The bridge to possible

Private 5G for Enterprise

Where we are and where do we go from here

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BRKSPM-2035

Hi Everyone,

My name is Azita Kia

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I am a solution manager in Cisco Mobility CTO office, have been working on 5G and Private Cellular for the past several years focusing on Use Cases and Verticals.

I hope you find this session useful.

Please feel free to reach out to me directly to continue discussions.

What to Expect from this session

- Get a better understanding of:
  - What is trending in P5G
  - P5G Verticals and Use Cases being deployed
  - Challenges of deployment of P5G for Enterprise
  - How is Cisco addressing P5G requirements
- Pointers to dig deeper into the P5G topic

Agenda

- Private 5G Architecture, options and status
- Critical components for P5G deployment
- Inserting P5G into Existing Enterprise Networks

Private 5G Architecture

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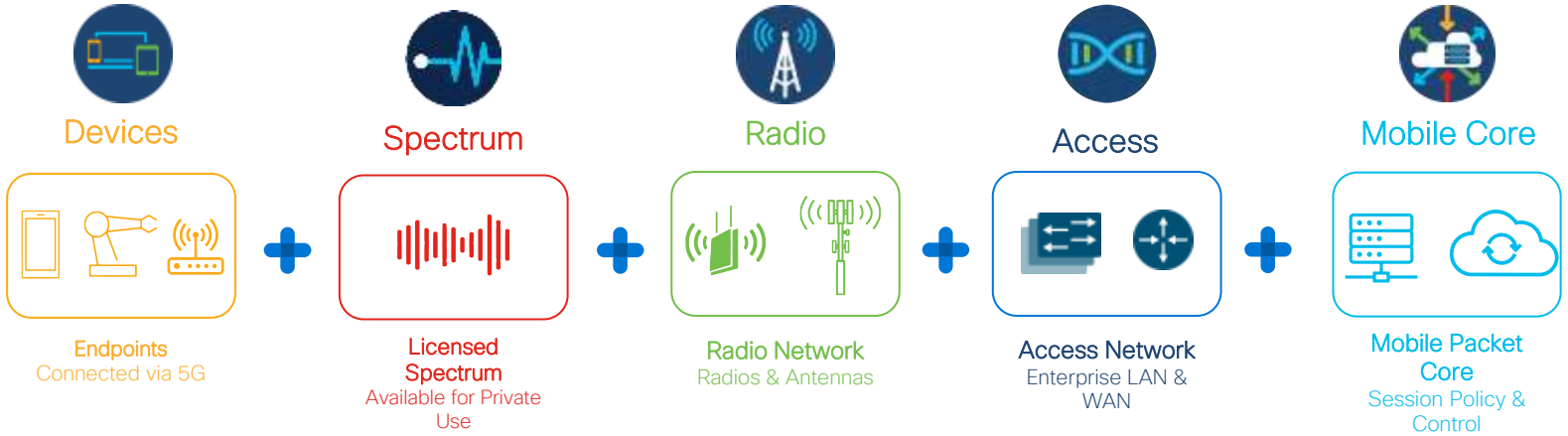
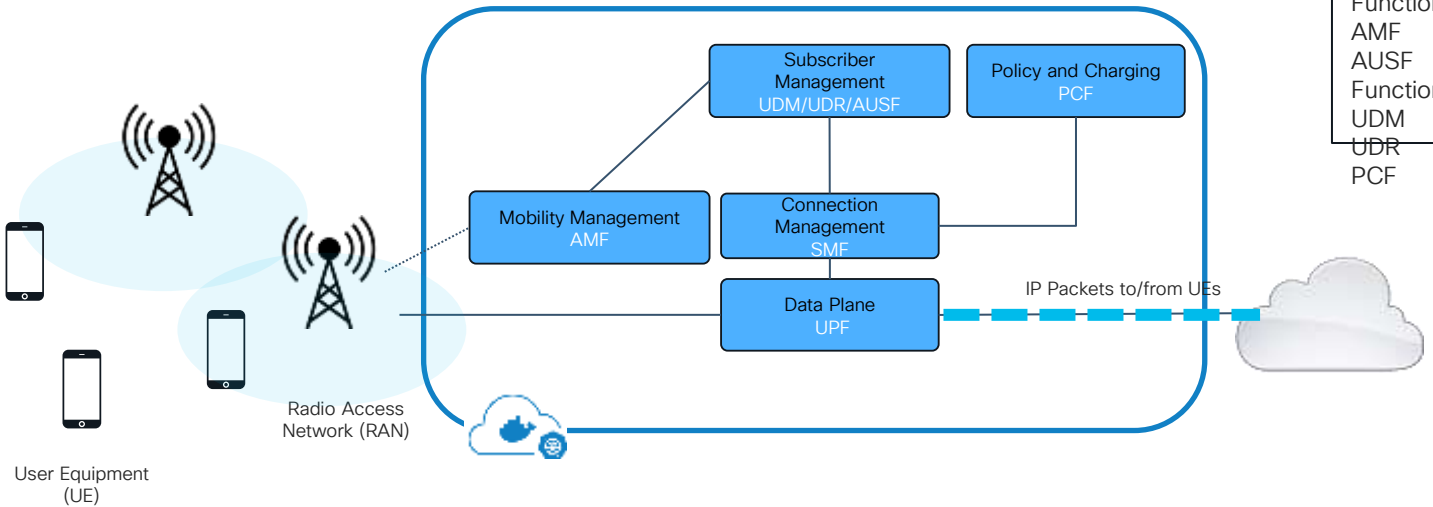
What is Private 5G?

