner

BRKEWN-2030

Agenda

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

Cisco Webex App

Questions?

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

How

1. Find this session in the Cisco Live Mobile App
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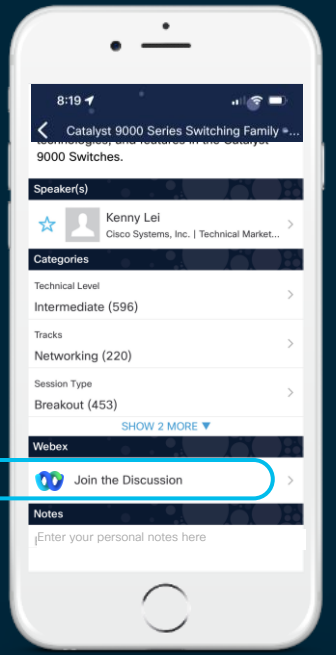
4. Enter messages/questions in the Webex space

Webex spaces will be moderated by the speaker until June 17, 2022.



https://ciscolive.ciscoevents.com/ciscolivebot/#BRKEWN-2030

Recent Evolutions in Wi-Fi 6 and 5G

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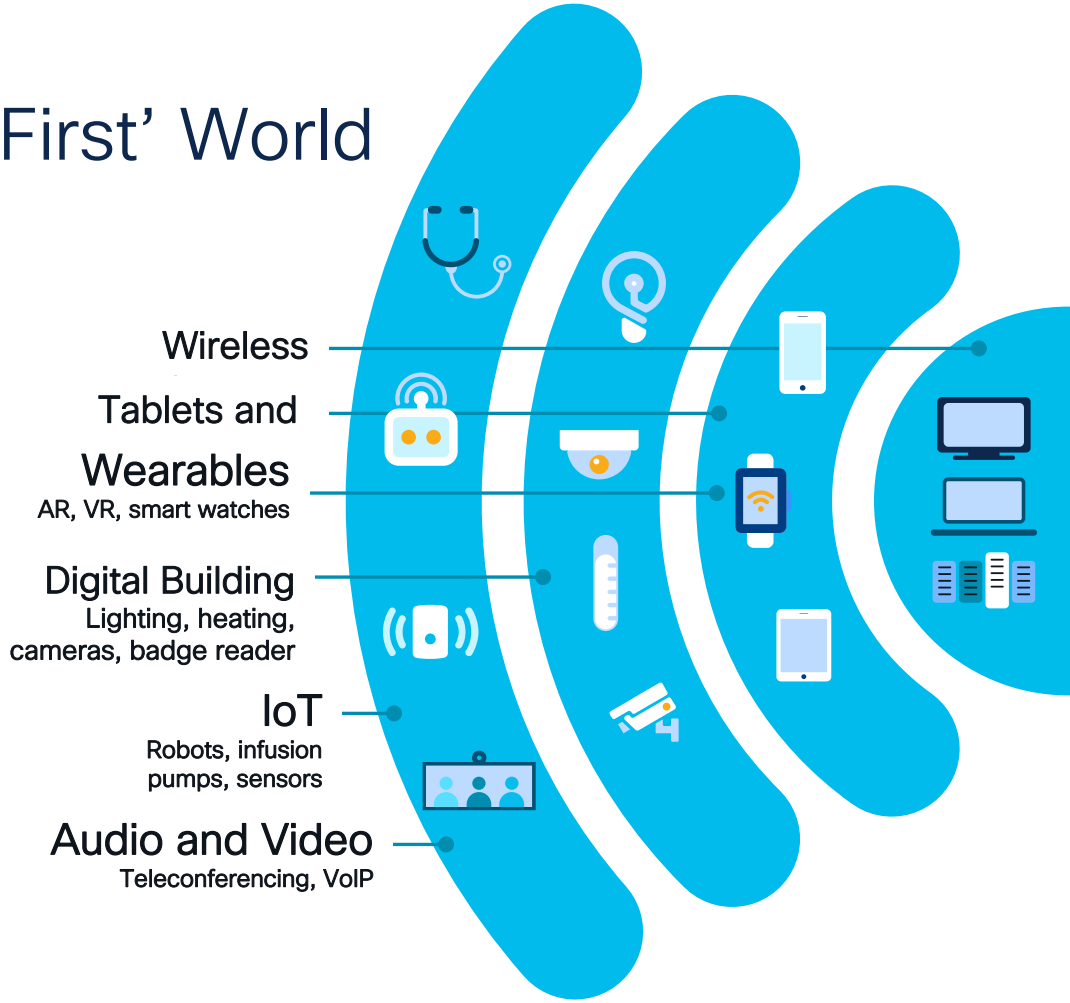
We are in a ‘Wireless-First’ World

Reliable
Always-on, low latency

Scalable
Wired for wireless

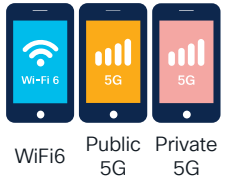
Secure
Software-defined fabric

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)

Zero-Trust Mega-trend
The Enterprise dilemma!

FYI

Enterprise apps migrating to Multi-Cloud environment

Data center

Multi-Cloud

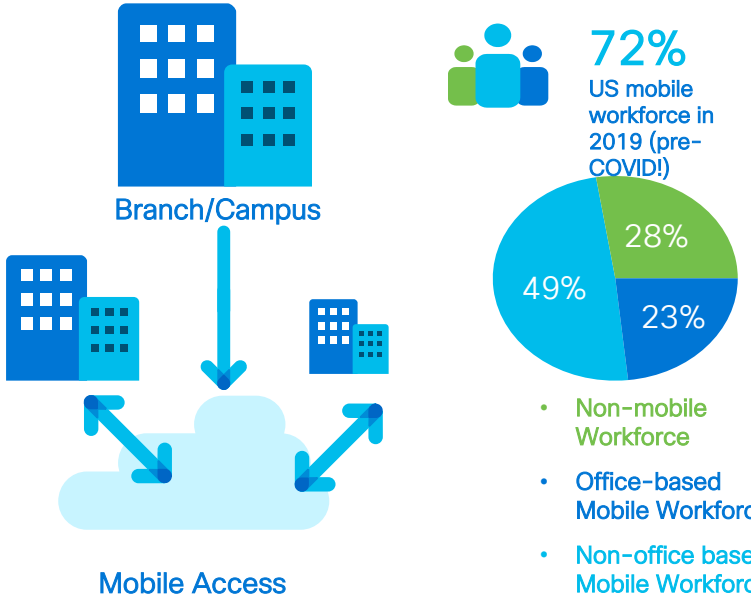
N=260 Enterprises worldwide

83% of survey respondents say that **cloud** is very or extremely important to their organizations' **future strategy and growth**.

