PRIVATE 5G IN THE TACTICAL SPACE

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AGENDA

What is Private 5G?

P5G vs Wi-Fi

Emergence of P5G

HPE P5G offering

WHAT IS PRIVATE 5G?

UNIQUE BENEFITS OF HPE PRIVATE 5G STAND ALONE NETWORK

True Private 5G Network designed and deployed to the specifications of the client's operational objectives:

- 5G stand alone network; most scalable private 5G network solution

- 3GPP Open Architecture

- Secured from Radio Access Network (RAN) through the 5G Core to Edge Compute environment; can offer WiFi6 to 5G interoperability

- Leverages private spectrum Citizen Broadband Radio Service (CBRS) and public (e.g. T-Mobile, AT&T, Verizon)
  - CBRS is a 150 MHz band of spectrum that operates in the 3.5GHz – 3.7GHz range
  - CBRS uses a three-tier priority systems
    - Incumbent Access – Grandfathered priority in the 150MHz spectrum
    - Priority Access – Purchased spectrum during CBRS auction
    - General Authorized Access – unlicensed/free to use

- Flexible deployment models…fixed or portable; 5G in-a-box or distributed architecture

WHAT IS PRIVATE 5G?
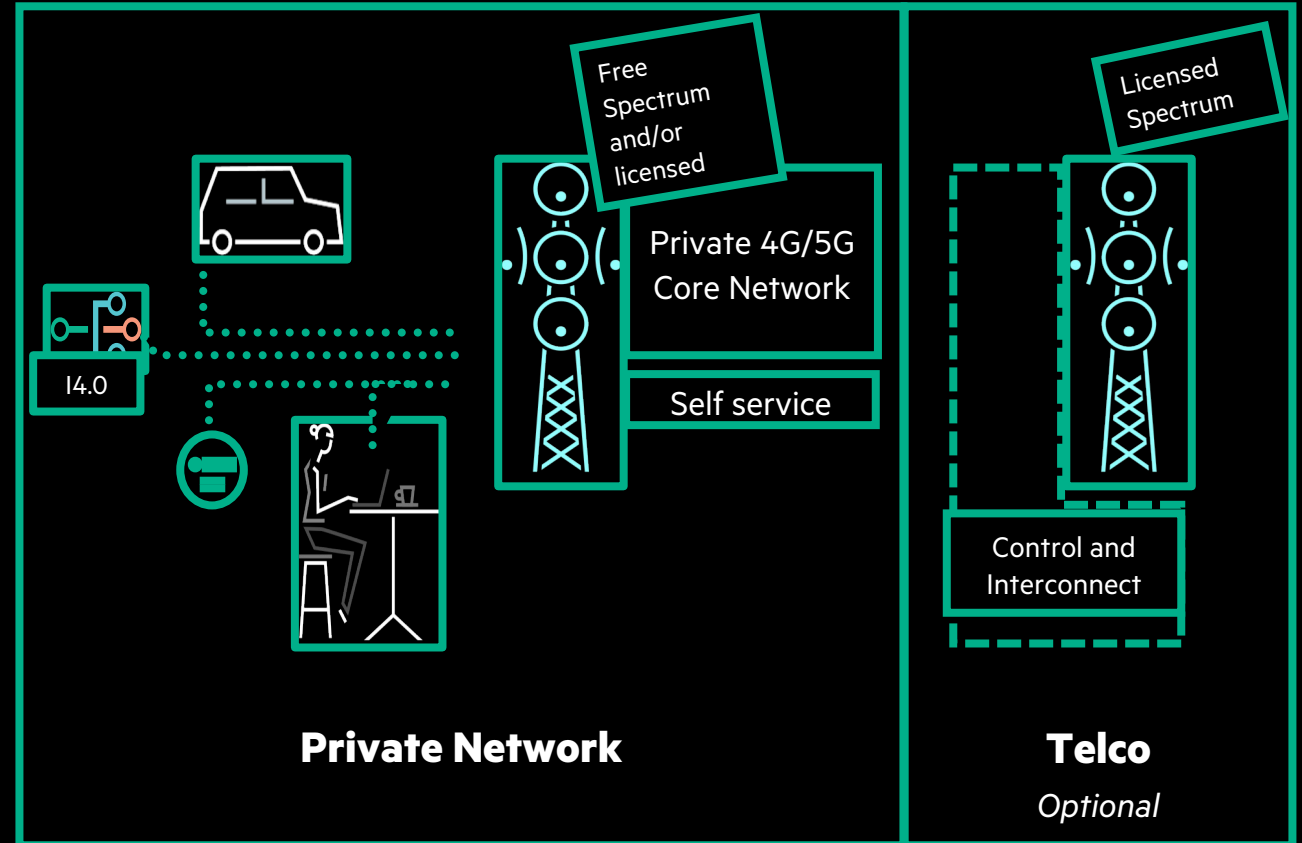
Same technology as Public 5G networks offered by Telcos

Wide area coverage
Nomadic connectivity
End-point security

Controlled by Enterprises, Businesses, Gov Agencies

Serving dedicated network services to Users, Staff, Systems or Applications

Radio in use:

Licensed spectrum - often leased from CSPs
Free spectrum (CBRS) – with verifying performance and device availability