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



Mobile Packet Core – What does it do?

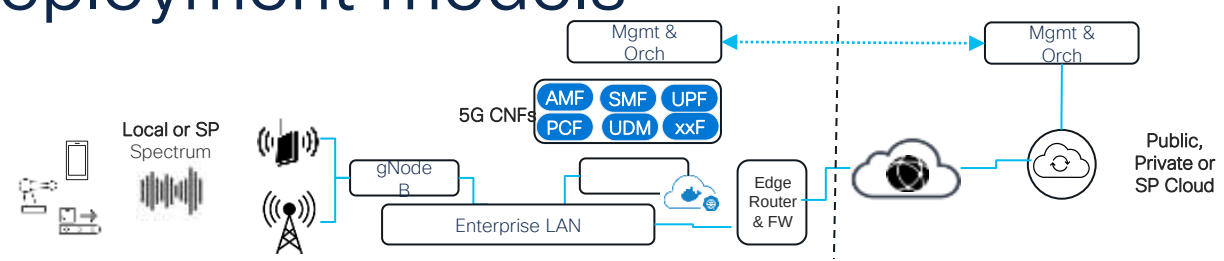


UPF	User Plane Function
SMF	Session Management Function
AMF	Access & Mobility Function
AUSF	Authentication Server Function
UDM	User Data Management
UDR	User Data Repository
PCF	Policy Control Function

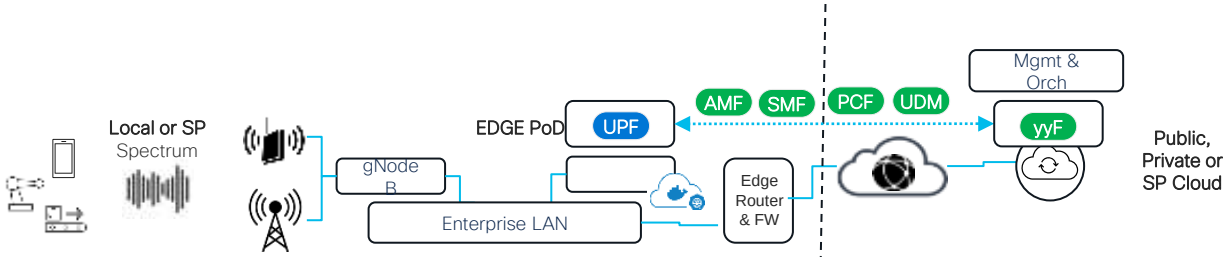
BRKSPG-2038 – Cisco Ultra Cloud Core – Taking 2G, 3G, 4G and 5G towards a common cloud-based mobile core future.

Private 5G Deployment models

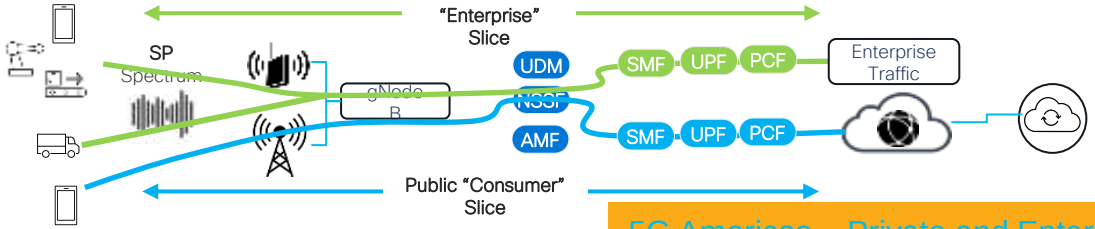
Full Private Deployment



Hybrid Cloud Private Deployment



Macros Slice Deployment



5G Americas – Private and Enterprise Networks

Usage Scenarios proposed by 3GPP

enhanced Mobile Broadband (**eMBB**)

Extreme high data rates, low latency and high coverage

massive Machine Type Communications (**mMTC**)

Large number of connections, low volume of data, long battery life

Ultra-reliable and low latency communications (**URLLC**)

High availability, very-low / predictable latency

Use cases can be addressed today – R15
- Device Availability bottleneck

Use cases requiring low latency, high degree of mobility and high availability will only be addressed in 3GPP releases 16 & 17
- Not supported by any solution today

Use cases requiring evolving NB-IoT and enhanced Machine Type Communication will only be addressed in 3GPP release 17
- Not supported by any solution today

BRKSPG-1003 – Evolution of Private 5G Network Standards

Private 5G Use Cases

Industrial/Manufacturing

- Robotics Process Automation and Emergency Control
- AGVs and driverless vehicles
- High speed SW downloads
- Surveillance and measurement

Government/Venues

- Building sensors
- Internal critical communication

Distribution/Warehouse

- Autonomous forklifts, AGVs, AMRs for inventory logistics
- Distribution line/workflow automation
- Push to talk
- Location tracking

Ports/Hubs/Oil & Gas

- Seamless coverage area
- Remote workers – for maintenance, repairs, data collection
- Video surveillance – remote safety

5G Americas - 5G verticals use cases

Considerations for Deployment

Applications

Latency, Reliability, Scalability, Ease of operations, throughput…

Devices

Local and global Eco-system

Handhelds, AGV/AMR, Dozer, Cranes, Rail

Deployment

Regional regulations: spectrum ?
Specify Environment: Indoor / Outdoor
Access / backhaul
Cyber-security

Technology

Wired: Ethernet, serial,DSL
Wireless: Wi-Fi & Ultra-Reliable Wireless Backhaul, Cellular, Wi-SUN, LoRaWAN,…
Spectrum: Unlicensed, Licensed: Private, Public, Shared

TCO

Product costs?
Operational costs?
Complexity?
Training?
Backward compatibility?