69% say that 60% or more of their organizations' **infrastructure and applications will be in the cloud** in two years.

Source Harvard Business Review: The State of Cloud-Driven Transformation Sponsored by Splunk

Workforce going Mobile



Dilemma cured: work context profile within OpenRoaming Enterprise Policy Everywhere

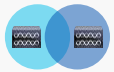
What changed in Wi-Fi 6/6e?

For your reference

6GHz Spectrum: 1.2 GHz of additional unlicensed spectrum to support high-bandwidth applications	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

What does 5G offer?

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

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

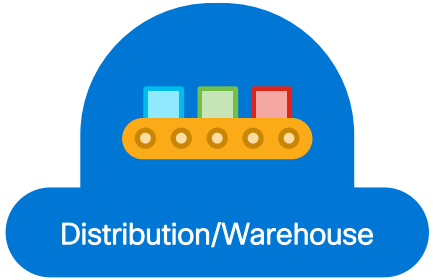
P5G – why now?

Enabling customers' digitization journey

Regulatory changes open cellular spectrum for private use

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

- Precision robotic control
- High speed SW downloads



- AGVs and driverless vehicles
- Distribution line automation

- Video surveillance
- Unmanned autonomous vehicles

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

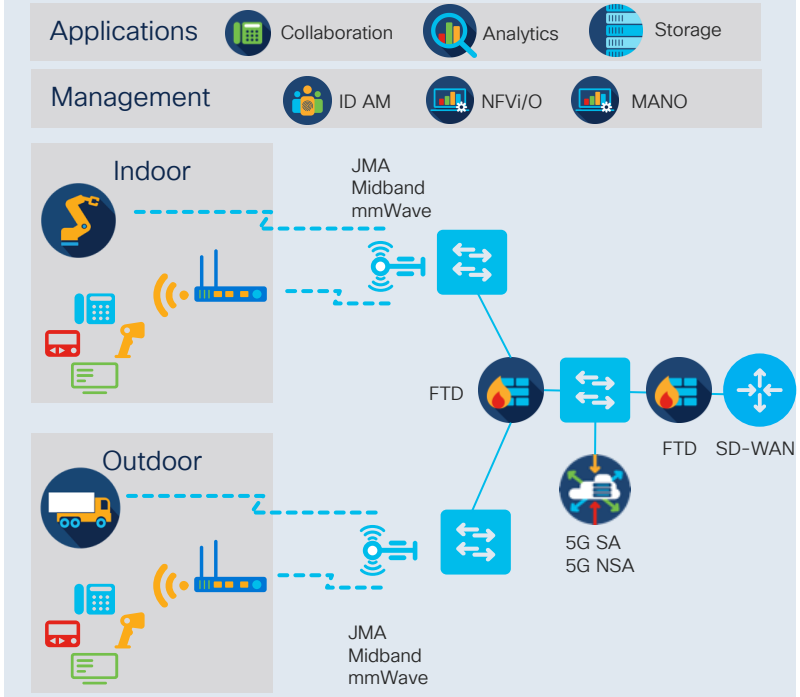
What are some use-case Examples?