Free Spectrum and/or licensed

Private 4G/5G Core Network

Self service

I4.0

Private Network

Licensed Spectrum

Control and Interconnect

Telco
Optional

CBRS SPECTRUM BREAKDOWN

Dynamic Spectrum Access

Tier 1 – Incumbent

Already using the band: US Naval Radar, DoD personnel

Permanent priority and site-specific protection for registered sites
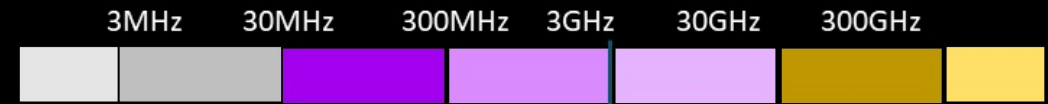
Tier 2 – PAL (Priority Access Licenses)

Allows to use the band if no Tier 1 user is active in same area

Pay a fee to request up to four PALs in a limited geographic area for three years

Get protection against lower tier activity

Tier 3 – GAA (General Authorized Access)

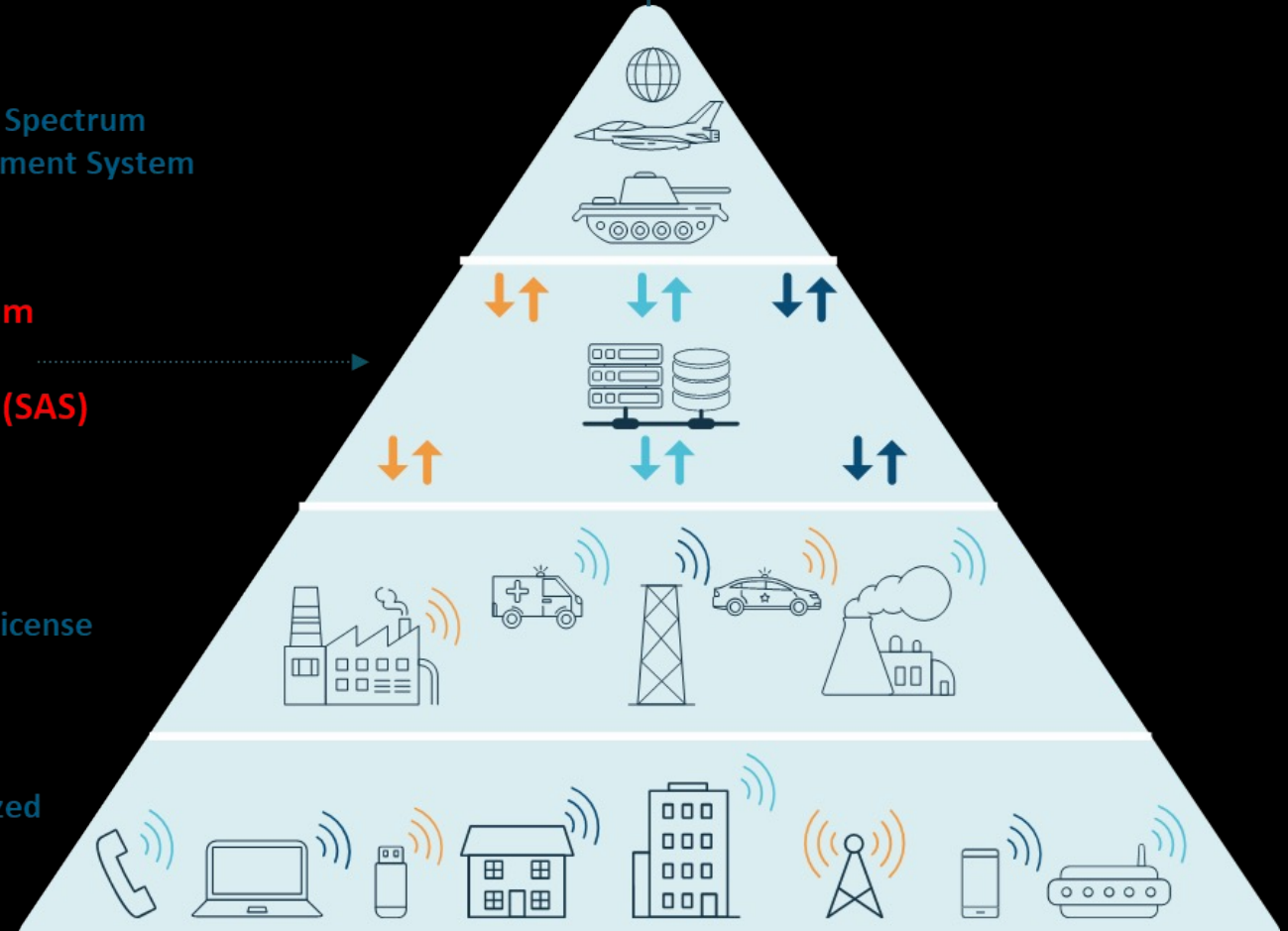Allows to use band if no Tier 1 or Tier 2 users are active in same area

3MHz 30MHz 300MHz 3GHz 30GHz 300GHz

1 **Military Spectrum Management System**

Spectrum Access System (SAS)