- Consider the use case including application, device, venue, and performance expectations
- Consider source and availability of spectrum
- Consider operational framework and requirements, management, security

Critical components for P5G Deployment

- Spectrum
- Device
- Radio

Characteristics of Mobile Spectrum

Low Bands
Below 1GHz
e.g. 600MHz, 700Mhz,
850 & 900MHz

Good Coverage
Longer distances

Good Propagation
Building penetration

Limited Bandwidth
Limited Capacity

Mid Bands
1 – 6GHz
e.g. 1.8GHz, 1.9GHz, 2.1GHz,
2.6GHz, 3.5GHz and more

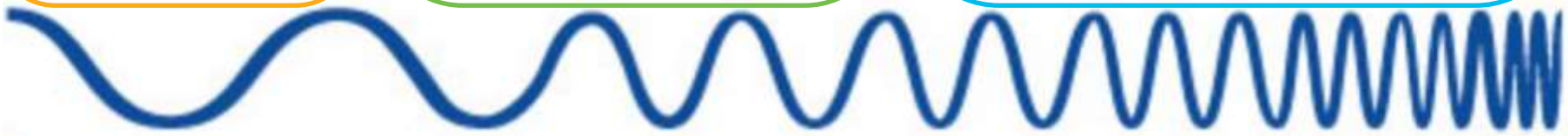
Best available mix of
Coverage, Penetration, Capacity

High Bands
(millimeter Wave, mmWave)
24GHz and higher
e.g. 24GHz, 26GHz, 28GHz, 37GHz, 39GHz,
47GHz and more

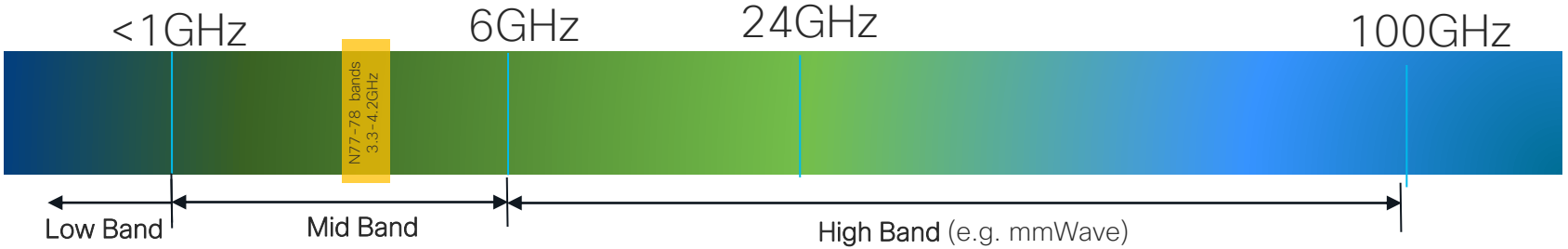
Limited coverage

Almost zero in building penetration

Extremely High Capacity



Spectrum Ramifications



LTE | LTE

5G NR (100Mbs) | 5G NR (mMIMO) 1-2Gbs

24.25-52.6 GHz Frequency Range 2 (FR2)

10Gbs | 5G NR mmWave (muMIMO & BF)

Licensed or Managed Spectrum

<10Gbs

2.4 GHz | 5 GHZ | 6Ghz

Unlicensed Bands (Spectrum)

LOW | MEDIUM | HIGH

Data Rates (Throughput)

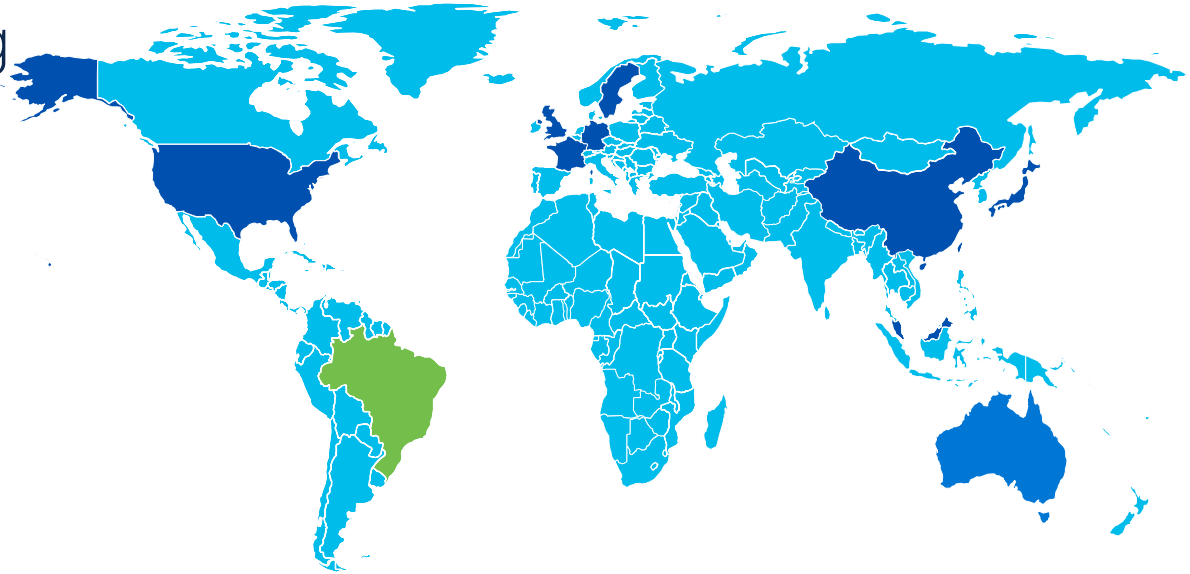
V HIGH | MEDIUM | VERY LOW

Coverage Area & Penetration

Will NOT penetrate building walls, glass or even human body

Full list of 5GNR bands here

Spectrum Sourcing



Models	Direct to ENT	Through SP
Public Spectrum Only	✗	✓
Private Spectrum Available	✓	✓