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: Manufacturing

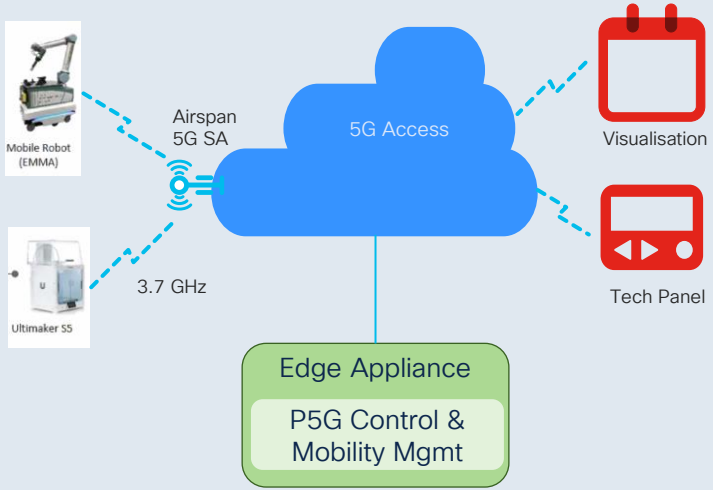
FYI

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

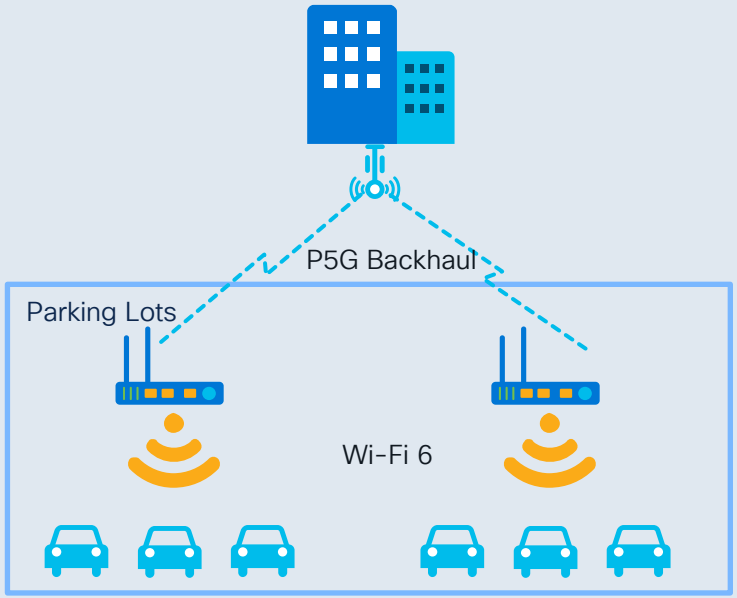


Private 5G use case: Automotive Manufacturing

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



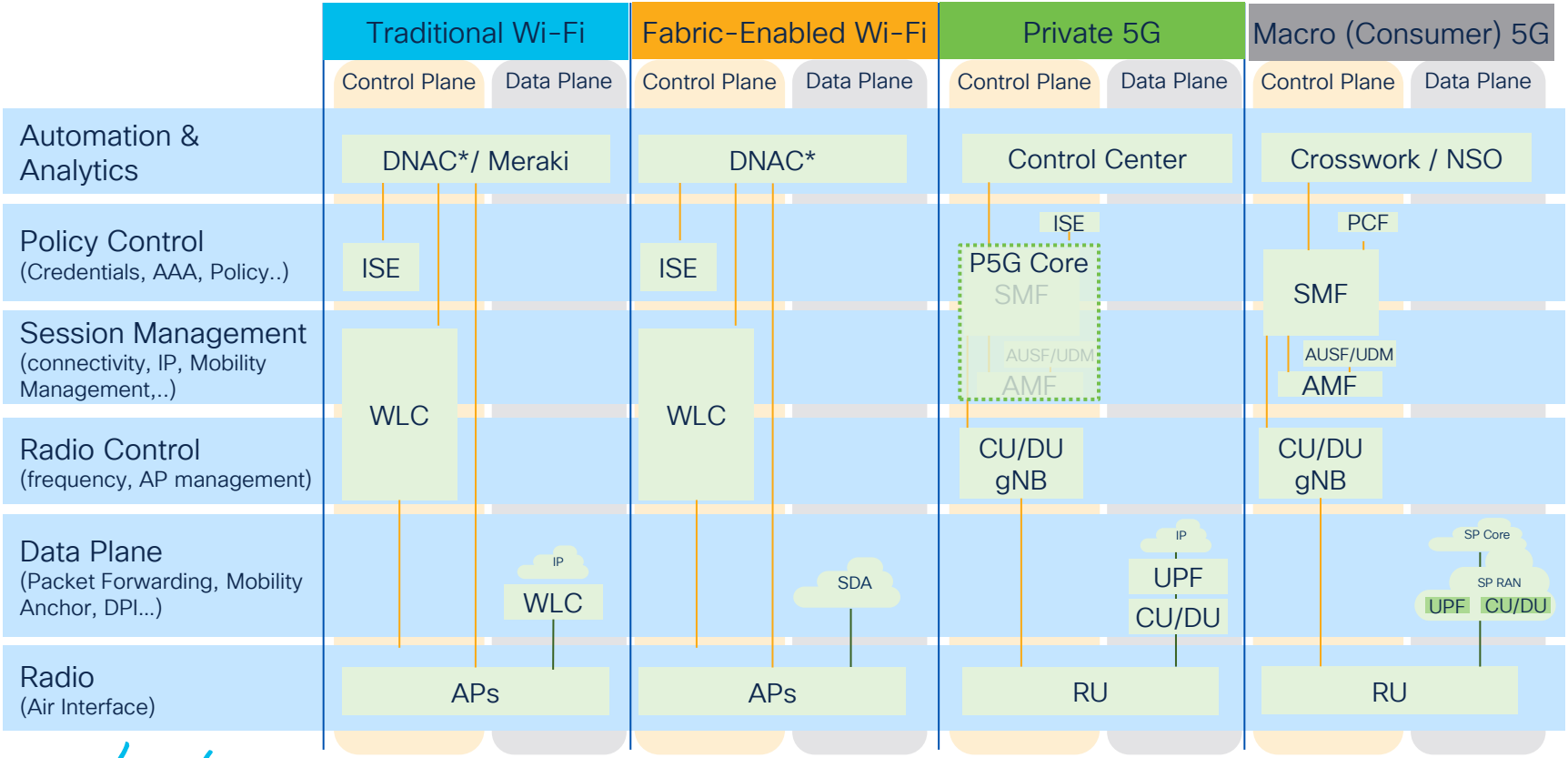
Is there a compelling technical difference?

The two next generation wireless Technologies

	Wi-Fi	P5G
Spectrum (economics)	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
Channel Width (bandwidth)	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
Radio (# Radios)	OFDMA, MU-MIMO, Beamforming	
	1024 QAM Antennas: 8T8R, 12T12R	256 QAM Indoor Antennas: 4T4R Outdoor Antennas: 64T64R
	Reach: 30-40m	Femto: 8-15m Pico: 200m Micro: 2000m
Infrastructure (operations)	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)
Identity / AAA	Typically enterprise ID and Authentication	ID: SUPI & SUCI mechanism (address 3/4G vulnerabilities) Auth: EAP-AKA or 5G-AKA
Security	Encryption: Galois/Counter Mode Protocol(GCMP-256) Key HMAC-SHA-384	Encryption: SNOW 3G, AES-CTR, and ZUC Key AHMAC-SHA-256
Endpoint Availability	Pervasive	Improving
Endpoint Mobility	Endpoint controlled/initiated	Network Initiated / Controlled
Target use-case	High Data Rates, Massive IoT, Low Latency	Macro Mobility, EMBB, mmTC, URLLC