2 **Priority Access License**

3 **General Authorized Access**

GENERAL SPECTRUM AVAILABILITY IS A GAME CHANGER

General spectrum

- **Available Today**
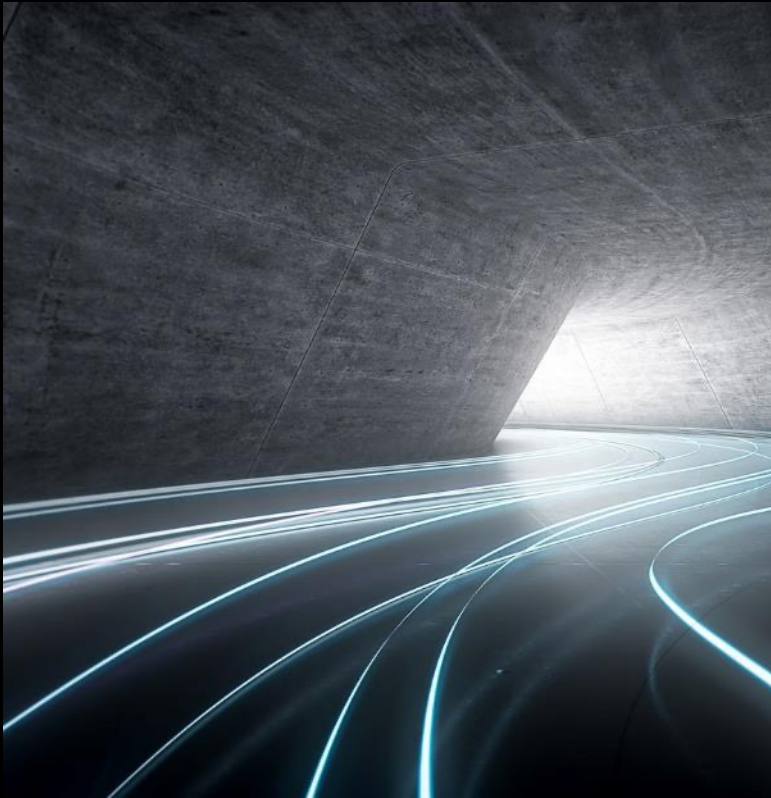- **Expected by YE2023**
- **Expected by YE2025**
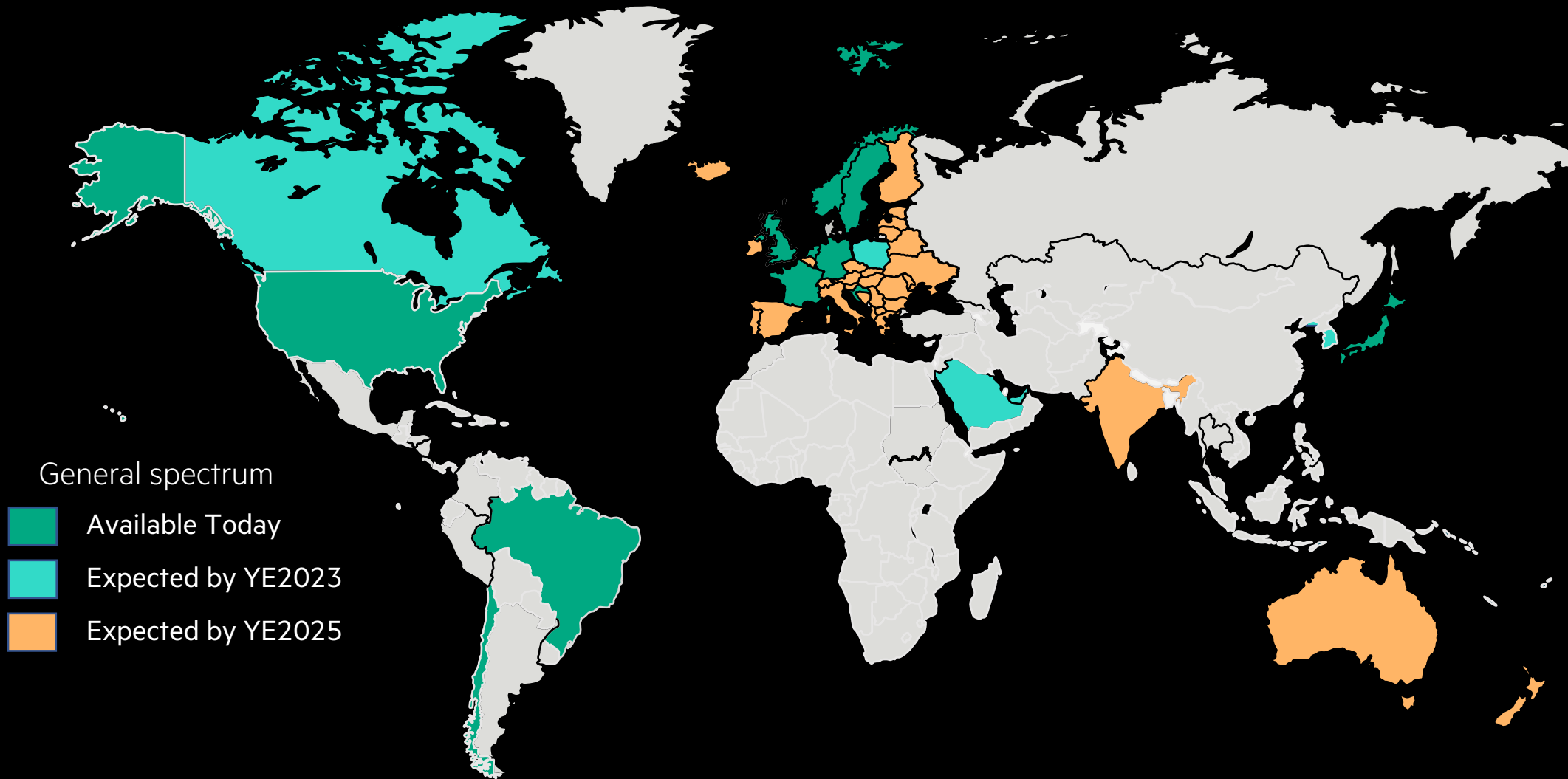
P5G availability by 2023:
- USA
- Canada
- Germany
- UK
- Poland
- Sweden
- Norway
- Brazil
- Japan
- South Korea
- Bahrain
- Saudi Arabia
- Korea