Private/Locally-licensed spectrum:

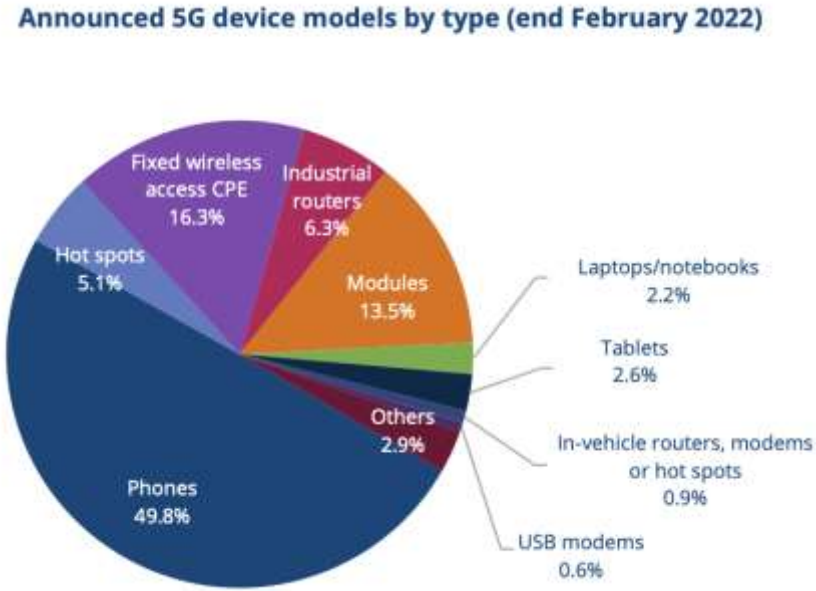
U.S.: 3.55-3.7 GHz CBRS (band 48)
U.K: 1.8, 2.3 GHz, 3.8-4.2 GHz
Germany: 3.7-3.8 GHz. 26GHz
Sweden: 3.7GHz
France: 2.6 GHz (via SP)

Australia: 1.8, 2.1GHz, 26/28GHz
Hong Kong: 28 GHz
Japan: 4.8, 28.2 GHz
Taiwan: 4.8 GHz
China: 4.4-4.5GHz, 5.9-7.1 GHz
Malaysia: 26.5-28.1 GHz

Brazil: 3.7-3.8 GHz
India: In process
Mexico: TBD
Argentina: TBD
Chile: TBD
Canada: TBD

5G Devices

- Use cases being covered primarily with commercial 5G services: Phone, FWA, Backhaul
- Spectrum bands most supported in 5G networks are C-band, 700 MHz, 26/28 GHz, 2.1 GHz, 2.5 GHz
- The bands most supported in announced 5G devices are C-band, 2.5 GHz, 2.1 GHz, 1800 MHz and 700 MHz (n28)
- Complex industrial use cases are in PoC: E.g. Robots, AGVs
- mmWave supported devices are not widely available yet
- No URLLC features available yet



https://gsacom.com/paper/5g-market-snapshot-march-2022/

What about 5G devices?

Hotspots and CPEs	Askey	HTC	Netgear	WNC
	Inseego	Netcomm	Nokia	ZTE
5G modules	Compal	Longsung	Sierra	SIMcom
	Fibocom	Quectel	Wireless	Telit

Mobile form factor:

QC: Snapdragon 865 / X55 chipset
Samsung: Exynos 990
MediaTek: Dimensity 1000
MediaTek: Helio M70

CPE & other:

Snapdragon 865 chipset & variants

Cisco's Wireless WAN Portfolio Evolution to 5G

Platforms Supporting LTE Modules

Catalyst 8300/8200

- Up to 5 Gbps
- CAT4/6/18/5G Module Support
- 5G/LTE Gateway Support
- WAN and voice module flexibility
- Cisco SD-WAN

ISR 4000

- Up to 3 Gbps
- CAT4/6 Module Support
- 5G/LTE Gateway Support
- WAN and voice module flexibility
- Cisco SD-WAN

Embedded LTE Platforms

ISR 1000

- Up to 350 Mbps
- Embedded & Module supported CAT4/6/18 LTE
- 5G/LTE Gateway Support
- Cisco SD-WAN
- 802.11ac Wi-Fi

ISR1100-4GLTE

- Up to 200 Mbps
- CAT4 LTE
- Cisco SD-WAN

ISR 900

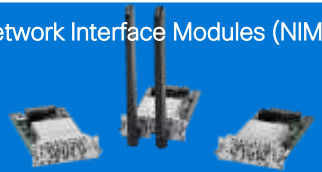
- Up to 250 Mbps
- Fixed & Fanless
- CAT4 LTE
- Classic IOS