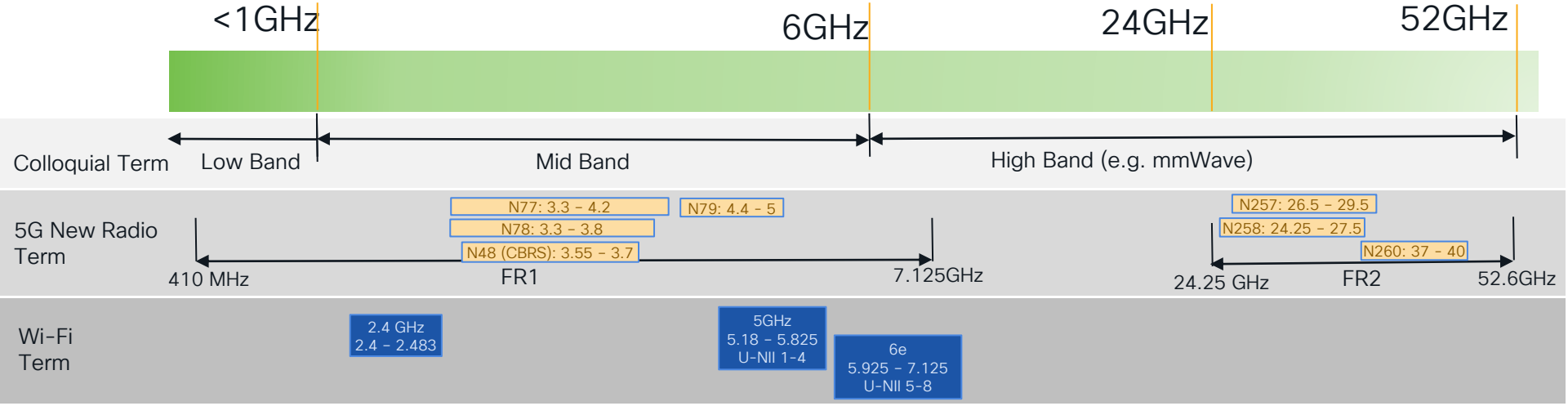
Typical Drivers to 5G

Wireless Architecture Functions at 30000 ft

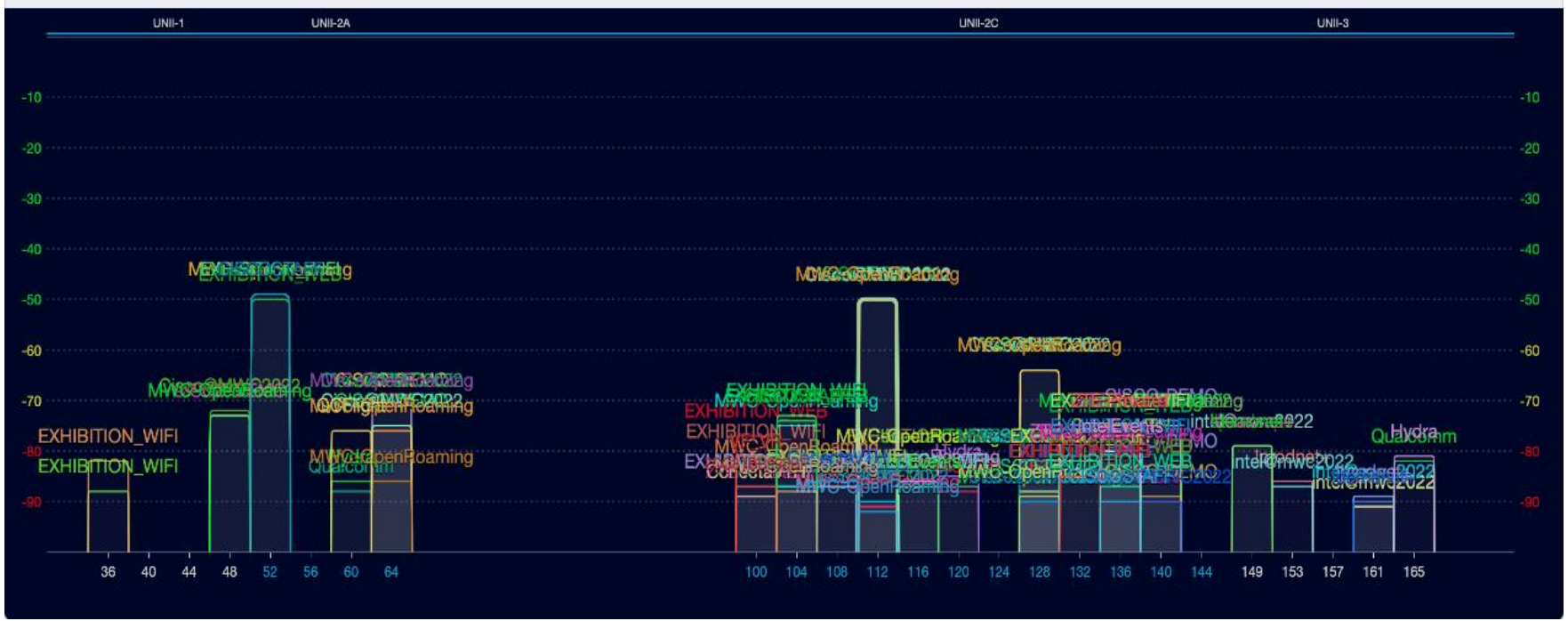


*Prime Evolution for. Wi-Fi

Spectrum Nomenclature & Properties



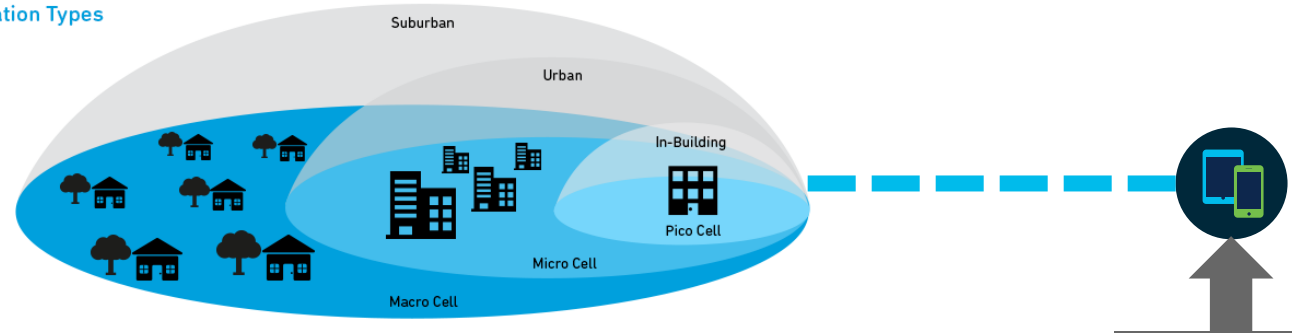
… And don’t forget about Interference in WiFi on 2.4 / 5GHz!



Power impacts Reach and Endpoint Handoffs

FYI

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 Limited by max client Tx power)	<70	30/256	Indoor
Wi-Fi 5 GHz	0.2 to 4*		<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

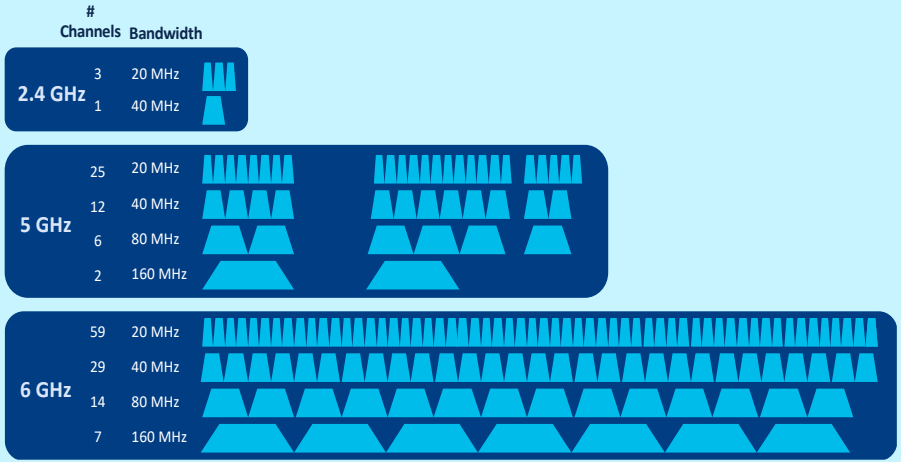
Variable Tx power.
e.g. 4G:
- Typical 0.1W or less but can go higher typically to 0.2W
- Cat 0 (M2M) max 0.2W

E.g. Wi-Fi6:
- Support for Dynamic Transmit Power Control (DTPC)
- Average 0.01W or less