P5G availability by 2025:
- Australia
- Mexico
- The Netherlands
- France
- Italy
- Luxembourg
- Spain
- Belgium
- Czech Republic
- Slovakia
- Turkey
- India
- United Arab Emirates
- South Africa

KEY COMPONENTS OF A PRIVATE CELLULAR NETWORK

Private network

Management & operations

Smart Bldg

IoT

Private 4G/5G

Wi-Fi

Short-Range IoT

Industry 4.0

Contactless Retail

People and things

Radio

Radio Access Network

4G / 5G Core

Mobility control, subscriber management, policy enforcement, APIs

Apps

Services

P5G or carrier spectrum

Public networks / Internet
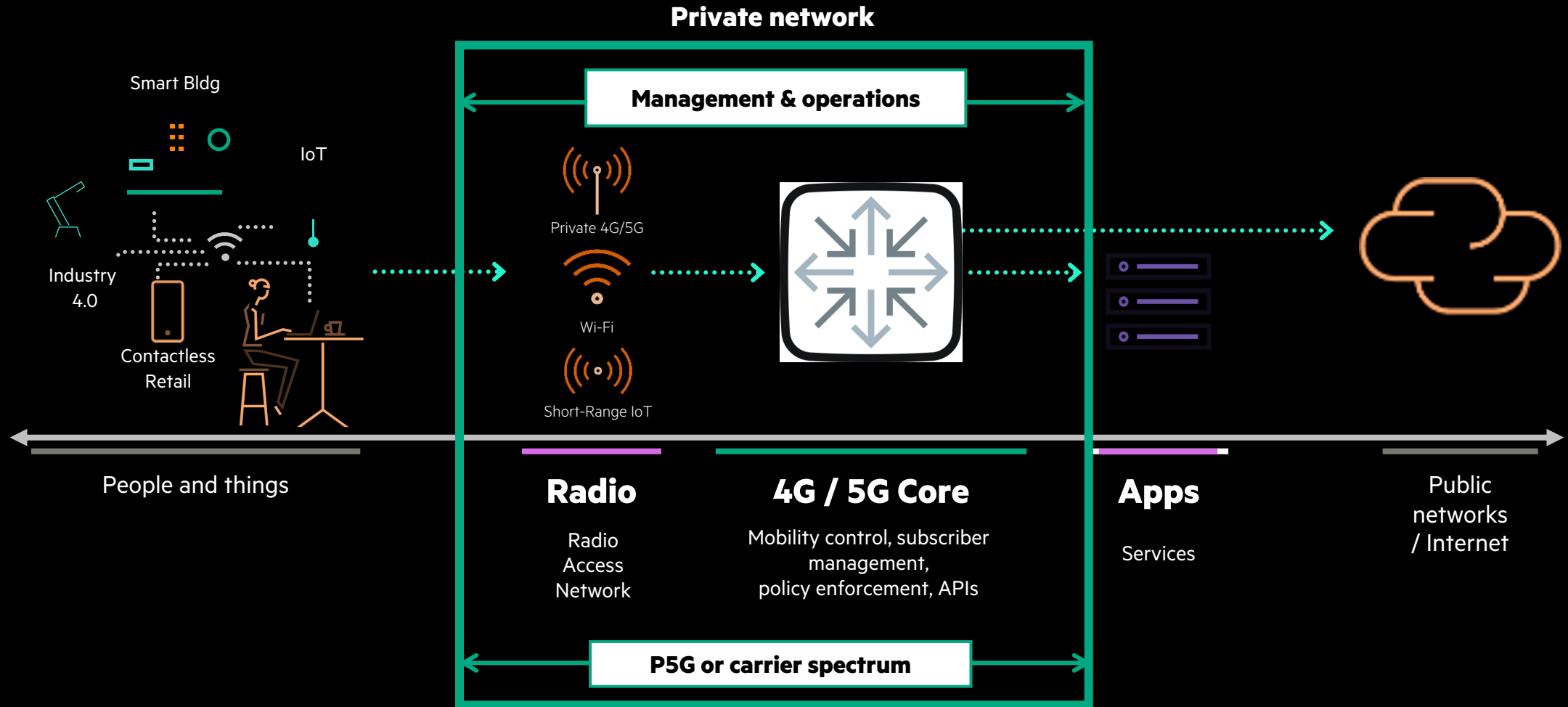
THE MUST HAVES OF PRIVATE 5G