Gateways and Modules

Catalyst Cellular Gateway

- 5G Sub-6 GHz & CAT18
- IP Passthrough, PoE, OOB Management
- Up to 3.3 Gbps Down/420 Mbps Up
- Compatible with all ISR1K/ISR4K/C8K

Network Interface Modules (NIM)



- CAT4/6 LTE Advanced NIM
- Up to 300 Mbps Down/50 Mbps Up
- Supported on ISR4K

Pluggable Interface Modules (PIM)

- 5G Sub-6 GHz/CAT18,CAT6/CAT4
- Down 150Mbps/300Mbps/1.2 Gbps Up 50/50/150 Mbps
- Supported on ISR1K/C8K

Cisco IOT Gateways
Path to Multi-Access Wireless

Use Cases

- Utilities
- Communities
- Oil & Gas
- Mining
- Transportation

Cisco IR1101
Rugged Series Router

Cisco Catalyst IR1800
Rugged Series Router

Cisco Catalyst IR8300
Rugged Series Router

Cisco Catalyst IR8100
Heavy Duty Series Router

5G NR EIO (Q2 FY22)
- *4G (similar to Cat18 PIM)*
- *5G NR Sub-6GHz and mmW*
- *IP67*

5G NR PIM
- *4G (similar to Cat18 PIM)*
- *5G NR Sub-6GHz*

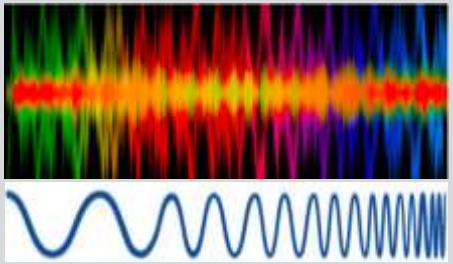
P-LTEAP18-GL (Cat 18)
- *(Multicarrier – Global)*
- *Private LTE, CBRS, Firstnet*

P-LTE-MNA (Cat 4)
- *(Multicarrier – Global)*
- *Firstnet*

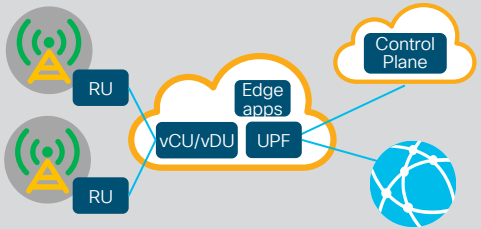
Wi-Fi6

5G New Radio – The Highlights

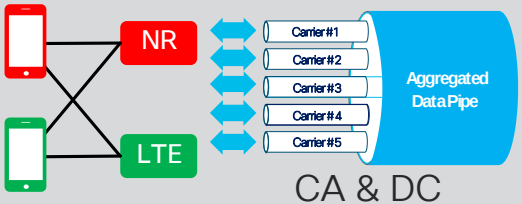
Expanded Spectrum: NR new bands



RAN Decomposition: Towards vRAN

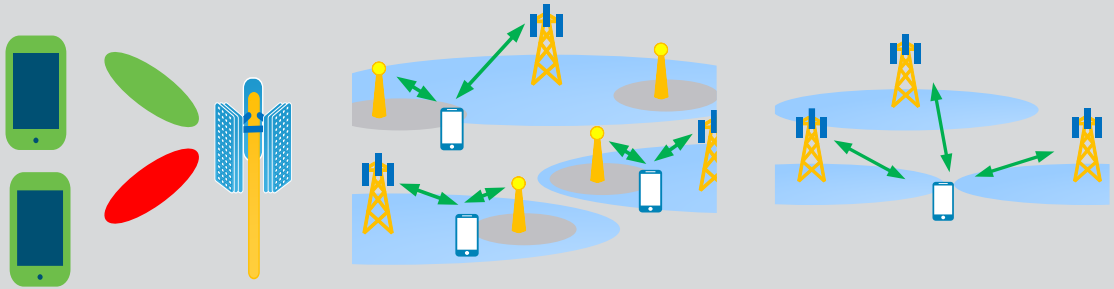


Multiband connectivity



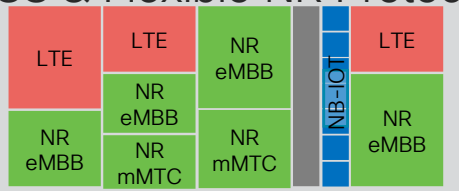
CA & DC options

Advanced Radio Techniques



Orthogonal Frequency-Division Multiple Access, Multi-User Multi Input Multi Output, Beam Formation

DSS & Flexible NR Protocol



Dynamic Spectrum Sharing (share spectrum 4G & 5G)
5G Bandwidth parts optimized for different service types / slices