How does this spectrum help me get more bandwidth – Part 1

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

- Wi-Fi
  - Configure channel widths for APs

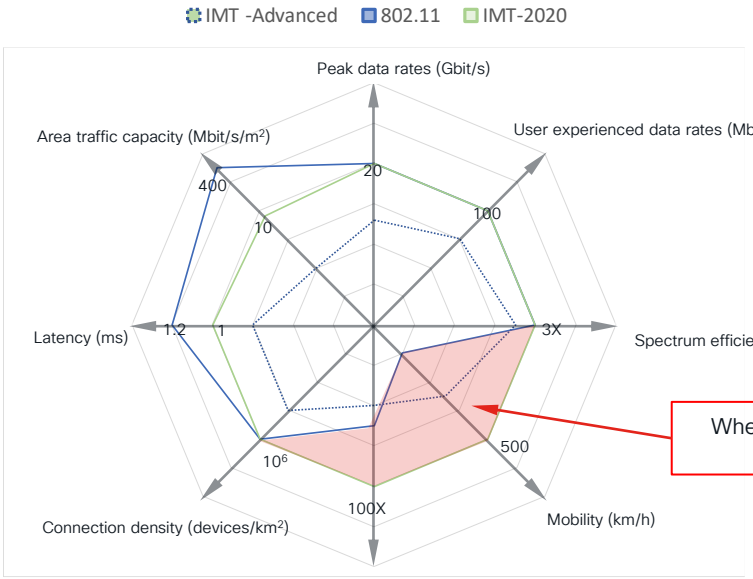


- 5G:
  - Allow for flexible bandwidth allocations over time
  - Varies by frequency band (e.g. n78) and Numerology (= sub-carrier spacing aka. 'μ')
  - Ranges from 10 MHz – 100 MHz
  - A Base station can support *multiple* channel widths per endpoint (c.f. UE bandwidth parts)
  - Also support for Carrier 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		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.nrexplained.com/bandwidth

Dominate stack use-case expansion
more overlap means better convergence!



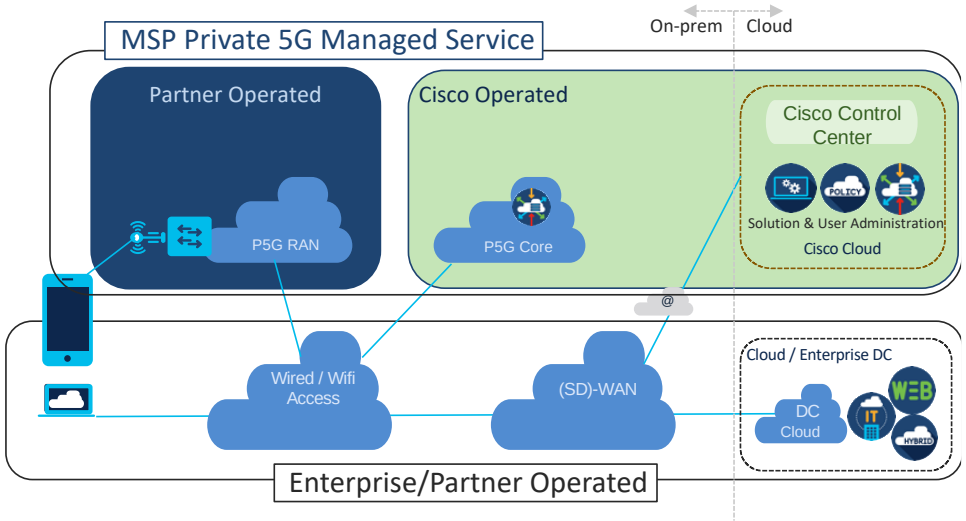
Where the technologies are complementary

Diagram adapted from: 5G Networks The Role of Wi-Wi and Unlicensed Technologies

Complementary technology - optimized access everywhere

Cisco's Private 5G Solution

Cisco Private 5G architecture

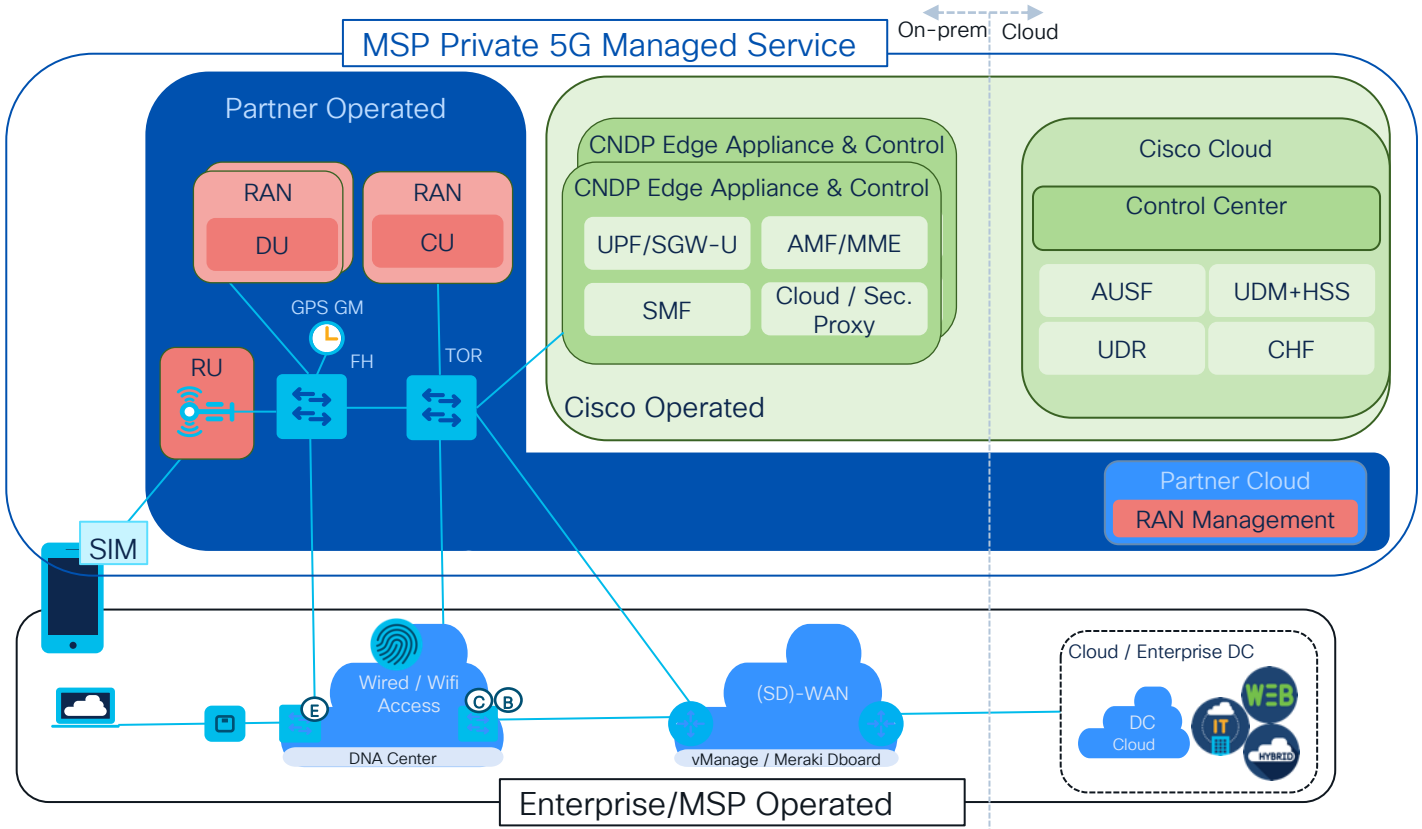


FYI

- ✓ Converged core architecture
- ✓ Full LCM and NW management
- ✓ Tight Enterprise integration
- ✓ Cisco security portfolio
- ✓ UX/API
- ✓ Automation focused
- ✓ AI/ML Tools