Fast, flexible deployment

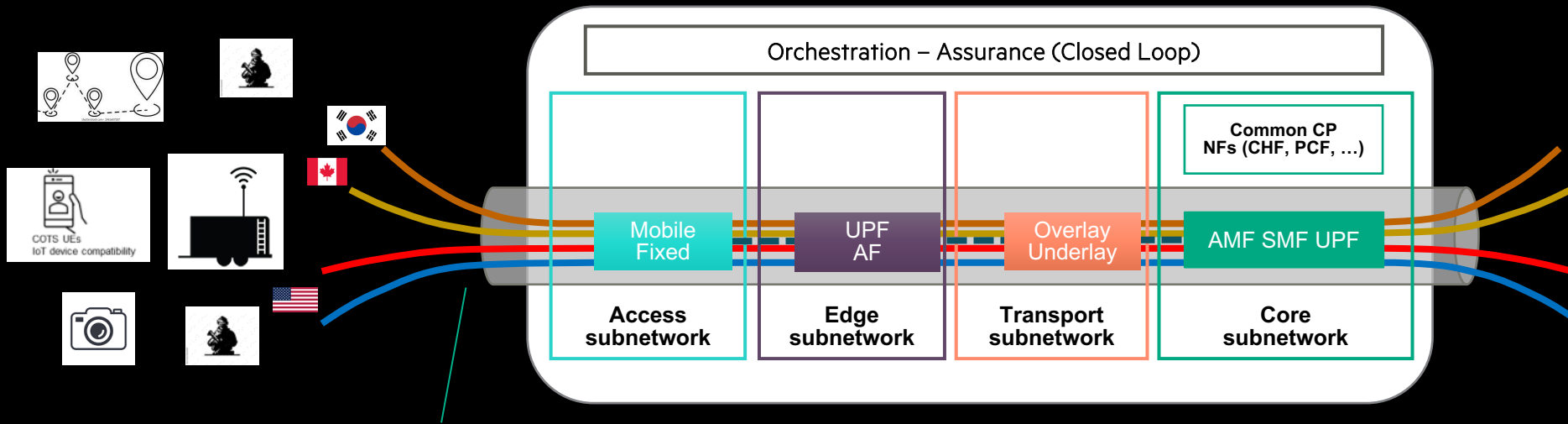Under 1 hour

Easy to operate

By Enterprise or Service Provider

Works well with Wi-Fi

Like a single network

5G SLICE MANAGEMENT – TACTICAL VALUE PROPOSITION

What is a slice and why is it needed?

Orchestration – Assurance (Closed Loop)

Command & Control (C2)

Common CP NFs (CHF, PCF, …)

| Mobile Fixed | UPF AF | Overlay Underlay | AMF SMF UPF |

| **Access subnetwork** | **Edge subnetwork** | **Transport subnetwork** | **Core subnetwork** |

COTS UEs
IoT device compatibility

Dedicated Slice Connection Configured on Network Functions

A network slice can be seen as a private network, providing a defined service quality for end user applications.

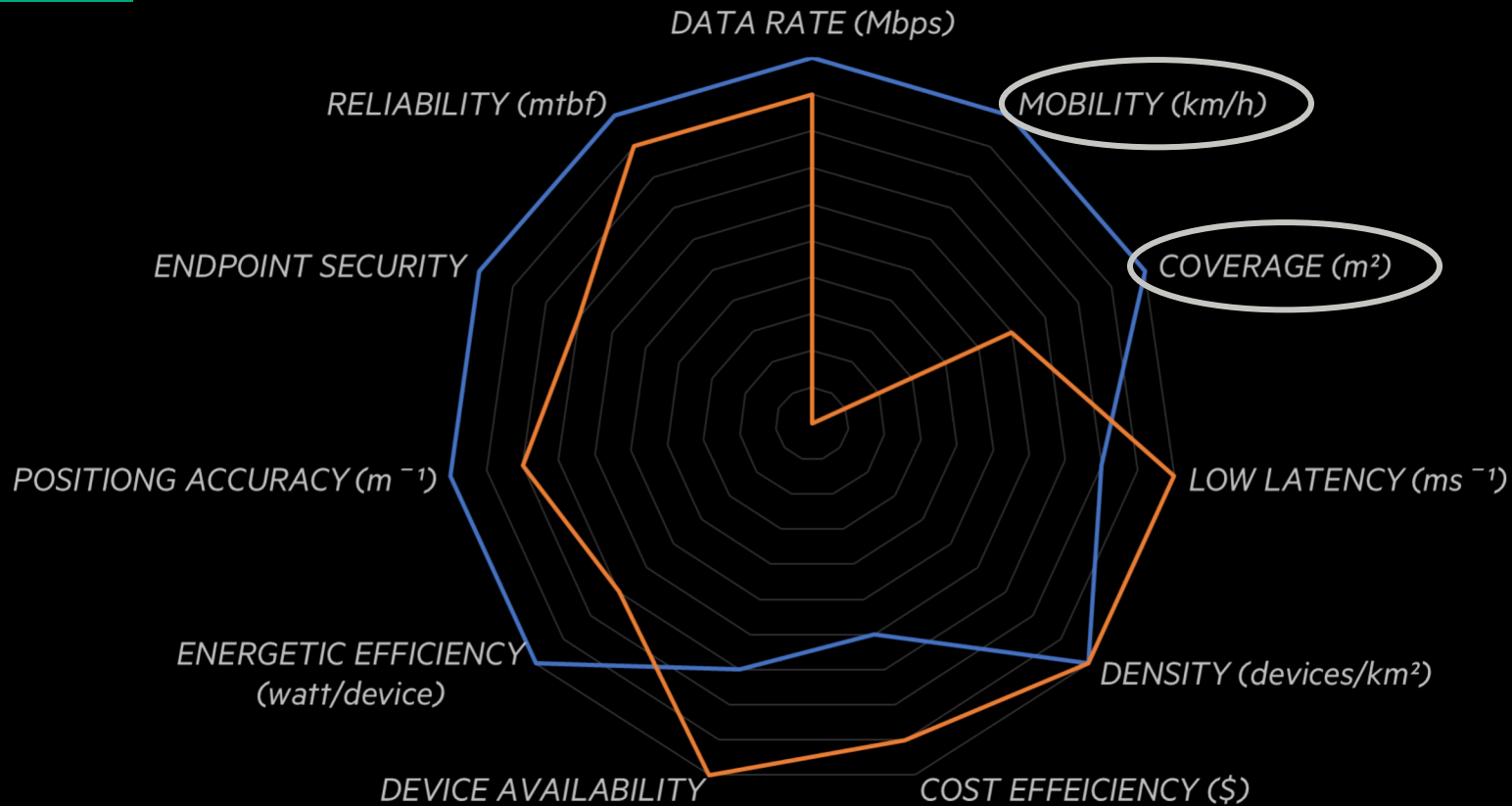It is configured on top of dedicated or shared virtual network functions, running on shared physical infrastructure.