Typical Radio Access Hierarchy 4G, 5G, Wi-Fi

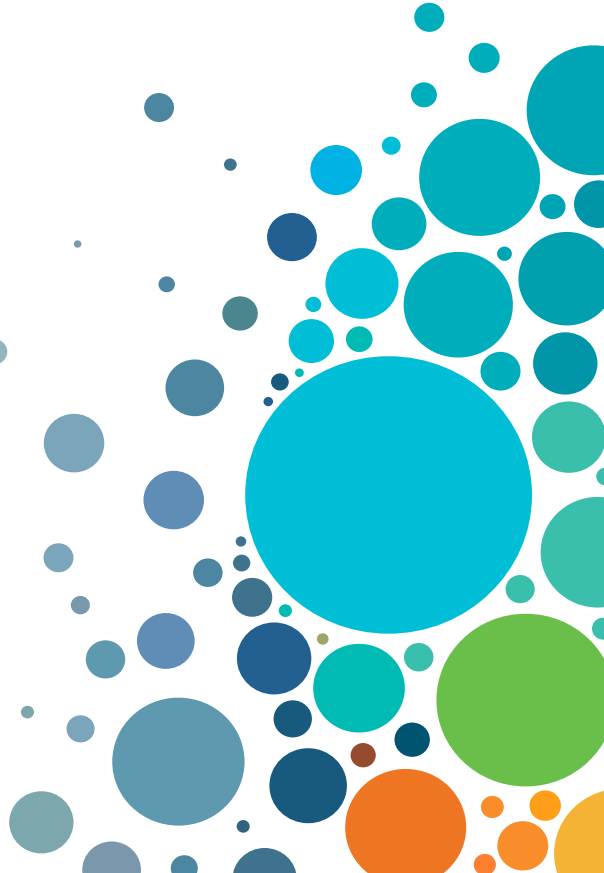
	Common Terms	Coverage (inter-site-dist)	Bandwidth (per operator)	Throughput (~user rate)	Optimal Service
mmWave unlicensed 60 GHz	WiFi, WiGig. 802.11ad/ay	50 m	7GHz shared (2GHz channel)	5,000 Mbps	Point to point. Indoor.
mmWave 24-50 GHz	Millimeter Wave	200 m	800MHz	2,300 Mbps	Hot-spot data, Point to multi-point
Unlicensed 5 GHz	Wi-Fi 802.11n/ac/ax. LTE-U, LAA	100 m	500MHz shared (80MHz channel)	300 Mbps	Hot-spot data, dense indoor
Upper mid bands 3-4 GHz	C-Band, sub 6Ghz, TDD, CBRS (US)	500 m	100MHz	290 Mbps	Supplementary data capacity Smallcells
Lower mid bands 1-3 GHz	1800/2300/2600MHz, FDD or TDD	1,000 m	80MHz (3x20MHz DL)	120 Mbps	Urban Voice, data capacity.
Low bands sub 1GHz	700-900MHz FDD. UHF, Digital Dividend	10,000 m	40MHz (20MHz channel)	40 Mbps	Voice, Data coverage. IoT.

* Depends on environment, site design, RF features (e.g. MIMO schemes)

* Depends on country specific regulatory allocation and number of operators

* Depends on # users, load, interference, etc. Not peak rate.

Inserting P5G into Existing Enterprise Networks



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Cisco Vision for Private 5G in the Enterprise