- Cisco Private 5G is architected to be a **partner-led** solution
- Partner to be **prime** bringing together the full stack solution along with Cisco and pre-certified radio vendors
- Deliver for Enterprise consumption with **ease of ordering, deploying and running**

The Cisco P5G Architecture in Detail



Cisco Private 5G Launch Content

Optimized Edge

- High available Edge (active/standby)
- 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 & Monitoring

- Automated installation and configuration from cloud after initial edge installation
- E2E Monitoring of the service
- Continuous enhancements

UX & API

- Web-based onboarding and service management dashboard.
- Multi-tenant views
- E2E network status in simplified traffic light view [R, Y, G]
- APIs for external consumption

Operations & Support

- 24x7x365 support
- Seamless software and firmware upgrade for edge appliance
- SIM Cards supply, provisioning and configuration
- Partner knowledgebase docs

Enterprise Integration

- Unified identity & policy through ISE integration in p5G (Secondary authorization)
- Umbrella DNS Security integration
- Leverage existing Catalyst portfolio

Wi-Fi6 and Private 5G – Better Together!

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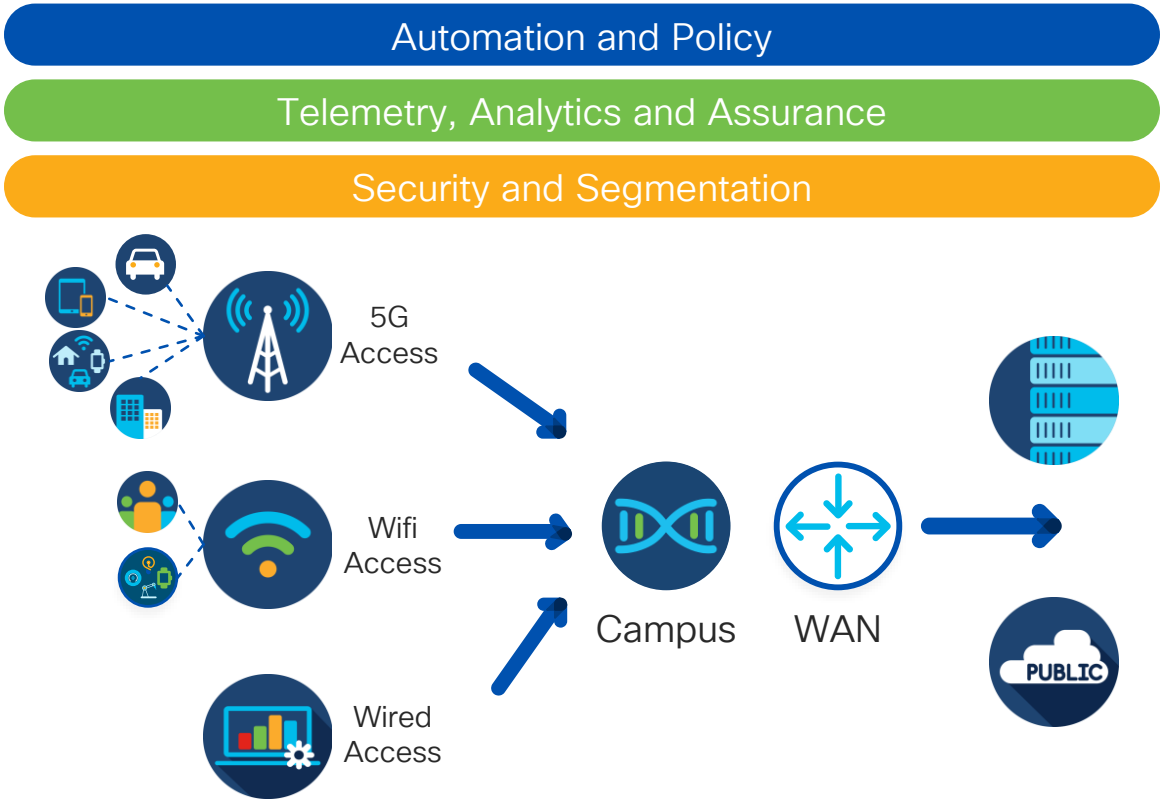
Cisco Vision for Private 5G in the Enterprise

Private 5G as an extension of the Enterprise Network

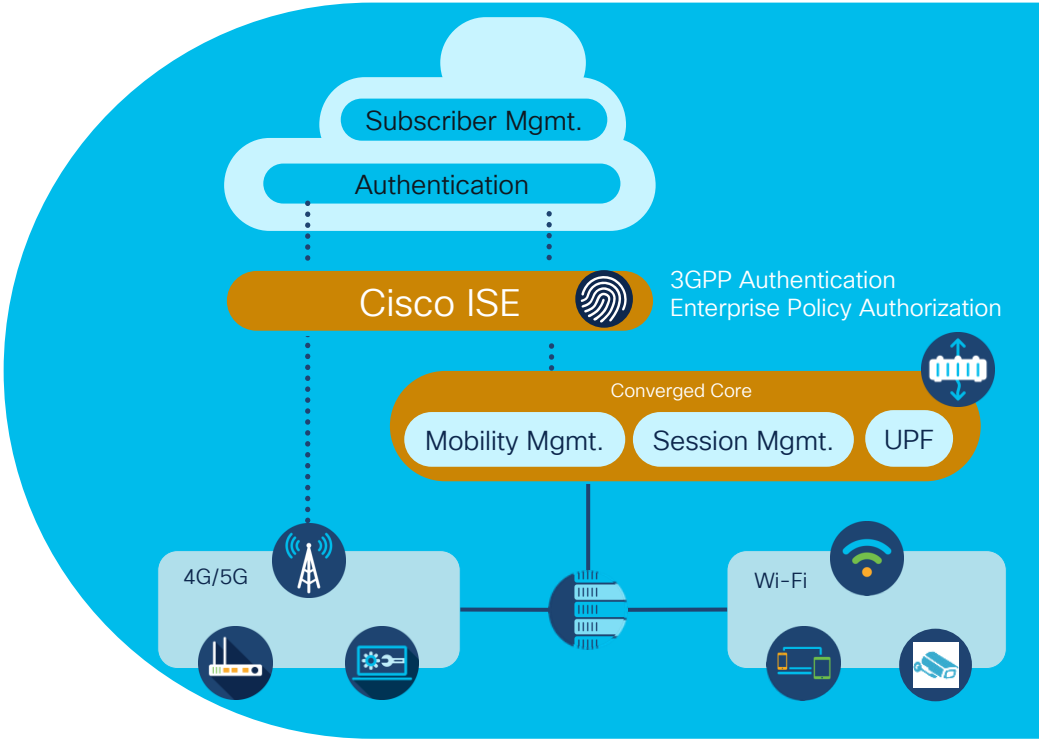
Cisco Private 5G

- Unified Identity Framework
- Common Enterprise Policy
- Unified Enterprise Operations
- Consolidated Insights & Analytics
- WiFi <-> 5G Mobility
- Leverages Existing Campus Transport
- Secured Private 5G
- Cisco UE/IoT GW Integration