PRIVATE 5G VS WI-FI

PRIVATE 5G VS WI-FI

ATTRIBUTE	5G	WIFI 6
PERFORMANCE ENHANCEMENTS OVERPREDECESSOR	10x speed, 10x less latency, 1000x more capacity	4x faster, 75% lower latency, 4x more capacity than wifi 5
OPTIMAL SPEED (Typically, some overhead will prevent achieving maximum)	~ 10 gbps (Depends on spectrum, with mm Wave being fastest. Note that currentspeed achievements fall between 1gbps and 10 gbps)	600Mbps to a max 9.6gbps (Depends on # of devices and other neighbors sharing spectrum)
OPTIMAL LATENCY (Typically, some overhead will prevent achieving maximum)	~ 1 ms	~ 1 ms (Greatly impacted by # of devices and others sharing spectrum)
RANGE	Can provide service within building/space and across campus or larger field area	Optimal use within a building or space
TRAFFIC FLOW	Enables device-to-device communications which provides additional capabilities (vehicle collision avoidance, et.) as well as not requiring the backhaul /trunk to support 100% of traffic	Requires a Wi-Fi 6 AP to communicate with router
HANDOFFS BETWEEN PRIVATE/COMMERCIAL	Enabled through dual SIMs (including eSIMs)	N/A
DEDICATE PURPOSEFUL SLICE(S) FOR DIFFERENT TRAFFIC	Yes	Yes, but limited
SECURITY	Smaller attack surface/Leverages eSIM	Partially due to its intended purpose, Wi-Fi 6 leverages unprotected unlicensed spectrum which has a larger attack surface and a lesssecure WPA3
COST	Higher cost and complexity	Overall lower cost compared to 5G
SPECTRUM	Licensed and Unlicensed – licensed require subscription such as for 5G cell service. Unlicensed space aslo includes protections from being impacted by others	Unlicensed
APPLICATION	Mobile connections covering larger areas and cases with a large # ofsensors such as manufacturing. Potentially used as alternative to wire to provide connectivity to home and business. Typically used for mission critical applications and those requiring low latency.	Home and businesses within a single building Typically used for non-mission critical applicationsor general access within a home or building

PRIVATE-5G + WI-FI 6

Radar chart comparing Wi-Fi 6 (orange) and Private 5G (blue) across: DATA RATE (Mbps), MOBILITY (km/h), COVERAGE (m²), LOW LATENCY (ms⁻¹), DENSITY (devices/km²), COST EFFEICIENCY ($), DEVICE AVAILABILITY, ENERGETIC EFFICIENCY (watt/device), POSITIONG ACCURACY (m⁻¹), ENDPOINT SECURITY, RELIABILITY (mtbf)

Wi-Fi 6
for cost-effective Indoors connectivity

Private 5G
for wide-coverage, high-mobility

Sources:
• WBA, "5G and Wi-Fi RAN Convergence Aligning the Industry on Opportunities and Challenges", Dec 2020
• WBA, "5G Networks: The Role of Wi-Fi and Unlicensed Technologies", Sept 2017
• 5G PPP, "5G Empowering vertical Industries", Feb, 2016
• HPE internal studies

WIRELESS BROADBAND ALLIANCE

EMERGENCE OF PRIVATE 5G

WHERE WE SEE PRIVATE 5G?

| Tactical forces | Healthcare | Manufacturing | Sea ports | Broadcasting |

| Oil Field | Security | AR/VR | Farming | Sponsored services |
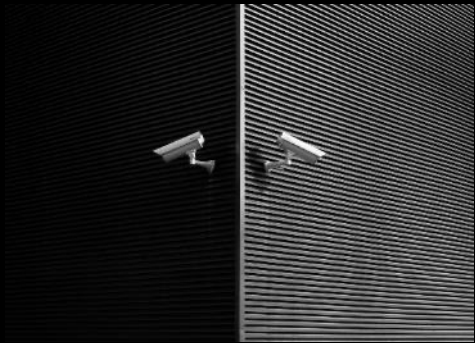
PRIVATE 5G – 3 PRINCIPAL TYPES

Enable autonomous operations ①

"5G in-a-box"

Support critical ②

"Head in the cloud, feet at the Edge"

Dedicated ③

"Virtual Private 5G"

ENTERPRISE USE CASES

TELEMEDICINE PRIVATE 5G

The Government of India allows large enterprises to leverage non-radiating experimental indoor spectrum license, specially allocated for non-Mobile Operator.

Telemedicine provider deploy a central 5G Core lab to do technical evaluations of Private 5G services with their healthcare devices, including: EMBB, URLLC and MEC (mm-wave) scenario, with Mobile X-ray units and scanners

HPE solution
- HPE 5G Core Stack centralized deployment
- Airspan 5G indoor RU: AV 2700 Sub 6GHz

PETRO-CHEMICAL COMPANY, USA
CONNECTIVITY DURING MAINTENANCE

With large area remote facilities, and metallic interferences, Petrochemical companies turn to cellular coverage.