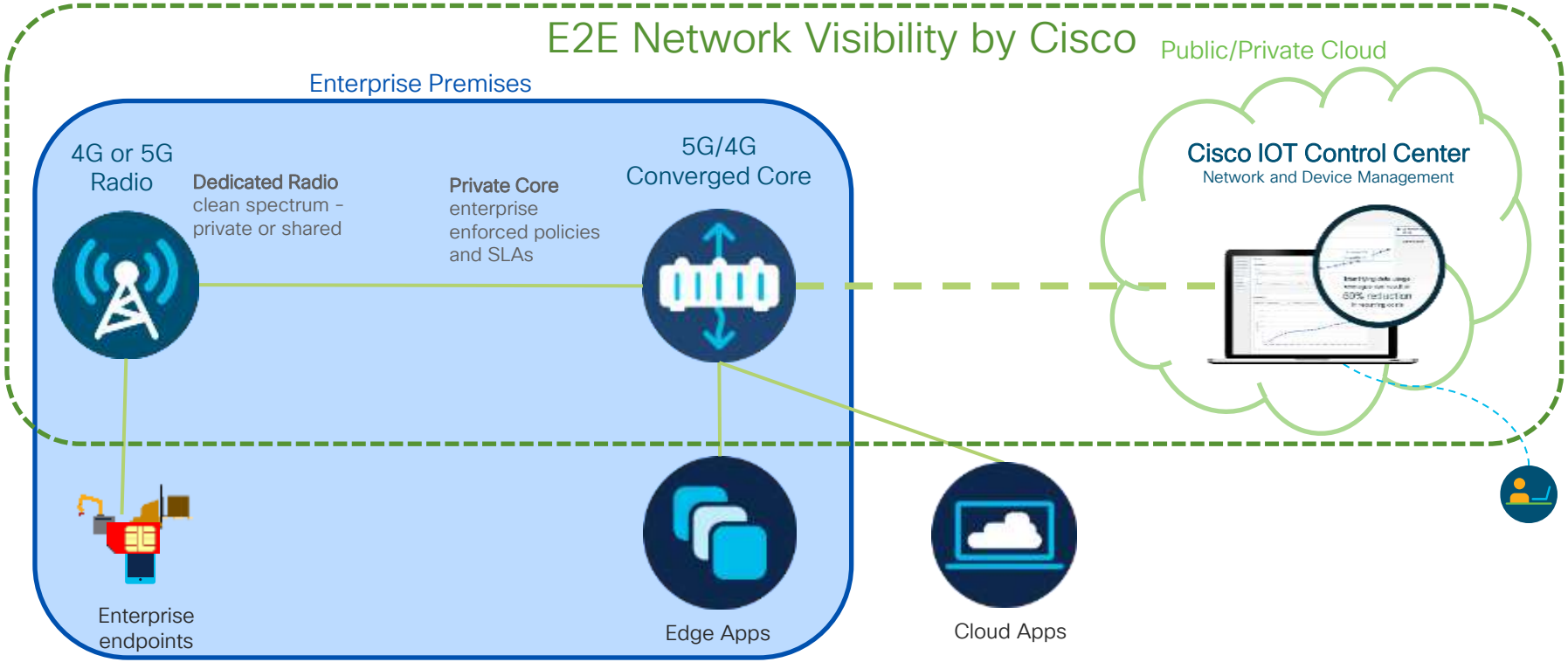
Enhancing the Enterprise Network

SIMPLE to subscribe and consume

INTUITIVE to integrate and operate

TRUSTED to securely run

Cisco Private 5G Architecture



Cisco IOT Control Center

Cisco's industry-leading SaaS platform for integrated automated connectivity

50+ service providers
30,000+ enterprise customers

185+M
connected devices

across a variety
of use cases

20%
device growth since last year

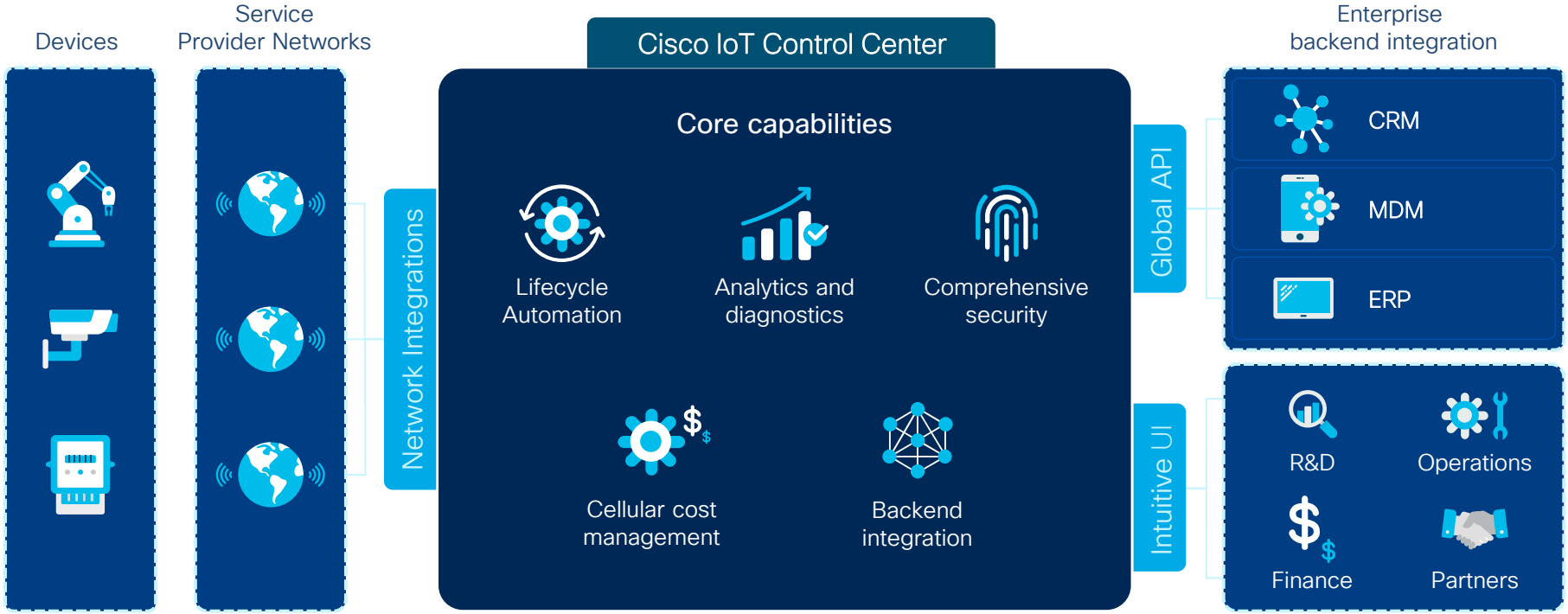
2M+
new devices per month

- Asset tracking
- Supply chain optimization
- Predictive maintenance
- Connecting remote operations
- Substation automation
- Advanced metering infrastructure
- Service fleet management
- Distribution automation
- Traffic operations
- Real-time road conditions