Unified Enterprise Access Policies

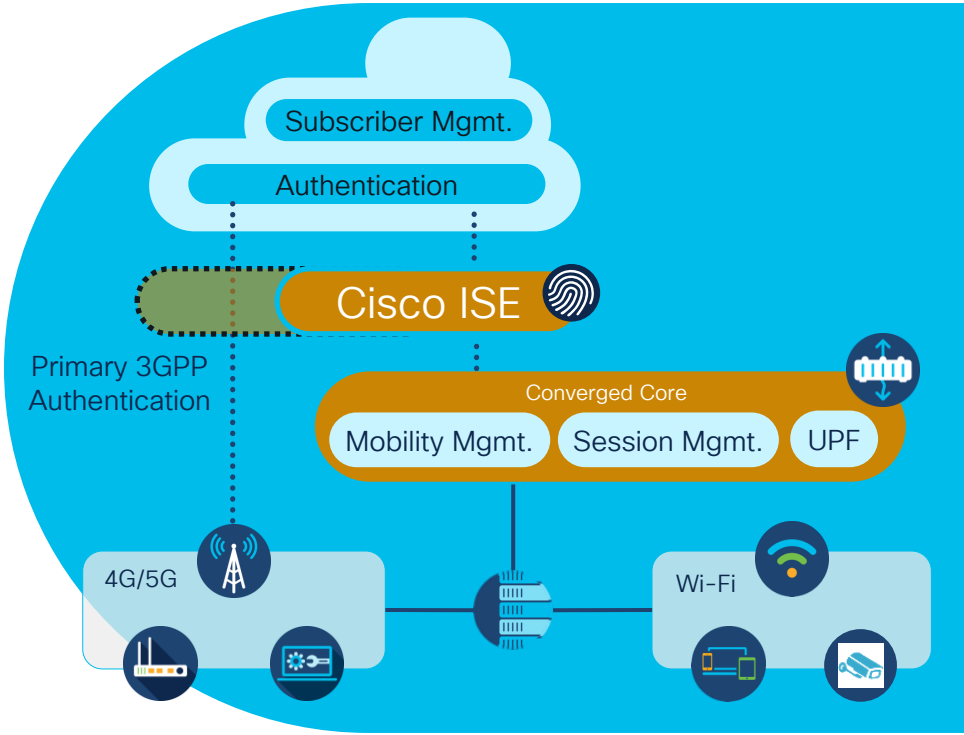
- Access Policies to the Enterprise Network MUST be consistent for 5G, WiFi and wired endpoints to enable consistent security and simplify operations
- Based on enterprise-wide unified Identity Framework
- Vision: Cisco ISE as a Single point for identity-based Enterprise Access Policies
  - Authentication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



Unified Identity Framework (cont'd)

(Fist 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



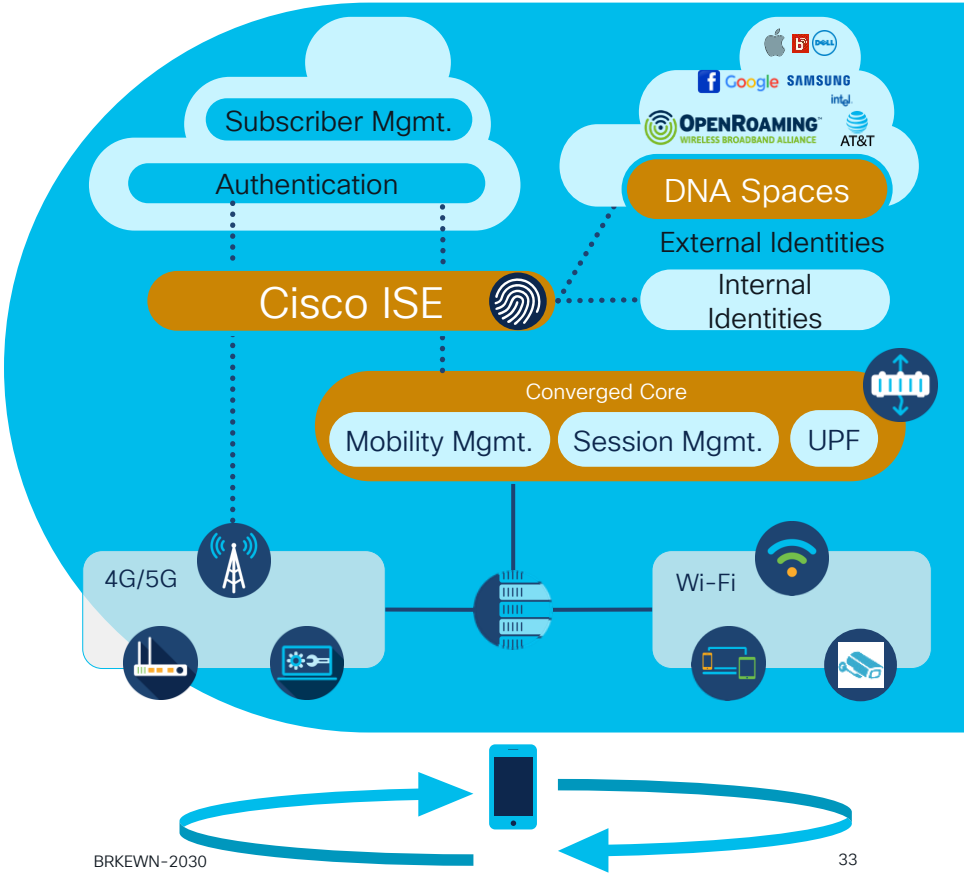
Foundation for common enterprise policies:
Access / Macro & Micro Segmentation / App Experience

Common Enterprise Policy – Private Mobility
(Partially Available in Phase 1)