Autonomous connectivity is needed for site maintenance

Co-existence with in-building WiFi

HPE 5G Core Stack
- Cellular on wheels:
  - HPE 5G Core Stack
  - Radio units

App

HPE 5G Core Stack

COW - Cellular On Wheels

AUTOMOTIVE MANUFACTURER
GERMANY

Networking machines and systems with a high-performance mobile network for a paperless ultra-dense Operational Technology (OT) environment.

Goals:

- Continuous bidirectional segregated data flows among OT and IT, with reliable, efficient and ultralow-latency connectivity.

- Designed to support "digital twin" solutions

HPE 5G Core Stack
HPE Service Director
HPE Dynamic SIM provisioning
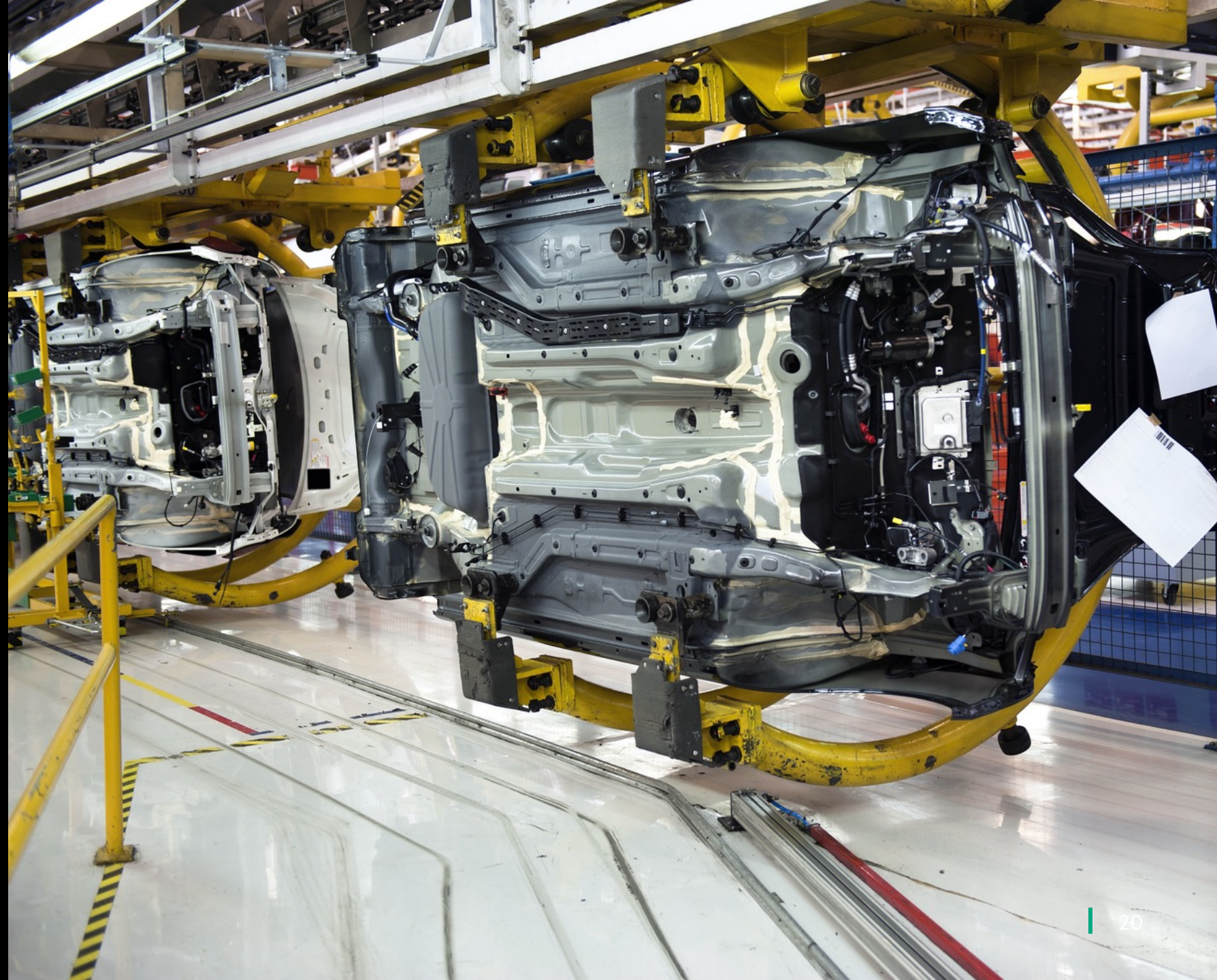
AUTONOMOUS NETWORKING AT TACTICAL LEVEL

✓ No surrounding infrastructure to depend on

✓ Extreme security

✓ Minimal footprint

✓ Military priority services (i.e., push-to-talk)

"5G in a box"

- **HPE 5G Core Stack** on **HPE EL8K**

- Scales down as low as a few users

- HPE Silicon root secure trust arch.

- Single pane of OAM (Operations, Administration and Maintenance)

HPE Edgeline EL8000

HPE PRIVATE 5G OFFERING

HPE TACTICAL 5G (IN-A-BOX) SOLUTION

- US DoD requested first 5G transportable production systems (HPE 5G Core Stack (CS) product in-a-box) for DoD base (USA) in Hawaii.