Cisco IoT Control Center

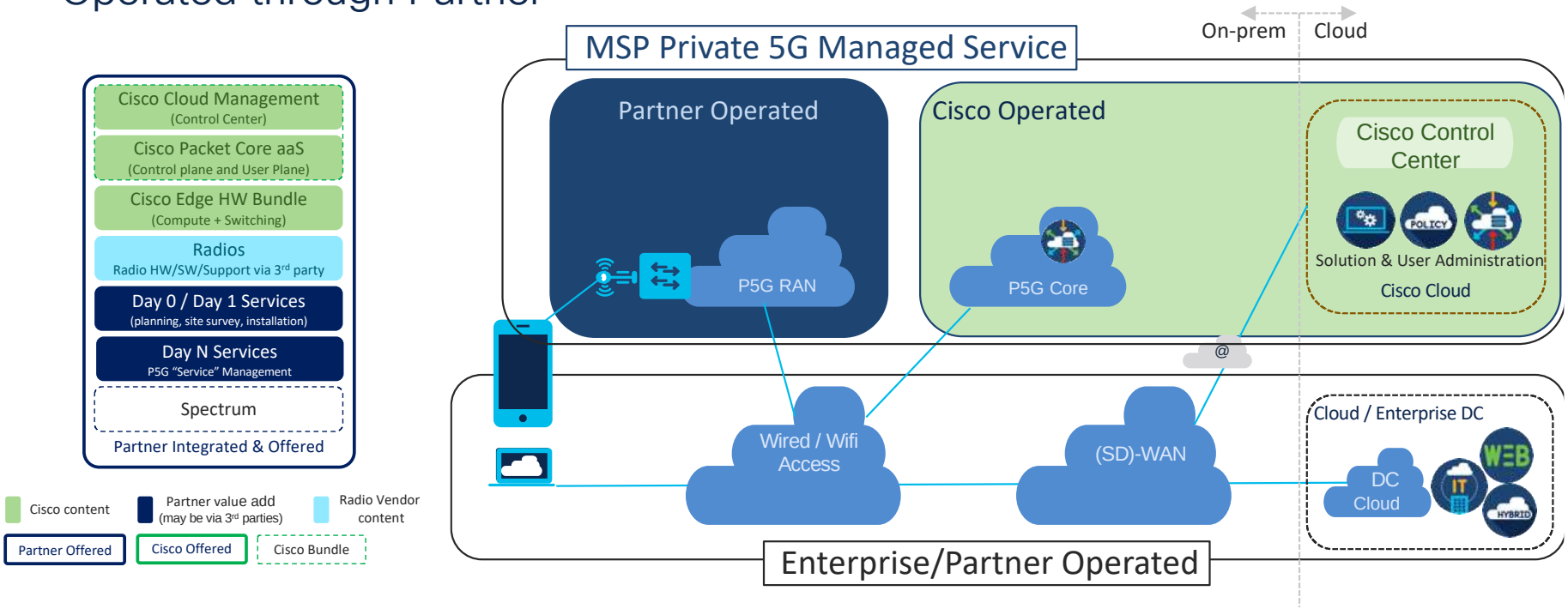
Now with 4G & 5G Mobile packet core as a Service

5G/4G
Converged Core



Cisco Private 5G Managed Service Offer

Operated through Partner



Cisco P5G Offer 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

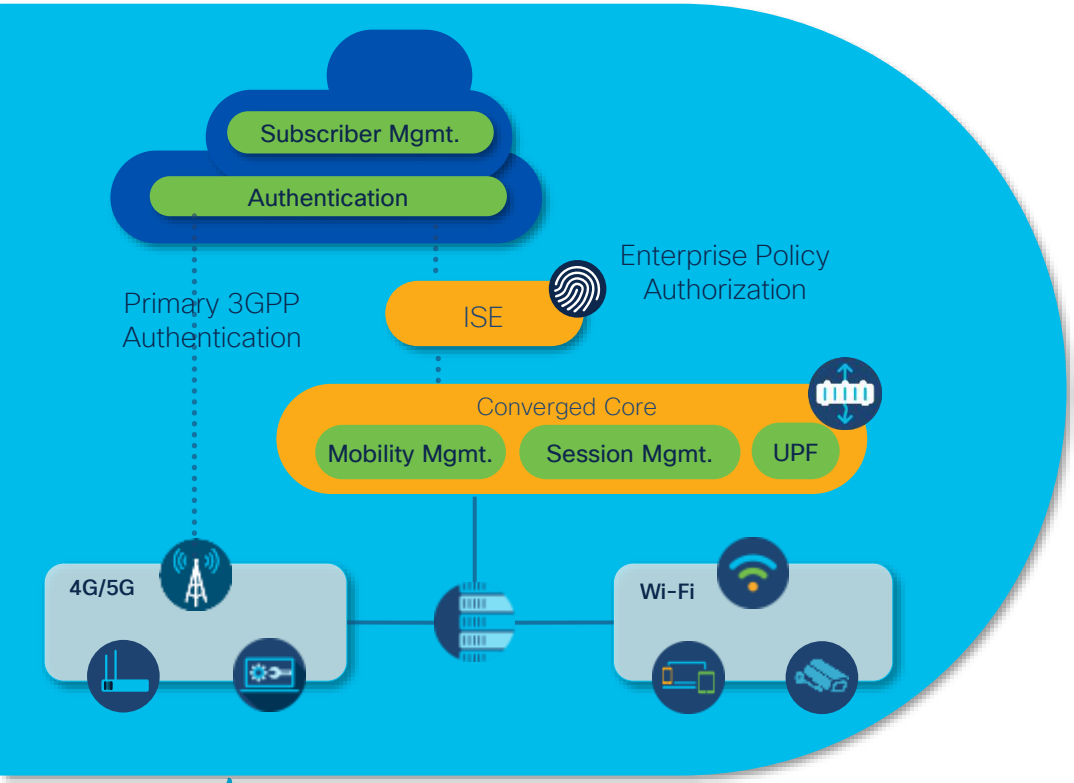
Operations & Support

- 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

Enterprise Integration – Identity and Policy



Single Point for Identity-Based Enterprise Policies

For Private 5G, Wi-Fi & Wired Networks

Conclusion and Takeaways

- Private 5G has arrived!
- Enterprises are exploring benefits as wireless demands soar
- Use cases are fast maturing
  - Early deployments include eMBB, FWA, Backhaul
  - Complex use cases such as AGV and AR/VR are maturing
- Successful deployment requires spectrum availability, as well as end device, radio, and application readiness
  - We can help you assess your venue and use cases for P5G readiness
- Cisco are aiming to simplify P5G deployment challenges and provide complementary wireless capabilities to existing Enterprise wireless deployments

Resources

Cisco Private 5G Solutions

White papers for further reading:

- 5G Americas – 5G verticals use cases
- 5G Americas – Private and Enterprise Networks
- 5G Americas – 5G Technologies in private networks

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

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Thank you


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ALL IN