FYI

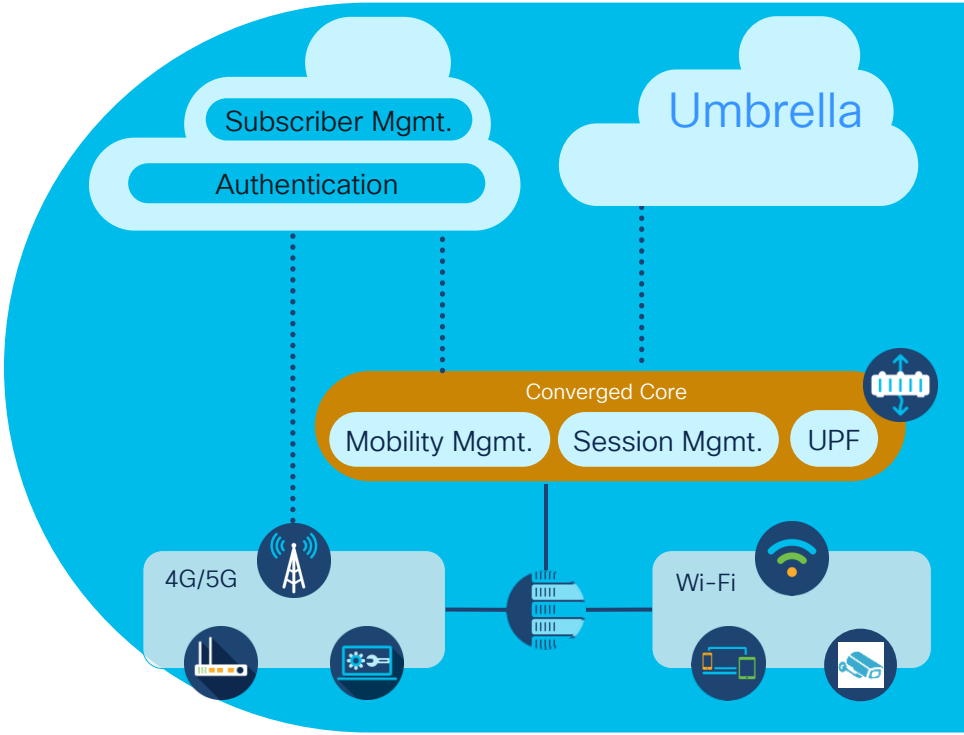
- Wi-Fi & 5G Mobility happens today, controlled to a great extent by the device and the application
- Cisco's vision enables devices to select any bearer based on Policy
  - Consistent and centralized user / device policy based on ISE
  - Apps seamless reconnect @ bearer change if necessary
  - Devices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



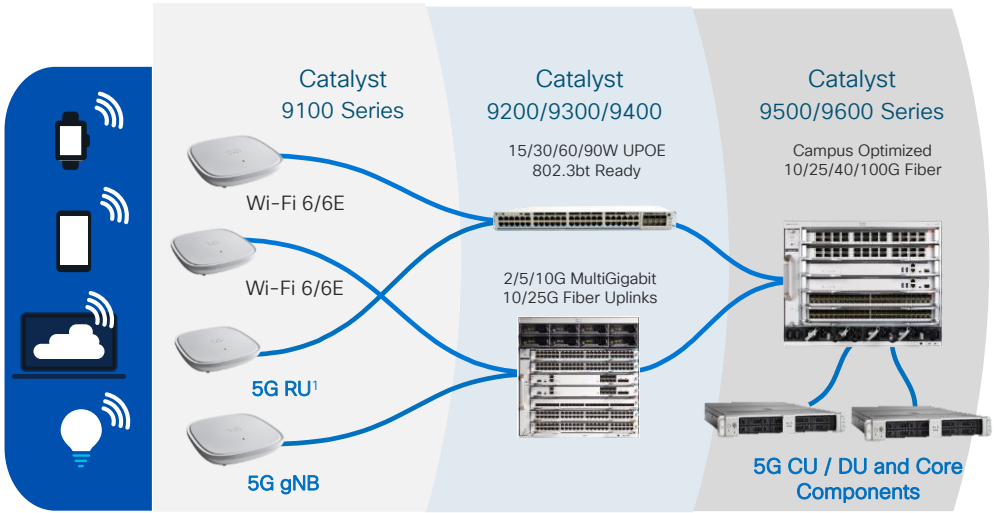
Common Enterprise Policy – Umbrella Security

- 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



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.



Get Engaged!

Technical Session Surveys

- Attendees who fill out a minimum of four session surveys and the overall event survey will get Cisco Live branded socks!
- 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.

Cisco Private 5G Learning Map

Start

June 12 | 2:00 pm

TECSPG-2432

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

June 13 | 11:00 am

BRKSPG-1003

Evolution of Private 5G Networks Standards

June 13 | 4:00 pm

BRKSPM-2842

Industry enablers making Private 5G a viable private networking option

June 14 | 4:00 pm

BRKXAR-2004

Unified Identity & Policy Across Private 5G and Wi-Fi

June 16 | 8:00 am

BRKEWN-2030

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

Finish

June 16 | 8:45 am

BRKSPM-3169

Customer Challenges and Practical Design Consideration for 5G Transformation

Cisco Private 5G Learning Map

Start

June 14 | 2:00 pm
PSOGEN-1029
Private 5G as-a-Service is Here: Get Ready

June 15 | 11:00 am
PSOIND-1004
Private 5G and it's role in Healthcare Infrastructure

June 14 | 4:00 pm
PSOIND-1003
Private 5G in Education: Innovation and Opportunity

June 16 | 4:00 pm
PSOSPG-1002
Leading Your Digital Transformation with Cisco Private 5G Network Offer

June 14 | 10:30 am
IBOSPG-2004
5G Customer Success Story: US Marine Corps Smart Warehouse

June 13 | 4:00 am
IBOSPG-2010
Getting Started with Enterprise Private 5G: An Interactive Design Workshop

June 16 | 121:00 am
IBOSPG-2010
Getting Started with Enterprise Private 5G: An Interactive Design Workshop

Finish

June 15 | 4:00 pm
IBOSPG-2004
5G Customer Success Story: US Marine Corps Smart Warehouse

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Network simulation platform for design, testing, and troubleshooting

Cisco Learning Network
Resource community portal for certifications and learning

Train

Cisco Training Bootcamps
Intensive team & individual automation and technology training programs

Cisco Learning Partner Program
Authorized training partners supporting Cisco technology and career certifications

Cisco Instructor-led and Virtual Instructor-led training
Accelerated curriculum of product, technology, and certification courses

Certify

Cisco Certifications and Specialist Certifications
Award-winning certification program empowers students and IT Professionals to advance their technical careers

Cisco Guided Study Groups
180-day certification prep program with learning and support

Cisco Continuing Education Program
Recertification training options for Cisco certified individuals

Here at the event? Visit us at **The Learning and Certifications lounge at the World of Solutions**

Continue your education

- 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

Thank you


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