- The solution is integrated into Ultralife Rugged Cases to be mobile/deployable and air droppable, with a custom high-capacity UPS.

- Provides high speed connectivity at the edge to support AI/ML sensor ingestion and data operations with over the top (OTT) applications for Mission Command communications.

Inseego 5G GW

Motorola Edge+ 5G Handsets

10/25 GB ethernet connection

5G system in a box

Portable 5G RAN on a tripod

HPE Tactical 5G Demo

FORM FACTOR & DEPLOYMENT TYPE

Full Network: EPC+IMS+PTT+Radio	Full Network: EPC+5GC+IMS+PTT+Radio	Full Network: EPC+5GC+IMS+PTT+Radio	Full Network: EPC+5GC+IMS+PTT+Radios	Fully HA Full Network: EPC+IMS+PTT+Radio
Radio: 2x1W	Radio: 2x5W	Radio: 3x 2x20W	3x Radio 2x8W	Multiple Radios
Concurrent sessions: 100	Coverage Radius: 1Km	Coverage Radius: 10Km – 1 macro-cell	Coverage Radius: 10s of Km w/macro-cells	Concurrent sessions: 32K
Autonomy: 5 hours (with hot-swap battery)	Concurrent sessions: 400	Concurrent sessions: 1,000	1,000 - 10,000 concurrent sessions	
	Autonomy: 5 hours (with hot-swap battery)	Autonomy: 4 hours (with hot-swap battery)	Autonomy: 20 minutes (with UPS option)	
	Weight: 17kg (19kg with batteries)	Weight: 60kg (100kg with batteries)	Weight: 50kg (90kg with UPS) Secured by iLO5 Silicon Root of Trust	

Portability ◄──► **Capacity and Coverage**

ENABLING VOICE, DATA, VIDEO AND PTT SERVICES

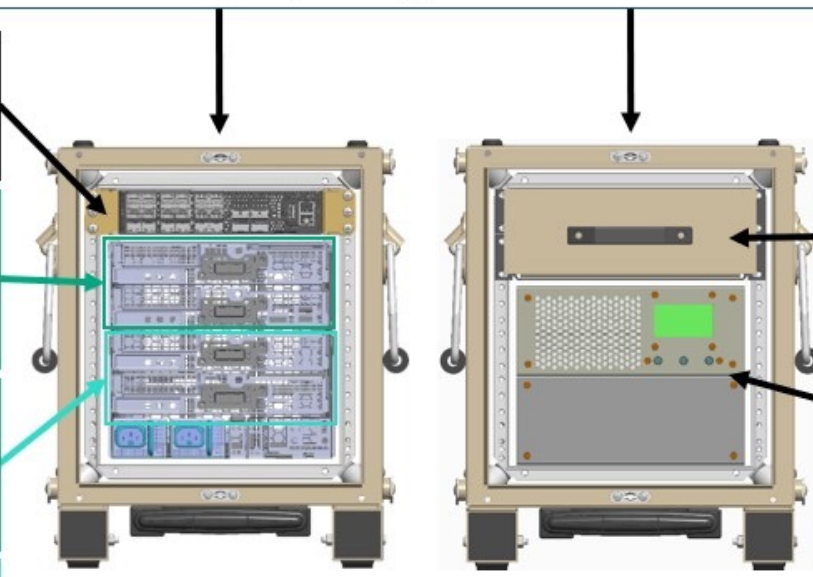|							
Business Communication & Team Collaboration	**MESSAGING**	Instant Messaging	Whiteboard				
	VoIP & PTT	Push-to-Talk (PTT)	VoIP Calls	Call Conferencing	Advanced Telephony		
	GEOLOCATION Indoor/Outdoor	Geolocation					
	VIDEO	Video Streaming	Video Calls	Screen sharing	Video Conferencing		
Emergency Services	**EMERGENCY**	Emergency Messages	Emergency Calls	Lone Worker Protection			
Business Process Management	**MY BUSINESS**	Digital Forms	Digital Processes				
	MY TOOLS	Patrol Routes					
API & SDK	**API**	API					
	SDK	SDK					

DEPLOYABLE PRIVATE 5G STAND ALONE SERVICE

- HPE's "5G-in-a-box" packaged in a Mil Spec 810H certified rugged case with a rugged Uninterruptible Power Supply can deploy into harsh environments to provide high speed communications at the tactical edge.

HPE EL8000 RUGGED PRIVATE 5G-IN-A-BOX

Mil Std 810H Certified Half Width/6U Rugged Cases with wheels and tow handles

HPE Storefabric SN2010M Switch:
- 18 ports SFP28 (up to 25GbE)
- 4 ports QSFP28 (up to 100GbE)

5G SA Core – on two ESXi nodes, each with:
- 32 Core Ice Lake Processor, up to 1.5TB RAM & 30TB NVMe Storage, 2p SFP28
- *3 VMs: each needing 8 Cores, 16GB RAM*

Two Servers available for workloads, each with:
- 32 Core Ice Lake Processor, up to 1.5TB RAM & 30TB NVMe Storage, and optional T4 or A2 GPU

Chassis:
- 2 x 10GbE Chassis Switches; iLO5
- -40C to + 55C Operating Temperature

2U Accessory Drawer

1800W Uninterruptible Power Supply (UPS)
- Cold Start capable
- Alarm silencing

Compute Case ~ 103lbs total

Accessory Case ~ 81lbs total

THANK YOU

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Tactical EL8000 Private 5G Demo:
https://www.youtube.com/watch?v=wELaVS0X_8c